



CARIBBEAN EXAMINATIONS COUNCIL

# CSEC<sup>®</sup> Agricultural Science

**SYLLABUS  
SPECIMEN PAPER  
MARK SCHEME  
SUBJECT REPORTS**

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## **Agricultural Science**

The Agricultural Science syllabus is designed to allow students to develop knowledge and understanding of the interaction between the component parts of agriculture and the scientific principles that explain the processes that take place when inputs are transformed into outputs. The syllabus requires students to treat with certain conceptual and theoretical issues associated with the discipline, while at the same time providing them with the opportunity to develop a wide range of practical skills and an awareness of the technologies associated with agriculture.

The syllabus provides for study leading to a Single Award or a Double Award in the subject and is arranged in five sections:

- Section A     The Business of Farming
- Section B     Crop Production
- Section C     Animal Production
- Section D     Horticulture
- Section E     Animal Management

Candidates presented for the Single Award examination must complete Sections A, B and C only, while candidates presented for the Double Award examination must complete Sections A to E (all five sections).



CARIBBEAN  
EXAMINATIONS  
COUNCIL

Caribbean Secondary  
Education Certificate®

# SYLLABUS

# AGRICULTURAL SCIENCE

CXC 07/G/SYLL 16

Effective for examinations from May–June 2018



CSEC®

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Please check the website, [www.cxc.org](http://www.cxc.org) for updates on CXC's syllabuses.



# Agricultural Science Syllabus

## ◆ RATIONALE

*This syllabus was developed in response to four (4) key objectives of the food and agriculture sector in the Caribbean; a region consisting mainly of Small Island Developing States. These objectives, which provide the framework for this syllabus, are to achieve the goal of food and nutrition security; adopt sustainable agricultural approaches that are responsive to an uncertain physical and economic environment; contribute to economic diversification through transformation of communities and improvement of livelihoods; and ensure that the human resource capacity available to the sector is adequate in quantity and quality.*

*Agriculture is viewed in its widest sense as all activities including production, processing and marketing of plant crops and animals for human well-being. Sustainability, that is, satisfying the current and future needs of a society for food and non-food products, in an environmentally friendly manner that also optimises profitability to the producers, will be achieved by using sound scientific approaches to build on relevant indigenous knowledge. These approaches reflect the multidisciplinary nature of agriculture by encompassing both the natural and social sciences, and its multifunctionality through its linkages with other sectors. Additionally, to meet the stated objectives and enhance the competitiveness of Caribbean agriculture in the twenty-first century, the application of best practices and appropriate modern technologies will be critical.*

*This Agricultural Science Syllabus has been developed to address these requirements and to lay the foundation for meeting the human resource needs of the food and agriculture sector. Therefore, it incorporates the features of the Science, Technology, Engineering, and Mathematics (STEM) principles. It seeks to equip students for entry to the world of work as skilled workers and for post-secondary and tertiary level agriculture education. Students will be exposed to learning experiences to equip them with relevant scientific and technical competencies, transferable skills such as critical thinking, innovativeness, team work, problem solving, communication, and other life skills. Dispositions such as concern for others, ethical conduct, stewardship of resources, and a keen interest in participation in national, regional and international affairs will also be fostered. The learning environment is infused with Information Communication Technologies (ICTs) and is particularly geared to engage youth by catering for different learning styles and needs, development of multiple intelligences, encouraging personal growth and development, and creating opportunity for entrepreneurship.*

*To ensure regional relevance, students where applicable, will be recognised for the achievement of competencies in the Caribbean Vocational Qualifications (CVQ<sup>\*1</sup>) that is aligned to the content in the syllabus. This will further enhance the development of the Ideal Caribbean Person as articulated by the CARICOM Heads of Government who is aware of the importance of living in harmony with the environment; demonstrates multiple literacies, independent and critical thinking, questions the beliefs and practices of the past and present, and brings this to bear on the innovative application of science and technology to problem-solving; and values and displays the creative imagination in its various manifestations and nurtures its development in the economic and entrepreneurial spheres in all other areas of life. The syllabus will also prepare students for lifelong learning based on the Pillars of Learning described by UNESCO as it will contribute to a person who will learn how to do, learn how to live together and learn to transform themselves and society.*

<sup>1</sup>CVQ<sup>\*</sup> is a registered trademark of the Caribbean Association of National Training Authorities (CANTA).

## ◆ AIMS

The syllabus aims to:

1. *develop knowledge and understanding of the importance of agriculture as it relates to food and nutrition security and the economies of the territories of the Caribbean Region;*
2. *provide knowledge of the dynamic nature of agricultural production, post-production and marketing in a complex national, regional and international market;*
3. *develop an appreciation of the importance of sustainable agriculture for the preservation of the environment;*
4. *develop an appreciation of the importance of agriculture in providing multiple pathways to employment and further education;*
5. *develop scientific and technical competencies, and transferable skills such as critical thinking, innovativeness, team work, problem solving, communication, and other life skills;*
6. *foster dispositions such as concern for others, ethical conduct, stewardship of resources, and a keen interest in participation in national, regional and international affairs; and,*
7. *develop competencies in the application of appropriate modern technologies.*

## ◆ CAREER CHOICES

The skills and knowledge acquired through the study of this syllabus may be further developed and employed in a variety of professions, including those below.

Agricultural Economist	Geneticist
Agricultural Engineer	Horticulturist
Agronomist	Hydrologist
Animal Nutritionist	Logging Engineer
Animal Physiologist	Marine Scientist
Aquaculturist	Molecular Biologist
Biochemist	Naturalist
Biometrician	Nutritionist/Dietician
Biosystems Engineer	Plant Pathologist
Botanist (Plant Biologist)	Plant Physiologist
Climatologist	Postharvest Technologist
Ecologist	Range Manager
Entomologist	Remote Sensing Specialist

Environmental Scientist	Science Writer
Farmer	Soil Scientist
Fisheries Scientist	Toxicologist
Florist	Turf Scientist
Food Process Engineer	Veterinarian
Food Scientist	Viticulturist
Food Inspector	Weed Scientist
Food Safety Specialist	Wildlife Biologist
Forage Agronomist	Wood Scientist
Forester	

## ◆ SUGGESTED RESOURCES

All schools presenting candidates for this subject **should provide the minimum facilities relevant to the areas to be covered**. However, where schools are having difficulties in providing these facilities, the practical requirements of the syllabus can be met through any or a combination of the following alternatives:

1. summer attachment programmes under guidance and supervision;
2. sharing practical instructional facilities;
3. visits to agricultural stations;
4. visits to private commercial farms; and,
5. sharing facilities with other schools.

Failure to provide these facilities may adversely affect students' performance. **It is recommended that participating schools provide the following facilities for each group of 30 students:**

### The Field

- |    |            |   |   |
|----|------------|---|---|
| 1. | Land Space | - | 1 bed with dimension of 3 x 1 meters<br>(approximately three square metres per student)               |
|    |            | - | Nursery, grow box unit for vegetables, spices and herbs   |
|    |            | - | Grass plots – 2 pasture grasses, 2 soiling grasses, 1 legume  |
|    |            | - | Land space for low cost greenhouse or shade house   |
| 2. | Livestock  | - | (a) poultry (i) Layers – 25 to 50 for the two-year period<br>(ii) Broilers – 50 to 100, once per term |
|    |            |   | (b) rabbits (i) 3 does; 1 buck  |
|    |            |   | OR guinea pigs 10 females; 1 male   |
|    |            |   | OR agouti   |

- |  |  |                              |  |
|--|--|------------------------------|--|
|  |  | (c) pigs                     | (i) 1 sow (access to a boar)             |
|  |  | (d) EITHER sheep<br>OR goats | (i) 2 ewes; 1 ram<br>(ii) 2 ewes; 1 buck |
3. Security
    - fencing
  4. Field Tools and Equipment
    - access to:
      - wheelbarrow
      - garden hose
      - watering cans
      - miscellaneous propagating tools, for example, pruning shears, secateurs, pruning saw, budding knife, tapes
      - other agricultural tools: spade, hoe, rake, fork, cutlass
        - field crates, buckets
      - scale
      - soil auger
      - rain gauge
      - wet and dry bulb thermometers, wind vane, anemometer, hygrometer
        - access to slaughter house/facilities
  5. Safety
    - first aid kit
      - protective gear
      - proper disposal facilities

### Other Requirements

1. Maintenance
  - 1 farm attendant
2. Field Tools, Materials and Equipment
  - access to: spraying equipment, for example, mist blowers.
    - irrigation system
    - pump
    - animal housing
    - access to tractor and ploughing equipment
  - 2 knapsack sprayers with shield
    - (a) Insecticides and fungicides
    - (b) herbicides
  - miscellaneous veterinary equipment, for example, syringes, ear markers, clinical thermometers.
    - compost bins
    - barrels/tanks for rainwater harvesting
    - cold storage/refrigerator
    - tanks/ponds for fish
    - access to apiary

- |                         |   |
|-------------------------|---|
| 3. Laboratory Equipment | <p>access to science laboratory:</p> <ul style="list-style-type: none"> <li>- simple balances</li> <li>- microscopes</li> <li>- hand lenses (one per student)</li> <li>- glassware including crucibles, beakers, test tubes</li> <li>- chemicals</li> <li>- lamps</li> <li>- 1 potometer</li> <li>- 1 desiccator</li> <li>- 1 set of sieves</li> <li>- measuring instruments: tapes, rulers, measuring cylinder, indicator paper, pH meter, soil test kits</li> </ul> |
| 4. Visual Aids          | <p>access to:</p> <ul style="list-style-type: none"> <li>- multimedia projector</li> <li>- models</li> <li>- charts and diagrams</li> <li>- computer with relevant software and internet access               <ul style="list-style-type: none"> <li>• camera</li> <li>• flip charts</li> </ul> </li> </ul>   |

## ◆ CANDIDATE REQUIREMENT

1. Candidates should have completed at least three years of secondary school science which would provide an introduction to basic scientific principles.
2. Candidates should be concurrently studying or have done **CSEC®** Mathematics or its equivalent and **CSEC®** English A or its equivalent.

## ◆ SUGGESTED TIMETABLE ALLOCATION

It is recommended that the syllabus be covered in a minimum of five (5) forty-minute periods per week for Single Award and ten (10) forty-minute periods per week for the Double Award.

## ◆ ORGANISATION OF THE SYLLABUS

The Agricultural Science Syllabus is arranged in six sections, namely, Sections A, B, C, D, E and F, each of which consists of General and Specific Objectives, Content and Suggested Practical Activities. Candidates presented for the **Single Award** examination must complete **Sections A, B, C and D ONLY**. Candidates presented for the **Double Award** examination **MUST** complete **Sections A to F** (all six Sections).

SECTION A	-	INTRODUCTION TO AGRICULTURE
SECTION B	-	CROP PRODUCTION
SECTION C	-	ANIMAL PRODUCTION
SECTION D	-	THE BUSINESS OF FARMING
*SECTION E	-	CROP AND ANIMAL MANAGEMENT TECHNOLOGIES
*SECTION F	-	ENTREPRENEURSHIP AND COMMUNICATION IN THE AGRICULTURAL SECTOR

**\* For Double Award Only**

## ◆ RECOMMENDED TEACHING APPROACHES

*It is recommended that Section A be taught first. The order in which Sections B, C and D are taught is flexible and dependent on the availability of resources. Sections A, B, C, and D provide the prerequisite knowledge for Sections E and F.*

*Teachers should use a practical approach in the teaching of the syllabus. Concepts developed in previous sections should be repeated where possible to establish the linkages among the sections. Teachers should also use the selected examples from crops and livestock species to provide a basis for management techniques.*

*Students should be able to make connections with agriculture in their local environment, as well as regionally and internationally. This can be done by engaging them in a variety of activities, some of which are outlined under the Suggested Teaching and Learning Activities.*

## ◆ CERTIFICATION AND DEFINITION OF PROFILE DIMENSIONS

*The syllabus is offered for General Proficiency certification only. A candidate's performance will be indicated on the certificate by an overall numerical grade on a six-point scale as well as a letter grade for each of three Profile dimensions, The Business of Farming, Crop Production and Animal Production for Single Award and Double Award. Additionally, candidates who attain competence in the Units of Regional Occupational Standard for the Caribbean Vocational Qualification (CVQ\*) listed below and to which the School-Based Assessment is aligned, will be awarded a Statement of Competence in recognition of their performance once all requirements for issuing the award are met.*

### **Regional Occupational Standard for the Caribbean Vocational Qualification (CVQ\*)**

- 1. CCAGH 10107 Level 1 in Crop Production**
- 2. CCAGL 10107 Level 1 in Livestock Rearing**

## ◆ SKILLS AND ABILITIES TO BE ASSESSED

The skills students are expected to have developed on completion of this syllabus have been grouped under two headings:

- (i) Knowledge and Comprehension; and,
- (ii) Application.

### **Knowledge and Comprehension (KC)**

Knowledge: The ability to identify, remember and grasp the meaning of basic facts, concepts and principles.

Comprehension: The ability to select appropriate ideas, match, compare and cite examples and principles in familiar situations.

### **Application (A)**

Application: The ability to use facts, concepts, principles and procedures in unfamiliar situations. The ability to analyse and interpret unfamiliar situations, and make reasoned judgements and recommendations.

## ◆ FORMAT OF THE EXAMINATIONS

*All candidates (Single Award and Double Award) are required to complete Paper 01 and Paper 02.*

### **For Single Award only**

**Paper 01**  
(1 hour 15 minutes)

*Multiple Choice (60 items) — 20 items (14 Knowledge and Comprehension, 6 Application) each drawn from the syllabus as follows:*

*Sections A and D — 20*

*Section B — 20*

*Section C — 20*

*Each item is worth 1 mark.*

**Paper 02**  
(2 hours)

*This paper consists of three sections for a total of 60 marks.*

*Section I: The Business of Farming*

*Two compulsory essay-type questions from Sections A and D of the syllabus. Each question is worth 10 marks, 3 Knowledge and Comprehension and 7 Application.*

*Section II: Crop Production*

*Two compulsory essay-type questions from Section B of the syllabus. Each question is worth 10 marks, 3 Knowledge and Comprehension and 7 Application.*

### *Section III: Animal Production*

*Two compulsory essay-type questions from Section C of the syllabus. Each question is worth 10 marks, 3 Knowledge and Comprehension and 7 Application.*

#### **Paper 03** (SBA)

*Candidates will be required to keep a Portfolio which comprises documentation on the performance of skills in the field and one investigation each in crop and animal production. Ten (10) skill performances in the field will be rated on a 5-point scale (0-4) by the teacher using criteria set out by CXC® (see pages 55-56 for details). Candidates will also conduct two investigations, one in crop production and the other in animal production (see pages 56-62). Each investigation will be marked out of 20 marks and will be scaled.*

**Total marks on the SBA will be 80.**

#### **For Double Award only**

#### **Paper 01** (1 hour 15 minutes)

*Multiple Choice (60 items) — 20 items (14 Knowledge and Comprehension, 6 Application) each drawn from the syllabus as follows:*

*Sections A and D — 20*

*Section B — 20*

*Section C — 20*

*Each item is worth 1 mark.*

#### **Paper 02** (2 hours)

*This paper consists of three sections for a total of 60 marks.*

##### *Section I: The Business of Farming*

*Two compulsory structured essay questions from Sections A and D of the syllabus. Each question is worth 10 marks, 3 Knowledge and Comprehension and 7 Application.*

##### *Section II: Crop Production*

*Two compulsory structured essay questions from Section B of the syllabus. Each question is worth 10 marks, 3 Knowledge and Comprehension and 7 Application.*

##### *Section III: Animal Production*

*Two compulsory structured essay questions from Section C of the syllabus. Each question is worth 10 marks, 3 Knowledge and Comprehension and 7 Application.*

#### **Paper 03** (2 hours)

*This paper consists of three sections for a total of 60 marks.*

##### *Section I: Entrepreneurship and Communication*

*Two compulsory structured essay questions from Section F of the syllabus. Each question is worth 10 marks, 4 Knowledge and Comprehension and 6 Application.*



**Paper 04**  
(SBA)

*Section II: Crop Management Technologies*

*Two compulsory structured essay questions from Section E of the syllabus. Each question is worth 10 marks, 3 Knowledge and Comprehension and 7 Application.*

*Section III: Animal Management Technologies*

*Two compulsory structured essay questions from Section E of the syllabus. Each question is worth 10 marks, 3 Knowledge and Comprehension and 7 Application.*

*Candidates will be required to integrate all the elements of the SBA for the Single Award in addition to the knowledge and skills in Sections E and F of the syllabus.*

*In addition to the skills in the Single Award, candidates will be required to keep a Portfolio which comprises documentation for a business plan for the establishment of a sustainable agricultural enterprise (20 marks); two projects that demonstrate sustainable agricultural production and management, one each for crops and livestock (20 marks each); and skills related to any aspect of the establishment and operation of a sustainable agricultural enterprise (see pages 56-62 for details).*

*The Business Plan and the Cost Analysis 2 will be associated with either the crops or livestock project. The project with these two components will be considered the extended project. Therefore, together with the skills outlined above, the Double Award candidate will complete:*

- (a) Investigative Project – (select EITHER crop OR animal) + Cost Analysis 1 (Production only) = 20 + 10 = 30 marks*
- (b) Extended Project – Business Plan + Investigative Project (whichever is not selected at (a) above) + Cost Analysis 2 (Production, Post Production and Value Addition) = 20 + 20 + 10 = 50 marks*

**Total marks on the SBA will be 120.**

## WEIGHTING OF PAPERS AND PROFILE DIMENSIONS

### SINGLE AWARD

**Table 1**  
**Relationship between Papers and Profile Dimensions**

<b>PROFILE</b>	<b>PAPER 01 Multiple Choice</b>	<b>PAPER 02 Structured/ Essay</b>	<b>PAPER 03 (SBA)</b>	<b>TOTAL MARKS (%)</b>	
<i>The Business of Farming (BF)</i>	20	20	20	60	(30%)
<i>Crop Production (CP)</i>	20	20	30	70	(35%)
<i>Animal Production (AP)</i>	20	20	30	70	(35%)
<b>TOTAL MARKS (%)</b>	<b>60 (30%)</b>	<b>60 (30%)</b>	<b>80 (40%)</b>	<b>200</b>	<b>(100%)</b>

**Table 2**  
**Relationship between Papers and Skills**

<b>Skills</b>	<b>PAPER 01 Multiple Choice</b>	<b>PAPER 02 Structured/ Essay</b>	<b>PAPER 03 (SBA)</b>	<b>TOTAL MARKS</b>
<i>Knowledge and Comprehension (KC)</i>	42	18	40	100
<i>Application (A)</i>	18	42	40	100
<b>TOTAL</b>	<b>60</b>	<b>60</b>	<b>80</b>	<b>200</b>

**Table 3**  
**Generalised Table of Specification**

<b>Profile</b>	<b>Number of Questions</b>			
	<b>Paper 01</b>	<b>Paper 02</b>	<b>Paper 03 (SBA)</b>	<b>Total Marks</b>
<i>BF</i>	20 (1 mark each) (14KC, 6A marks)	2 (3KC, 7A marks each)	2 Cost Analyses (10 marks each)	60
<i>CP</i>	20 (1 mark each) (14KC, 6A marks)	2 (3KC, 7A marks each)	5 practical skills (4 marks each) 1 investigation/project (10 marks)	70
<i>AP</i>	20 (1 mark each) (14KC, 6A marks)	2 (3KC, 7A marks each)	5 practical skills (4 marks each) 1 investigation/project (10 marks)	70
<b>TOTAL</b>	<b>60</b>	<b>60</b>	<b>80</b>	<b>200</b>

### DOUBLE AWARD

**Table 4**  
**Relationship between Papers and Profile Dimensions**

PROFILE	PAPER 01 Multiple Choice	PAPER 02 Structured Essay	PAPER 03 Structured Essay	PAPER 04 (SBA)	TOTAL MARKS (%)	
The Business of Farming (BF)	20	20	20	40	100	(33⅓%)
Crop Production (CP)	20	20	20	40	100	(33⅓%)
Animal Production (AP)	20	20	20	40	100	(33⅓%)
<b>TOTAL MARKS (%)</b>	<b>60 (20%)</b>	<b>60 (20%)</b>	<b>60 (20%)</b>	<b>120 (40%)</b>	<b>300</b>	<b>(100%)</b>

**Table 5**  
**Relationship between Papers and Skills**

Skills	PAPER 01 Multiple Choice	PAPER 02 Structured Essay	PAPER 03 Structured Essay	PAPER 04 (SBA)	TOTAL MARKS
Knowledge and Comprehension (KC)	42	18	20	40	120
Application (A)	18	42	40	80	180
<b>TOTAL</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>120</b>	<b>300</b>

**Table 6**  
**Generalised Table of Specification**

Profile	Number of Questions				
	Paper 01	Paper 02	Paper 03	Paper 04 (SBA)	Total
BF	20 (1 mark each) (14KC, 6A marks)	2 (3KC, 7A marks each)	2 (4KC, 6A marks each) - From Section F of the syllabus	2 Cost Analyses (1 Cost Analysis 1 & 1 Cost Analysis 2) (10 marks each) Extended Research - Business Plan (20 marks)	100
CP	20 (1 mark each) (14KC, 6A marks)	2 (3KC, 7A marks each)	2 (3KC, 7A marks each) - From Section E of the syllabus	5 practical skills (4 marks each) 1 investigation/project (20 marks)	100
AP	20 (1 mark each) (14KC, 6A marks)	2 (3KC, 7A marks each)	2 (3KC, 7A marks each) - From Section E of the syllabus	5 practical skills (4 marks each) 1 investigation/project (20 marks)	100
<b>TOTAL</b>	<b>60</b>	<b>60</b>	<b>60</b>	<b>120</b>	<b>300</b>

## ◆ RELATIONSHIP BETWEEN AGRICULTURAL SCIENCE AND ALLIED SUBJECTS

It is suggested that the laboratory exercises for the syllabus should be done in conjunction with those of the allied subjects of Biology, Chemistry, Physics, Integrated Science and Home Economics.

## ◆ REGULATIONS FOR PRIVATE CANDIDATES

*Private candidates will be required to sit all components of the examination for the selected syllabus. Private candidates for the Single Award must be required to write Papers 01, 02 and 03. Private candidates for the Double Award must be required to write Papers 01, 02, 03 and 04. A private candidate must enter through a school, a recognised institution (technical institute or community college) or the Local Registrar's Office. The institution of learning will be required to accept responsibility for the assessment of the School-Based Assessment component of the syllabus. The name, school, and territory of the identified teacher or tutor should be submitted to the Council on registration for the subject.*

## ◆ REGULATIONS FOR RESIT CANDIDATES

*Resit candidates for the Single Award must complete Papers 01 and 02 of the examination for the year for which they re-register. Resit candidates for the Double Award must complete Papers 01, 02 and Paper 03 of the examination for the year for which they re-register. However, resit candidates who have earned a moderated score 50 per cent or more of the maximum score for the School-Based Assessment component may elect not to repeat this component, provided they rewrite the examination no later than 2 years immediately following their first attempt.*

*Resit candidates who have obtained a moderated score of less than 50 per cent of the maximum score for the School-Based Assessment component must repeat the component at any subsequent sittings. Resit candidates may enter through schools, recognised educational institutions or the Local Registrar's Office.*

## ◆ SECTION A: INTRODUCTION TO AGRICULTURE

### GENERAL OBJECTIVES

On completion of this section, students should:

1. *understand the concept of agricultural science and agriculture;*
2. *understand the role of agriculture in the local, regional and international economies;*
3. *be aware of the role of support services in modern agricultural economies; and,*
4. *be aware of the challenges affecting agriculture locally and regionally.*

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>1. <i>Agricultural Science and Agriculture</i></b>		
<i>Students should be able to:</i>		
1.1 <i>explain the relationship between agriculture and agricultural science;</i>	<i>Definition and scope of agriculture and agricultural science.</i>	
1.2 <i>explain the history of agriculture in the Caribbean;</i>	<i>Brief discussion of the development of agriculture in the region in pre-colonial, colonial and post-colonial times.</i>	
1.3 <i>describe conventional and non-conventional crops and livestock farming systems; and,</i>	<i>Aquaponics, hydroponics. Grow box, trough culture, urban and peri-urban farming.</i>	<i>Use non-conventional methods to grow crops, for example, grow box and trough culture.</i>
1.4 <i>explain the principles that govern organic farming.</i>	<i>Maintaining ecological balance and biodiversity; integrated pest and disease management of soils, crops and livestock; companion planting.</i>  <i>Certification of organic farms.</i>	<i>Use of herbal extract to control pests and diseases. For example, neem for crop and control of internal parasites in animals, Aloe Vera used in poultry.</i>

## SECTION A: INTRODUCTION TO AGRICULTURE (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>2. Role of Agriculture and Support Services</b>		
<i>Students should be able to:</i>		
2.1 discuss the importance of agriculture in national, regional and international economies;	<i>Role and importance of:</i> (a) <i>concept of food and nutrition security;</i> (b) <i>imported food compared to locally produced food;</i> (c) <i>foreign exchange earnings;</i> (d) <i>contribution to GDP;</i> (e) <i>employment;</i> (f) <i>land area in agriculture;</i> (g) <i>national and regional policies and plans for agricultural development and food and nutrition security; and,</i> (h) <i>trade liberalisation.</i>	<i>Interpretation and analysis of national, regional and international statistical reports.</i>
2.2 describe types of agricultural enterprises; and,	<i>Brief description of the scope and scale of agricultural operations from input suppliers, production, processing and marketing.</i>	
2.3 state the functions of the local, regional and international institutions.	<i>Local:</i> (a) <i>Ministries of Agriculture (MA); and,</i> (b) <i>Development Banks.</i>	

## SECTION A: INTRODUCTION TO AGRICULTURE (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Role of Agriculture and Support Services (cont'd)</b>		
<i>Students should be able to:</i>		
	<i>Regional:</i>	
	(a) <i>Caribbean Development Bank (CDB);</i>	
	(b) <i>Caribbean Agricultural Research and Development Institute (CARDI);</i>	
	(c) <i>The University of the West Indies (UWI) – Faculty of Food and Agriculture;</i>	
	(d) <i>College of Agriculture, Science and Education (CASE);</i>	
	(e) <i>The University of Trinidad and Tobago (UTT-ECIAF); and,</i>	
	(f) <i>Guyana School of Agriculture (GSA).</i>	
	<i>International:</i>	
	(a) <i>Inter-American Institute for Cooperation on Agriculture (IICA);</i>	
	(b) <i>Food and Agriculture Organization (FAO);</i>	
	(c) <i>Inter-American Development Bank (IDB);</i>	
	(d) <i>International Fund for Agriculture Development (IFAD);</i>	
	(e) <i>World Food Programme(WFP); and,</i>	
	(f) <i>Technical Centre for Agriculture and Rural Cooperation (CTA).</i>	

## SECTION A: INTRODUCTION TO AGRICULTURE (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>3. Challenges in Agriculture</b>		
<i>Students should be able to:</i>		
3.1 discuss the major challenges affecting local and regional agriculture and possible solutions.	Climate and topography, lack of appropriate technology, rural infrastructure, extension services, access to financing, praedial larceny, land tenure systems, environmental issues, availability of labour, ageing farming population, limited participation of youth, food safety (access to regional and international markets), natural disasters.	

### **Suggested Teaching and Learning Activities**

*To facilitate students' attainment of the objectives of this Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to promote inquiry-based learning that caters to students with various learning styles.*

1. *Encourage students to set up a small aquaponics system in the school.*
2. *Have students visit an organic farm to observe how the ecological balance is maintained.*
3. *Organise debates on the importance of Agriculture in national, regional and international economic.*
4. *Use computer-aided technology, for example, video clips, diagrams and charts obtained from the internet to aid in the teaching of topics.*
5. *Have students use the Internet to conduct literature review on challenges affecting local and regional agriculture.*
6. *Have students conduct Interview with farmers in the community on the challenges affecting them.*
7. *Encourage students to use the Internet to research the local, regional and international institutions and their role in the agricultural sector.*



## ◆ SECTION B: CROP PRODUCTION

### GENERAL OBJECTIVES

On completion of this section, students should:

1. understand the relationships between the physical environment and agriculture;
2. develop practical and investigative skills;
3. understand the structure and functions of plants;
4. understand the stages of crop growth in relation to yield;
5. produce vegetable crops efficiently and profitably;
6. develop safe practices in handling chemicals in crop production;
7. understand how crops can be improved by breeding, selection and biotechnology;
8. understand the significance of the various stages of maturity in relation to harvesting times; and,
9. understand the methods and importance of preserving crops.

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>1. Anatomy and Physiology</b>		
Students should be able to:		
1.1 explain the uses of plants in agriculture;	<i>Food, feed fibre, fuel, medicine, industrial uses and amenity (ornamental and recreational) uses.</i>	
1.2 describe the external and internal structure of plants;	External and internal structures of <i>monocotyledonous and dicotyledonous plants. Structure of cells, tissues and organs – seeds, stems roots, leaves, flowers and fruits. Relate structures to uses.</i>	Laboratory practical exercises, line drawings. <i>Use microscopes to view plant structures.</i>  <i>Select plants of agricultural and horticultural importance.</i>
1.3 describe the physiological functions of plants;	<i>Role of photosynthesis, respiration, transpiration, water and nutrient uptake, translocation, photoperiodism and phototropism. Relate structures to functions.</i>	

## SECTION B: CROP PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Anatomy and Physiology (cont'd)</b>		
Students should be able to:		
1.4 <i>distinguish between sexual and asexual reproduction in plants;</i>	<p>Sexual reproduction: pollination, fertilisation, seed formation.</p> <p>Asexual reproduction (vegetative propagation) – natural and artificial).</p> <p>Natural – rhizome, suckers, corms, bulbs, tuber, runners, stolons.</p> <p><i>Artificial (propagation techniques) – layering, root cuttings, stem cuttings, budding, grafting, tissue culture.</i></p> <p>Advantages and disadvantages of sexual and asexual reproduction including tissue culture.</p>	<p><i>Examination of different types of seeds.</i></p> <p><i>Visit plant nursery facility.</i></p>
1.5 <i>demonstrate the techniques used in plant propagation; and,</i>	<i>Techniques and technologies in plant nurseries, for example, seed planting, setting seeds, artificial plant propagation techniques.</i>	<p><i>Demonstration of budding and grafting techniques.</i></p> <p><i>Setting seeds and cuttings, layering.</i></p>
1.6 describe conditions necessary for germination of seeds, growing of seedlings and vegetative propagation.	Germination: hypogeal and epigeal growth, <i>conditions necessary for germination, growing of seedlings and vegetative propagation</i> ; nursery environment; stages of plant growth.	<p>Growing seedlings under varying conditions.</p> <p>Germination tests.</p>

## SECTION B: CROP PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>2. Environmental factors affecting crop growth</b>		
<i>Students should be able to:</i>		
2.1 discuss the effects of environmental factors on plant growth and development;	<p><i>Appropriate area for planting in relation to environmental factors (aerial and soil).</i></p> <p><i>Aerial: climate, temperature and sunlight, rainfall, wind, relative humidity.</i></p> <p><i>Soil: Type and fertility.</i></p> <p><i>Climate change.</i></p>	Set up and use of the rain gauge.
2.2 describe the process of soil formation;	Types of weathering – biological, chemical and physical.	
2.3 explain the importance of a soil profile;	Horizons – O, A, B, C and D ( <i>apply to crop management</i> ).	Examination of soil profiles from different locations.
2.4 describe the major components of soil;	<p>Inorganic – sand, silt, clay particles, <i>water and air</i>.</p> <p>Organic – humus, soil organisms.</p>	Collect soil sample and identify components by mechanical analysis.
2.5 describe the physical and chemical properties of soil types;	<p>Physical properties of soil: soil texture and structure; soil porosity and soil aeration; soil organic and mineral matter; soil temperature and soil organisms; soil water.</p> <p>Chemical properties of soils: <i>pH, nutrient content, organic matter content.</i></p> <p>Soil types: sand, <i>silt</i> and clay (<i>loam</i>).</p>	Laboratory activities to demonstrate water retention, pH, texture.

## SECTION B: CROP PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Environmental factors affecting crop growth (cont'd)</b>		
Students should be able to:		
2.6	<p><i>describe the availability of soil water for crop use;</i></p> <p>Hygroscopic, capillary, gravitational.</p> <p><i>Relate to soil types.</i></p>	Laboratory practical exercises involving soil water.
2.7	<p><i>explain the causes and effects of soil erosion;</i></p> <p><i>Definition of soil erosion.</i></p> <p><i>Agents (water, wind and man).</i></p> <p><i>Causes (for example, deforestation, burning and poor land and crop management).</i></p> <p><i>Effects (for example, loss of fertility and devaluation of land).</i></p>	<i>Observation of conditions in the environment.</i>
2.8	<p><i>state the importance of major nutrients used in crop production;</i></p> <p><i>Role of major nutrients.</i></p> <p><i>Identification of minor and trace nutrients.</i></p> <p>Deficiency symptoms of NPK.</p>	
2.9	<p><i>explain the factors affecting soil fertility;</i></p> <p><i>Definition of soil fertility.</i></p> <p>Climatic factors; biotic factors; topographic factors; soil factors (physical and chemical conditions of the soil and the nature of the parent material) and management.</p>	<p>Test and correct soil acidity and alkalinity.</p> <p>Experimental trials to grow seedlings using an organic fertilised soil versus an inorganic fertiliser on soil.</p>
2.10	<p><i>explain how soil fertility can be maintained; and,</i></p> <p>Factors enhancing soil fertility; soil and land management – cover cropping; irrigation and drainage, tillage, <i>measures to prevent erosion.</i></p>	<p>Identification of different types of fertilisers.</p> <p>Demonstration of fertiliser application.</p> <p>Practical field application.</p>

## SECTION B: CROP PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Environmental factors affecting crop growth (cont'd)</b>		
Students should be able to:		
2.11 explain soil and water conservation methods.	Forestry, terracing, windbreaks, grass bunds or barriers, strip cropping, contour cropping, vegetative cover, gabion, drains, ponds, tanks.	Field trip to water shed management area. Use an "A" frame (level) to establish contour lines.
<b>3. Genetics, breeding and biotechnology</b>		
Students should be able to:		
3.1 explain the basic principles of genetic inheritance in plant breeding;	The cell with emphasis on the nucleus and cell division, genes and chromosomes, variation.	Conduct laboratory activities.
3.2 <i>explain the role of plant breeding in the development of cultivars; and,</i>	<p>The importance of germplasm to maintain biodiversity.</p> <p>Heredity and environment (genotype and phenotype).</p> <p>Simple monohybrid crosses: homozygous and heterozygous conditions; dominance and recessiveness; hybridisation.</p> <p>Purpose of selection and breeding: objectives of increased yields and resistant varieties; issues involved.</p>	<p>Field trips to observe germplasm collections.</p> <p>Varietal trials: growing and making observations on the growth and production of different varieties of a given crop.</p> <p>Laboratory exercises.</p>
3.3 explain the nature and purpose of biotechnology in plant improvement.	<p>The significance of genetically engineered crops (artificial alteration of the genetic composition of the organisms); benefits and concerns.</p> <p><i>Genetically Modified Organisms (GMOs)</i></p> <p><i>Mutation breeding.</i></p>	Research on genetically transgenic crops.

## SECTION B: CROP PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>4. Land preparation and farm machinery</b>		
Students should be able to:		
4.1 explain land preparation methods;	<p><i>Purposes of land preparation.</i></p> <p>Site selection, land clearing, primary and secondary tillage, ridges and furrows, cambered beds, drains.</p>	Prepare land for planting a crop.
4.2 discuss the importance <i>and functions</i> of machinery in crop husbandry;	<p><i>Discussion on the importance of mechanisation.</i></p> <p><i>Simple machines.</i></p> <p>Seeders, harvesters, tractors and attachments.</p>	<i>Research Turners' sorrel harvesting machine.</i>
4.3 describe the safety precautions in the operation of tools, machinery and equipment; and,	Use of protective clothing, timing of operations, correct procedures.	
4.4 describe the care and maintenance of simple tools and equipment.	Simple tools, knapsack sprayer and mist blower.	Clean and maintain simple tools and knapsack sprayer.
<b>5. Crop management</b>		
Students should be able to:		
5.1 cultivate a fruit, root, and leaf crop;	<p>Fruit crop – for example, bean, tomato, sweet pepper, hot pepper, cucumber, okro.</p> <p>Root crop – for example, sweet potato, cassava, yam.</p> <p>Leaf crop – for example, lettuce, cabbage, chinese cabbage (pakchoi), spinach, seasoning herbs.</p>	<p>Include crop production activities in portfolio.</p> <p>Prepare business plan for one crop.</p>

## SECTION B: CROP PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Crop management (cont'd)</b>		
Students should be able to:		
5.2 describe the major cropping systems;	Include mixed cropping, mixed farming.	Plan a one-year crop rotation programme using leaf, legumes, root and fruit vegetables.
5.3 discuss the benefits of the cultural practices associated with crop production;	Moulding, mulching, staking, pruning, irrigating, fertilising.	Use cultural practices in producing a fruit, leaf, flower, and root vegetable crop.
5.4 explain the effects of weeds on crop production;	Weed-definition.  Effects of weeds on crops.	Collection and identification of 10 common weeds.  Practise weed control in vegetable production.
5.5 identify insect pests and the damages they caused;	Symptoms of damage caused by biting and chewing, piercing and sucking pests.	Collection of and categorising insects into groups of biting and chewing, piercing and sucking.
5.6 identify the cause, symptoms and mode of transmission of major crop diseases;	Fungi, bacteria, viruses, protozoa, nematodes, mycoplasma and insect transmitted diseases.	Collection and identification of diseased plants.
5.7 <i>explain</i> the effects of indiscriminate use of chemicals in the environment;	Pollution of groundwater, atmosphere, eutrophication, destruction of flora and fauna and marine life.	Safe handling, storage and disposal of chemical containers.
5.8 recommend the appropriate <i>methods of control of</i> weeds, pests and disease management; and,	Cultural, manual, mechanical, chemical, biological, Integrated Crop Management (ICM), categories of pesticides, genetic resistant varieties.	Use two appropriate methods to control pests and diseases.  Collect insect deterrent crops.

## SECTION B: CROP PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Crop management (cont'd)</b>		
Students should be able to:		
5.9 explain the importance of plant quarantine.	Plant regulations and measures.	Visit to quarantine stations.
<b>6. Harvesting and Post Production Management</b>		
Students should be able to:		
6.1 identify when crops are ready to for harvesting;	<i>Appropriate stages of maturity:</i> Cucumber, tomato, bean, sweet pepper, cassava, sweet potato, yam, okra, lettuce, cabbage.	
6.2 recommend the appropriate harvesting methods for crops;		
6.3 explain post-harvest handling procedures for various crops; and,	<i>Root crops.</i> <i>Fruit crops.</i> <i>Leafy vegetables.</i> <i>Ornamentals.</i>	
6.4 explain the importance of preserving crops.	Methods of preserving crops; cooling, freezing and drying.	Visit a food processing plant.  Develop a processed product from the crops cultivated. Conduct an open day in collaboration with other departments.



## SECTION B: CROP PRODUCTION (cont'd)

### Suggested Teaching and Learning Activities

*To facilitate students' attainment of the objectives of this Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to promote inquiry-based learning that caters to students with various learning styles.*

- 1. Encourage students to keep a practical/laboratory note book on all practical activities drawn from this section.*
- 2. Engage students in conducting group and individual research projects on topics such as Genetics, Breeding and Biotechnology.*
- 3. Invite resource persons to address topics such as the effects of environmental factors on plant growth, and the role of plant breeding in the development of cultivars.*
- 4. Conduct guided tours, field trips and demonstration visits to agricultural stations and farms that relate to topics in this section. For example, the techniques used in plant propagation- such as budding and grafting; view machinery and equipment used in crop production such as seeders, harvesters, types of tractors and attachments.*
- 5. Use video clips, diagrams and charts obtained from the internet to aid in the teaching of topics. A wide range of resources are available at [www.agrisciencevideos.blogspot.com](http://www.agrisciencevideos.blogspot.com)*
- 6. Encourage students to write newspaper articles for fact sheets and publications on a range of topics in this section.*
- 7. Ask students to create posters and charts relating to Post-Production Management and Integrated Crop Management.*
- 8. Conduct class discussions and debates on topics such as the use of chemicals in the environment and the purpose of biotechnology in plant improvement.*
- 9. Encourage students to develop a glossary of Crop Production terms and definitions drawn from this section.*
- 10. Engage students in group activities such as collecting and mounting specimens for weeds and insects.*
- 11. Have students visit agricultural exhibitions and related activities (for example, flower shows, farm equipment and machinery displays).*
- 12. Encourage students to collect publications – bulletins, magazines, newspaper articles as they are related to specific topics in this section.*

## ◆ SECTION C: ANIMAL PRODUCTION

### GENERAL OBJECTIVES

On completion of this section, students should:

1. demonstrate an understanding of livestock production in the Caribbean region;
2. understand the principles of good management practices of the rearing of livestock;
3. understand the technologies used in producing animals and animal products;
4. *demonstrate an understanding of the scientific principles that inform livestock production, management and technologies;*
5. appreciate the economic importance to be derived from the rearing of livestock; and,
6. *develop practical and investigative skills.*

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>1. Introduction to animal sciences</b>			
Students should be able to:			
1.1	List the breeds of each class of animals commonly reared in the Caribbean;	<u>Cattle Dairy:</u> Jersey Jamaica Hope, Holstein. <u>Beef:</u> Jamaica Black, Charolaes, Zebu, Buffalypso.	
1.2	state the purpose for which the different breeds of animals are reared; and,	<u>Pigs:</u> Landrace, Large White, Duroc, Hampshire, Tamworth. <u>Goats:</u> British Alpine, Anglo Nubian, Saanen, Toggenburg. <u>Sheep:</u> Barbados Black Belly, Black Head Persian, West African, Virgin Island White.	

## SECTION C: ANIMAL PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Introduction to animal sciences (cont'd)</b>		
Students should be able to:		
<u>Rabbits:</u>	Flemish Giant, New Zealand White and Red, California, Chinchilla.	
<u>Poultry:</u>	Layers-White Leghorn, Rhode Island Red, Bevan Brown, Hyline or Hybrid Crosses; Broilers – Vantress Cross or other hybrid crosses, for example, Peterson, Shaver.	
1.3 <i>list the species of fish and bees.</i>	<i>Fresh water and marine culture</i>	
<b>2. <i>Structure, anatomy and physiology</i></b>		
Students should be able to:		
2.1 compare the structures and functions of the digestive systems ruminants and non-ruminants;	(a) Birds; (b) Pigs; and, (c) Sheep, goat or cattle.	Examine and identify the parts of the digestive system of a bird.  Visits to abattoir.  Video presentation.  View preserved parts of the digestive system of ruminant and non-ruminant animals.

## SECTION C: ANIMAL PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
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### **Structure, anatomy and physiology (cont'd)**

Students should be able to:

2.2	describe the process of digestion in ruminant and non-ruminant animals; and,	
2.3	compare digestion between ruminant and pseudo-ruminant animals.	Rabbit.  Examine and identify the parts of the digestive system of a rabbit.

### **3. Animal nutrition and management**

3.1	state the functions of carbohydrates, proteins, fats, minerals, vitamins and water;	Sources of nutrients:  - Use of bagasse, molasses, fish meal, rice bran, broken rice, wheat middling, citrus meal, coconut meal, brewers grain (hops), cocoa pod meal, urea.  Macro and micro minerals (copper, zinc, selenium, calcium, phosphorus, cobalt) and B vitamins.	Use simple food tests to identify carbohydrates, proteins and fats.  Examine samples of different feedstuffs.
3.2	explain 'a complete ration';	Production and maintenance ration.	Examine labels from commercial ration and identify the nutrient components.  Visit a feed mill.
3.3	select appropriate rations for each stage of growth of broilers and layers;	Include: (a) starter; (b) grower; (c) finisher; and, (d) layer feed.	Rear a batch of broilers and layers.  Record feed intake, weight gain for batch of broilers.

## SECTION C: ANIMAL PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b><i>Animal nutrition and management (cont'd)</i></b>		
Students should be able to:		
3.4	calculate Feed Conversion Ratio (FCR);	
3.5	explain the importance of FCR;	<i>Optimise income/revenue.</i> <i>Minimise waste.</i> <i>Manage factor affecting FCR.</i>
3.6	describe systems of grazing;	Include rotational grazing, zero grazing, continuous grazing.  Field trip: observe pasture management.
3.7	state the advantages and disadvantages of different grazing systems;	
3.8	explain the importance of forages (grasses and legumes) in livestock feeding;	Grasses: pangola, elephant, guatemala, antelope, african star, para, guinea, tanner, king grass.  Legumes: gliricidia, kudzu, stylosanthes, desmodium, leucaena, centrosema.  Other forages: mulberry, neem.  Maintenance of small grass and legume plots.  Identify, collect and mount forage plants.
3.9	explain the measures used to feed ruminants when forage is unavailable;	Supplementary feeding, concentrate, silage, hay.
3.10	describe the management practices associated with the care of baby chicks and baby rabbits (kittens);	Conduct management practices in rearing broilers, layers and rabbits.

## SECTION C: ANIMAL PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
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### Animal nutrition and management (cont'd)

Students should be able to:

3.11	explain the management practices associated with rearing broilers, layers and rabbits;	Include feeding, cannibalism, sanitation.	Rear rabbits and a batch of broilers and layers.
3.12	rear a batch of 50 broilers per term;		Prepare a simple business plan for a batch of broilers.
3.13	describe the general signs of illness in farm animals;		
3.14	identify the cause, clinical signs prevention and control of pests and diseases of poultry and rabbits;	Poultry – coccidiosis.  Rabbits – air mites, sniffles.	
3.15	identify the cause, signs, prevention and control of internal parasites of livestock;		
3.16	explain the factors to be considered in establishment and management of a fish farm;	(a) Side selection; (b) Feeding, fertilisation; (c) Weed control; (d) Predator control; (e) Drainage; and, (f) Harvesting.	

## SECTION C: ANIMAL PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
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### Animal nutrition and management (cont'd)

Students should be able to:

- |      |   |                       |
|------|---|-----------------------|
| 3.17 | explain the factors to be considered in the siting and establishment of an apiary;                          |                       |
| 3.18 | explain the economic importance of bees;  |                       |
| 3.19 | differentiate among the types of bees in a hive;  | Queen, drone, worker. |
| 3.20 | describe the social activities of bees;   |                       |
| 3.21 | identify the causes, symptoms, prevention, control and cure of pests and diseases infestation in bees; and, |                       |
| 3.22 | describe the harvesting of honey and other bee products.  |                       |

## SECTION C: ANIMAL PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>4. Animal genetics, breeding and reproduction</b>		
Students should be able to:		
4.1	explain different breeding systems in animal production;	Cross-breeding, upgrading, in-breeding, back crossing.
4.2	explain the advantages of cross-breeding;	Advantages of cross-breeding: heterosis, disease resistance, improved production.
4.3	explain genetic engineering in livestock production;	The significance of biotechnology or genetic engineering (artificial alteration of the generic composition of the (organisms); benefits and concerns including ethical and religious.
4.4	differentiate among the terms:  (a) ovulation;  (b) fertilisation;  (c) gestation;  (d) oestrous cycle; and,  (e) kindling, parturition, farrowing.	
4.5	describe the process of artificial insemination (AI) in farm animals;	Artificial insemination; frozen semen.
4.6	evaluate the use of AI in farm animals;	Advantages and disadvantages of AI. Signs of heat in farm animals.



## SECTION C: ANIMAL PRODUCTION (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
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### Animal genetics, breeding and reproduction (cont'd)

Students should be able to:

4.7	state the benefits of oestrus synchronisation;	Oestrus synchronisation – fixed to form artificial insemination.  Benefits:  (a) improvements of the herd;  (b) cheaper than importing an animal;  (c) reduces the transmission of diseases;  (d) animals having difficulty with breeding will be able to produce a young to increase and improve herd; and,  (e) ease of management.	
4.8	relate the structure of the parts of an egg to its function; and,		Examine the internal and external parts of an egg.
4.9	describe the process of incubation in poultry.	Natural and artificial incubation.  Candling.	Experiment with small scale incubators.  Visit to hatcheries.

### 5. Animal products

Students should be able to:

5.1	<i>demonstrate proper procedures in slaughtering, dressing and handling farm animals;</i>	Age five to six weeks.  <i>Slaughtering procedures.</i>  <i>Disposal of waste.</i>  <i>Proper storage.</i>  <i>Proper sanitation practices.</i>	Slaughter and dress broilers (availability of animals).  Conduct marketing strategies to sell broilers.  Conduct an open day in collaboration with other departments.
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## SECTION C: ANIMAL PRODUCTION (cont'd)

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Animal products (cont'd)</b>			
Students should be able to:			
5.2	determine the dressing percentage of different farm animals;	Economic age, weight and time to slaughter animals, live weight versus carcass weight.	Calculation of dressing percentage of broilers.
5.3	list the principal farm animal products and by-products including those derived from the offal; and,	<p>Egg production, milk processing and preservation, honey production, wax, bee bread and royal jelly.</p> <p>Importance of fish as a source of protein for human nutrition and livestock feed.</p> <p>Eggs – dried eggs, shell as fertiliser, handicraft, calcium supplements for bird.</p> <p>Meat – cured meat (sausage, ham, bologna).</p> <p>Milk – cheese, yogurt.</p> <p>Manure – biogas.</p>	<p>Identification of meat cuts and carcass quality.</p> <p>Visit to milk processing facility.</p>
5.4	<i>demonstrate the practices involved in rearing layer birds and the production of eggs.</i>	<i>Housing, nesting, feeding, litter management.</i>	Collect, clean, sort, grade and pack eggs.

### Suggested Teaching and Learning Activities

*To facilitate students' attainment of the objectives of this Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to promote inquiry-based learning that caters to students with various learning styles.*

1. *Have students create a scrap book containing pictures of the various classes and breeds of livestock in the Caribbean.*
2. *Organise visits to livestock farms to observe management practices and physical characteristic of farm animals.*

## SECTION C: ANIMAL PRODUCTION (cont'd)

3. *Have students create models of the three main systems of the management of livestock.*
4. *Invite subject area specialist to lecture on areas such as Biotechnology and GMOs.*
5. *Have students collect, mount and display pasture grasses and legumes found within their community.*
6. *Use PowerPoint presentations to show the effects of diseases in animals.*
7. *Organise debates on issues such as the pros and cons of genetic improvement and genetic modification of organisms.*

## ◆ SECTION D: THE BUSINESS OF FARMING

### GENERAL OBJECTIVES

On completion of this section, students should:

1. understand that the farm is an economic unit engaged in profitable production of commodities;
2. *appreciate* that success in any business venture is dependent on proper planning, management and accurate record keeping;
3. understand the importance of marketing as an economic activity that links production to consumption; and,
4. understand the role of international trade agreements and their impact on the agricultural sector.

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>1. Economic factors of production</b>		
Students should be able to:		
1.1 relate the factors of production to agriculture;	Land – suitability.  Labour – farmer’s and hired.  Capital:  (a) Source – commercial banks; agricultural banks; cooperatives; credit unions; and,  (b) Types – fixed capital, working capital.  Management/Entrepreneurship.	
1.2 <i>explain the concepts of value chain and supply chain;</i>	<i>Include definition of supply chain and value chain.</i>	
1.3 explain the relationship among production, marketing and consumption;	<i>Include definition of production, marketing, and consumption.</i>	

## SECTION D: THE BUSINESS OF FARMING (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Economic factors of production (cont'd)</b>		
Students should be able to:		
1.4	relate changes of demand and supply to pricing; and,  <i>Including definition of demand and supply, factors affecting demand and supply, factors influencing changes in demand and supply and its impact on pricing.</i>  Equilibrium points.	Plotting of demand and supply curves.
1.5	explain the law of diminishing returns.  <i>Total product, average product, marginal product, marginal cost. Include calculations and graphical representations.</i>	
<b>2. Farm financing and support services</b>		
2.1	outline the process of obtaining capital from established sources;  <i>Collateral, credit history, budget, employment status, business plan (project proposal).</i>  <i>Types of financial institutions that provide credit and state their functions.</i>  Challenges in obtaining credit.	
2.2	discuss the roles and functions of agricultural cooperatives; and,  <i>Include principles of cooperatives, types of cooperatives, benefits and management problems.</i>	
2.3	discuss the incentives that are available to farmers.  Subsidies, price support and tax exemptions.	

## SECTION D: THE BUSINESS OF FARMING (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>3. Farm organisation and planning</b>		
Students should be able to:		
3.1 prepare different types of farm records;	Benefits of record-keeping.  Crop production records: <i>labour, financial, chemical treatment, farm inventory, growth.</i>  <i>Livestock production records: health, feeding, reproduction and production.</i>	Analysis of records for decision making.
3.2 calculate gross farm income and net farm income, gross margin and net profit; and,	Income and expenditure: value of outputs, fixed costs and variable costs, importance of gross margin, interpret gross margin and net profit.	Use of farm records.
3.3 differentiate a complete budget from a partial budget.		Prepare a complete budget and a partial budget. Use budget for decision making.  Create a simple business plan.
<b>4. Marketing of agricultural products</b>		
4.1 discuss the role of marketing in agricultural production;	Identification of different market segments for agricultural products.  Use of market information in production decisions.	Visit supermarkets, hotels, and other buyers.  Administer questionnaires/ conduct interviews.
4.2 identify the steps of marketing;	Pricing, advertising, labelling and distribution, assembling, sorting and grading, processing, packaging, storage and transportation.	Research samples of marketing plans on the internet.  Critique labelling samples.

## SECTION D: THE BUSINESS OF FARMING (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Marketing of agricultural products (cont'd)</b>		
<i>Students should be able to:</i>		
4.3	explain the process involved in the marketing of agricultural products; and,  Processes involved in the marketing of agricultural produce (crops, eggs, meat).	
4.4	explain the importance international trade agreements on the agricultural sector and peoples of the Caribbean.  Explanation of the importance of trade and trade agreements to market access.  Examples include:  (a) CARICOM Single Market and Economy (CSME);  (b) World Trade Organisation (WTO);  (c) Economic Partnership Agreement (EPA); and,  (d) Caribbean Basin Initiative (CBI).	Research on internet.

### **Suggested Teaching and Learning Activities**

*To facilitate students' attainment of the objectives of this Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to promote inquiry-based learning that caters to students with various learning styles.*

1. *Invite guest lecturer to speak on the marketing of agricultural products.*
2. *Show students examples of complete and partial budgets and then ask them to prepare a sample partial budget.*
3. *Allow students to do presentations on trade agreements.*
4. *Have students collect and analyse farm records from the school farm.*

## ◆ SECTION E: CROP AND ANIMAL MANAGEMENT TECHNOLOGIES

### GENERAL OBJECTIVES

*On completion of this section, students should:*

1. *appreciate the importance of data collection and use in decision making in crop and livestock management;*
2. *employ good agricultural practices in crop and livestock production, and post-production management;*
3. *demonstrate the use of appropriate technologies for crop and livestock production, and post-production management;*
4. *appreciate the importance of value chains in the agriculture sector; and,*
5. *appreciate the use of farm buildings and machinery in the crop and livestock production, and post-harvest management.*

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>1. Environmental monitoring</b>		
<i>Students should be able to:</i>		
1.1 demonstrate the use of appropriate technology for collection of environmental data;	<i>Precision agriculture – definition and advantages.</i>  <i>Equipment used for agrometeorology, soil water and nutrient monitoring.</i>	
1.2 analyse environmental data;	<i>Analysing data using descriptive statistics and graphs; trends.</i>	
1.3 apply environmental data to decision-making in crop and livestock management; and,	<i>Decision-making about environmental management for different crops (greenhouse, container gardens, field) and livestock (intensive and extensive systems) production systems.</i>	



## SECTION E: CROP AND ANIMAL MANAGEMENT TECHNOLOGIES (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Environmental monitoring (cont'd)</b>		
<i>Students should be able to:</i>		
1.4 demonstrate the use of appropriate technologies for conservation of environmental resources.	<i>Climate smart agriculture. Soil, soil nutrient and water conservation strategies (rain water harvesting, organic and plastic mulches).  Pasture management – overgrazing, compaction.  Integrated approaches to production.  Careers.  Entrepreneurial opportunities.</i>	

### **2. Nursery management technologies**

*Students should be able to:*

2.1 demonstrate the preparation of compost using suitable materials;	<i>Composting – use of composts; materials; composting methods, and equipment.</i>
2.2 prepare appropriate propagation and growing media for seedlings and vegetatively propagated crops;	<i>Sterilise propagation and growing media.  Ornamental, turf grass, vegetables, fruit crop species (citrus, mango, avocado, golden apple/June plum), roots and tubers (tissue culture).</i>
2.3 demonstrate proper handling procedures for different types of media;	

## SECTION E: CROP AND ANIMAL MANAGEMENT TECHNOLOGIES (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Environmental monitoring (cont'd)</b>		
<i>Students should be able to:</i>		
2.4	<i>assess seed quality;</i>	
2.5	<i>recommend suitable seed storage procedures; and,</i>	
2.6	<i>demonstrate proper procedures and choice of equipment for establishing plants in a nursery.</i>	<i>Use of growth regulators.  Opportunity for careers and entrepreneurship.</i>
<b>3. Technologies for non-conventional crop production</b>		
<i>Students should be able to:</i>		
3.1	<i>explain the importance of alternative crop production systems in the Caribbean;</i>	<i>Protected agriculture; soilless agriculture; container gardens; hydroponics. Organic agriculture.</i>
3.2	<i>recommend crop cultivars that are tolerant or resistant to specific abiotic and biotic stresses;</i>	<i>Heat, drought, disease, herbicide resistant/ tolerant cultivars.</i>

## SECTION E: CROP AND ANIMAL MANAGEMENT TECHNOLOGIES (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Technologies for non-conventional crop production (cont'd)</b>		
<i>Students should be able to:</i>		
3.3 design a suitable cropping system for production of a crop under conditions of environmental stress using appropriate techniques and technologies;	Cropping systems and environmental stress-abiotic and biotic including spacing and plant arrangement; time of planting.	
3.4 recommend appropriate strategies for water and nutrition management;	Water and nutrient management strategies; factors influencing choice.  Use of data to determine crop nutrient and water needs, including calculations (quantities and rates).	
3.5 demonstrate the use of simple water and nutrition management technologies;	Irrigation technologies.  Nutrition application technologies – organic and inorganic.	
3.6 design an integrated pest management programme;	Concept of integrated pest management. Components of an IPM programme.	
3.7 demonstrate the use of pest management technologies; and,	Biological (including compost teas), cultural, chemical technologies.  Calculations – rates, quantities.	

## SECTION E: CROP AND ANIMAL MANAGEMENT TECHNOLOGIES (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Technologies for non-conventional crop production (cont'd)</b>		
<i>Students should be able to:</i>		
3.8 apply other required crop management strategies.	Staking, size management, pruning.  Opportunity for careers and entrepreneurship.	
<b>4. Management practices for livestock</b>		
<i>Students should be able to:</i>		
4.1 demonstrate the practices involved in the care of young farm animals;	Hatcheries for fish and birds. Temperature control for incubation period, type of feed, brooding, immunisation, feeding, debeaking, sanitation. Economic uses of young animals.	Visit hatchery.  Visit livestock farm.
4.2 suggest the housing requirements for different classes of livestock;	Types of material – advantages and disadvantages.  Types of housing designs: orientation of building; ventilation; temperature; ease of cleaning.	
4.3 describe management practices in the rearing livestock;	Poultry, sheep and goat, pig, rabbit, bees.	
4.4 identify the major pests and diseases affecting different classes of livestock;	Good agricultural practices, ethical issues – use of antibiotics, and hormones.	
4.5 implement control measures for various pests and diseases; and,	Pest and disease prevention control: deworming, spraying, vaccinations.	

## SECTION E: CROP AND ANIMAL MANAGEMENT TECHNOLOGIES (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Management practices for livestock (cont'd)</b>		
<i>Students should be able to:</i>		
4.6	discuss the role of biotechnology in animal production.	<p>Concept of biotechnology.</p> <p>Mention methods.</p> <p>Benefits and challenges.</p>
<b>5. Harvesting, post-harvesting management and value addition</b>		
<i>Students should be able to:</i>		
5.1	determine the correct stage for harvesting crops;	<p>Maturity indices.</p> <p>Display samples of various crops at acceptable stages of maturity.</p>
5.2	recommend appropriate harvesting procedures;	<p>Harvesting procedures: time of day, manual versus mechanical harvesting methods, removal of the crop, concern for harvested portion and plant.</p>
5.3	use appropriate harvesting technology;	<p>Techniques in manual harvesting and the use of harvesting aids to minimise damage, choice and handling of containers.</p>
5.4	design a post-harvest management system;	<p>Definition of post-harvest management.</p> <p>Advantages: maintaining crop quality and reducing crop loss.</p> <p>Procedures: transport from the field, humidity management, sanitation, minimising of damage, sorting of damaged or diseased and storage.</p> <p>Differences in crop requirements.</p>
5.5	implement proper post-harvesting procedures; and,	<p>Specific post-harvesting procedures for different crops.</p> <p>Post-harvest equipment.</p>

## SECTION E: CROP AND ANIMAL MANAGEMENT TECHNOLOGIES (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Management practices for livestock (cont'd)</b>		
<i>Students should be able to:</i>		
5.6 recommend processes for adding value to the crop produced.	Minimal processing, packaging, product transformation (for example freezing, preservation to create products such as flour, chips), labelling, grading.  Opportunity for careers and entrepreneurship.	Prepare a value-added product.
<b>6. Post production handling and processing of livestock</b>		
<i>Students should be able to:</i>		
6.1 describe the processes used to prevent food spoilage;	Include cooling, drying, pasteurisation, UHT (Ultra High Temperature), curing, smoking of animal products.	Demonstration of preservation by smoking and salting meat.
6.2 identify principal cuts of meat;	Cuts of meat in animals sought by consumers. Quality requirements of various meat cuts.	Use charts, and video presentations.
6.3 describe the food safety requirements for the processing of food; and,	Application of Hazard Analysis Critical Control Points (HACCP) for these processes.	
6.4 describe the utilisation of animal by-products and animal waste into value added products.	Include biogas, organic fertilisers, pen manure.	

## SECTION E: CROP AND ANIMAL MANAGEMENT TECHNOLOGIES (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>7. Agro-engineering</b>		
<i>Students should be able to:</i>		
7.1 design simple farm structures;	Plant nursery, greenhouse structures, post-production facilities, machinery shed, compost shed, worker's facilities.	Make models, visit farms.
7.2 recommend suitable materials for use in farm buildings;	Types of materials.  Advantages and disadvantages.  Proper maintenance.	
7.3 demonstrate the safety precautions in the operation of tools, machinery and equipment;	Occupational health and safety in the workplace.  Certification.  Proper use and disposal of agricultural chemicals and containers.	
7.4 describe the use and operation of mechanical systems in farm equipment; and,	Transmission systems, pulleys, levers, gears, engines, wheels and axle.	Visit to a mechanical shop or the engineering department of a farm or a school, trade shows or agricultural exhibition.
7.5 demonstrate the appropriate care and maintenance of simple tools and equipment.	The care and maintenance of knapsack sprayer, simple tools, mist blower, weed trimmer, irrigation pumps or equipment.  Defeathering machines, debeakers, clippers, milking machine	

## **SECTION E: CROP AND ANIMAL MANAGEMENT TECHNOLOGIES (cont'd)**

### **Suggested Teaching and Learning Activities**

*To facilitate students' attainment of the objectives of this Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to promote inquiry-based learning that caters to students with various learning styles.*

1. *Have students collect weather data for the last five years at the school or for the area in which the school is located and analyse the data using graphs and descriptive statistics. Student should use the information from the weather data analysis to predict the weather conditions during the crop and livestock projects.*
2. *Encourage students to develop a crop or livestock production plan using good agricultural practices and climate-smart technologies based on the predicted weather conditions.*
3. *Allow students to demonstrate proper use and maintenance of equipment during crop and livestock production.*
4. *Have students demonstrate proper harvesting/collection and post-production management of crop/livestock products.*
5. *Allow students to prepare the value-added crop and livestock products for sale.*
6. *Encourage students to use appropriate technology in data collection, analysis, storage, production planning, crops and livestock production, post-production management and value-addition activities.*



## ◆ SECTION F: ENTREPRENEURSHIP AND COMMUNICATION IN THE AGRICULTURAL SECTOR

### GENERAL OBJECTIVES

On completion of this section, students should:

1. appreciate the importance of entrepreneurship to the agricultural sector;
2. understand the importance of effective communication to the success of an enterprise;
3. employ a range of tools and techniques to communicate effectively to different audiences; and,
4. demonstrate the use of effective planning for the establishment of a new enterprise.

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>1. Entrepreneurship in agriculture</b>		
<i>Students should be able to:</i>		
1.1 discuss the concept of entrepreneurship;	<p>Definition of entrepreneurship and the entrepreneur.</p> <p>Types of entrepreneurs (opportunity based entrepreneur and necessity based entrepreneur).</p> <p>Reasons for starting a business (desire for financial independence, self-fulfilment, self-actualisation).</p> <p>Characteristics of an entrepreneur (innovative, creative, risk taker, visionary, dynamic, persistent, achievement-oriented).</p>	
1.2 discuss the forms of business organisations and arrangements;	<p>Characteristics of the sole trader, partnerships, cooperatives, limited company, franchises, state-owned corporations and non-government organisations.</p> <p>Advantages and disadvantages of each.</p>	

## **SECTION F: ENTREPRENEURSHIP AND COMMUNICATION IN THE AGRICULTURAL SECTOR (cont'd)**

<b>SPECIFIC OBJECTIVES</b>	<b>CONTENT</b>	<b>SUGGESTED PRACTICAL ACTIVITIES</b>
<b><i>Entrepreneurship in agriculture (cont'd)</i></b>		
<i>Students should be able to:</i>		
1.3 explain the steps in the establishing an agricultural enterprise;	Identification of business opportunities (research).	Prepare a business and marketing plan.
	Feasibility analysis (management, operational, financial and marketing).	Make oral presentation, utilising relevant communication tools on potential new business.
	Development of business plan (basic structure of a business plan – Title page, table of contents, executive summary, description of company, products and services, marketing plan, operational plan, management structure, financial plan and farm plan).	
	Determination of resources (land, human, financial, material).	
	Acquiring resources: sources of capital, savings, equity and debt; land – lease, family owned, purchase, rent.	
1.4 discuss the importance of Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis in decision making for agricultural enterprises;	Management of the operations of the enterprise.	
	Examples of SWOT analysis for different types of agricultural enterprises.	Develop a SWOT analysis with students based on current trends.

## SECTION F: ENTREPRENEURSHIP AND COMMUNICATION IN THE AGRICULTURAL SECTOR (cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>Entrepreneurship in agriculture (cont'd)</b>		
<i>Students should be able to:</i>		
1.5 identify the factors that contribute to the success and failure of entrepreneurs in agricultural enterprises; and,	<p><i>Factors influencing success should include: knowledge of business; development of a business and marketing plan/strategy; management of financial and human resources; understanding and interpretation of financial statements (profit and loss statements, record keeping, compliance, adequate financing, cash flow management); favourable enabling/policy environment; access to factors of production; farm management; business ethics.</i></p> <p><i>Factors influencing failure should include: management, operational, marketing and financial failures; farm management; other internal factors related to the enterprise; external factors, including weak enabling environment.</i></p>	
1.6 explain the purpose of key financial statements in decision making.	<i>Purpose and interpretation of: profit and loss account; balance sheet; and, cash flow.</i>	<i>Provide examples of each.</i>

**SECTION F: ENTREPRENEURSHIP AND COMMUNICATION IN THE AGRICULTURAL SECTOR**  
(cont'd)

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<b>2. Communication in Agri-Business</b>		
<i>Students should be able to:</i>		
2.1 describe the various channels of communication used in agricultural enterprises;	<p><i>Channels of Communication:</i></p> <p>(a) <i>Directional formal/official; informal/unofficial.</i></p> <p>(b) <i>Oral face to face; interviews; meetings and conferences; radio and television; telephone; intercom.</i></p> <p>(c) <i>Electronic tele-conferencing, video-conferencing; computer, Internet, intranet, world wide web, electronic mail, social media; telephone; facsimile; scanning, scan to email, scan to file, SMS.</i></p> <p>(d) <i>Written letters; memoranda; agendas, notices of meetings; reports, minutes; questionnaires; itineraries; notices, press releases; advertisements.</i></p> <p>(e) <i>Visual pictures, charts, graphs; signs; multi-media presentations; body language; brochures, posters, flyers.</i></p>	<p><i>Create blogs, posters, jingles for 'local eat what you grow' campaign.</i></p> <p><i>Create five-minute PowerPoint presentations to 'potential investors' or bankers of business idea using graphics.</i></p> <p><i>Create one-minute advertisement to promote products produced by agricultural enterprise.</i></p> <p><i>Create labels for products or produce.</i></p> <p><i>Use social media to promote products produced by enterprise.</i></p> <p><i>Create a logo and slogan for a product from an agricultural enterprise.</i></p>

## **SECTION F: ENTREPRENEURSHIP AND COMMUNICATION IN THE AGRICULTURAL SECTOR (cont'd)**

<b>SPECIFIC OBJECTIVES</b>	<b>CONTENT</b>	<b>SUGGESTED PRACTICAL ACTIVITIES</b>
<b>Communication in Agri-Business (cont'd)</b>		
<i>Students should be able to:</i>		
2.2 identify factors affecting the selection of communication channel;	<p><i>Factors to be considered in selecting communication channel:</i></p> <ul style="list-style-type: none"> <li>(a) degree of urgency;</li> <li>(b) genre (oral, written, electronic, visual);</li> <li>(c) level of confidentiality, privacy;</li> <li>(d) location and distance, time zones;</li> <li>(f) cost, efficiency, effectiveness; and,</li> <li>(g) audience size.</li> </ul>	
2.3 discuss the barriers to effective communication;	<p><i>Barriers to communication, including:</i></p> <ul style="list-style-type: none"> <li>(a) perceptual, cultural and personal bias;</li> <li>(b) semantics;</li> <li>(c) language;</li> <li>(d) literacy skills; and,</li> <li>(e) Internal, external barriers.</li> </ul>	<i>Use local situations to depict these barriers to communication to students.</i>
2.4 explain the advantages and disadvantages of different communication tools and technologies; and,	<i>Speaking, writing, photography skills. Presentation tools – Microsoft PowerPoint, Prezi. Use of the internet in communication – emails, blogs, social media. Etiquette.</i>	

## **SECTION F: ENTREPRENEURSHIP AND COMMUNICATION IN THE AGRICULTURAL SECTOR (cont'd)**

<b>SPECIFIC OBJECTIVES</b>	<b>CONTENT</b>	<b>SUGGESTED PRACTICAL ACTIVITIES</b>
<b>Communication in Agri-Business (cont'd)</b>		
<i>Students should be able to:</i>		
2.5 communicate effectively for different purposes within and outside of the food and agriculture sector.	<p><i>Purposes of communication – awareness, information, education, persuasion (demonstrations, interviews, newsletters, manuals, posters, social media).</i></p> <p><i>Communication in the workplace – letters, memos, instructions.</i></p> <p><i>Communication with stakeholders in food and agriculture.</i></p>	

### **Suggested Teaching and Learning Activities**

*To facilitate students' attainment of the objectives of this Syllabus, teachers are advised to engage students in the teaching and learning activities below. These activities are designed to promote inquiry-based learning that caters to students with various learning styles.*

1. *Organise visits to small agro business enterprises to observe their operation and management practices as it relates to the agriculture sector.*
2. *Guide students in the preparation of financial statements for crop and animal production projects they have done.*
3. *Have students organise and manage the marketing of products produced within the school from their projects.*
4. *Have students examine the means of communication systems within the agricultural sector in their area.*
5. *Organise visits to the department or ministry of agriculture for students to observe the methods and channels of communications used within the sector.*

## ◆ GUIDELINES FOR THE CONDUCT OF SCHOOL-BASED ASSESSMENT

### RATIONALE

School-Based Assessment (SBA) is an integral part of student assessment in the course covered by this syllabus. It is intended to assist students in acquiring certain knowledge, skills and attitudes that are critical to the subject. The activities for the SBA are linked to the “Suggested Practical Activities” and should form part of the learning activities to enable the student to achieve the objectives of the syllabus.

During the course of study of the subject, students obtain marks for the competence they develop and demonstrate in undertaking their SBA assignments. These marks contribute to the final marks and grades that are awarded to students for their performance in the examination.

The guidelines and samples provided in the syllabus are intended to assist teachers and students in selecting activities that are valid for purposes of SBA. The assessment criteria provided are intended to assist teachers in awarding marks that are reliable estimates of the achievement of students on the SBA and other components of the syllabus.

*The School-Based Assessment component of the syllabus will comprise assignments which integrate the **CVQ\*** Level 1 standards. Students will complete assignments which incorporate relevant **CVQ\*** Level 1 units. Candidates who successfully complete the **CSEC®** examination will be awarded the **CSEC®** certificate. Where applicable candidates may also be awarded a Statement of Competence with the Units for which they have attained competence for the Level 1 **CVQ\***.*

**Regional Occupational Standard for the Caribbean Vocational Qualification (CVQ\*) are:**

1. **CCAGH 10107 Level 1 in Crop Production; and,**
2. **CCAGL 10107 Level 1 in Livestock Rearing.**

### PROCEDURES FOR CONDUCTING SBA

Candidates are required to keep a Portfolio which comprises documentation on the skills performed in the field, one investigation in crop production and one investigation in animal production.

#### (i) **Assessment of Skills in the Field**

The student will be credited for performance on each of ten (10) skills on which he or she is examined. The score on each skill can range from 0 – 4; the performance criteria for awarding marks are described below:

- 0 - indicates a performance which demonstrates incompetence, carelessness, neglect or forgetfulness.
- 1 - indicates a performance which demonstrates some of the basic mechanics and is uncertain, clumsy or imprecise.
- 2 - indicates a performance which demonstrates all of the basic mechanics of a skill, but is either slow or clumsy.

- 3 - indicates a performance which demonstrates all of the mechanics of a skill with an acceptable degree of competence.
- 4 - indicates a skilled performance in which there are no flaws and more than acceptable competence in all aspects of the skill.

It is to be expected that for certain skills some students will need additional time to acquire the necessary competence. For this reason, a student's score on a first assessment may be quite low. In such cases, the assessment procedure permits a re-evaluation of performance where a score of 2 or less was obtained.

(ii) **Farm Production Systems Investigation**

In addition to (i) above, students are required to do Investigative Projects. The student should be able to apply appropriate experimental techniques, technologies, research methods and data presentation and analysis techniques in relation to agricultural problems and situations.

The research project enables students to study a particular agricultural issue or problem. The material submitted by students for the research project must consist of a report. The report communicates the research methodology, data analysis and evaluation. It must consist of approximately 1000 words. The text can be supplemented by additional appropriate material such as graphs, figures, tables, slides and labelled photographs. Wherever a candidate exceeds the maximum length for the project by more than 10 per cent, the teacher must impose a penalty of 10 per cent of the score that the candidate achieves on the project. On the candidate's script, the teacher should clearly indicate the candidate's original score – that is, the score before the deduction is made – the marks which are to be deducted, and the final score that the candidate receives after the deduction has been made. Only the final score is to be indicated on the record sheets which are submitted to **CXC**<sup>®</sup>. It must be submitted to the teacher and marked by 31 January of the year of the examination and kept to be examined by the **CXC**<sup>®</sup> moderator.

The work presented must have been undertaken by the student and the results must be based on the student's own investigation. **Information may be used from the Internet, pamphlets and textbooks but should not be copied directly.** Any information used from such sources must be appropriately acknowledged by having the relevant reference included in the bibliography.



**CSEC Agricultural Science – SINGLE AWARD**  
**Rubric for Crop and Broiler Production Investigations**

Rubric for Crop and Broker Production Investigations					
Item		Descriptor		Marks	
				Total	Awarded
Introduction (2)	Name of Student		-	-	
	Student Registration Number		-	-	
	Name of School		-	-	
	Title of Project		-	-	
	Start Date		-	-	
	Termination Date		-	-	
	Table of Contents		-	-	
	Problem statement clearly written		1		
	Aim clearly stated		1		
Methodology (6)	Experimental Design		1		
	List of Materials and Equipment Used		1		
	Activities (2)	5 or more activities described	2		
		1 to 4 activities described	1		
		No activities described	0		
	3 or more photographs showing student engaged in this investigation		1		
Data Collection		1			
Results (4)	Collected relevant data		1		
	Presentation of results		1		
	Interpretation of results (2)	Fully interprets results	2		
		Partially interprets results	1		
		Did not attempt to interpret results	0		
Discussion (3)	Fully discussed findings with reference to relevant supporting literature		3		
	Partially discussed findings with reference to relevant supporting literature		2		
	Discussed finding with no supporting literature		1		
	Did not attempt to discuss findings		0		
Conclusion, Limitation & Recommendations (3)	Conclusion		1		
	Limitations		1		
	Recommendations for improvement		1		
Presentation (1)	Less than 5 spelling and grammatical errors contained in the report		1		
References (1)	At least 2 references properly cited		1		
TOTAL (Technical Report)			20 ÷ 2 = 10	..... ÷ 2 = .....	
Cost Analysis	Complete Budget	Projected Income – output, price, total	1		
		Projected Expenditure – inputs, price, total	1		
		Surplus/Shortfall correctly calculated	1		
	Actual Income & Expenditure	Income/Sale of Produce – quantity, price, total	1		
		Expenditure – quantity, price, total	1		
		Surplus/Shortfall correctly calculated	1		

<div>Comparison of Projected and Actual</div> <div>- Income</div> <div>- Expenditure</div> <div>- Surplus/shortfall</div>	Provides a full and accurate comparison of all 3 parameters	4	
	Partially compares all 3 parameters	3	
	Correctly compares any 2 parameters	2	
	Correctly compares any 1 parameter	1	
	Did not attempt to compare any parameter	0	
TOTAL (Cost Analysis)		10	

### **For Single Award Only**

#### **CSEC Agricultural Science – SINGLE AWARD**

#### **Guidelines for Crop and Broiler Production Investigations (Template)**

**Name of Project:** Carrot/Broiler Birds Production

**Location:** Brown High School

**Starting Date:** TBA

**Termination Date:** TBA

<b>Item</b>	<b>Descriptor</b>	<b>Total Marks</b>
<b>Introduction</b>	<p><b>Problem or Issue:</b></p> <ul style="list-style-type: none"> <li>- State the problem or issue that is being investigated. <b>(1mark)</b></li> </ul> <p><b>Objectives of the investigation:</b></p> <ul style="list-style-type: none"> <li>- Technical and business objectives. <b>(1 mark)</b></li> </ul>	<b>2 marks</b>
<b>Research Methodology</b>	<p><b>Experimental Design:</b></p> <ul style="list-style-type: none"> <li>- How the investigation was carried out e.g. two sets of birds and each set was fed with a different type of ration. <b>(1 mark)</b></li> </ul> <p><b>List of materials and equipment used:</b></p> <ul style="list-style-type: none"> <li>- This involves materials and equipment that were used in the production activities, with a description of how they were used. For example, waterers, feeders, hay fork, feed, chicks. <b>(1 mark)</b></li> </ul> <p><b>Activities (2 marks)</b></p> <ul style="list-style-type: none"> <li>- How the birds were cared for and maintained from day old to slaughtering.</li> </ul> <p><b>These activities for either project may include:</b></p> <ul style="list-style-type: none"> <li>- Construction of brooding area</li> <li>- Arrival of day old chicks</li> <li>- Feeding of birds</li> <li>- Watering of birds</li> <li>- Application of medication</li> <li>- Turning of litter</li> <li>- Expansion of brooding area</li> <li>- Culling of birds</li> </ul>	<b>6 marks</b>

	<ul style="list-style-type: none"> <li>- Slaughtering of birds</li> <li>- Packaging of carcass</li> <li>- Marketing</li> <li>- Seedbed/tray preparation (or Planting material preparation – allows for crops not grown from seeds)</li> <li>- Land preparation</li> <li>- Planting/Transplanting</li> <li>- Application of fertilizer (Nutrition)</li> <li>- Irrigation -to include the type of irrigation</li> <li>- Moulding / Pruning/Staking (select the activity that suits the crop that is being cultivated)</li> <li>- Pest and disease management</li> <li>- Weed control</li> <li>- Harvesting /Reaping</li> <li>- Packaging/Marketing</li> </ul> <p><b>Data Collection (2 marks)</b></p> <ul style="list-style-type: none"> <li>- Pictures showing students engaged in investigation.</li> <li>- <u>At least two (2) sets</u> of relevant information. For example, weighing of birds at different age, temperature or lighting regulation, plant height, length; marketable weight/plot.</li> </ul>	
<b>Results/Findings</b>	<p><b>Technical Results (4 marks)</b></p> <ul style="list-style-type: none"> <li>- Present the data collected, for example, how did the crops perform/the growth rate of birds. <b>(1mark)</b></li> <li>- State what each set of data show. <b>(1mark)</b></li> <li>- Each set of results interpreted accurately. <b>(1mark)</b></li> <li>- Proper presentation of the results. For example, labelled tables, charts, diagrams, photographs. <b>(1mark)</b></li> </ul>	<b>4 marks</b>
<b>Discussion</b>	<ul style="list-style-type: none"> <li>- Discuss how the technical results relate to the issue and refer to relevant literature. <b>(3 marks)</b> <ul style="list-style-type: none"> <li>• Discuss how the technical results affected or can affect the profitability of the birds and refer to relevant literature.</li> <li>• Discussion on how the overall findings relate to the issue.</li> </ul> </li> </ul>	<b>3 marks</b>
<b>Conclusion, Limitations &amp; Recommendations</b>	<ul style="list-style-type: none"> <li>- Provide a conclusion/summary of the project based on the outcome of the project. <b>(1 mark)</b></li> <li>- Provide an overview of the project to include: <ul style="list-style-type: none"> <li>• Limitations. <b>(1 mark)</b></li> <li>• Recommendations for improvement. <b>(1 mark)</b></li> </ul> </li> </ul>	<b>3 marks</b>
<b>Presentation</b>	<ul style="list-style-type: none"> <li>- Clarity of language and proper grammar, spelling <b>(1 mark)</b></li> </ul>	<b>1 mark</b>
<b>List of References</b>	<ul style="list-style-type: none"> <li>- Each reference (at least 2) is properly cited – author name, date, title of book or article, source. For example, publisher, magazine or website. For online references the website should be provided. <b>(1 mark)</b></li> </ul>	<b>1 mark</b>
<b>Total Marks (Total to be scale down to 10 marks)</b>		<b>20 marks</b>

## **COST ANALYSIS (TEMPLATE)**

<b>COST ANALYSIS</b>	<p><i>In this section, you are expected to prepare at least two budgets (depending on the investigation). The first is a complete budget showing your projected income, expenditure and profit/loss (surplus/shortfall). The second is an income and expenditure statement showing your actual income, expenditure and your actual profit/loss (surplus/shortfall). (3 marks each)</i></p> <ul style="list-style-type: none"> <li>- Income – quantity sold, price/unit, total sales or income. (1 mark)</li> <li>- Expenses – for each item purchased: quantity, unit cost and total cost. (1 mark)</li> <li>- Profit/loss (surplus/shortfall). (1 mark)</li> </ul> <p><i>After each budget is completed, an analysis/comparison of the projected and actual income, expenditure and profit/loss (surplus/shortfall) must be done. (4 marks)</i></p> <p><i>For each of the <b>three</b> parameters listed above:</i></p> <ul style="list-style-type: none"> <li>- Account for the difference in the increase. (2 marks)</li> <li>- Identify whether or not there was a profit, loss or breakeven outcome. (1 mark)</li> <li>- Account for the result. (1 mark)</li> </ul> <p><b>NB.</b> You can also use graphs to show the comparison between:</p> <ul style="list-style-type: none"> <li>• Projected income and actual income.</li> <li>• Projected expenditure and actual expenditure.</li> <li>• Projected profit/loss and actual profit/loss.</li> </ul>	<b>10 marks</b>
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### **Sample Projected Budget**

**(NB. The income and expenditure values are not based on actual figures)**

<b>Income</b>	<b>Weight (kg)</b>	<b>Unit Cost (\$)</b>	<b>Total (\$)</b>
Sale of meat	345	340	117,300
Sale of edible parts			
- sale of chicken feet	10	200	2000
- sale of gizzard	6	120	720
<b>Total projected income</b>			<b>120,020</b>
<b>Expenditure</b>	<b>Quantity</b>	<b>Unit Cost (\$)</b>	<b>Total (\$)</b>
Chicks	200	85	17,000
Feed	40*25kg	1400	56,000
Vitamins/electrolyte	1	520	520
Polythene	2pk (9*14)	160	320
Litter material (saw dust)	12 bags	100	1200
<b>Total projected expenditure</b>			<b>75,040</b>

<b>Projected profit = Total projected income – total projected expenditure</b>			<b>120,020 – 75,040 = 44,980</b>
<b>Sample of Actual Income and Expenditure Statement</b>			
<b>Income</b>	<b>Quantity (kg)</b>	<b>Unit Cost (\$)</b>	<b>Total (\$)</b>
Sale of meat	375	345	129,375
Sale of edible parts of chicken:			
Feet	12	200	2400
Gizzard	7	120	840
<b>Total Actual Income</b>			<b>132,615</b>
<b>Actual Expenditure</b>	<b>Quantity</b>	<b>Unit Cost (\$)</b>	<b>Total (\$)</b>
Chicks	200	100	20,000
Feed	40 *25 kg	1500	60,000
Vitamins/electrolyte	1pk	580	580
Rat Blocks	4	80	320
Litter material (saw dust)	12 bags	100	1200
Polythene	2pk (9*14)	160	320
<b>Total actual expenditure</b>			<b>82,420</b>
<b>Actual profit =total actual income – total actual expenditure</b>			<b>132,615 – 82,420 = 50,195</b>
For example, upon completion of the project there was an actual profit (surplus) of \$50,195 compared with a projected profit of \$44,980. This shows an increase of \$5,215 in the actual profit based on what was projected, even though there was an increase in expenditure (actual expenditure, \$82 420, compared with a projected total expenditure of \$75 040). The actual income, \$132 615, was higher than the projected income of \$120, 020 as a result of an increase in the quantity and price of meat. This accounted for the increase in the actual profit.			
<b>Total Cost Analysis</b>			<b>10 marks</b>

**Additional Guidelines:**

1. The candidate name, registration number, name of school, and the title of the project should be clearly written on the outside of the folder and on the first page of the report.
2. The report should be clearly and legibly written or typed.
3. A table of contents should be included at the beginning of the report.
4. Tables, graphs, diagrams, photographs or any form of illustration should be suitably chosen, structured and integrated into the report.
5. References should be in alphabetical order in a list of references at the end of the report.

6. Appendices should appear at the end of the report.
7. A mark scheme should be included at the end of the report, indicating clearly the teacher assessment of the project.

**N.B.** Students are allowed to prepare **at least** two budgets for this project, depending on the type of investigation. For instance, if the investigation involves comparison of two diets or two treatments as suggested by the example, then two actual budgets should be prepared for comparison both with the projected budget and with one another. This will allow the students to state which treatment was more profitable and give a reason.

## ASSESSMENT SKILLS PROCEDURES

### Commencement of Assessment

Regionally, the academic year begins in September and the Agricultural Science programme is of a two-year duration. **CXC**<sup>®</sup> regulations, however, require that assessments do not commence before the beginning of the month of November, allowing teachers and students time to settle into what may be a new physical environment.

### Selection of Practical Skills

The teacher is required to conduct practical exercises within the limits prescribed by the syllabus. Of these, ten practical skills will form the complement on which the candidates will be assessed. The ten practical exercises must consist of five skills from Section B: Crop Production and five skills from Section C: Animal Production. These skills are listed on pages 65–67 of the syllabus.

### Assessment Procedure

Assessment of a candidate does not begin until the teacher has prepared the whole class in that particular skill.

At the time of assessment only a few predetermined candidates are observed, and this activity is conducted in the field/farm, and must be done individually, physically and practically. It is not an oral or written question and answer examination.

The criteria to be used in the assessment of practical skills should be established well in advance, and be put into use first, when the skills are being taught, so that at assessment time both teacher and candidate are well aware of the acceptable requirement.

The teacher observes the level of the candidate's skills (dexterity) in performing the task, the time taken for completion, the confidence exhibited, and the resourcefulness shown in handling any problems which may arise. Marks are thus awarded for technique and competency.

Technique	-	the extent to which the candidate has the ability to select and the capacity to use, the most appropriate and acceptable methods and procedures for the effective performance of the particular skill.
Competency	-	The level of mastery with which the candidate is able to carry out the performance.

The competency factor can be developed through the regular usage of the correct technique taught. Mere practice is not enough. Positive reinforcement takes place only when the correct techniques are regularly practised.

The following rating scale should be used for assessing technique and competency.

#### Technique

1 - Unsatisfactory

2 - Satisfactory

3 - Excellent

#### Competency

1 - Non-mastery

2 - Limited competence

3 - Mastery

#### Conversion of Marks to SBA Credits

1 mark = 0

2 marks = 1

3 marks = 2

4 marks = 3

5 marks = 4

### **Recording of the Skills Assessment**

Candidates' marks on each of the ten skills are recorded in the School-Based Assessment Sheet – Record of Marks for Agricultural Science. This is an official record and care must be taken to ensure its accuracy and security.

The maximum number of credits for each skill is 4. Candidates who earn less than 2 credits on any skill should be given the opportunity to improve the performance on this skill, before the mark is recorded on the Assessment Sheet.

At the end of the assessment in Year 2, the Assessment Sheet – Record of Marks for Agricultural Science – should be signed by the teacher and the Principal, and submitted via the Moderator to the Local Registrar by April 15 of the year of the examination.

*The cost analyses and Portfolios for Single and Double Award are to be kept by the school after moderation by the visiting Moderator. These may be requested by **CXC®** as the need arises.*

## Non-fulfilment of SBA Requirements

Candidates who are absent when a practical skill is being assessed must be given the opportunity on subsequent occasions to demonstrate the skill.

**Candidates, who fail to be assessed in at least two-thirds of the complement of the practical skills (that is, seven skills) of the syllabus, may not qualify to have their SBA considered for the examination except a valid explanation from the Principal supported by the CXC® Moderator is submitted to CXC®.**

## Moderation of School-Based Assessment

The reliability (consistency) of the marks awarded by teachers on the School-Based Assessment is an important characteristic of high quality assessment. To assist in this process, the Council undertakes on-site moderation of the School-Based Assessment, conducted by visiting External Moderators.

Teachers must make available to the Moderators ALL Assessment Sheets (Record of Marks for Agricultural Science, cost analyses and Research Projects). **Teachers are NOT required to submit to CXC® samples of candidates' work, unless specifically requested to do so by the Council.**

During the fifth term of the second year, the Moderator will remark the skills, cost analyses and projects of a sample of five candidates, who are selected using the guidelines listed below.

1. Candidates' total marks on the SBA are arranged in descending order (highest to lowest);
2. The candidates scoring the:
  - (a) highest Total mark;
  - (b) middle Total mark;
  - (c) lowest Total mark;
  - (d) mark midway between the highest and middle Total mark; and,
  - (e) mark midway between the middle and lowest Total mark; are selected to perform some practical skills.
3. The cost analyses for candidates presented for the Single Award are also remarked by the Moderator. The Moderator also remarks the cost analyses and business plans for candidates presented for the Double Award.

Teachers' marks may be adjusted as a result of the moderation and feedback will be provided by the Moderator to the teachers.

The Moderator may remark additional candidates. Where the total number of candidates is five or fewer, all the candidates will form the sample.



**The Moderator will also remark a sample of the Year 1 candidates.** A copy of this report must be retained by the teacher, and be made available to the Moderator during the fifth term of the second year.

The Moderator will submit the Assessment Sheets, moderation of SBA Sample and the moderation reports to the Local Registrar by April 30 of the year of the examination. A copy of the Assessment Sheets and candidates' work must be retained by the school, until three months after publication, by **CXC®**, of the examination results.

## **SBA Skills – CROP PRODUCTION**

### Section B

1. Identify the textural classes of soil.
2. Determine the pH of soil.
3. Use techniques of fertiliser application appropriate to type of crop, cropping system, climate and topography.
4. Use appropriate techniques in applying soil amendments.
5. Use an 'A' frame (level) to establish contour lines.
6. Demonstrate land preparation techniques:
  - (a) land clearing;
  - (b) primary and secondary tillage;
  - (c) drain formation; and,
  - (d) ridges and furrows.
7. Clean and maintain simple tools and the knapsack sprayer.
8. Demonstrate plant propagation techniques;
  - (a) budding;
  - (b) grafting;
  - (c) layering; and,
  - (d) cuttings.
9. Prepare seed boxes/beds and sow of seeds.
10. Thinning out seedlings.
11. Transplanting and proper spacing.

12. Demonstrate cultural practices associated with crop production:
  - (a) moulding;
  - (b) mulching;
  - (c) staking;
  - (d) pruning;
  - (e) irrigating;
  - (f) weed control; and,
  - (g) pests and diseases control.
13. Use appropriate harvest and postharvest techniques.
14. Propagate ornamental plants.
15. Establish a fruit orchard.
16. Select and establish planting materials for banana production.
17. Prune horticultural plants.
18. Harvest flowers of ornamental plants.

## **SBA Skills – ANIMAL PRODUCTION**

### Section C

1. Use food tests to identify carbohydrates, fats and proteins in feeds.
2. Identify, collect and mount forage plants.
3. Determine the space requirements for different batches of broilers, layers.
4. Prepare a brooder for baby chicks.
5. Clean and disinfect pens/poultry house.
6. Prepare eggs for incubation in a small-scale incubator.
7. Slaughter and dress broilers.
8. Collection, cleaning and grading of eggs.

9. Attend to young animals:
  - (a) inoculate;
  - (b) treat navel against flies;
  - (c) clip teeth in piglets; and,
  - (d) administer iron injection.
10. Apply first aid procedures in animals.
11. Maintain animals and surroundings in a hygienic condition.
12. Administer control measures against internal and external parasites.

### **SBA FOR THE DOUBLE AWARD ONLY**

*The SBA for the Double Award will integrate all the elements of the SBA for the Single Award in addition to the knowledge and skills in Sections E and F of the syllabus.*

#### **Components:**

1. *A business plan for the establishment of a sustainable agricultural enterprise. This plan must be based on relevant market data and may be related to **either** the crop **or** livestock project described in 2 below.*
2. *Two projects that demonstrate sustainable agricultural production and management, one each for crops and livestock. Post-production and value-addition aspects should be included. These projects should provide opportunity for inquiry-based learning. A simple production plan for each project should be prepared and should be based on relevant market and environmental data.*
3. *Skills related to any aspect of the establishment and operation of a sustainable agricultural enterprise related to 1 and 2 above, including collection and use of data environmental monitoring, crop and livestock production and management, post-production activities, use of equipment, application of technologies and communication.*

#### **1. The Business Plan**

*Students who are completing the **CSEC®** Agricultural Science Double Award syllabus will be required to prepare a Business Plan for the **establishment** of an agricultural enterprise related to any area relevant to crop or livestock production and post-production management that was covered by the syllabus. The development of the plan is a research-based exercise. **All enterprises selected must be within the law and students should be encouraged to focus on enterprises that are relevant to one or more of the four key objectives for the food and agriculture sector in the Caribbean as stated in the Rationale for the syllabus. The plan should allow students to demonstrate knowledge and competencies developed over the entire syllabus.***

*The Business Plan must include the following elements:*

- (a) The Title
- (b) Table of Contents
- (c) List of Acronyms and Abbreviations
- (d) Description of Business
- (e) Justification for the business
- (f) Products and Services
- (g) Marketing Plan
- (h) Operational Plan
- (i) Financial Plan
- (j) Bibliography

*The length of the document should be 1500 to 1800 words (not including appendices). The document must reflect effective use of a range of communication skills including but not limited to, photographs, figures, charts, graphs and tables.*

*The work presented must have been undertaken by the student and the results must be based on the student's own investigation. Information may be used from the Internet, pamphlets and textbooks but **should not be copied directly**. Any information used from such sources **must be appropriately acknowledged** by having the relevant reference included in the bibliography.*

*As a research-based learning activity, the business plan will contribute 20 per cent of the SBA marks. The plan should be marked in accordance with the guidelines provided in Table 1 below. If the length of the document falls below or exceeds the specified length by more than 10 per cent, the teacher must impose a penalty of **not more than** 10 per cent of the score that the candidate achieves on the project. On the candidate's script, the teacher should clearly indicate the candidate's original score – that is, the score before the deduction is made – the marks which are to be deducted, and the final score that the candidate receives after the deduction has been made. Only the final score is to be indicated on the record sheets which are submitted to **CXC**<sup>®</sup>. The plan must be submitted to the teacher for marking by 31 January of the year of the examination and kept to be examined by the **CXC**<sup>®</sup> moderator.*

*The project should be marked out of 40 using the specified criteria that are weighted as follows:*

### **Rubric for the Business Plan**

<b>Item</b>	<b>Description</b>	<b>Total</b>
<i>Description of the Business</i>	<i>Name and nature of business (1 mark)</i> <i>Form of business (1 mark)</i> <i>Mission Statement (1 mark)</i> <i>Objectives of Business (1 mark for stating two objectives)</i> <i>Location (1 mark)</i>	<i>5 marks</i>

<b>Item</b>	<b>Description</b>	<b>Total</b>
<i>Justification for the Business</i>	<p><b>Market research:</b></p> <ul style="list-style-type: none"> <li>- Target population/market segment and size of market</li> <li>- Price of similar products and/ services and main competitors</li> <li>- Availability and comparative price of substitutes.</li> <li>- Sales forecast (assess/describe)</li> <li>- Industry outlook</li> </ul> <p>(Any 3 points – 3 marks)</p> <p><b>SWOT analysis:</b></p> <ul style="list-style-type: none"> <li>- strengths and opportunities (1 mark)</li> <li>- weaknesses and threats (1 mark)</li> </ul> <p><i>Justification for location (1 mark)</i></p>	6 marks
<i>Products and Services</i>	Describe two main features of products and/ or services are that will be offered (1 mark)	1 mark
<b>Marketing Plan:</b>		
<i>Product/Service</i>	<ul style="list-style-type: none"> <li>- Describe branding and/or packaging relating to the product. (1 mark)</li> <li>- State slogan for company (1 mark)</li> </ul>	2 marks
<i>Pricing Strategy</i>	- Describe and justify the pricing strategy used (1 mark)	1 mark
<i>Place (distribution channels)</i>	- Describe main distribution channels that will be used and their advantages (2 marks)	2 marks
<i>Promotion Mix</i>	<ul style="list-style-type: none"> <li>- Discuss the various promotional strategies used by the business (advertising, sales promotion, after sales services, public relations, personal selling, promotional pricing)</li> </ul> <p>Any two (1 mark each)</p>	2 marks
<b>Operational Plan</b>		
<i>Management Structure</i>	<p>Outline functional areas of the business. Organisational chart (2 marks)</p> <p>Explain why production will be done by the company or outsourced (1 mark)</p>	3 marks

<b>Item</b>	<b>Description</b>	<b>Total</b>
<i>Selection of appropriate labour</i>	<i>- Outline number of persons to be employed and their duties or functions (2 marks)</i>	<i>2 marks</i>
<i>Use of technology to enhance efficiency of the business</i>	<i>Outline how at least two technologies will be used to enhance the efficiency of the business operations (2 marks)</i>	<i>2 marks</i>
<b>Financial Plan</b>		
<i>Projected Performance</i>	<i>Projected Profit and Loss Account depicting profitability of business (3 marks)</i>  <i>Projected Balance Sheet showing fixed assets, variable assets, capital and liability (3 marks)</i>	<i>6 marks</i>
<i>Sources of Finance</i>	<i>- Determine and justify sources of capital for the business (2 marks)</i>	<i>2 marks</i>
<b>Communication</b>		
<i>Communication of information in a logical manner using correct grammar</i>  <i>Effective use of communication tools</i>	<i>Good to Excellent command of English Language (2 marks)</i>  <i>Fair command of English Language (1 mark)</i>  <i>Use of graphs, figures, tables, charts and photographs (2 mark)</i>	<i>2 marks</i>   <i>2 marks</i>
<i>Overall presentation: (Format)</i>	<i>title page, table of contents, list of acronyms and abbreviations (at least 3 features - 1 mark)</i>  <i>Bibliography (1 mark)</i>	<i>2 marks</i>
<b>Total score</b>		<b>40 marks</b>

## 2. Projects

### CSEC® Agricultural Science – DOUBLE AWARD

#### Rubric for Crop and Broiler Production Investigations

ITEM	DESCRIPTOR		Marks	
			Total	Awarded
<b>INTRODUCTION (6)</b>	Name of Student		-	-
	Student Registration Number		-	-
	Name of School		-	-
	Title of Project		-	-
	Start Date		-	-
	Termination Date		-	-
	Table of Contents		-	-
	Literature Review (3)	Provided a clear and accurate summary of literature reviewed	2	
		At least 3 references cited in summary	1	
	Problem statement clearly written		1	
<b>METHODOLOGY (11)</b>	Experimental Design (2)	Technical /technology related objective addressing production and post-production levels	1	
		Income related	1	
	Experimental Design (2)	Experimental design clearly described	1	
		Comparison of production technology / management practice / value-addition technology	1	
	Materials and Equipment (2)	Materials	1	
		Tools and Equipment	1	
	Activities (production and processing) (4)		4	
<b>RESULTS (9)</b> - Production and Post-Production Value Addition (where applicable)	Data Collection - Data (at least 2 sets) and how it was collected (3)		3	
	Presented and described data including performance of value added products / comparison of value added and non-value added product where applicable (3)		3	
	Interpreted results accurately (3)		3	
	Presented results properly (2)		2	
<b>DISCUSSION (8)</b>	Labelled tables, charts (1)		1	
	How technical results relate to the issue (2)	Provided a full discussion of results"	1	
		Relating results to literature accurately with reference	1	
<b>DISCUSSION (8)</b>	Effect of the technology used during production/	discussed the effect of technology used during production/post-production as it relates to value	2	

	after production / for value addition (2)	addition with supporting evidence and cited relevant literature			
	Effect of technical / technology on profitability (2)	Fully discussed the effect of technical / technology on profitability and referring to relevant data with supporting evidence and cited relevant literature	2		
	Overall findings as it relates to the issue (2)	Fully discussed the findings as it relates to issue with supporting evidence and cited relevant literature	2		
<b>CONCLUSION, LIMITATION &amp; RECOMMENDATIONS (4)</b>	Conclusion (2)	Based on outcomes with respect to technical / technological aspects	1		
		Based on outcomes and income aspect	1		
	Limitations (1)		1		
	Recommendations (1)		1		
<b>PRESENTATION (2)</b>	Less than 5 spelling and grammatical errors contained in the report (1)		1		
	At least 3 references properly cited (1)		1		
<b>TOTAL (Technical Report)</b>			<b>40 ÷ 2 = 20</b>	<b>..... ÷ 2 = .....</b>	
<b>COST ANALYSIS (10)</b> (Please tick ✓ which is applicable)  <input type="checkbox"/> <b>1</b> (Production, Post-Production)  or <input type="checkbox"/> <b>2</b> (Production, Post-Production and Value Addition)	<b>Complete Budget</b>	Projected Income – output, price, total	1		
		Projected Expenditure – inputs, price, total	1		
		Surplus/Shortfall correctly calculated	1		
	<b>Actual Income &amp; Expenditure</b>	Income/Sale of Produce – quantity, price, total	1		
		Expenditure – quantity, price, total	1		
		Surplus/Shortfall correctly calculated	1		
	<b>Comparison of Projected and Actual</b> - <b>Income</b> - <b>Expenditure</b> - <b>Surplus/shortfall</b>	Provides a full and accurate comparison of all 3 parameters	4		
		Partially compares all 3 parameters	3		
		Correctly compares any 2 parameters	2		
		Correctly compares any 1 parameter	1		
		Did not attempt to compare any parameter	0		
	<b>TOTAL COST ANALYSIS</b>			<b>10</b>	



**FOR DOUBLE AWARD ONLY****Guidelines for Crop and Animal production investigations (Template)**

Name of Project: Animal/Crop Production

Location: Brown High School

Starting Date: TBA

Termination Date: TBA

<b>Item</b>	<b>Description</b>	<b>Total</b>
<b>INTRODUCTION</b>	<p><b><u>Brief literature review:</u></b></p> <p>A summary of relevant literature on the topic, with references cited. <b>(3 marks)</b></p> <ul style="list-style-type: none"><li>- At least 3 references cited in the summary; they must be relevant to the overall topic and the problem. (1 mark)</li><li>- Clear and accurate summary. (2 marks)</li></ul> <p><b><u>Statement of problem or issue:</u></b></p> <ul style="list-style-type: none"><li>- State the problem or issue that is being investigated. <b>(1 mark)</b></li></ul> <p><b><u>Aims of the investigation:</u> (2 marks)</b></p> <ul style="list-style-type: none"><li>- Technical and/or technology related, (should address both the production and post-production levels). (1 mark)</li><li>- Income related. (1 mark)</li></ul> <p><b>(Note: the business objectives for value addition will only be included in the investigation that has the business plan and Cost Analysis 2 for the value-addition aspects.)</b></p>	<b>6 marks</b>
<b>METHODOLOGY</b>	<p><b><u>Experimental design:</u> (2 marks)</b></p> <ul style="list-style-type: none"><li>- How the investigation was carried out, for example, one set of birds were fed with a different type of ration, one plot each of two cultivars for comparison. (1mark)</li><li>- Comparison of production technology or management practice or value-addition technology. (1 mark)</li></ul> <p><b><u>List of materials, tools and equipment used:</u> (2 marks)</b></p> <ul style="list-style-type: none"><li>- A list of the materials.</li><li>- Tools and equipment that were used in the production and value-addition activities. (1 mark)</li><li>- A description of how they were used. For example, waterers, feeders, hay fork, feed, chicks, seeds, refrigerator, food processor, thermometer. (1 mark)</li></ul>	<b>11 marks</b>

	<p><b><u>Activities (4 marks)</u></b></p> <p><i>How the crops/birds were:</i></p> <ul style="list-style-type: none"> <li>- maintained (1 mark)</li> <li>- processed (1 mark)</li> </ul> <p><b><i>These activities may include:</i></b></p> <ul style="list-style-type: none"> <li>- Construction of brooding area</li> <li>- Arrival of day old chicks</li> <li>- Feeding of birds</li> <li>- Watering of birds</li> <li>- Application of medication</li> <li>- Turning of litter</li> <li>- Expansion of brooding area</li> <li>- Culling of birds</li> <li>- Slaughtering of birds</li> <li>- Packaging of carcass</li> <li>- Marketing</li> <li>- Value addition</li> <li>- Seedbed/tray preparation (or Planting material preparation – allows for crops not grown from seeds)</li> <li>- Land preparation</li> <li>- Planting/Transplanting</li> <li>- Application of fertilizer (Nutrition)</li> <li>- Irrigation -to include the type of irrigation</li> <li>- Moulding / Pruning/Staking (select the activity that suit the crop you are cultivating)</li> <li>- Pest and disease management</li> <li>- Weed control</li> <li>- Harvesting /Reaping</li> <li>- Packaging/Marketing</li> <li>- Value addition</li> </ul> <p><b><u>Data collection (3 marks)</u></b></p> <ul style="list-style-type: none"> <li>- What information was collected; <u>at least 2 sets</u> of relevant information, for example, weighting of birds at different age, temperature or lighting regulation; daily temperature, rainfall, plant height; carrot length; marketable carrot weight/plot. (1 mark)</li> <li>- Description of how the information was collected e.g. how was the weight of the birds measured? How was the length of the plants measured? (1 mark)</li> </ul>	
<b>RESULTS</b>	<p><b><u>Technical Results – production and post-production and value addition (where applicable) (9 marks)</u></b></p> <ul style="list-style-type: none"> <li>- How did the crop/animal perform i.e. present and describe the data collected including performance of value added products/comparison of value added and non-value added products where applicable? (3 marks)</li> </ul>	<b>9 marks</b>

	<ul style="list-style-type: none"> <li>- Each set of results interpreted accurately. (3 marks)</li> <li>- Proper presentation of the results. For example, table, chart, diagram, photograph. (2 marks)</li> <li>- Properly labelled tables, charts. (1 mark)</li> </ul>	
<b>DISCUSSION</b>	<ul style="list-style-type: none"> <li>- Discuss how the technical results relate to the issue and refer to relevant literature. <b>(2 marks)</b> <ul style="list-style-type: none"> <li>• The proper discussion of the results. (1 mark)</li> <li>• Relating results to the literature accurately with proper citation/references. (1 mark)</li> </ul> </li> <li>- Discuss the effect of the technology used either during or after production or for value-addition and refer to relevant literature. <b>(2 marks)</b></li> <li>- Discuss how the technical/ technology results affected or can affect the profitability of the birds and refer to relevant literature. <b>(2 marks)</b></li> <li>- Discussion on how the overall findings relate to the issue, with supporting evidence and refer to relevant literature. <b>(2 marks)</b></li> </ul>	<b>8 marks</b>
<b>CONCLUSION, LIMITATION &amp; RECOMMENDATIONS</b>	<ul style="list-style-type: none"> <li>- <b>A summary of the project based on:</b> <ul style="list-style-type: none"> <li>• The outcomes with respect to the technical/ technological aspects. <b>(1 mark)</b></li> <li>• The outcomes with respect to the income aspect. <b>(1 mark)</b></li> </ul> </li> <li>- <b>An overview of the project to include:</b> <ul style="list-style-type: none"> <li>• Limitations. <b>(1 mark)</b></li> <li>• Recommendations for improvement. <b>(1 mark)</b></li> </ul> </li> </ul>	<b>4 marks</b>
<b>PRESENTATION</b>	<ul style="list-style-type: none"> <li>- Clarity of language and proper grammar, spelling and proper layout of the report – use of headings and subheadings, page number. <b>(1 mark)</b></li> <li>- At least three references properly cited – author name, date, title of book or article, source e.g. publisher, magazine or website. For online references the website should be provided. <b>(1 mark)</b></li> </ul>	<b>2 marks</b>
<b>TOTAL MARKS (to be scaled to 20 marks)</b>		<b>40 marks</b>

## COST ANALYSIS

<b>COST ANALYSIS 1</b>	<p><i>In this section, you are expected to prepare at least two budgets (depending on the investigation). The first is a complete budget showing your projected income, expenditure and profit/loss (surplus/shortfall). The second is an income and expenditure statement showing your actual income, expenditure and your actual profit/loss (surplus/shortfall). (3 marks each)</i></p> <ul style="list-style-type: none"> <li>- <i>Income – quantity sold, price/unit, total sales or income. (1 mark)</i></li> <li>- <i>Expenses – for each item purchased: quantity, unit cost and total cost. (1 mark)</i></li> <li>- <i>Profit/loss (surplus/shortfall). (1 mark)</i></li> </ul> <p><i>After each budget is completed, an analysis/comparison of the projected and actual income, expenditure and profit/loss (surplus/shortfall) must be done. (4 marks)</i></p> <p><i>For each of the <b>three</b> parameters listed above:</i></p> <ul style="list-style-type: none"> <li>- <i>Account for the difference in the increase. (2 marks)</i></li> <li>- <i>Identify whether or not there was a profit, loss or breakeven outcome. (1 mark)</i></li> <li>- <i>Account for the result. (1 mark)</i></li> </ul> <p><b>NB.</b> <i>You can also use graphs to show the comparison between:</i></p> <ul style="list-style-type: none"> <li>• <i>Projected income and actual income.</i></li> <li>• <i>Projected expenditure and actual exp.</i></li> <li>• <i>Projected profit/loss and actual profit/loss.</i></li> </ul>	<b>10 marks</b>
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### **Sample Projected Budget – Growing Hot Peppers**

**(NB. The income and expenditure values are not based on actual figures)**

<b>Income</b>	<b>Quantity</b>	<b>Unit</b>	<b>Price (\$)</b>	<b>Total (\$)</b>
Sale of hot peppers (12 kg cartons)	1,000	cartons	25	25,000
<b>Total projected income</b>				<b>25,000</b>
<b>Expenditure</b>	<b>Quantity</b>		<b>Unit Cost (\$)</b>	<b>Total (\$)</b>
Transplants	11,100	acre	0.10	1,110
Labour	130	hour	12	1,560
Fertilizer (20 kg bag)	2	bag	520	1,040
Polythene	1,600	feet	0.05	80
Herbicide/fungicide/insecticide	1	acre	400/940/610	1,950
Cartons	1,000	cartons	2.50	2,500
Drip irrigation	1	acre		1,500
Miscellaneous (for example, repairs)				1,000
<b>Total projected expenditure</b>				<b>10,740</b>

<b>Projected profit =</b> <b>Total projected income – total</b> <b>projected expenditure</b>				<b>25,000 –</b> <b>10,740</b> <b>= 14,260</b>
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#### **Sample of Actual Income and Expenditure Statement**

<b>Income</b>	<b>Quantity</b>	<b>Unit</b>	<b>Price (\$)</b>	<b>Total (\$)</b>
Sale of hot peppers (12 kg cartons)	1,050	cartons	27.50	28,875
<b>Total projected income</b>				<b>28,875</b>
<b>Expenditure</b>	<b>Quantity</b>		<b>Unit Cost (\$)</b>	<b>Total (\$)</b>
Transplants	11,100	acre	0.10	1,110
Labour	130	hour	12	1,560
Fertilizer (20 kg bag)	2	bag	520	1,040
Polythene	1,600	feet	0.07	112
Herbicide/fungicide/insecticide	1	acre	400/940/610	1,950
Cartons	1,050	cartons	2.50	2,625
Drip irrigation	1	acre	1,700	1,700
Miscellaneous (for example, repairs)				1,500
<b>Total projected expenditure</b>				<b>11,597</b>
<b>Projected profit =</b> <b>Total projected income – total</b> <b>projected expenditure</b>				<b>28,875 –</b> <b>11,597</b> <b>= 17,278</b>

For example, upon completion of the project there was an actual profit (surplus) of \$17,278 compared with a projected profit of \$14,260. This shows an increase of \$3,018 in the actual profit based on what was projected, even though there was an increase in expenditure (actual expenditure, \$11,597, compared with a projected total expenditure of \$10,740). The actual income, \$28,875, was higher than the projected income of \$25,000 as a result of an increase in the quantity and also the price of the hot peppers. This accounted for the increase in the actual profit.

#### **OR COST ANALYSIS** **2 – (Production,** **Post-Production** **and Value-addition)**

As for Cost Analysis 1, but includes details on value-addition. A separate statement can be done for the value-addition aspects of the project or it can be incorporated with the production and post-production aspects.

**10 marks**

*This analysis is to be done only if the investigative project includes the business plan.*

#### **Sample Projected Budget – Growing Hot Peppers**

(Project is based on an estimated production of 1,000 cartons of hot peppers of which quarter of the amount will be used for value addition.)

<b>Income</b>	<b>Quantity</b>	<b>Unit</b>	<b>Price (\$)</b>	<b>Total (\$)</b>
Sale of hot peppers (12 kg cartons)	750	cartons	25	18,700
<b>Sale of value-added products:</b>				
- Hot pepper sauce	750	bottle	12	9,000
- Dehydrated pepper	400	pack	8	3,200
<b>Total projected income</b>				<b>30,900</b>

<b>Expenditure</b>	<b>Quantity</b>		<b>Unit Cost (\$)</b>	<b>Total (\$)</b>
Transplants	11,100	acre	0.10	1,110
Labour	130	hour	12	1,560
Fertilizer (20 kg bag)	2	bag	520	1,040
Polythene	1,600	feet	0.05	80
Herbicide/fungicide/insecticide	1	acre	400/940/610	1,950
Cartons	1,000	cartons	2.50	2,500
Drip irrigation	1	acre		1,500
Miscellaneous (for example, repairs)				1,000
<b>Expenses: Value-added products</b>				
- Bottles	750	bottle	0.05	37.50
- Plastic bags	400	bag	0.01	4.00
- Vinegar	1	gallon	150	150
- Salt	5	kg	1.50	7.50
- Seasoning	5	kg	3.60	18
- Labour	10	hour	12	120
<b>Total projected expenditure</b>				<b>11,077</b>
<b>Projected profit = Total projected income – total projected expenditure</b>				<b>30,900 – 11,077 = 19,823</b>

#### **Sample of Actual Income and Expenditure Statement**

<b>Income</b>	<b>Quantity</b>	<b>Unit</b>	<b>Price (\$)</b>	<b>Total (\$)</b>
Sale of hot peppers (12 kg cartons)	750	cartons	25	18,700
<b>Sale of value-added products:</b>				
- Hot pepper sauce	750	bottle	13	9,750
- Dehydrated pepper	400	pack	8.50	3,400
<b>Total projected income</b>				<b>31,850</b>
<b>Expenditure</b>	<b>Quantity</b>		<b>Unit Cost (\$)</b>	<b>Total (\$)</b>
Transplants	11,100	acre	0.10	1,110
Labour	130	hour	12	1,560
Fertilizer (20 kg bag)	2	bag	520	1,040
Polythene	1,600	feet	0.05	80
Herbicide/fungicide/insecticide	1	acre	1,400/940/1,610	3,950
Cartons	1,000	cartons	2.50	2,500
Drip irrigation	1	acre		1,500
Miscellaneous (for example repairs)				1,000
<b>Expenses: Value-added products</b>				
- Bottles	750	bottle	0.04	30
- Plastic bags	400	bag	0.01	4
- Vinegar	1	gallon	150	150
- Salt	5	kg	1.50	7.50
- Seasoning	5	kg	3.60	18
- Labour	10	hour	12	120

<b>Total projected expenditure</b>				<b>13,069.50</b>
<b>Actual profit =total actual income – total actual expenditure</b>				<b>31,850 – 13,069.50 = 18,780.50</b>

For example, upon completion of the project there was an actual profit (surplus) of \$18,780.50 compared with a projected profit of \$19,823. This shows a decrease of \$1,042.50 in the actual profit based on what was projected. There was an increase in expenditure (actual expenditure, \$13,069.50, compared with a projected total expenditure of \$11,077) due to the increase in price of herbicide and insecticide. This accounted for the decrease in the actual profit over the projected profit. The actual income, \$31,850, was higher than the projected income of \$30,900 as a result of an increase in the quantity and also the price of the value-added products.

**Investigation = 40 marks.**

**Cost analysis 1 (production) – 10 marks**

**Cost Analysis 2 (value-addition) – 10 marks**

(Cost Analysis 2 is the ONLY cost analysis to be included in the project that has the business plan)

**For the extended project:**

**Business plan - 20 marks**

**Additional Information:**

1. The candidate name, registration number, name of school, and the title of the project should be clearly written on the outside of the folder and on the first page of the report.
2. The report should be clearly and legibly and written or typed.
3. A table of contents should be included at the beginning of the report.
4. Tables, graphs, diagrams, or any form of illustration should be suitably chosen, structured and integrated into the report.
5. References should be in alphabetical order in a reference list at the end of the report.
6. Appendices should appear at the end of the report. A mark scheme should be included at the end of the report, indicating clearly the teacher assessment of the project.
7. A mark scheme should be included at the end of the report, indicating clearly the teacher assessment of the project.

**N.B.** Students are allowed to prepare **at least** two budgets for this project, depending on the type of investigation. For instance, if the investigation involves comparison of two diets or two treatments as suggested by the example, then two actual budgets should be prepared for comparison both with the projected budget and with one another. This will allow the students to state which treatment was more profitable and give a reason.

### **3. Skills – Crop Production and Management**

#### Section E

*Section B as for the Single Award (see pages 57-62) AND the skills listed below.*

- (a) Collect data on weather, soil water content and soil nutrient content using appropriate equipment.*
- (b) Enter data to a computer using a suitable format for analysis, or otherwise organising data for analysis.*
- (c) Analyse data using descriptive statistics, graphs, trend lines.*
- (d) Calculate rates and quantities of water and nutrients required for crops.*
- (e) Design simple research activities.*
- (f) Prepare a plan for the sustainable production of a crop.*
- (g) Design a simple rain water harvesting system.*
- (h) Prepare a compost heap.*
- (i) Prepare propagation media.*
- (j) Sterilise media.*
- (k) Design simple non-conventional crop production systems.*
- (l) Design simple farm structures.*
- (m) Use and maintain tools and small equipment.*
- (n) Demonstrate the use of maturity indices for harvesting crops.*
- (o) Demonstrate the use of proper post-harvest management techniques.*
- (p) Prepare a value added crop product.*
- (q) Demonstrate safe use of tools and equipment.*
- (r) Dispose of agricultural chemicals and containers safely.*

#### **Skills for Livestock Production and Management**

*Section C as for the Single Award (see pages 57-62) **AND** the skills listed below.*

- (a) Demonstrate good agricultural practices in the rearing of livestock.*



- (b) Identify principal cuts of meat.
- (c) Apply HACCP in all production and postproduction activities.
- (d) Preserve meat or fish using simple postproduction technologies.
- (e) Prepare a value added livestock product.

### **Skills for Entrepreneurship and Communication in Agriculture**

#### Section F

These skills may be drawn from the suggested practical activities and the learning objectives.

#### **CRITERIA FOR ASSESSING SKILLS**

1.	<b>Single Award</b>		
	Skills 10 x 4 Production Projects 2 cost analyses – one on AP and one on CP	40 KC marks 20 Application marks 20 Application marks	
	<b>Contribution to Total Marks</b>	<b>80 marks</b>	<b>40%</b>
2.	<b>Double Award</b>		
	Skills 10 x 4 2 Production Projects 2 Cost Analyses – Cost Analysis 1 on AP and Cost Analysis 2 on CP <b>OR</b> Cost Analysis 1 on CP and Cost Analysis 2 on AP. (Cost Analysis 2 is done <b>ONLY</b> for the project with the business plan) Extended Research Project – Business Plan	40 KC marks 40 Application marks 20 Application marks  20 Application marks	
	<b>Contribution to Total Marks</b>	<b>120 marks</b>	<b>40%</b>

## ◆ RESOURCES

The following books, other printed material and websites can be used for the **CXC**® Agricultural Science programme. The books and websites are by no means prescribed but intended only to indicate possible sources which teachers could use as appropriate.

Ramharacksingh, R.                      *Agricultural Science for CSEC Examination*. Oxford: Macmillan Publishers, 2011.

Ramgoonanan, S.                      *CXC Agriculture*. Trinidad and Tobago: Caribbean Educational Publishers, 2001.

### **Websites:**

Agricultural Science Digital Resources  
<http://agrisciencevideos.blogspot.com>

Career profiles – Careers in Agriculture  
<http://Agcareers.com/career-profiles>

<http://www.cardi.org>

<http://www.cta.int>

<http://www.fao.org>

<http://www.dexiaexport.com>

## ◆ GLOSSARY

<u>WORD/TERM</u>	<u>DEFINITION/MEANING</u>	<u>NOTES</u>
account for	Present reason for action or event	
annotate	add a brief note to a label	Simple phrase or a few words only.
apply	use knowledge of principles to solve problems	Make inferences and conclusions.
assess	present reasons for the importance of particular structures, relationships or process	Compare the advantages and disadvantages or the merits and demerits of a particular structure, relationship or process.
calculate	arrive at the solution to a numerical problem	steps should be shown; units must be included.
classify	divide into groups according to observable characteristics	
comment	state opinion or view with supporting reasons	
compare	state similarities and differences	An explanation of the significance of each similarity and difference stated may be required for comparisons which are other than structural.
construct	use a specific format to make and draw a graph, histogram, pie chart or other representation using data or material provided or drawn from practical investigations, build (for example, a model), draw scale diagram	Such representations should normally bear a title, appropriate headings and legend.
deduce	make a logical connection between two or more pieces of information; use data to arrive at a conclusion	
define	state concisely the meaning of a word or term	This should include the defining equation or formula where relevant.
demonstrate	show; direct attention to...	

<b><u>WORD/TERM</u></b>	<b><u>DEFINITION/MEANING</u></b>	<b><u>NOTES</u></b>
describe	provide detailed factual information of the appearance or arrangement of a specific structure or a sequence of a specific process	Description may be in words, drawings or diagrams or any appropriate combination. Drawings or diagrams should be annotated to show appropriate detail where necessary.
determine	find the value of a physical quantity	
design	plan and present with appropriate practical detail	Where hypotheses are stated or when tests are to be conducted, possible outcomes should be clearly stated and/or the way in which data will be analysed and presented.
develop	expand or elaborate an idea or argument with supporting reasons	
diagram	simplified representation showing the relationship between components.	
differentiate or	state or explain briefly those differences between or among items which can be used to define the items or place them into separate categories.	
discuss	present reasoned argument; consider points both for and against; explain the relative merits of a case	
draw	make a line representation from specimens or apparatus which shows an accurate relation between the parts	In the case of drawings from specimens, the magnification must always be stated.
estimate	make an approximate quantitative judgement	
evaluate	weigh evidence and make judgements based on given criteria	The use of logical supporting reasons for a particular point of view is more important than the view held; usually both sides of an argument should be considered.
explain	give reasons based on recall; account for	
find	locate a feature or obtain as from a graph	

<b><u>WORD/TERM</u></b>	<b><u>DEFINITION/MEANING</u></b>	<b><u>NOTES</u></b>
formulate	devise a hypothesis	
identify	name or point out specific components or features	
illustrate	show clearly by using appropriate examples or diagrams, sketches	
investigate	use simple systematic procedures to observe, record data and draw logical conclusions	
label	add names to identify structures or parts indicated by pointers	
list	itemise without detail	
measure	take accurate quantitative readings using appropriate instruments	
name	give only the name of	No additional information is required.
note	write down observations	
observe	pay attention to details which characterise a specimen, reaction or change taking place; to examine and note scientifically	Observations may involve all the senses and/or extensions of them but would normally exclude the sense of taste; XS
outline	Give basic steps only	
plan	prepare to conduct an investigation	
predict	use information provided to arrive at a likely conclusion or suggest a possible outcome	
record	write an accurate description of the full range of observations made during a given procedure	This includes the values for any variable being investigated; where appropriate, recorded data may be depicted in graphs, histograms or tables.
relate	show connections between; explain how one set of facts or data depend on others or are determined by them	

<b><u>WORD/TERM</u></b>	<b><u>DEFINITION/MEANING</u></b>	<b><u>NOTES</u></b>
sketch	make a simple freehand diagram showing relevant proportions and any important details	
state	provide factual information in concise terms outlining explanations	
suggest	offer an explanation deduced from information provided or previous knowledge (... a hypothesis; provide a generalisation which offers a likely explanation for a set of data or observations)	No correct or incorrect solution is presumed but suggestions must be acceptable within the limits of scientific knowledge.
test	to find out, following set procedures	

**Western Zone Office**  
**15 February 2017**

# CARIBBEAN EXAMINATIONS COUNCIL

Caribbean Secondary Education Certificate®  
**CSEC®**



## AGRICULTURAL SCIENCE

### Specimen Papers and Mark Schemes/Keys

**Specimen Papers:**

Paper 01

Paper 02

Paper 03

**Mark Schemes and Keys:**

Paper 01

Paper 02 (Single Award; Double Award)

Paper 03 (Double Award)



TEST CODE **01202010**

**SPEC 2016/01202010**

**C A R I B B E A N E X A M I N A T I O N S C O U N C I L**

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®  
EXAMINATION**

**AGRICULTURAL SCIENCE**

**SPECIMEN PAPER**

**Paper 01**

*1 hour 30 minutes*

**READ THE FOLLOWING INSTRUCTIONS CAREFULLY.**

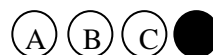
1. This test consists of 60 items. You will have 1 hour and 30 minutes to answer them.
2. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
3. Look at the sample item below.

Sample Item

Open-leaf lettuce which were planted on 16 May should be harvested

- (A) 30 May
- (B) 6 June
- (C) 13 June
- (D) 20 June

Sample Answer



The best answer to this item is “20 June” so answer space (D) has been shaded.

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1. Which of the following is a method of non-conventional farming?
  - (A) Grow box
  - (B) Trough culture
  - (C) Organic farming
  - (D) Peri-urban farming
2. Which of the following is NOT a principle governing organic farming?
  - (A) Use of compost
  - (B) Strip cropping
  - (C) Biological pest control
  - (D) Protecting ecological balance
3. Which of the following occurs as a result of trade liberalisation?
  - (A) Local farmers face more foreign competition.
  - (B) More local farmers plant exotic crops.
  - (C) More people buy the crops locally.
  - (D) Foreign competition is kept out.
4. Which of the following groups of conditions adversely affects local and regional agriculture?
  - (A) Praedial larceny, lack of extension service, adequate rainfall
  - (B) Poor marketing facilities, lack of credit, high technology usage
  - (C) Lack of appropriate technology, land fragmentation, praedial larceny
  - (D) Access to appropriate technology, lack of extension services, upgraded marketing facilities
5. The funding of regional agriculture projects is usually undertaken by the
  - (A) Central Bank
  - (B) National Agricultural Bank
  - (C) National Development Bank
  - (D) Caribbean Development Bank
6. Which of the following is NOT a factor of production?
  - (A) Building
  - (B) Capital
  - (C) Labour
  - (D) Land

7. Farmer George intends to increase the size of his livestock farm by building an additional pig unit. Before doing this, farmer George should first prepare a
- (A) partial budget
  - (B) farm inventory
  - (C) complete budget
  - (D) production record
8. A budget is a useful decision-making tool because it
- (A) is used to calculate depreciation costs
  - (B) is an audited statement of the past year
  - (C) is very accurate in the absence of records
  - (D) predicts production estimates and future prices
9. Demand is BEST defined as
- (A) the willingness of consumers to buy goods and services
  - (B) a place where buyers and sellers meet to carry out business activities
  - (C) the desires of all individuals in a market to purchase a good or service
  - (D) the quantity that would be bought at a given price in a given time period
10. Supply is BEST defined as
- (A) the willingness and ability of producers to make and sell products
  - (B) the willingness and ability to consume a given quantity of a good or service
  - (C) the willingness of sellers to sell more as the price goes higher for a good or a service
  - (D) the schedule or curve which shows the quantities which would be offered for sale at various prices
11. When the price of okra increases, consumers generally respond by
- (A) buying less
  - (B) buying more
  - (C) not buying any okra
  - (D) buying the same amount
12. Marketing channels may also be described as
- (A) communication channels
  - (B) channels of distribution
  - (C) intermediary channels
  - (D) promotional channels
13. When demand increases, price usually increases because
- (A) the elasticity of demand for the good is equal to infinity
  - (B) producers will increase prices in response to a higher demand
  - (C) higher demand causes a shortage and competing buyers offer higher bids
  - (D) higher demand means the cost of production goes up so suppliers will increase prices

- 14.** Increasing levels of inputs results in increasing levels of output up to a point, then there is a decreasing rate of output. This response demonstrates the law of
- (A) supply
  - (B) demand
  - (C) production function
  - (D) diminishing returns
- 15.** A subsidy can be classified as an incentive given to farmers in the form of
- (A) tax exemption
  - (B) a guaranteed price for crop export
  - (C) set minimum prices for agriculture produce
  - (D) financial assistance for the purchasing of farm equipment
- 16.** Advertising and sales promotion are referred to as
- (A) market research
  - (B) market practices
  - (C) marketing strategies
  - (D) merchandising techniques
- 17.** Which of the following groups of inputs BEST represents variable expenses?
- (A) Feed, medication and feeders
  - (B) Depreciation and machinery
  - (C) Pens, waterers and feeders
  - (D) Machinery and labour
- 18.** One of the MAIN characteristics of fixed cost is that they
- (A) represent costs of capital items
  - (B) vary with the level of production
  - (C) can be controlled by the manager
  - (D) include wages of casual workers
- 19.** Which of the following persons would MOST likely be a researcher in a CARICOM agricultural research institute?
- (A) Pharmacist
  - (B) Cardiologist
  - (C) Microbiologist
  - (D) Forensic pathologist
- 20.** Which of the following is a regional agricultural institution?
- (A) CBI
  - (B) IDB
  - (C) OAS
  - (D) CARDI

- 21.** Which of the above practices improves the oxygen and moisture content of the soil?
- (A) Liming
  - (B) Weeding
  - (C) Mulching
  - (D) Ploughing
- 22.** Which of the following is MOST effective in reducing the occurrence of blockage in the nozzle of a knapsack sprayer?
- (A) Selecting the correct chemicals
  - (B) Ensuring the presence of filters
  - (C) Mixing the spray properly
  - (D) Replacing the nozzle
- 23.** While spraying with an insecticide, you realise that the delivery hose is blocked. To correct this, you should
- (A) quickly remove the nozzle, and clear it under running water
  - (B) very carefully place nozzle to your mouth and blow it clear
  - (C) dismantle the spray unit and give it a thorough cleaning
  - (D) remove the lance, and clear the next section
- 24.** A farmer needs to prune his tomato plants. Which of the following is the MOST appropriate tool for him to use?
- (A) Cutlass
  - (B) Secateur
  - (C) Sharp knife
  - (D) Budding knife
- 25.** Which of the following is BEST suited for the establishment of contour lines for ploughing on a slope?
- (A) Knapsack sprayer
  - (B) Seed planter
  - (C) 'A' Level
  - (D) Ridger
- 26.** The part of a bean seed which consists of the plumule and radicle is called the
- (A) testa
  - (B) embryo
  - (C) cotyledon
  - (D) endosperm
- 27.** Which of the following statements is NOT true of mitosis?
- (A) The process of mitosis can be observed in the tip of a developing shoot.
  - (B) In asexual reproduction, cell division occurs by mitosis.
  - (C) Mitosis produces a diploid number of chromosomes.
  - (D) Mitosis produces female gametes in the ovary.

**28. Minerals in soils result from**

- (A) the decomposition of rocks
- (B) decomposition of organic materials
- (C) a mixture of organic matter and clay
- (D) the application of inorganic fertilizers

**29. Which of the following are aspects of biotechnology?**

- I. Genetically engineered rice containing pro-vitamin A
- II. Increased crop yield due to healthier planting material derived from tissue culture
- III. DNA fingerprinting to allow faster development of improved genotypes

- (A) I and II only
- (B) I and III only
- (C) II and III only
- (D) I, II and III

**30. Soil conservation is of vital importance to a farmer because it maintains**

- I. soil fertility
- II. the habitat of certain insect pests
- III. the top soil at a rather constant depth

- (A) I only
- (B) I and III only
- (C) II and III only
- (D) I, II and III

**31. Which of the following groups of factors is necessary for successful germination of seeds?**

- (A) Air, fertilizer, sunlight
- (B) Moisture, air, suitable temperature
- (C) Moisture, sunlight, suitable temperature
- (D) Moisture, fertilizer, suitable temperature

**32. Which of the following is NOT required for photosynthesis to occur?**

- (A) Light
- (B) Water
- (C) Oxygen
- (D) Chlorophyll

**33. Which of the following is a MAJOR difference between monocotyledons and dicotyledons?**

- (A) The arrangement of the xylem and phloem
- (B) The functions of the xylem and phloem
- (C) The quantity of the xylem and phloem
- (D) The size of the xylem and phloem

**34. A natural** vegetative process is establishing crops by

- (A) seeds
- (B) budding
- (C) grafting
- (D) stem tubers

**35.** The conservation of rain forests is of ecological importance because they

- I. provide a source of great genetic diversity
- II. provide ideal conditions for grazing livestock
- III. play an important part in the water cycle by encouraging cloud formation

Which of the above statements are CORRECT?

- (A) I and II only
- (B) I and III only
- (C) II and III only
- (D) I, II and III

**36.** A heterozygous tall plant is crossed with a homozygous short plant. Tall is dominant over short. The phenotype of the F<sub>1</sub> generation will most likely be

- (A) all tall
- (B) all short
- (C) 25% tall, 75% short
- (D) 50% tall, 50% short

**37.** Postharvest losses are LEAST likely to occur in the process of

- (A) storage
- (B) labelling
- (C) packaging
- (D) transportation

**38.** ‘Damping off’ of tomato seedlings in a seed box is caused by

- (A) a virus
- (B) a fungus
- (C) an aphid
- (D) a nematode

**39.** Which of the following practices can BEST assist with both the maintenance of soil fertility and the control of pests and diseases?

- (A) Heaving penmanuring
- (B) Multiple cropping
- (C) Soil fumigation
- (D) Crop rotation

- 40.** Which of the following crops is MOST likely to be attacked by leaf miner?
- (A) Yam
  - (B) Tomato
  - (C) Banana
  - (D) Sugarcane
- 41.** The purpose of the gizzard in the alimentary canal of a bird is to
- (A) secrete digestive juices
  - (B) churn and grind up food
  - (C) store large amounts of food
  - (D) absorb water from the food
- 42.** Roughages are typically high in
- (A) fats
  - (B) fibre
  - (C) protein
  - (D) starches
- 43.** Hay is grass which has been
- (A) cut, dried, and stored in bales
  - (B) cut and fed fresh to livestock
  - (C) cut, compressed and buried in an airtight pit
  - (D) cut, finely chopped and crushed between rollers
- 44.** Chicks are debeaked in order to prevent
- (A) pullorum
  - (B) coccidiosis
  - (C) pediculosis
  - (D) cannibalism
- 45.** Which of the following statements is NOT true about drones in a hive of bees?
- (A) They are infertile.
  - (B) They have no sting.
  - (C) Drones cannot secrete wax.
  - (D) They have the largest compound eyes.
- 46.** How does a beekeeper recognise when a hive is about to swarm?
- (A) Some workers start to build queen cells.
  - (B) There are no guard bees at the entrance.
  - (C) The bees become more aggressive.
  - (D) The workers stop eating honey.

**47.** In crossbreeding, the offspring are often of superior quality to either parent. This is referred to as

- (A) parthenogenesis
- (B) paedogenesis
- (C) homeostasis
- (D) heterosis

**48.** The part of the egg which provides energy for the unhatched chick is the

- (A) inner membrane
- (B) albumen
- (C) chalaza
- (D) yolk

**49.** A balanced ration is BEST described as a

- (A) high-protein diet given to pregnant and lactating animals
- (B) feed which is given to young animals immediately after birth
- (C) concentrate feed which has to be weighed, and must be very exact
- (D) diet which contains all the food nutrients needed in the correct proportion

**50.** The purpose of the crop in the alimentary canal of the bird is to

- (A) store ingested food
- (B) secrete digestive enzymes
- (C) churn and grind food to aid digestion
- (D) absorb digested food in the blood stream

**51.** Blotches, pimples and black scabs on the unfeathered parts of the bodies of poultry are symptoms of

- (A) roup
- (B) cholera
- (C) fowl pox
- (D) Newcastle disease

**52.** The fusion between male and female gametes in sexual reproduction is called

- (A) coition
- (B) gestation
- (C) copulation
- (D) fertilization



**53.** Which of the following statements about artificial insemination (AI) are correct?

- I. AI improves the chances of an egg being fertilized.
- II. It increases the number of offspring produced by one male in a year.
- III. AI prevents the spread of venereal diseases.

- (A) I and II only
- (B) I and III only
- (C) II and III only
- (D) I, II and III

**54.** The incubation period of a hen's egg is

- (A) 9 days
- (B) 15 days
- (C) 21 days
- (D) 31 days

**55.** When should a rabbit, being a nocturnal animal, receive the larger portion of its ration?

- (A) At midday
- (B) Mid- morning
- (C) Early morning
- (D) Late afternoon

**56.** Coccidiosis in rabbits is caused by a

- (A) virus
- (B) fungus
- (C) bacterium
- (D) protozoan

**57.** Which of the following are freshwater fish?

- (A) Trout, catfish, tilapia
- (B) Grouper, snapper, sardine
- (C) Cavalla, barracuda, kingfish
- (D) Spanish mackerel, marlin, tuna

**58.** If calves do not receive colostrum within the first 24 hours after birth, they may develop

- (A) scours
- (B) mastitis
- (C) brucellosis
- (D) anaplasmosis

**59.** Which of the following statements concerning the Barbados Blackbelly sheep is INCORRECT?

- (A) They are one of the most prolific breeds of sheep.
- (B) They cannot survive in areas of poor vegetation.
- (C) They have a high tolerance to worm infestation.
- (D) They are very heat-tolerant.

**60.** The most common breed of dairy cattle reared in the Caribbean is the

- (A) Zebu
- (B) Jersey
- (C) Holstein
- (D) Brahman

**C A R I B B E A N E X A M I N A T I O N S C O U N C I L**  
**SECONDARY EDUCATION CERTIFICATE EXAMINATION**  
**AGRICULTURAL SCIENCE**  
**SPECIMEN PAPER 01**

**2016**  
**KEY**

<b>Item #</b>	<b>Key</b>
1	C
2	B
3	A
4	C
5	D
6	A
7	A
8	D
9	D
10	A
11	A
12	B
13	C
14	D
15	D
16	C
17	B
18	A
19	C
20	D
21	C
22	C
23	D
24	B
25	C
26	B
27	D
28	A
29	D
30	A

<b>Item #</b>	<b>Key</b>
31	B
32	C
33	A
34	D
35	B
36	D
37	B
38	B
39	D
40	B
41	B
42	B
43	A
44	D
45	A
46	A
47	D
48	C
49	D
50	A
51	C
52	D
53	C
54	C
55	D
56	D
57	A
58	A
59	A
60	C



TEST CODE **01202020**

**SPEC 2016/01202020**

**C A R I B B E A N E X A M I N A T I O N S C O U N C I L**

**CARIBBEAN SECONDARY EDUCATION CERTIFICATE®  
EXAMINATION**

**AGRICULTURAL SCIENCE**

**SPECIMEN PAPER**

**Paper 02**

***2 hours***

**READ THE FOLLOWING INSTRUCTIONS CAREFULLY.**

1. This paper consists of SIX questions in THREE sections.
2. Answer ALL questions.
3. Write your answers in the spaces provided in this booklet.
4. DO NOT write in the margins.
5. If you need to rewrite any answer and there is not enough space to do so on the original page, you must use the extra lined page(s) provided at the back of this booklet.  
**Remember to draw a line through your original answer.**
6. **If you use the extra page(s) you MUST write the question number clearly in the box provided at the top of the extra page(s) and, where relevant, include the question part beside the answer.**

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**DO NOT TURN THIS PAGE UNTIL YOU ARE TOLD TO DO SO.**

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**SECTION I**

**Answer ALL questions in this section.**

**Write your answers in the spaces provided in this booklet.**

**1. (a)** Identify the agricultural career associated with EACH of the following:

(i) A person who advises farmers on crop and livestock management

.....  
**(1 mark)**

(ii) A person who treats diseases in livestock

.....  
**(1 mark)**

(b) In urban communities, people often use containers to grow vegetables, condiments and medicinal plants.

State ONE advantage of using containers to cultivate these plants.

.....  
.....  
.....  
**(1 mark)**

(c) A biotechnologist predicts that in the near future the Caribbean region will be faced with severe food shortages. Suggest TWO ways in which biotechnology can improve

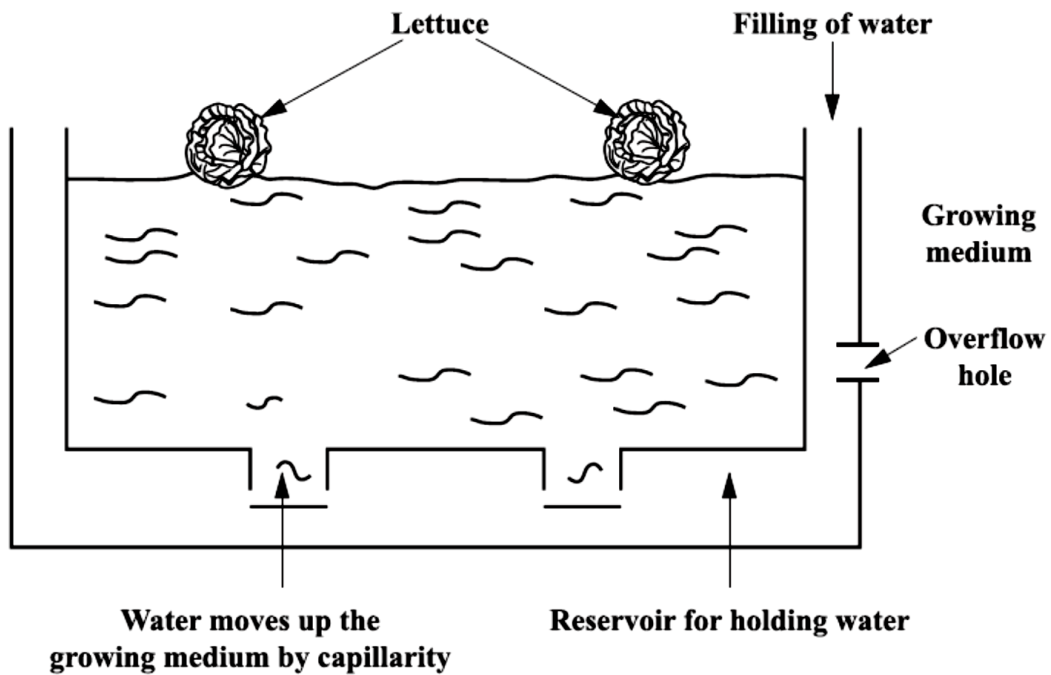
(i) crop production

.....  
.....  
.....  
**(2 marks)**

(ii) livestock production.

.....  
.....  
.....  
**(2 marks)**

(d) Figure 1 shows a cross section of a container used for growing vegetable crops.



**Figure 1. Cross section of a container used for growing vegetable crops**

Suggest THREE ways in which this system could be modified for greater efficiency in growing lettuce.

.....

.....

.....

.....

**(3 marks)**

**Total 10 marks**

2. (a) (i) Explain the meaning of the term ‘gross farm income’.

.....

.....

(1 mark)

- (b) Table 1 shows the information for Farmer Broderick’s 100-unit broiler farm.

**TABLE 1: INCOME AND EXPENSES FOR BROILER FARM**

<b>Descriptor</b>	<b>Amount (\$)</b>
Average weight per kg of bird	2 kg
Selling price per kg of bird	\$20
Number of birds	100
<b>Total Income</b>	<b>4000</b>
<b>Expenses</b>	<b>\$</b>
Depreciation	100
Feed	400
Interest on loan	300
Baby chicks	800
Utilities	200
Labour	700
Insurance	200
<b>Total Expenses</b>	<b>2700</b>

Using the information provided in Table 1, identify one fixed cost and ONE variable cost.

Variable Cost:

.....

Fixed Cost:

.....

(2 marks)

- (c) Farmer Broderick wants to increase the number of birds reared by 50 units. As a result, his variable costs will increase by \$1500. Calculate, stating the formula in EACH case,

- (i) his additional income

.....

.....

.....

.....

(2 marks)

- (ii) the change in net profit.

.....

.....

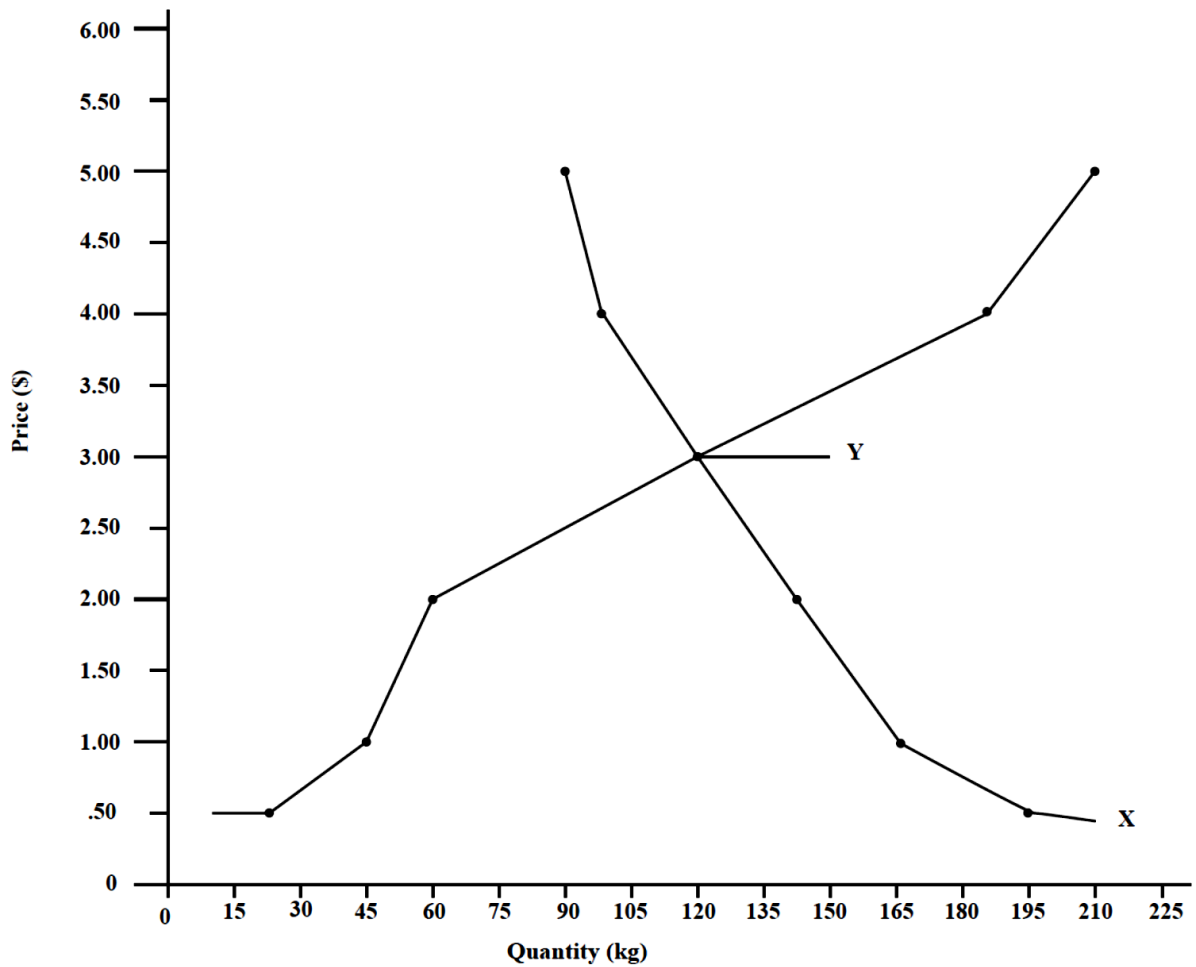
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**(2 marks)**



(d) Figure 2 shows the demand and supply curves for sorrel in the Caribbean.



**Figure 2. Demand and supply curve for sorrel**

(i) Identify X and Y in Figure 2.

X.....

Y.....

**(2 marks)**

(ii) A farmer observes over the years that in January there is an oversupply of sorrel on the market. Suggest ONE strategy that the farmer can use to make money from his surplus sorrel crop.

.....

.....

**(1 mark)**

**Total 10 marks**

**SECTION II**

**Answer ALL questions in this section.**

**Write your answers in the spaces provided in this booklet.**

3. (a) Briefly describe EACH of the following methods of controlling pests and diseases in agriculture:

Manual

.....

Mechanical

.....

**(2 marks)**

- (b) State ONE way in which technology is used to enhance crop production.

.....

.....

**(1 mark)**

- (c) CARDI has been informing farmers about the effects of white fly infestation on tomato production. The Organization conducted an experiment on the use of sticky traps and insecticides on white fly control. Table 2 shows the results of the experiment.

**TABLE 2: CONTROL OF WHITE FLY IN TOMATO PRODUCTION  
USING DIFFERENT METHODS**

<b>Control of White Fly</b>	<b>Sticky Trap</b>	<b>Insecticide</b>	<b>Sticky Trap and Insecticide</b>
Number of dead white flies	1 000	4 000	5 100

- (i) What TWO conclusions can be drawn from the information in Table 2?

.....

.....

.....

**(2 marks)**

- (ii) Suggest THREE OTHER methods that can be used to control the effect of white flies on tomato production.

.....

.....

.....

.....

**(3 marks)**

- (d) A livestock officer decided to introduce a new forage legume from Africa into a Caribbean country. The legume seeds arrived at the airport but had to be destroyed by the plant quarantine officer.

Suggest TWO possible reasons why the seeds had to be destroyed by the plant quarantine officer.

.....

.....

.....

.....

**(2 marks)**

**Total 10 marks**

4. (a) Moulding is a crop management practice that is recommended by extension officers under certain conditions.

(i) State what is meant by 'moulding'.

.....  
.....

**(1 mark)**

(ii) Identify TWO benefits of moulding.

.....  
.....  
.....  
.....

**(2 marks)**

(iii) Suggest ONE reason why the use of chemicals should be restricted.

.....  
.....  
.....

**(1 mark)**

- (b) Figure 3 shows two plant leaves, labelled A and B, which are affected by two different plant pests.



**Figure 3. Plant leaves affected by two different plant pests**

- (i) Identify EACH pest responsible for the damage shown in Leaf A and Leaf B.

Leaf A .....

Leaf B .....

**(2 marks)**

- (ii) Explain TWO ways in which the damage caused by these pests can affect farm profitability.

.....  
.....  
.....  
.....

**(2 marks)**

- (iii) Suggest TWO ways by which these pests can be controlled.

.....  
.....  
.....  
.....

**(2 marks)**

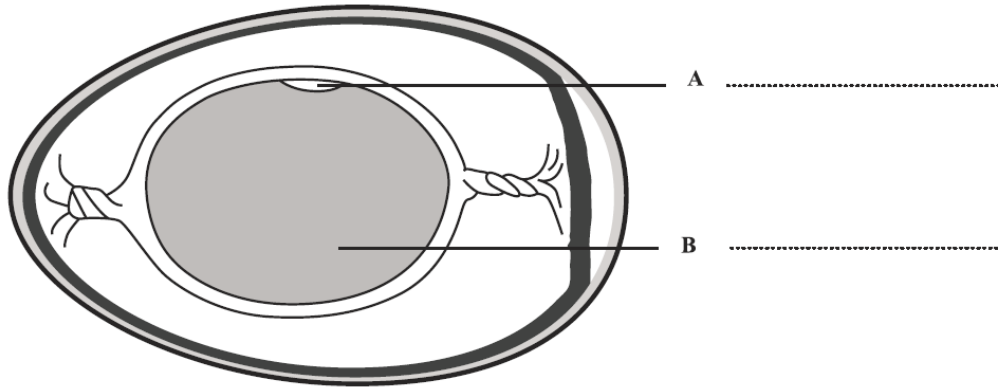
**Total 10 marks**

**SECTION III**

**Answer ALL questions in this section.**

**Write your answers in the spaces provided in this booklet.**

5. (a) (i) Figure 4 shows a section through a hen's egg.



**Figure 4. A section through a hen's egg**

Identify the parts labelled A and B in Figure 4. Write your answers in the spaces provided in Figure 4.

**(2 marks)**

- (ii) The shell of a hen's egg is thin and cracks easily.

- (a) Suggest ONE way how this is likely to affect the marketability of the egg.

.....  
.....

**(1 mark)**

- (b) Suggest TWO ways by which this problem can be eliminated.

.....  
.....  
.....

**(2 marks)**

- (b) Farmer George noticed that only one of his heifers calved since he was unable to recognize the signs of heat.

- (i) List TWO signs of heat (oestrus) Farmer George should look for in his heifers.

.....

.....

.....

.....

**(1 mark)**

- (ii) Suggest TWO benefits to Farmer George of artificially inseminating his young heifers.

.....

.....

.....

**(2marks)**

- (c) A farmer wants to produce goats during the months of October to December. His extension officer advises him to use oestrus synchronization or artificial insemination. His advice to the farmer is based on the information in Table 3.

**TABLE 3: NUMBER OF GOATS PRODUCED USING DIFFERENT REPRODUCTIVE TECHNIQUES**

Reproductive Technique	Number of Goats Produced		
	October	November	December
Artificial insemination	70	100	130
Oestrus synchronization	100	100	130

Which is the better reproductive technique for producing goats over the months of October to December? Give ONE reason for your answer.

.....

**(2 marks)**

**Total 10 marks**

6. (a) (i) What does the acronym 'FCR' mean?

.....

.....

**(1 mark)**

- (ii) Name FOUR ingredients that can be used in making livestock feeds.

.....

.....

.....

.....

**(2 marks)**

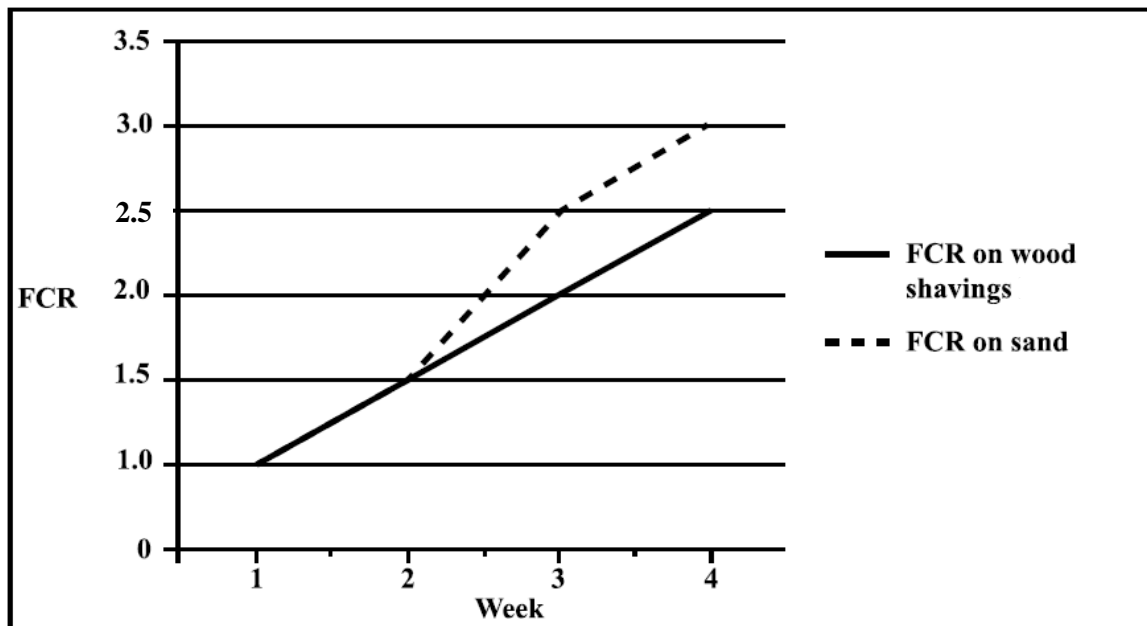


- (b) A poultry farmer wants to know, which of two types of litter, wood shavings or sand, is better for rearing broilers. The effect of sand and wood shavings on feed conversion ratio (FCR) over four weeks is shown in Table 4.

**TABLE 4: EFFECT OF SAND AND WOOD SHAVINGS ON  
FEED CONVERSION RATIO (FCR) IN BROILERS**

Week	FCR on Sand	FCR on Wood Shavings
1	1.0	1.0
2	1.5	1.5
3	2.5	2.0
4	3.0	2.5

Figure 5 represents the data in Table 4.



**Figure 5. Effect of sand and wood shavings on FCR in broilers**

- (i) Calculate the average FCR over the four weeks on the sand and wood shavings systems.

Sand

.....

Wood shavings

.....

(2 marks)

(ii) Which is the better system of rearing broilers? Suggest ONE reason for your answer.

.....

.....

**(2 marks)**

(iii) Explain ONE possible effect of EACH of the two systems on the health of the broilers.

.....

.....

**(2 marks)**

(iv) Suggest TWO OTHER management practices that can affect the performance of broilers up to market age.

.....

.....

.....

.....

**(1 mark)**

**Total 10 marks**

**END OF TEST**

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CARIBBEAN SECONDARY EDUCATION CERTIFICATE®  
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AGRICULTURAL SCIENCE

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DOUBLE AWARD

GENERAL PROFICIENCY

MARK SCHEME FOR SPECIMEN PAPER 02

AGRICULTURAL SCIENCE

SINGLE AWARD

DOUBLE AWARD

Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
1.				
(a) (i)	Extension Officer/Agronomist + Livestock	1 mark for any correct response	1	
(ii)	Veterinarian/Vet Assistant/Animal Health Officer	1 mark for any correct response	1	
(b)	Advantages of using containers for growing vegetables, condiments and medicinal plants  <ul style="list-style-type: none"> <li>- Containers are portable and can be moved from place to place.</li> <li>- Crops can be cultivated where soil conditions are inappropriate for crop growth</li> <li>- Ease of management.</li> <li>- Environmentally friendly method of growing crops e.g. encourages recycling of containers, reduction in leaching of fertilizers.</li> <li>- Containers can be decorated to improve the aesthetic appeal of the environment.</li> <li>- Convenience e.g. containers can be positioned to facilitate the elderly as well as the differently-abled.</li> <li>- Better control of pests and diseases/less pests and diseases.</li> <li>- Better control of weeds/less weeds.</li> </ul>	1 mark for any correct response	1	
(c) (i)	Three ways in which biotechnology can improve crop production  <ul style="list-style-type: none"> <li>- More nutritious</li> <li>- Production of new plant varieties/more crops/more planting materials/transgenic plants/planting materials/high yields</li> <li>- Production of biological pesticides</li> <li>- Improved disease resistance – drought resistance/water tolerant</li> </ul>	1 mark for each up to a maximum of 3 marks		2

AGRICULTURAL SCIENCE

SINGLE AWARD  
DOUBLE AWARD

Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
(ii)	Two ways in which biotechnology can improve animal production  <ul style="list-style-type: none"> <li>- Improved animal breeds/types of breeds</li> <li>- Vaccine production</li> <li>- Better managed animals/docile</li> <li>- High quality embryos</li> <li>- More animals produced/high yields</li> <li>- Better quality animals/FCR/milk production/disease resistance/healthier</li> <li>- Better quality feed/grasses</li> <li>- More feed-variation for animals</li> <li>- Improved fertility</li> <li>- Drought resistance/water tolerant(crops)</li> <li>- Larger offspring</li> </ul>	1 mark for each up to a maximum of 2 marks		2
(d)	Three ways of modifying the container (Figure 1) to improve efficiency  <ul style="list-style-type: none"> <li>- Use of an automated system to fill water in the container</li> <li>- Reduced spacing between plants</li> <li>- Use of a mulch to reduce evaporation of water from the growing medium</li> <li>- The need for drainage holes at the bottom of the inner part of the box to prevent waterlogging of the growing medium</li> </ul> <b>S.O. A1.3, A3.1</b>	1 mark for each up to a maximum of 3 marks		3
	<b>TOTAL</b>		<b>3</b>	<b>7</b>

AGRICULTURAL SCIENCE

SINGLE AWARD  
DOUBLE AWARD

Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
2. (a)	Define gross farm income - Gross farm income is a <u>total of all monies earned by the farm/total income/total revenue.</u>	1 mark for underlined phrase	1	
(b)	Variable Costs: <ul style="list-style-type: none"> <li>• Feed</li> <li>• Baby Chicks</li> <li>• Labour</li> <li>• Utilities</li> </ul> Fixed Costs: <ul style="list-style-type: none"> <li>• Depreciation</li> <li>• Interest on loan</li> <li>• Insurance</li> </ul> (If the candidate uses the cost of the item for each variable cost listed above, then the mark can be awarded)	1 mark for any correct response          1 mark for any correct response		2
(c) (i)	<u>Additional Income</u> Formula:  = Average weight per kg of bird × Selling price per kg of bird × Number of birds  = 2 kg × \$20 × 50= \$2,000	1 mark for correct substitution   1 mark for correct calculation/or correct calculation using candidate's substitution		2

AGRICULTURAL SCIENCE

SINGLE AWARD  
DOUBLE AWARD

Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
(ii)	<p><u>Change in Net Profit</u> Formula: Additional Income – Additional Variable Cost \$2,000 – \$1,500 = \$500</p> <p><b>OR</b> Formula = New Net profit – Old Net profit</p> <p><b>OR</b> Change in Net profit = [ (Total Income + Additional Income) – (Total Expenses + Additional Variable Costs) ] – (Total Income – Total Expenses)</p> <p>= [ (\$4000 + \$2000) – (\$2700 + \$1500) ] – (\$4000 – \$2700) = (\$6000 – \$4200) – \$1300 = \$1800 – \$1300 = \$500</p>	<p>1 mark for correct formula</p> <p>1 mark for correct substitution</p> <p>1 mark for correct calculation/or correct calculation using candidate's substitution</p>		2
(d) (i)	<p>X-Demand curve Y-Equilibrium point/Equilibrium</p> <p>Strategies that the farmer can use to make money from his surplus crop:</p> <ul style="list-style-type: none"> <li>• Increased shelf life</li> <li>• Storage of surplus until price increases</li> <li>• Processing the surplus/value added</li> <li>• Exporting the surplus/sell it</li> <li>• Using the sample for market promotion/display</li> <li>• Reducing the price for consumers to buy</li> </ul> <p><b>S.O. D1.2, D1.4, D3.2</b></p>	<p>1 mark for each correct response</p> <p>1 mark for each correct response up to a maximum of 2 marks</p>	2	1
	<b>TOTAL</b>		3	7

AGRICULTURAL SCIENCE

SINGLE AWARD  
DOUBLE AWARD

Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
3. (a)	Manual methods Physical or done by hand, e.g. hand cutting, hoeing, weeding, forking, cutlasses, traps.  Mechanical Using machinery, e.g. shoots, brushcutting, sticky traps, ploughing, harrowing, rotavating, forking, cutlasses, traps, power washing pen.	1 mark for each method up to a maximum of 2 marks	2	
(b)	Use of technology to enhance crop production  <ul style="list-style-type: none"> <li>• Land preparation</li> <li>• Plant breeding</li> <li>• Irrigation systems</li> <li>• Use of GPS on large farms or any other acceptable answer</li> </ul>	1 mark for any correct response	1	
(c) (i)	– Best treatment = Sticky trap + insecticide – Worst treatment = Sticky trap only – Moderate treatment = insecticide better than sticky trap but not as good as insecticide and sticky trap together.  Any other reasonable conclusions	1 mark for each up to a maximum of 2 marks	2	
(ii)	Biological control <ul style="list-style-type: none"> <li>– Pest predators</li> <li>– Sterile male</li> <li>– Pheromones trap</li> <li>– Bio-pesticides</li> <li>– Green house (restrict entry of insects), enclosed environment, keep out flies/ nets</li> <li>– IPM</li> </ul>	1 mark for each up to a maximum of 3 marks		3



AGRICULTURAL SCIENCE

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DOUBLE AWARD

Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
(d)	Cultural methods - Resistant tolerant varieties - Mulching - Repellent plants/trap crops - Wider spacing - Crop rotation - Field sanitation (remove infected leaves/fruits) - Weed removal/field sanitation	1 mark for each up to a maximum of 3 marks		2
	Reasons why the seeds had to be destroyed - Import procedures not followed/protocol not followed/illegal to the country - No import certificates/phyto-sanitary certification - Pests and diseases detected on the seeds - To control the spread of pests and diseases - To prevent the introduction of new pests and disease/ weeds - To control the spread to other economic crops - It is considered an evasive/species/ toxic to man/animals/other crops, weed seeds  <b>S.O. B3.3, B5.5, B5.8, B5.9</b>			
	<b>TOTAL</b>		<b>3</b>	<b>7</b>

AGRICULTURAL SCIENCE

SINGLE AWARD  
DOUBLE AWARD

Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
<b>4.</b>	<b>S.O. B5.2, B5.3, B5.8</b>			
(a) (i)	<ul style="list-style-type: none"> <li>- Moulding involves heaping/pulling/placing/applying gathering/adding/manure/animal dung/soil around the base of the plant</li> </ul>	1 mark for each correct response	<b>1</b>	
(ii)	<p>Two benefits of moulding</p> <ul style="list-style-type: none"> <li>- Increases drainage/reduces waterlogged conditions at the base of the plant</li> <li>- Assists with recycling of plant nutrients</li> <li>- Stimulates root growth on the stem</li> <li>- Help to stabilize the plant/anchor the plant</li> <li>- Keeps the plant upright</li> <li>- Covers exposed roots</li> <li>- Aeration of the soil</li> <li>- Provides a more compact soil for</li> <li>- The growing of certain root crops</li> <li>- Helps to retain soil moisture.</li> </ul>	1 mark for each up to a maximum of 2 marks	<b>2</b>	
(iii)	<p>Reasons for restricted use of chemicals</p> <ul style="list-style-type: none"> <li>• Is environmentally unfriendly</li> <li>• Residual effects on human health</li> <li>• Kills good insects (pollinators)</li> </ul>	1 mark for any correct response		<b>1</b>
(c) (i)	<p>Identify the pests responsible for damage to Leaf A and Leaf B</p> <ul style="list-style-type: none"> <li>- A = Leaf miner</li> <li>- B = Cut worm/worm/caterpillars/flee beetle/beetle/slug/snail/grasshopper/hairy worms/acoushi ants/drugger/locust</li> </ul>	1 mark for each up to a maximum of 2 marks		<b>2</b>

AGRICULTURAL SCIENCE

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Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
(ii)	Two ways in which damage caused by Pest A and Pest B above can affect farm profitability  <ul style="list-style-type: none"> <li>- Reduction in quantity of leafy vegetable available for sale</li> <li>- Reduction in quality of produce</li> <li>- Reduction in price of produce</li> <li>- Reduction in farm income</li> <li>- Increase in farm expenditure/increased expenditure on pesticide/labour costs</li> <li>- Reduction in profitability</li> </ul>	1 mark for each up to a maximum of 2 marks		2
(iii)	Suggest two ways of controlling these pests  <ul style="list-style-type: none"> <li>- Application of pesticides/insecticides, etc.</li> <li>- Field sanitation</li> <li>- Planting companion plants with repellent properties</li> <li>- Crop rotation</li> <li>- Mulching e.g. plastic mulch</li> <li>- Turning of soil at the base of the plant</li> </ul> <p><b>S.O. B5.2, B5.3, B5.8</b></p>	1 mark for each up to a maximum of 2 marks		2
	<b>TOTAL</b>		<b>3</b>	<b>7</b>

AGRICULTURAL SCIENCE

SINGLE AWARD

DOUBLE AWARD

Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
5.				
(a) (i)	Identify parts of a hen's egg A - Germinal Disc/Disc/Embryo/Germ B - Yolk/yellow/egg yellow	1 mark for each part correctly labelled	2	
(ii) a)	Marketability: - Sale of eggs is likely to decrease due to increase breakage/spoilage/bad odour/stinks/low price/customers will not want to buy/reduced shelf life/no profit - Spoilage due to contamination/bacteria	1 mark for any correct response		1
(ii) (b)	Two ways of eliminating this problem  - Feeding birds a ration with higher levels of calcium  - Feed birds with calcium/egg shell/oyster shell/sea shell feed bonemeal/feed oyster shell	1 mark for each up to a maximum of 2 marks		1
(b) (i)	Signs of heat in cows  - Reddened and swollen vulva - restlessness - Willingness to be mounted by other animals - Trying to mount other animals - constant bellowing - Loss of appetite - Clear mucus discharge from vulva - Drop in milk yield	1 mark for each up to a maximum of 3 marks	1	
(ii)	Benefits of artificial insemination  - Farmers are more motivated to keep records. - An improvement or upgrading of the farmer's stock of animals. - It removes the risks involved in rearing dangerous male animals.	1 mark for each benefit up to a maximum of 2 marks		2

SINGLE AWARD  
DOUBLE AWARD

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
(c)	<ul style="list-style-type: none"> <li>- The costs to the farmer are less than the cost of rearing a male animal to maturity.</li> <li>- Female animals do not need to be taken to the breeding station for servicing.</li> <li>- The spread of venereal diseases is reduced or prevented.</li> <li>- Young females are prevented from physical injuries during mating due to the weight of mature bulls.</li> <li>- Semen from a pedigree male can be used to service several hundred females.</li> <li>- Semen from injured males or males that cannot mount females can be used.</li> <li>- Frozen semen can be stored and used for many years, even after the death of the male animals.</li> </ul> <p>Better reproductive technique</p> <ul style="list-style-type: none"> <li>- Oestrus synchronization</li> </ul> <p>Reasons:</p> <ul style="list-style-type: none"> <li>- Better management of pregnant and lactating animals</li> <li>- More/higher number of offspring</li> <li>- More sales/money/markets</li> </ul> <p><b>S.O. C4.5, C4.6, C4.8</b></p>	<p>1 mark for naming correct technique</p>       <p>1 mark for any correct reason</p>		<b>2</b>
	<b>TOTAL</b>		<b>3</b>	<b>7</b>

AGRICULTURAL SCIENCE

SINGLE AWARD  
DOUBLE AWARD

Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
6.				
(a) (i)	- FCR - Feed conversion ratio	1 mark for correct response	1	
(ii)	Ingredients for livestock feed Rice bran, poultry litter, bonemeal, meat meal, grass/legumes, coconut meal, cotton seed meal, rice bran, soya hull, wheat middling, brewers grain, broken rice, rice, fish meal, fish silage, cocoa pod meal, molasses, citrus, water, wheat peel/rind, corn, soghum, bagasse vegetable peelings, root crops, crop residues, salt, milk, egg shells, oyster shells, sea shells, water.	1 mark for any two ingredients up to a maximum of 2 marks	2	
(b) (i)	FCR sand $(1.0 + 1.5 + 2.5 + 3.0) \div 4 = 2.0 = 8/4$ FCR litter $(1.0 + 1.5 + 2.0 + 2.5) \div 4 = 1.75 = 7/4$	1 mark for correct calculation		2
(ii)	Better system for rearing birds FCR on wood shavings is the better system.  Lower FCR, better conversion of feed into meat/1.75 kg feed for 1 kg meat on wood shavings compared to 2 kg feed to 1 kg meat on sand.	1 mark for selecting better system for rearing birds  1 mark for reason		2
(iii)	Any suitable management practice Effect of systems on the health of broilers  - Sand has wetter faeces than wood Shavings, hence more breathing problems/colds/high mortality.	1 mark for each up to a maximum of 2 marks		2

AGRICULTURAL SCIENCE

SINGLE AWARD  
DOUBLE AWARD

Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
(c)	<ul style="list-style-type: none"> <li>– Wood shavings litter reduces flies/maggots/spread of diseases.</li> <li>– Wood shavings litter more ruffling of feathers and spread of litter faecal dust to waterers/contamination of waterer with bacteria.</li> <li>– Wood shavings can be broken down by microorganisms which will reduce diseases</li> <li>– Wood shavings absorb moisture from faeces</li> <li>– Wood shavings/injury to birds' feet</li> <li>– Feed compaction of digestive system/choking</li> </ul>	1 mark for any 2 management practices		
	<p>Other management practices</p> <ul style="list-style-type: none"> <li>– Adequate light to encourage feeding</li> <li>– Avoid overcrowding</li> <li>– Proper feeding of starter and finisher/correct amounts of feed/correct FCR</li> <li>– Adequate water supply</li> <li>– Addition of vitamins and minerals</li> <li>– Antibiotics to reduce stress</li> <li>– Ensure adequate ventilation/fans</li> <li>– Turning the litter weekly</li> <li>– Cleaning of feeders and waterers</li> <li>– Vaccination of birds</li> <li>– Use of feed additives/coccidiostats/wormers</li> <li>– Ensure adequate spacing for birds</li> <li>– Ensure adequate spacing for waterers/feeders</li> <li>– Adequate feeders and waterers</li> <li>– Foot bath/ sanitation</li> <li>– Vermin protection for rats, mongooses</li> <li>– Daily observation of broilers for diseases/pests.</li> </ul> <p>S.O. C3.4, C3.5, C3.11</p>			1
	<b>TOTAL</b>		<b>3</b>	<b>7</b>



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**Paper 03**

*2 hours*

**READ THE FOLLOWING INSTRUCTIONS CAREFULLY.**

1. There are six questions in this booklet, two in Section I, two in Section II and two in Section III.  
Answer ALL questions.
2. Each question carries 10 marks.
3. Write your answers in the spaces provided in this booklet.

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**SECTION I**

**Answer ALL questions in this section.**

**Write your answers in the spaces provided in this booklet.**

1. John has recently graduated from high school and wants to raise broilers to supply a major poultry processing plant. John is not sure what steps to take and has sought the advice of a business development officer from the Ministry of Agriculture.

- (a) Advise John of ONE type of business organization under which he can operate his poultry farm.

.....  
(1 mark)

- (b) State TWO advantages and ONE disadvantage of the business organization named in 3(a) above.

Advantages .....

.....

.....

(2 marks)

Disadvantage .....

.....

.....

(1 mark)

(c) Suggest FIVE steps John must take in establishing his poultry farm.

.....

.....

.....

.....

.....

.....

.....

.....

**(5 marks)**

(d) Suggest ONE appropriate electronic method that John can use to advertise his business effectively.

.....

.....

**(1 mark)**

**Total 10 marks**

2. Ingrid is presently employed as a bank manager, but wants to earn additional income by establishing a mango orchard to supply the export market in Canada. Based on her research, she has learned that the Canadian market for mangoes is oversupplied and the prices are low. However, she has heard that her country has been granted permission to ship mangoes to the United States, but plant quarantine regulations of that country are complicated and expensive to meet. Ingrid has recently gone to a forum in which she learned that local hotels and high end supermarkets are demanding more mangoes and willing to pay premium prices for selected varieties.

(a) (i) State the TWO main types of entrepreneur.

.....

.....

**(2 marks)**

(ii) State TWO characteristics of an entrepreneur.

.....

.....

.....

.....

**(2 marks)**

(iii) Based on the case study above, what type of entrepreneur is Ingrid? Give ONE reason for your answer.

Type

.....

.....

Reason

.....

.....

.....

**(2 marks)**

- (b) Explain ONE opportunity and ONE threat to Ingrid in establishing her mango orchard.

Opportunity .....

.....

.....

.....

.....

.....

Threat .....

.....

.....

**(2 marks)**

- (c) Ingrid, who only speaks English, has been contacted by a Spanish speaking investor from Latin America who wants to enter into a partnership to set up the farm.

Describe TWO barriers to communication that Ingrid will face in dealing with the investor.

.....

.....

.....

.....

**(2 marks)**

**Total 10 marks**

**SECTION II**

**Answer ALL questions in this section.**

**Write your answers in the spaces provided in this booklet.**

3. (a) (i) State TWO important features of 'precision agriculture'.

.....

.....

.....

**(2 marks)**

- (ii) What instrument can a farmer use to measure the temperature in his greenhouse for one week if he wants to find out what is the hottest period of the day?

.....

.....

**(1 mark)**

- (b) Mrs. Peters wishes to raise vegetables for her family but she lives in an area with a limited water supply and she has a paved backyard that measures only 8 m long by 4 m wide.

Recommend a suitable technology that Mrs Peters can use to grow vegetables. Give ONE reason for your choice.

Technology .....

.....

.....

Reason .....

.....

.....

**(2 marks)**

- (i) Describe how Mrs Peters can manage the water supply for the vegetables in the rainy season and in the dry season.

.....

.....

.....

.....

**(2 marks)**

- (ii) For any **named** insect pest that can attack lettuce, suggest how Mrs Peters can control this pest without the use of pesticides.

Insect pest .....

Method of control .....

.....

.....

**(3 marks)**

**Total 10 marks**

4. (a) (i) How can a farmer obtain information on the nutrient content of a soil?

.....  
.....

**(1 mark)**

(ii) State TWO ways in which the information obtained on the nutrient content of a soil is useful to farmers?

.....  
.....  
.....  
.....

**(2 marks)**

(b) Mr Bristol has his farm on a hillside where he grows 3 acres of bananas for the fresh market. The yields on Mr Bristol's farm are low and he does not make much money. Some of the problems at the site are that the soil is eroded and infertile, and strong winds cause the plants to fall. Another problem is fruit damage, which occurs when the plants fall and when harvested fruits are being transported uphill to the road for sale. Mr Bristol is able to sell only the undamaged fruit.

Describe effective but low-cost techniques and technologies that Mr Bristol can use to achieve the following objectives in order to increase the banana yield and his farm income:

(i) improving soil fertility

.....  
.....  
.....  
.....

**(3 marks)**

(ii) reducing fruit damage

.....

.....

.....

.....

**(2 marks)**

(ii) adding value to the fruit.

.....

.....

.....

.....

**(2 marks)**

**Total 10 marks**



**SECTION III**

**Answer ALL questions in this section.**

**Write your answers in the spaces provided in this booklet.**

5. (a) (i) Give TWO important reasons why poultry should have access to adequate amounts of cool and clean water.

.....

.....

.....

.....

**(2 marks)**

- (ii) How much space should be allowed for each mature layer bird at a drinker?

.....

.....

**(1 mark)**

- (b) Mr Gomez is a young farmer who has just started a small farm for egg production. The farm is located in a sheltered area that receives sunlight late on mornings and is dark and very cool on evenings. His two-week old chicks are healthy but they are not showing much growth.

- (i) Provide guidelines for Mr Gomez, with brief explanations, on how light should be used for chicks, growing layers and mature layers in an intensive system.

For chicks.....

.....

.....

For growing layers .....

.....

.....

For mature layers .....  
.....  
.....

**(5 marks)**

- (ii) For proper lighting in the pens, suggest a suitable wattage and spacing for the bulbs and explain how they are used to ensure adequate lightning as necessary.

Wattage and spacing .....  
.....  
.....  
.....

Explanation .....  
.....  
.....  
.....

**(2 marks)**

**Total 10 marks**

6. (a) (i) Differentiate between an intensive and an extensive production system in the rearing of a named farm animal.

Intensive system.....

.....  
.....

Extensive system .....

.....  
.....

**(2 marks)**

- (ii) State ONE advantage of an intensive system.

.....  
.....

**(1 mark)**

- (b) Advise Farmer Tom on the requirements of building a goat pen to ensure optimal usage. In your answer, suggest TWO points under EACH of the following FOUR headings.

Site selection .....

.....  
.....  
.....  
.....

Pen size .....

.....  
.....  
.....

Type of material .....  
.....  
.....

Orientation and design.....  
.....  
.....  
.....

**(7 marks)**

**END OF TEST**



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AGRICULTURAL SCIENCE

DOUBLE AWARD

Paper 03 MARK SCHEME

Question	Possible Answer	Instructions	Profiles	
			KC	APP
1 (a)	<p><b>S.O. F1.2, F1.3, F2.1</b></p> <p><b>Type of business:</b></p> <ul style="list-style-type: none"> <li>- Sole trader</li> <li>- Limited Liability Company</li> </ul>	1 mark for each up to a maximum of 1	1	
(b)	<p><b>Advantages and disadvantages of business named:</b></p> <p><b>Sole trader</b></p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>- Retains full control of the business</li> <li>- Retain all the profits of the business</li> <li>- Information is kept private/not public</li> <li>- Quick decision making</li> </ul> <p><u>Disadvantages</u></p> <ul style="list-style-type: none"> <li>- Subject to unlimited liability</li> <li>- May find it difficult to raise funds for business</li> <li>- Unable to take advantage of economies of scale due to limited scope</li> <li>- Success or failure of the business depends on one person, given the closed decision making process.</li> </ul> <p><b>Limited Liability Company</b></p> <p><u>Advantages:</u></p> <ul style="list-style-type: none"> <li>- Limited Liability - shareholders will only be liable for any debt the company, which accrues according to the levels of their own investment.</li> <li>- Separate Entity - A limited company is deemed to be a separate legal entity from its owners. / The company can exist beyond the life of its members.</li> <li>- Limited Companies are only taxed on their profits.</li> <li>- Registration of a company names makes the company more visible in the marketplace.</li> </ul>	<p>1 mark for each advantage up to a maximum of 2 marks</p> <p>1 mark for any correct disadvantage</p>	3	

AGRICULTURAL SCIENCE

DOUBLE AWARD

Paper 03 MARK SCHEME

Question	Possible Answer	Instructions	Profiles	
			KC	APP
	<ul style="list-style-type: none"> <li>- Employees can purchase shares in the company, which makes them feel part and parcel of the business.</li> </ul> <p><u>Disadvantages</u></p> <ul style="list-style-type: none"> <li>- Reporting requirements may be onerous.</li> <li>- It may be costly and time consuming to set up.</li> <li>- Dilution of power among shareholders may negatively impact on management's ability to make speedy decisions.</li> </ul>			
(c)	<p><b>Steps in establishing poultry farm:</b></p> <ol style="list-style-type: none"> <li>1. Conduct research to determine: (i) the requirements for establishing the poultry farm, that is, infrastructure, purchasing of chicks and other inputs; (ii) demand for broilers by processing plant; (iii) type of arrangement under which John will supply the processing plant; (iv) experiences of other chicken farmers conducting similar ventures.</li> <li>2. Conduct feasibility analysis: management, operational, financial and marketing.</li> <li>3. Develop business plan - The business plan should entail: basic structure of a business plan - Title page, table of contents, executive summary, description of company, products and services, marketing plan,</li> </ol>	1 mark each for any five steps identified correctly		5

AGRICULTURAL SCIENCE

DOUBLE AWARD

Paper 03 MARK SCHEME

Question	Possible Answer	Instructions	Profiles	
			KC	APP
	<p>operational plan, management structure, financial plan and farm plan.</p> <p>4. Determine resources- location of poultry farm; acquisition of land (lease, family land, own land, rental); labour requirements (family, hire, self); capital/financial resources - cost of setting up the farm and operational costs; material inputs (poultry housing, chicks, medication, feed).</p> <p>5. Acquire resources: loan, own savings, family resources, material input.</p>			
(iv)	<p><b>Appropriate Electronic method</b></p> <ul style="list-style-type: none"> <li>- Internet/world wide web</li> <li>- Electronic mail</li> <li>- Social media</li> </ul>	1 mark for each up to a maximum of 1		1
	<b>TOTAL</b>		<b>4</b>	<b>6</b>



AGRICULTURAL SCIENCE

DOUBLE AWARD

Paper 03 MARK SCHEME

Question	Possible Answer	Instructions	Profiles	
			KC	APP
2. (a) (i)	<b>S.O. F1.1, F1.4, F2.3</b>  <b>Types of entrepreneur:</b> - Opportunity based - Necessity based	1 mark for each up to a total of 2 marks	2	
(ii)	<b>Characteristics of an entrepreneur:</b> - Innovative - Creative - Risk takers - Visionary - Dynamic - Persistent - Achievement oriented - Planners - Hard-working - Self-confident.	1 mark for each up to a maximum of 2 marks.	2	
(iii)	<b>What type of entrepreneur is Ingrid?</b>  - Opportunity based.  Reason: <u>She is already employed as a bank manager and is seeking to earn additional income.</u>	1 mark for stating the type of entrepreneur  1 mark for the reason		2

AGRICULTURAL SCIENCE

DOUBLE AWARD

Paper 03 MARK SCHEME

Question	Possible Answer	Instructions	Profiles	
			KC	APP
(b)	<b>Opportunities for Ingrid in establishing orchard:</b> <ul style="list-style-type: none"> <li>- Country granted access to supply the United States market with mangoes. There is the potential for supplying this market once plant quarantine regulations are met.</li> <li>- Local hotels demanding mangoes at premium prices. More income can be earned by selecting and supplying the right varieties.</li> <li>- Local supermarkets demanding mangoes at premium prices. More income can be earned by selecting and supplying the right varieties.</li> </ul>	1 mark for any correct opportunity stated.		1
	<b>Threats:</b> <ul style="list-style-type: none"> <li>- Mango is over-supplied in the Canadian market. Ingrid may not find any buyers willing to accept her produce. There may be little to no income to be earned because of this situation.</li> <li>- Prices are low in the Canadian market. This may affect the profitability of the mango orchard.</li> <li>- Plant quarantine regulations are complex to meet. Ingrid may not have the capacity or expertise to meet these requirements.</li> <li>- Plant quarantine regulations are too expensive to meet. Ingrid may not have the resources to meet these requirements.</li> </ul>	1 mark for any threat correctly stated.		1
(c)	Barriers to communication <ul style="list-style-type: none"> <li>- Cultural</li> <li>- Language</li> <li>- External</li> </ul>	1 mark for each up to a maximum of 2 marks		2
	<b>Total</b>		<b>4</b>	<b>6</b>

## DOUBLE AWARD

Question Number	Possible Answers	Instructions	Marks	
			KC	APP
3.	S.O. E1.1, E1.4			
(a) (i)	<b>Features of precision agriculture:</b> <ul style="list-style-type: none"> <li>- Precision agriculture makes use of instruments to detect environmental variations on a farm.</li> <li>- It involves site specific management/It uses environmental information to determine how to vary the level of inputs applied to different sites on the farm.</li> <li>- It reduces the waste of resources/inputs.</li> <li>- It lowers cost of production.</li> </ul>	1 mark for any correct feature up to a maximum of 2 marks	2	
a(ii)	<b>Instrument to measure temperature in greenhouse</b> <ul style="list-style-type: none"> <li>- A temperature data logger.</li> </ul>	1 mark for naming correct instrument	1	
(b) (i)	<b>Suitable technology:</b> <ul style="list-style-type: none"> <li>- Container gardening</li> <li>- Grow boxes.</li> </ul> <p>Reasons:</p> <ul style="list-style-type: none"> <li>- Unavailability of adequate space</li> <li>- Growing media can be specific to crop</li> <li>- Plants can be moved around</li> <li>- Garden can be built anywhere</li> <li>- Compaction is reduced</li> <li>- Pests and weeds are easier to control</li> <li>- A variety of crops is possible</li> <li>- Accessibility</li> <li>- Time and labour savings</li> </ul>	1 mark for naming correct technology  1 mark for any correct response		2
b(ii)	<b>Management of water supply:</b> <ul style="list-style-type: none"> <li>- In the rainy season, ensure proper drainage of the soil</li> </ul>	Every 2 correct points, 1 mark up to a maximum of 2 marks		2

AGRICULTURAL SCIENCE

DOUBLE AWARD

Paper 03 MARK SCHEME

Question Number	Possible Answers	Instructions	Marks	
			KC	APP
b(iii)	<ul style="list-style-type: none"> <li>- Store excess water in a large container or tank</li> <li>- In the dry season, the stored water can be used for the crops</li> <li>- Soil water can be conserved by mulching.</li> </ul> <p><b>Controlling named pest without the use of pesticide:</b></p> <ul style="list-style-type: none"> <li>- Caterpillars - use repellent crops e.g. condiments; physical removal of the pest.</li> <li>- For cutting or biting insects e.g. bachacs, used baits and physical barriers.</li> <li>- Sucking insects e.g aphids - spray with mild, soapy water.</li> </ul>	1 mark for each method of control of the named pest, up to a maximum of 3 marks		3
	<b>TOTAL</b>		<b>3</b>	<b>7</b>

AGRICULTURAL SCIENCE

DOUBLE AWARD

Paper 03 MARK SCHEME

Question	Possible Answer	Instructions	Profiles	
			KC	APP
4. (a) (i)	<b>S.O. F1.1, F1.4, F2.3</b> <b>Obtaining information on the nutrient content of a soil:</b>  - Conduct a soil test	1 mark for naming test	1	
(ii)	<b>Ways in which the information on the nutrient content of a soil is useful to farmers:</b>  - They will be able to know exactly which nutrients are needed; - They will know how much is needed of each important nutrient - They will be able to save money by not applying nutrients that are in sufficient quantities	1 mark for each up to a maximum of 2 marks.	2	
b(i)	<b>Low-cost techniques and technologies used to achieve:</b>  <b>Improved soil fertility</b> - Reducing erosion e.g. by using contour drains, - Placing the banana trash along the contours to reduce erosion, and to add organic matter and nutrients to the soil when it rots, - Grow a leguminous cover crop for mulch to reduce erosion, and for nitrogen to nourish the plant.	1 mark each for any 3 relevant points with an explanation		3

AGRICULTURAL SCIENCE

DOUBLE AWARD

Paper 03 MARK SCHEME

b(ii)	<b>Reducing fruit damage</b> <ul style="list-style-type: none"> <li>- Establishing a windbreak to shelter the bananas and prevent falling plants;</li> <li>- Reduce damage during transport by reducing handling and bruising by using a simple pulley system to reduce handling;</li> <li>- Use sturdy crates or boxes to transport the fruits;</li> <li>- Harvest fruit when mature but not ripe to reduce susceptibility to damage</li> </ul>	1 mark each for any 2 relevant points with an explanation		2
b(iii)	<b>Adding value to the fruit</b> <ul style="list-style-type: none"> <li>- Use fruit harvested at the right stage to make chips, banana flour, banana bread, banana punch or other suitable products that require low technology but have a demand</li> </ul>	1 mark each for any 2 relevant points with an explanation		2
	<b>Total</b>		<b>3</b>	<b>7</b>

AGRICULTURAL SCIENCE

DOUBLE AWARD

Paper 03 MARK SCHEME

Questions	Possible Answer	Instructions	Marks	
			KC	APP
5 (a) (i)	<b>S.O. E4.2, E4.3</b>  Reasons: - to keep them cool enough to encourage their growth - to keep them healthy through lower levels of pathogens	1 mark for each up to a maximum of 2 marks	2	
(ii)	<b>Space requirement for mature layer bird:</b>  - 1 to 2 cm	1 mark for correct space requirement	1	
(b) (i)	<b>Guidelines with explanations:</b>  - Provide artificial light to ensure that the young chicks have 24 hours of light daily to encourage them to eat/because they have to see the feed to identify it - When the birds start growing natural light is best/because the birds should not be allowed to start laying before they are mature - However, if they are receiving less than 12 hours of light or the light is less than 5 lux/artificial light must be used to help the growing birds to eat more and become mature - Once the birds mature (begin to lay), gradually increase the light to 14 hours per day and maintain this level of lighting/to maintain a high level of egg production	1 mark for each correct response up to a maximum of 5 marks		5

AGRICULTURAL SCIENCE

DOUBLE AWARD

Paper 03 MARK SCHEME

Questions	Possible Answer	Instructions	Marks	
			KC	APP
(ii)	<b>Provision for proper lighting:</b> <ul style="list-style-type: none"> <li>- Ordinary light bulbs can be used - 40 or 60W</li> <li>- They should be uniformly spaced at 3 or 5 m apart, respectively</li> <li>- Light can be provided on early mornings to give a 12-hour day, and gradually extended on evenings to a day length of about 14 hours.</li> </ul>	1 mark for spacing and wattage  1 mark for explanation		2
	<b>TOTAL</b>		3	7



AGRICULTURAL SCIENCE

DOUBLE AWARD

Paper 03 MARK SCHEME

Questions	Possible Answer	Instructions	Marks	
			KC	APP
6 (a) (i)	<p><b>S.O. E4.2</b></p> <p><b>Intensive vs. Extensive systems:</b></p> <ul style="list-style-type: none"> <li>- In an <b>intensive</b> system, animals are kept in a confined area. E.g. in a pen all the time whereas, in an <b>extensive</b> system, they are allowed to roam/open pasture.</li> </ul>	<p>1 mark for any logical explanation of an intensive system, 1 mark for extensive.</p>	2	
(ii)	<p><b>Advantages of an intensive system:</b></p> <ul style="list-style-type: none"> <li>- less space required</li> <li>- less exposure to injury</li> <li>- less exposure to predator/thief</li> <li>- tend to gain weight faster due to less movement</li> <li>-</li> </ul>	<p>1 mark for any correct advantage.</p>	1	
(b)	<p><b>Requirements under each heading:</b></p> <ul style="list-style-type: none"> <li>- Site selection <ul style="list-style-type: none"> <li>o area with food</li> <li>o area away from human population</li> </ul> </li> <li>- Pen size <ul style="list-style-type: none"> <li>o based on number of ewes and</li> <li>o at least one ram</li> </ul> </li> <li>- Type of material <ul style="list-style-type: none"> <li>o Wood</li> <li>o Zinc/thatch</li> <li>o Cement</li> </ul> </li> <li>- Orientation and design <ul style="list-style-type: none"> <li>o Wind flow</li> <li>o Eaves to prevent excess sunshine and rain from affecting the animals</li> </ul> </li> </ul>	<p>1 mark for each correct response up to a maximum of 2 marks</p> <p>1 mark for any two correct responses up to a maximum of 1 mark</p> <p>1 mark for each correct response up to a maximum of 2 marks</p> <p>1 mark for each correct response up to a maximum of 2 marks</p>		7

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DOUBLE AWARD

Paper 03 MARK SCHEME

Questions	Possible Answer	Instructions	Marks	
			KC	APP
	<ul style="list-style-type: none"><li>o Slatted floor for easy disposal of faeces</li><li>o Slatted side walls about 90 to 120 cm in height</li></ul>			
	<b>TOTAL</b>		<b>3</b>	<b>7</b>

**C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATION  
JUNE 2004**

**AGRICULTURAL SCIENCE  
(SINGLE AWARD)**

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**AGRICULTURAL SCIENCE  
(SINGLE AWARD)  
GENERAL PROFICIENCY EXAMINATIONS  
JUNE 2004**

**GENERAL COMMENTS**

The Caribbean Examinations Council offered Agricultural Science (Single Award) General Proficiency Examination for the twelfth year in 2004. The rationale for this offering in the area of agriculture is to make agricultural education available to a larger group of the secondary school population than is presently catered for by the Double Award. This increased exposure is desirable for improving attitudes to agriculture, promoting agriculture as a business, encouraging larger numbers of school leavers to enter fields related to agricultural endeavours, and for sustainability in selected agricultural commodities in the CARICOM region.

The examination is conducted with the assumption that there is compulsory exposure to the subject during the first three years of secondary education and a careful and systematic study of the requirements of the syllabus during the fourth and fifth years.

The 2004 examination was designed to provide a comprehensive test of candidates' knowledge and skills in all dimensions of the syllabus.

Specifically, the examination intended to test candidates'

- (a) knowledge and understanding of the content of the syllabus
- (b) grasp of fundamentals of Agricultural Science
- (c) ability to make precise links between Agricultural Science theory and practice
- (d) ability to perform a selected range of general agricultural skills from the core and the chosen option
- (e) ability to communicate knowledge and understanding in the approach to answering the questions and solving problems.

Candidates can choose from two options: Option A - Crops and Soils (C&S), Option B - Animal Science (AS). Candidates choose an option at the beginning of the first year and complete the SBA component for that option during the two years. They are examined on the core of the syllabus and write an essay paper based on the previously chosen option.

This year, 4 590 candidates were entered for the examination. Two thousand five hundred and twenty-five candidates chose the Crops and Soils Option, and 2 065 candidates opted for Animal Science.

The Examining Committee is satisfied that the objectives of the examination were satisfactorily met and that the results reflect a valid discrimination among candidates, on the basis of their abilities to deal with the content of the syllabus.

**Form of the Examination**

The examination comprised three written papers as described briefly below and a School Based Assessment (SBA) component.

- |     |                         |  |
|-----|-------------------------|--|
| (a) | Paper 01                | Sixty Multiple Choice items under the Knowledge and Comprehension Profile dimension and based on objectives on the core of the syllabus.   |
| (b) | Paper 02                | Ten compulsory structured questions based on the objectives in the core of the syllabus under the two profile dimensions – Knowledge and Comprehension and Use of Knowledge.   |
| (c) | Paper 03                | Four essay-type questions set on each option: candidates were required to answer three questions from the option chosen. These were also tested under the Knowledge and Comprehension and Use of Knowledge profiles. |
| (d) | School Based Assessment | Candidates were assessed on a number of skill objectives, preparation of a Farm Diary and compilation of Farm Records.   |

### **SPECIFIC COMMENTS**

#### **PAPER 01**

This paper consisted of 60 multiple-choice items distributed over the five units in the core of the syllabus.

Candidates opting for the Animal Science Option performed better than the candidates opting for Crops and Soils Option, mainly through a superior performance in Unit 5, Introduction to Animal Science. Candidates performed best in the Introduction to Crops and Soils Option, and poorly in the Agricultural Mechanization Unit.

Over 80 per cent of the candidates of both options had correct responses to 18 per cent of the items. These items were spread across all five units. Candidates seemed to be comfortable with the role and function of regional agricultural institutions, farm budgeting and marketing concepts. Questions on erosion, the identification of NPK fertilizers and weed control were adequately answered. In the Animal Science Unit, most candidates understood the theory involved in the slaughtering of broilers and debeaking young chicks.

In both options, the majority of candidates had difficulties with items relating to the tools used for cleaning a knapsack sprayer, signs of potassium deficiency in plants and the misuse of antibiotics in animal feeds. Less than 40 per cent of candidates gave correct responses to those items.

Overall, the performance in this paper could be considered very good.

#### **PAPER 02**

##### **Question 1**

This question required candidates to identify major constraints to agricultural development in the Caribbean, and discuss the main features of commercial and mixed farming.

Most candidates correctly identified major constraints to agricultural development. A few, however, gave minor local problems, and others misunderstood the question and listed international institutions rather than constraints as requested. In Part (b), many candidates correctly identified products and practices of large scale farming. In the case of mixed farming, however, many candidates confused mixed farming with mixed cropping and gave very good responses for mixed cropping. Few distinguished between the two and gave the correct response.

##### **Question 2**

This question tested the candidates' knowledge of the major marketing information one needs to obtain before embarking on a vegetable enterprise. In Part (b) of the question, candidates' knowledge of the 'Law of Supply and Demand' was tested when examining the yield and price of a farmer's tomato crop over a three year period.

Many candidates correctly identified at least three areas of information. Some candidates incorrectly listed strategies for selling produce, for example, sell to wholesalers or supermarkets at a higher price, or agronomic practices involved in the growing of vegetables. In Part (b), it was evident that many candidates understood the concept of supply and demand, and could apply it successfully.

### **Question 3**

This question required candidates to identify the two main types of costs associated with budgeting on a farm, and to give an example of each. They were then required to explain how farm income is calculated, and to calculate net farm income from a given example.

Most candidates correctly named fixed and variable costs as the two types of costs associated with the farm, and gave correct examples. Some, however, gave examples as the types of costs, and types of costs as examples. Others incorrectly gave definitions for both types of costs and examples.

With respect to the concept, net farm income, candidates generally had difficulty theoretically explaining how it is calculated. However, most provided the correct answer to the calculation.

### **Question 4**

The objective of this question was to assess candidates' knowledge of farm machinery and equipment through testing their competence in selecting appropriate implements for specific farming activities. They were then required to explain the uses and importance of farm machinery for specific operations.

This question was fairly well done. Of the four farming activities for which candidates were required to choose the most appropriate piece of equipment, most candidates correctly chose at least two. Many candidates selected the cutlass for planting seeds, and although this may be true on small farms, candidates should be made aware of the use of seeders on commercial farms. Candidates also were not familiar with the plough and rotavator being used in primary and secondary tillage, respectively. The second part of the question was not well done, as candidates limited themselves to the tools and implements named in the examples, and thus were restricted in their responses.

### **Question 5**

This question tested candidates' knowledge of vegetables that are sown directly in the field, and the major requirements necessary for the germination of vegetables. Candidates were also required to use their knowledge of vegetable production to solve a problem in the germination of vegetables.

Most of the candidates correctly identified the crops and the requirements for germination. A few, however, listed incorrect requirements, for example, manure, soil nutrients, shade and rainfall. Part (c) tested candidates' knowledge of the problems associated with broadcasting certain vegetable seeds that are normally planted in nurseries. Responses were fair, as numerous candidates could not deduce that when seeds are broadcasted there would be competition for nutrients, water, light and root space. These candidates concentrated on a lack of cultural practices as the major deterrent for poor growth and survival.

### **Question 6**

Candidates' knowledge of soil properties and their understanding of soil management practices were required in this question. In Part (a) candidates were asked to name a soil type from its description and list two properties of the named soil. In Part (b) candidates were asked to discuss farming practices when growing crops on soil with the properties listed in Part (a).

Most candidates knew the soil type, and knew its properties. Some candidates did not give the correct name of the soil, but knew the properties. In Part (b), almost all of the candidates knew the farming practices to adopt when cultivating on a clay soil. The most popular responses were the need for adequate drainage, addition of pen manure and an appropriate irrigation system.

### **Question 7**

This question tested candidates' knowledge of the different methods of weed control. In the second part, they were required to explain the adverse effects of exceeding recommended levels of insecticide.

Both parts of the question were well done, with candidates familiar with the methods of weed control, and it was heartening to see many of them listing biological control methods. A few were completely incorrect, listing the use of insecticides and fungicides as methods of weed control. In Part (b), most candidates correctly stated and explained the adverse effects of exceeding the recommended levels of insecticide. Encouraging responses included insects developing immunity, accumulation of residue on the crop, destruction of the environment/ecosystem and injury/adverse effect to the farmer/consumer/animals. Some candidates were not too clear on the distinction between insecticide, weedicide and fungicide and used them interchangeably in both sections of the question.

### **Question 8**

This question tested candidates' knowledge of the links between agriculture and forestry. Candidates were asked to state the detrimental effects of indiscriminately clearing forested land, and to explain the functions of the forest in soil and water conservation.

Candidates' responses were very good, suggesting that both teachers and students are cognizant of this topical subject. Positive responses to Part (a) included destruction of the habitat for wild animals, pollution, exposure to wind and water erosion and destruction of useful soil organisms. In Part (b), candidates also showed an appreciation of the topic, with responses including providing cover thereby reducing the likelihood of erosion, improving the organic matter content of the soil, and reducing water loss through evaporation.

### **Question 9**

Candidates were given a list of various classes of animals, and were required to identify different breeds of livestock commonly reared in the Caribbean. In Part (b), they were asked to identify suitable dairy breeds to be used in a cross-breeding programme in the Caribbean, and to discuss the benefits of cross-breeding.

The response was good as most candidates were able to correctly identify at least two breeds. However, there was slight confusion between the identification of goat and sheep breeds, with many candidates listing the Barbados Black Belly, which is the most identifiable breed of sheep in the Caribbean, as a goat. Candidates had problems with Part (b), as a number of them named beef breeds, and a few listed other species of livestock as cattle. Finally, many candidates provided responses that showed strong linkages between life sciences and agriculture, using terms like heterosis, heterozygous and pedigree; however, they were completely out of context.

### **Question 10**

This question tested the candidates' knowledge of the care and management of broilers. Candidates were first required to list practices, and then to describe, with reasons, one of the practices named.

The responses in Part (a) were very good, as many candidates knew most practices involved in broiler rearing, probably from practical experience. Part (b) proved to be more difficult, as some candidates repeated practices, whereas others defined the terms, for example, many candidates defined debeaking without giving reasons for debeaking, and others stated how to spread litter rather than why litter was used.

## **PAPER 03**

### **OPTION A - Crops and Soils**

#### **Question 1**

In Part (a) of this question, candidates were asked to list four methods which may be used in the vegetative propagation of crops, and to list three advantages of propagating plants by using these methods. The second part tested candidates' appreciation of problems associated with the management of disease resistant varieties of corn that can lead to low yields. Candidates were also asked to state reasons why a farmer would chose to sell corn to a local market rather than a foreign market.

Generally, the question was not well answered. In Part (a), almost all candidates listed at least two correct methods. However, many of them incorrectly named bulbs, corms and rhizomes as methods. Many candidates were also confused about benefits, some even stating that higher yields are a result of having more than one fruit on the same tree. Generally Part (b) was well answered, as many candidates recognised the need for an adequate fertilizer regime and soil fertility for a high yield. Some, however, incorrectly listed praedial larceny, climatic conditions and bad land preparation as reasons.

#### **Question 2**

In this question candidates were presented with an incomplete table listing four crops, and they were required to complete the table by naming the botanical part of the crop harvested, and the type of planting material used. They were also asked to list three harvesting or post harvesting activities that must be followed for two of the crops. In the second part of the question, they were required to discuss three methods to control weeds in rice or sugar cane, and precautions necessary for the safe use and storage of weedicides/herbicides.

The question was well answered. Many candidates were able to correctly identify the parts harvested, and planting material used. Candidates, however, responded poorly to harvesting/post-harvesting activities, many of them discussing management practices associated with the growth of the crop, for example, fertilizing and irrigating techniques.

The second part of the question was well answered, as candidates were familiar with weed control measures, and it was gratifying to see that most candidates fully understood the environmental concerns when disposing of agricultural chemicals.

#### **Question 3**

The ways in which water is lost from the soil, and measures to conserve moisture were the main focus of Part (a) of this question. In Part (b) candidates were asked to advise on benefits of using water conservation practices on a vegetable farm.

The question was reasonably well done with a mean of 52 per cent. Part (a) was reasonably well done, as many candidates were able to correctly identify ways in which water is lost from the soil. Candidates included answers such as drainage and uptake by plants. Responses to Part (b) were disappointing, especially after the promising answers in Part (a). It was assumed that the concept of water conservation was well understood, but only a few candidates ably responded by applying the concept to a specific situation in this section.

#### **Question 4**

Candidates were required to list common pests and diseases of the crops presented, and to state the time to maturity of those crops. In Part (b), candidates were required to discuss the establishment, management, harvesting and post harvesting practices when cultivating banana/plantain. Finally, two symptoms of nematode infestation of banana/plantain were to be described.



The question was not well answered by the candidates. Part (a) was poorly done as only a few candidates were able to identify the pests and diseases of the crops presented. Very few candidates knew the time to maturity of the crops, cocoa and maize/corn. In Part (b), some candidates exhibited extensive practical and theoretical knowledge of banana/plantain production. However, many candidates were not aware of the procedures involved in the establishment/management of the crops and had even more difficulty when discussing harvesting/post-harvesting techniques. Many candidates were aware of symptoms of nematode infestation, but a few incorrectly discussed normal senescence as a symptom of nematode infestation.

## **OPTION B - Animal Science**

### **Question 1**

The general objectives of this question were to test candidates' knowledge of the signs of heat in cattle and to identify major diseases in different breeds of animals and list control measures. Candidates were then required to discuss advantages and disadvantages of artificial insemination in farm animals, and the steps to follow in the castration of pigs.

Candidate performance on this question was very good. Part (a), which dealt with the signs of heat in cattle, was very well done by most candidates. The range of responses indicated that the topic was taught extensively in Caribbean schools. A few candidates were not clear about specific signs of heat in cattle, and confused them with signs of heat in other farm animals with which they were familiar, for example, pigs or rabbits. Part (b) was poorly done, as candidates were not familiar with major diseases and their control measures in the following farm animals: sheep, poultry, cattle and pigs. Many candidates listed the same diseases with different control measures for all classes, or the same control measures with different diseases. Additionally, candidates' competence in the spelling of agricultural terms was poor. Some terms that were consistently spelt incorrectly were scours, pox, brucellosis and Mareks. In Part (c), candidates were familiar with the artificial insemination process in farm animals, and gave practical examples of advantages and disadvantages. In Part (d), the steps in the castration of pigs were adequately listed, with candidates describing castration of young animals, and adult animals, and both surgical and non-surgical methods.

### **Question 2**

Candidates were required in this question to name raw materials used in the formulation of rations for livestock, and list three broad groups of nutrients that should be included in livestock rations. The second part of the question needed candidates to name and describe three types of grazing systems.

Candidate performance on this question was poor. In the first part of the question, candidates had problems grasping the concepts of grazing systems, raw materials, nutrient groups and balanced ration. This part of the question proved to be very difficult for most candidates. In Parts (c) and (d) of the question, many candidates correctly identified two grazing systems. Most, however, had incorrect responses for the third system including answers such as overgrazing, semi-intensive grazing, and extensive grazing.

### **Question 3**

The general objectives of this question were to test candidates' knowledge and competence of the practice of aquaculture, the uses and importance of quarantine with respect to the importation of animals and the guiding principles with respect to the housing of sheep.

This question was very well done. Many candidates correctly defined aquaculture, and listed the management practices required. A few, however, listed management practices applicable to all classes of livestock, and not specific to aquaculture. In Parts (c) and (d), many candidates were able to discuss the importance of quarantine

measures. Some did not understand the concept of quarantine, incorrectly stating that quarantine was used to treat animals or to acclimatize animals being imported. Additionally some candidates were not able to differentiate between quarantine as used at points of entry to a country, and quarantine as a means of isolating sick animals from the rest of the herd. In Part (d), candidates knew the requirements for building pens for sheep.

#### **Question 4**

This was an applied question that required candidates to first name the class of livestock that graze the two types of forages provided in a diagram. They were then asked to name the family of plants to which each forage belongs and give one example of each. In Part (b) candidates were expected to explain suitable management practices in the care and management of an orphaned calf.

Candidate performance was very good. Most candidates were able to correctly identify the class of livestock; in addition candidates displayed a wide knowledge of forage/fodder plants grown in the Caribbean, with some of them supplying correctly spelt botanical names. A few, however, had problems with the concepts, class of livestock and family of plants, giving common names of animals, and terms such as monocotyledons and dicotyledons were used.

Part (b) of this question, which required candidates to explain management practices in the care and management of orphaned calves, was very well done. The responses provided suggested that the topic was widely taught in schools across the Caribbean, and that most learners generally understood the concepts. Many responses also showed a good understanding of the practical principles involved, suggesting that students were exposed to the topic either through practical work or field trips.

### **SCHOOL-BASED ASSESSMENT**

The School-Based Assessment for Agricultural Science, (SA) is worth twenty-five per cent of the total marks for the subject. The candidates' performance is assessed on the basis of practical skills assessed at their school/centre and presentation of practical notebooks that should contain a continuous record of the candidates' day-to-day practical activities and samples of at least six farm records. The records should reflect economic analysis of data generated from the day-to-day activities or other relevant data, production records, predictive or decision-making records.

This year 2004, CXC relied on the original marking of the teachers in the schools, and on SBA moderators. The latter did the practical assessment in the field, and remarked a stratified sample of the candidates' Farm Records and Practical Notebooks. The moderated results were submitted directly to CXC by a specified date.

Books from selected schools in selected territories where there were new moderators were examined by CXC's examiners and remarked. There were differences between the marks of Teachers and Moderators, and those of CXC's markers signifying that Moderators need training to bring them up to the standard expected by CXC.

The performance of candidates in this component of the examination could be considered very good.

### **RECOMMENDATIONS TO TEACHERS**

Based on its assessment of the candidates' performance during the 2004 Examination, the Examining Committee wishes to make the following recommendations to teachers preparing candidates for future examinations.

### **General Recommendations**

1. In preparing students for the examination, teachers should ensure that the **range of topics** outlined in the syllabus is dealt with adequately.
2. Teachers should constantly seek to provide opportunities for exposing students to practical exercises and demonstrations to enhance their abilities to make appropriate links between theory and practical agriculture.
3. Teachers should venture outside the standard text-books, and relate examples cited with everyday situations to assist in forging the links referred to in (2) above, especially with regard to new objectives in the syllabus.
4. Teachers should encourage students to **read questions carefully and follow all directions** before answering them, and to try to be direct in their answers.
5. Teachers should encourage students to be observant on field trips and take notes. Post-mortems should also be held after a field trip, and misconceptions cleared up immediately.
6. Teachers should encourage personnel from Regional and International Agricultural Organizations/Agencies to visit their schools and interact with their students to broaden their horizons.
7. Teachers should grasp the opportunity to obtain as many free agricultural publications as possible from both local and international institutions for use in the classroom.
8. Teachers are reminded of the new additions to the syllabus, and should expose students through mechanisms mentioned above, for example, Global Warming, Gender Issues, Biodiversity.

### **Specific Recommendations**

1. Teachers should concentrate on teaching the objectives as outlined in the syllabus. There is, however, the need to amplify the content around objectives to avoid limiting students' knowledge and understanding of essential content.
2. Efforts should be made to improve the communication skills of students. Candidates' performance was limited in many cases by their inability to adequately express themselves.
3. Ample opportunities must be afforded students to practise answering essay-type questions, to provide them with the opportunity for problem-solving, to enhance their skills of expression and to make use of knowledge to adequately interpret data.
4. Teachers are encouraged to teach students widely accepted technical terms, and not rely solely on terms of local origin. The use of agricultural rather than colloquial terms needs to be addressed, and more attention should be paid to the correct spelling of these terms.
5. It is recommended that workshops be held for new moderators so that moderation would be standardized throughout the region.
6. Teachers are encouraged to follow the guidelines as outlined in the syllabus, page 32, with respect to students' preparation of farm records. These **MUST** show evidence of: single entry accounting, budgeting exercises, production projects and records for use in making predictions and decisions.

**C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATIONS  
JUNE 2004**

**AGRICULTURAL SCIENCE  
(DOUBLE-AWARD)**

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**AGRICULTURAL SCIENCE (DOUBLE AWARD)**  
**GENERAL PROFICIENCY EXAMINATION**  
**JUNE 2004**

This is a report of the Agricultural Science General Proficiency (Double Award) examination conducted by the Caribbean Examinations Council in May/June 2004.

The examination is intended to assess and evaluate the extent to which the syllabus objectives of the programme have been achieved.

Candidate performance is examined through four written papers, and a practical School-Based Assessment exercise conducted by the teachers themselves on the school farm. This last component carries 25 per cent of the total marks.

**GENERAL COMMENTS**

The overall performance of the candidates in 2004 was fair and stable when compared with the results of 2003.

Hereunder are some comments on candidate performance in the four written papers and the School-Based Assessment.

**PAPER 01 – Multiple Choice**

The 60 Multiple Choice items, worth 60 marks, covered General and Specific Objectives distributed over the four profiles of the syllabus.

Candidates performed best in Crops and Soils, Animal Science and Agricultural Economics, but were weakest in Profile 3, Agricultural Mechanisation.

A comparison of the available statistics on the mean and standard deviation of the performances of the candidates of Year 2003 with Year 2004, shows that the general level of performance of the Year 2004 cohort was just marginally lower than that of 2003, while the statistics on the Equating items indicate that the difficulty level of Year 2004 items was very similar.

**PAPER 02 – Structured Questions**

The paper consisted of 15 questions with a maximum of 3 marks each.

Candidates performed best in Crops and Soils, and Animal Science, but were weaker in Agricultural Economics and Agricultural Mechanisation.

Many candidates did not even attempt some of the questions. Whether this was because there were gaps in the syllabus coverage, or that adequate time and effort were not invested in those particular topics, it was difficult to determine. In other cases, the questions sought specific answers, but the candidates' responses were largely imprecise.

Following are some comments on individual questions.

### Question 1

This question tested candidates' knowledge of the main factors of soil formation, and of how these contribute to the formation of soil profiles.

Most candidates were able to list one or more of the factors which accounted for the difference in the two soil profiles presented to them, but they were unable to briefly describe how each of the factors contributed to the changes in the structures of Profile II.

Some candidates correctly stated:

- That the factor, temperature, contributed to the changes because “the varying temperatures will cause rocks to expand and contract, and after some time it will disintegrate”;
- The biotic factors operate as humans expose soil by cultivating; plants' roots enter crevices and split the rocks apart

Many candidates correctly listed factors like climate, but instead of explaining how climate can cause the changes in Profile II, they concentrated on describing climate, or giving such answers as:

- “Climate changes soil type”
- “Climate involves sunshine, humidity, rainfall, temperature”

### Question 2

Candidates' knowledge of the effect of given environmental factors on the growth, development and production of crops was required in answering this question.

Most candidates provided evidence that they were aware that the environmental factors given had some effect on crop production, but many could not state the specific favourable, or unfavourable effects of wind, rainfall and light. Some correct answers included the following:

<b>Environmental factor</b>	<b>Favourable effect</b>	<b>Unfavourable effect</b>
(a) Wind	<ul style="list-style-type: none"><li>- Pollination of flowers is facilitated.</li><li>- The scent of flowers carried by the wind attracts pollinating insects.</li></ul>	<ul style="list-style-type: none"><li>- Desiccation of leaves.</li><li>- Soil erosion.</li><li>- Blowing down of crops (bananas).</li></ul>
(b) Rainfall	<ul style="list-style-type: none"><li>- This may help the crop to grow because water is needed to help crops grow.</li><li>- Water is needed for dissolving mineral salts and nutrients.</li></ul>	<ul style="list-style-type: none"><li>- Too much water may cause water erosion.</li><li>- Soils become water-logged.</li></ul>
(c) Light	<ul style="list-style-type: none"><li>- Light is needed for the process of photosynthesis to occur.</li><li>- It is a source of energy to plants.</li></ul>	<ul style="list-style-type: none"><li>- Light causes plants to bend if it is not overhead.</li><li>- Light may prevent some plants from flowering.</li></ul>

Some candidates gave erroneous responses as:

- “The wind was needed to reduce air pollution”
- With too much rainfall “the plant will change its colour and may die”

Far too many candidates, however, interchanged the concepts of light with temperature, responding that “too much light can burn the leaves of the plant”, or “cause dehydration in the root of the crops”, or “will cause the soil to become hard”.

### Question 3

This question tested candidates’ knowledge on the process of layering as a method of plant propagation was required.

Candidates appeared to be somewhat hazy about the technique of layering and they did not fully understand the theory behind the practical process.

Too few candidates were able to correctly name two ornamental plants produced by layering or the type of layering used in the Caribbean.

Some candidates stated that the reason for scraping of the stem of the plant after “ring-barking” was

- “to remove unwanted flesh”
- “so that the new fertilized soil can blend with the plant and form a root”
- “so that the plant can have the characteristics that the gardener wants to have”

Few mentioned the correct response, which was “to cut off the flow of nutrients to the layered section stimulating it to form roots.”

Instead of naming a rooting hormone or auxin, candidates named “rum, ethanol and methylated spirits”.

### Question 4

This question tested candidates’ knowledge of the use of herbicides, an understanding of their effect upon plant life, and of the necessary measures to adopt in the event of over-usage.

Many candidates were able to respond accurately to Parts (a), (b) and (e), but Parts (c) and (d), requiring application of knowledge were not well answered. Candidates were able to state that the effects of regular spraying of selective herbicides on pastures, were:

- Legumes were destroyed
- The residual effect was likely to be that the toxicity of the affected areas would render them unsuitable for the planting and growth of legumes in the short-term

Candidates, however, had difficulty in suggesting the following measures the farmer may employ to ensure that the legumes were not destroyed:

- Control the use of herbicides by careful spot - spraying of the weeds
- Mechanically or manually removing weeds in the vicinity of the legumes
- Allow sufficient time to elapse between spraying so that legumes could regenerate

### Question 5

This question tested candidates' knowledge of the problems within the banana industry, and their ability to formulate appropriate solutions to these problems.

Not many candidates were able to respond to this question satisfactorily.

Many candidates concentrated on the marketing of bananas instead of the production. Some even included details on storage and packaging in response to "suggestions for the improvement of banana production." Some correct responses were:

- Avoid areas prone to flooding
- Use of suitable and improved varieties
- Use of suitable planting material
- Adequate control of pests and diseases
- Improved field sanitation
- Plant in wind-sheltered areas

Many candidates had no knowledge of the banana exporting countries like Jamaica, Dominica, Grenada, St. Vincent and the Grenadines and St. Lucia.

They listed instead "Guyana, Barbados, Trinidad and Tobago, and even Europe" as banana-exporting countries in CARICOM.

### Question 6

For this question, candidates' knowledge and understanding of "swill" in the feeding regime of pigs were required.

This question was fairly well done. Most candidates were able to identify kitchen waste and table scraps as swill, and the farm animal which used this as its main diet as the pig.

In response to Part (c), dangers of using the feed, candidates correctly included:

- Digestive disorders
- Infection by human diseases
- Physical injury to animals through the swallowing of foreign materials (fish / animal bones)

Candidates' responses to the precautions the farmer should take before feeding kitchen waste were correctly stated as:

- Cooking
- Removing bones and other foreign matter
- Ensuring that swill was "fresh"

Candidates also correctly stated that an advantage of this feeding material was that it was inexpensive / cheap / not costly.



### Question 7

Candidates' knowledge of the digestion of rabbits was required for this question.

The question was generally not well answered.

Many candidates could not state that rabbits were herbivores.

In terms of digestion, too many candidates referred to rabbits as ruminants, or described digestion in the bird rather than digestion in the rabbit.

Instead of listing the caecum as the main organ involved in digestion in rabbits, many candidates listed "the stomach, rumen, omasum, and small intestines".

Many candidates responded to Part (e) by referring to regurgitation, instead of coprophagy, or the reingesting of food material after being passed out of the rabbit for the first time.

While many candidates were aware that the herbage fed to rabbits was supplemented by other feeds they had difficulty in stating the term concentrates. Instead, they responded with "rabbit pellet, pellet, pellet rations, other rations" and even "bag food".

### Question 8

Candidates' knowledge of the duration of the reproductive cycles of common farm animals was required for this question.

This question was very poorly answered. Candidates seemed to know only the length of the oestrus cycle of cattle (21 days), and the gestation period of the pig (114 - 118 days).

The correct responses are listed in the following table:

<b>Reproduction factors</b>	<b>Farm animals</b>		
	<b>Cattle</b>	<b>Sheep</b>	<b>Pigs</b>
1. Duration of oestrus	17 - 19 hours	<u>35 - 36 hours</u>	48 - 60 hours
2. Length of oestrus cycle	<u>21 days</u>	<u>17 days</u>	21 days
3. Time of ovulation	<u>10 - 12 hours after the end of oestrus</u>	12 hours before oestrus	Second day of oestrus
4. Gestation	270 - 280 days	<u>145 - 150 days</u>	<u>114 - 118 days</u>

### Question 9

Candidates' knowledge and understanding of agriculture as practised by Caribbean farmers were required for this question.

This question was fairly well answered by the candidates.

Candidates were able to define aquaculture as the rearing / production of fish and other sea creatures.

Some candidates however confused agriculture with aquaculture, and defined that instead. Others mentioned "catching" instead of rearing or producing of fish.

In response to Part (b), candidates listed the following correct benefits:

- Provision of income
- Provision of employment / jobs
- Diversification of agricultural production
- Cheap source of protein / improved nutrition
- Productive use of available land

In Part (c) where candidates were asked to name two species reared in aquaculture in the Caribbean, they correctly named:

- Tilapia
- Lobster
- Crayfish
- Shrimp
- Cascadura.

Some candidates just indiscriminately listed any fish that they knew, including "red snapper, soloman, dolphin, gold fish, turtle" and even sea mammals like the "manatee".

### Question 10

This question tested candidates' understanding of the term food conversion ratio and their ability to use this knowledge to make relevant farming decisions.

This question was fairly well answered by the candidates.

Most of them were able to state that F.C.R. was an abbreviation of feed conversion ratio but few were able to correctly define it as the ratio of a unit quantity of feed to produce one unit of meat.

Incorrect responses included the:

- Amount of feed converted to flesh
- Gain in weight
- The amount of feed eaten by the animal to gain weight

In response to Part (c), most candidates were able to identify "Speedo" as the better ration with reference to F.C.R., but when the higher price factor of "Speedo" was included, many were unable to determine why the feed with the F.C.R. of 2:1 was better to use than the cheaper feed with the F.C.R. of 3:1.

They failed to see that it costs less to produce a bird of marketable weight / a kg. of meat.

Some incorrect responses included:

- It costs less
- Higher profits using cheaper feed
- Feed has more nutrients
- Because it is more expensive
- Because it is less expensive and the farmer will be able to afford more

### Question 11

Candidates' knowledge relating to egg fertility and the process of incubation of eggs was required for this question.

Candidates answered this question satisfactorily.

Most candidates were able to identify candling as the method used to determine the fertility of eggs, though some could describe the process fairly well, but could not name it.

In response to Part (b) most candidates correctly stated that a dark spot in the egg was indicative of the formation of a nucleus, and therefore fertility.

Candidates generally knew that the correct response to Part (c) was incubation though some candidates referred to it incorrectly as "hatching, ovulation, gestation, brooding, fertilisation" and "insemination".

Most candidates were able to respond to Part (d) as 21 days, though it was surprising to find candidates stating such times as "5 days, 1 week" and "3 months".

In Part (e), candidates knew that the two main methods used to produce chicks were:

- Natural Incubation
- Artificial Incubation

### Question 12

This question tested the candidates' knowledge and understanding of how the internal combustion engine works.

This question was not satisfactorily answered by 94 per cent of the candidates.

Few candidates were able to correctly identify the spark plug in Part (a). Candidates incorrectly mentioned the "gas tank, hose, filter, radiator" or any other part of the engine that they knew.

Yet fewer candidates were able to identify the cylinder as the place where ignition occurs.

Candidates were unable to identify the power source for igniting the fuel as the battery (Part (c)), and to state the causes of poor performance of the spark plug (Part (d)) as:

- Corrosion
- Incorrect spark-plug gap
- Burnt electrode
- Inadequate contact between the distributor and the battery
- Flooding of spark plug with fuel / oil

With respect to Part (e), most candidates were unable to state that the farmer should adjust the spark plug.

### Question 13

Candidates' knowledge of the housing requirement of dairy goats was required for this question.

Forty-nine per cent of the candidates answered this question satisfactorily.

Many candidates were able to answer Part (b) reasonably well, but were weak in responding to Parts (a) and (c).

Correct responses for Part (a) should have included the following:

- Near the homestead to protect from predators and to guard against theft.
- High ground / well drained area
- Leeward side of homestead

Many candidates instead incorrectly stated that pens should be sited:

- Far away from houses
- Near the source of food / pasture and water

With reference to Part (b), many candidates did not focus on sloping / slatted floor, or on the importance of a solid base of compact clay or concrete.

In response to Part (c), few candidates correctly listed the following:

- Feeding Racks
- Milking Stands
- Waterers
- Milking Equipment
- Facilities for ration / mineral licks

Most candidates listed tools such as "hammer, saw", and materials like "nails, bricks, galvanized iron", for which they were not credited with marks.

### Question 14

This question tested candidates' knowledge of international bodies which have a close relationship with agricultural pursuits of CARICOM countries.

This question was not well answered by candidates.

Candidates were unable to state what the abbreviations, W.T.O., F.T.A.A., and A.C.P. represented.

In response to Part (b), too many candidates could not correctly name two member states of CARICOM.

Some candidates listed:

- England
- United States of America
- Venezuela

They were unable to state that bananas and sugarcane are crops given preferential treatment in Europe.

Many candidates were also unable to state one measure which the Caribbean Community was mandated to adopt under the Agricultural Marketing Protocol. These included:

- Establish regional agricultural marketing information systems
- Strengthen producer associations
- Facilitate joint venture marketing
- Facilitate niche marketing
- Facilitate enhanced food quality / security

#### Question 15

This question tested candidates' understanding of the term, budget, and their ability to relate this to given situations.

This question was poorly answered by most of the candidates.

Many candidates did not recognise that a budget was a plan of the economic activity of an enterprise projecting income and expenditure for a specific period of time. They likened it to an economic analysis that would indicate profit or loss made. A significant number also referred to a budget as a record of income earned and expenses made.

In response to Part (c) few candidates correctly stated the reasons for preparing a budget. These are to:

- Project / forecast income and / or expenditure
- Facilitate the accessing of loans
- Provide information on the management of the enterprise
- Plan for a successful enterprise

Clearly, more attention needs to be paid to this aspect of the programme.

Some candidates knew that the type of budget referred to in Part (b) was a partial budget, but many responded incorrectly with answers like "Price Budget, Farm Budget, Financial Budget" and "Split Budget".

### **PAPER 03 – Extended Response**

Candidates were required to respond to seven of ten essay-type questions based on three of the four profiles of the syllabus. The profile, Animal Mechanisation, is not tested in this paper.

Candidates performed best in Crops and Soils, but were weakest in Animal Science.

There was evidence that candidates had information related to the topics evaluated, but not a full grasp of the basic concepts, ideas and practices. In addition, when asked to describe, explain or discuss, as should be expected in an essay-type paper, many just listed points. Detailed comments on the questions of this paper follow.

#### Question 1

This question tested the candidates' application of knowledge with respect to seedbed preparation in a given location under four main headings:

- Selection of site
- Land Preparation
- Seeding
- Care of Seedlings

This question was fairly well answered by 40 per cent of the candidates, though many wrote about the production of seedlings in a nursery shed, instead of in the field.

In terms of Part (a) candidates correctly stated that the area should be:

- Flat, or gently sloping
- Within easy access of the river (water)
- So located as to avoid flooding
- Of good internal drainage
- In an area with a good depth of top soil (about 10 cm)
- Away from heavy overhead shade.

Many gave vague responses like “need for good soil,” “area that is moist,” “free from pests and diseases.”

Others focused on closeness to home, although the question itself stated that the area to be considered was 5 km away.

In response to (b), the majority of the candidates correctly identified

- The cleaning of weeds and foreign matter
- Primary and secondary ploughing
- Rotovating and improving tilth
- Treatment of the soil for pests and diseases
- The addition of organic and inorganic manures
- Raking and levelling of the seedbed.

Some candidates merely said that the beds should be well-prepared without stating how, while others concentrated instead on the dimensions of the seedbed.

Candidates answered Part (c) reasonably well, but many failed to include light covering of the bed with grass until germination begins.

Some candidates stated that the seeds should not be sown too deeply, and went on to suggest the ridiculous depth of “3 - 10 cm” for cabbage seeds. These seemed to have a problem with the metric system.

For Part (d), most candidates were well aware of the need to remove weeds, to irrigate as required, to control pests and diseases, and to provide limited shade.

Few candidates used the terms thinning or hardening off, but they correctly described the process.

## Question 2

This question tested candidates’ knowledge and understanding of the negative effects of excessive use of insecticide on the environment.

This question was poorly answered by most of the candidates.

Many stated that excessive use of insecticides could be injurious to their health but were not specific in describing clearly how the practice affected their health through the air or the soil, as required by the question.

Some candidates correctly stated that:

- Chemicals may cause respiratory problems to man and animals
- Chemicals may cause skin / eye irritation
- Insecticides may have a deadly effect on useful insects and birds

Very few mentioned the part played by spray drifting into pastures and affecting grazing animals, or affecting aquaculture enterprises, or the destruction of fish, which feed on the poisoned insects that fall into small rivers and ponds.

For Part (b), the few candidates who scored reasonably well mentioned the following points:

- Destruction of microorganisms, and the consequent imbalance in the ecosystem
- Build-up of toxic chemicals in the soil
- Residual effect of insecticides in plants which may be eaten by man / animals and be negatively affected
- Run-off water may take chemicals to water courses causing pollution

Many candidates did not have a clear idea of how the environment could be harmed, so they ventured responses like:

- Insecticides cause soil to be acid
- Insecticides break down nutrients in the soil
- Fertility of the soil is reduced
- Insecticides cause plants to die

### Question 3

This question tested candidates' knowledge and understanding of the processes of harvesting and storage of dry peas (Cajanus cajan).

Candidates seemed to know very little about the harvesting of dry pigeon peas (Cajanus cajan).

Candidates' response to Part (a) should have been:

- Pods should be dry
- Seeds should be mature
- Harvest during dry / sunny weather
- Reject diseased / insect damaged pods

Many candidates had a better idea of storage procedures, but too many candidates listed incorrect responses, such as

- Wash the peas
- Cook the peas
- Refrigerate
- Wipe with a dry cloth.

This aspect, harvesting and post-harvesting, seems to have been neglected.

### Question 4

This question tested the candidates' knowledge and understanding of the difficulties associated with hillside farming, and their ability to suggest appropriate solutions.

Most candidates were able to discuss Part (a) fairly satisfactorily.

Their correct responses included:

- Depth of top soil
- Soil erosion
- Inadequate soil moisture
- Wind damage
- Access to holding
- Movement of harvested produce

However, some candidates listed problems which were not at all specific to hillside farming, such as, praedial larceny, sunlight and increased pest and disease problems.

Generally, the solutions suggested (Part (b)) were quite appropriate.

### Question 5

This question tested candidates' knowledge of the digestive system of a ruminant and a non ruminant.

It was surprising to find that many candidates were not aware that the sheep is a ruminant.

Most, however, were able to identify the four parts of the ruminant stomach, and at least one correct function of two of the sections.

Many candidates were aware of what takes place in the digestive tract of the ruminant, but had difficulty in associating the functions with the specific segment of the stomach.

In response to Part (b), many candidates found difficulty in identifying two reasons why pigs were unable to benefit from a meal of grass. The response should have been:

- Pigs have a simple, one-compartment stomach not designed to cope with large quantities of grass
- Grass contains a high percentage of cellulose, which cannot be broken down by the digestive juices produced in the stomach of the pig
- The stomach of the pig does not contain the bacteria which digest the cellulose in the grass

Many candidates gave incorrect reasons why the pig could not benefit from a meal of grass, such as:

- Pangola was a very hard grass that was difficult to digest, and had little nutrients
- The pig does not chew its cud and regurgitate its food

### Question 6

This question tested candidates' knowledge of the brooding of layer chicks.

Five per cent of the candidates answered the question satisfactorily.

Part (a) was answered reasonably well by most candidates, but many wrote about the housing of layers, and not about housing in the brooder, as the question required.

They missed the important points of:

- Concreted floor
- Rat-proofing of the area
- Provision of heat and light
- Provision of litter, and paper on which to introduce feeding
- Protection from draughts



In response to Part (b) candidates suggested the correct activities, such as, sanitation, debeaking, and vaccination, but many were unable to name the vaccinations correctly, or to match them with the disease they were intended to control.

Some candidates, unsure of the correct procedure, suggested debeaking “continuously”, or “as often as possible”.

Most candidates were weak in their responses to Part (c). They failed to state the

- Type of feed to be used (Starter Rations)
- Method of feeding chicks in the brooder
- Adjustment of the height of the feeding hoppers
- Importance of not over-filling the hoppers

#### Question 7

This question tested candidates’ knowledge of the formation of the hen’s egg from the ovary to the point of lay.

Generally, this question was not well answered.

Many candidates were able to identify the parts of the reproductive tract of the hen, but could not associate the corresponding process of egg-development with the part named. Some candidates had a general idea of what occurred but no grasp of the specifics. These resorted to statements like, “The yolk is formed, and then it moves down the tract where the white is added, then shell.”

Many candidates just did not know, as they related the reproduction of the bird to that of a mammal, referring to the Fallopian tube or to parts of the digestive system of the bird.

#### Question 8

This question tested candidates’ understanding of the marketing factors affecting the demand for ornamental crops by the Caribbean farmer, as well as their knowledge of the reasons why some plants may be unacceptable to the consumer.

Many candidates were unable to correctly name four ornamental plants produced by local farmers for export and therefore included food crops like pepper, tomato and corn.

Candidates clearly found difficulty in differentiating between production and marketing factors, and in dealing with the former were unable to identify the factors that would render ornamentals plants unacceptable to the consumer. The correct factors, malformation of blossoms or foliage, pest and disease damage, blemishes and physical damage, and unsuitable variety, size or colour were not common responses.

Some candidates instead gave answers that had no agro-economic bases. These included:

- Persons prefer natural rather than ornamental
- The farmers were not well known
- Some persons expect farmers to grow vegetable crops only
- The consumer may tell the farmer that he would never plant the crop, so the farmer will destroy his farm

In response to Part (c) some candidates mentioned correct factors like “market price, consumer preference, reliability of supply, quality and presentation”, but failed to develop or discuss the factors as required by the question.

### Question 9

This question tested candidates' knowledge of, and experience in record-keeping.

Candidates' responses to this question were fairly satisfactory.

Many candidates were unable to identify characteristics of a good record-keeping system. They interpreted this to mean the benefits / advantages of record-keeping, and responded thus:

- Predicts profits
- Tell the type of crops that gave most profit
- Loan could be obtained
- Keeps track of cash; and
- You can record milk production, equipment / labour

Few candidates listed correct characteristics like:

- Accuracy
- Completeness
- Simplicity
- Easy interpretability
- Easy accessibility / retrievability
- Up-to-date

In responding to Part (c) some candidates did not understand what was a mixed fruit orchard. They confused it with mixed farming, and therefore included livestock record information in the mixed fruit orchard record.

Those who interpreted the question properly listed correct types of information like:

- Inventory of plants
- Variety of plants
- Propagation methods used
- Establishment dates
- Date of first bud
- Date of fruit set
- Fertilizer regimes
- Date of harvest
- Care and maintenance
- Yields
- Costs

### Question 10

This question was intended to test candidates' knowledge and understanding of subsidy and price support measures, and their effects on farmers.

This was a fairly popular question, selected by about 60 per cent of the candidates, but fairly well answered by only about 4 per cent.

Many candidates merely listed situations in which subsidies and price support mechanism were provided, but did not describe them.

Some others, however, had incorrect ideas, stating that these measures were provided when:

- There was hurricane or flood damage (compensation for crop-damage)
- There were low interest rates
- One wants to go away to study

Candidates again had correct ideas for Parts (b) and (c), but many failed to discuss the advantages and disadvantages. Just stating, “Greater Production”, or “Better Quality Produce” did not satisfy the demands of the question.

Candidates needed at least to state that “the accession of the subsidy would enable the farmer to better maintain the area under cultivation, or to increase it and thereby produce more”.

Some candidates seemed to have acceptable ideas for Part (c), but often, these were very vaguely expressed, for example, “Rich farmers may take advantage over the low prices of machinery and tools.”

They should have said that “Farmers with larger farms, who may not really have needed State assistance, may benefit to a greater degree than the small farmers who need the help to survive.”

There is a great need for teachers to assist their students to express their views both orally and written, in standard English. Language should be simple, but clear and precise.

#### **PAPER 04 – PRACTICAL PAPER**

This paper, a supporting element of Paper 05, the School Based Assessment, is a substitute for a hands-on practical examination, and aims to assess the candidates’ capability in the field / farm.

It attempts to transport actual and / or simulated agricultural field / farm situations indoors into the examination room, and then requires the candidates to make appropriate written responses to the stimuli presented.

Ten stations are set up, and the candidates are required to answer a given question on each.

All questions are compulsory, and the paper carries a total of 30 marks. Agricultural Economics is not tested in this paper.

Inadequate exposure to field activities will certainly hamper candidate performance in this paper. Many were unable to perform better because they apparently had little or no contact with the equipment on which they were tested, or with the crops in the field. They apparently never saw a bee-keeper’s smoker, were unclear on the basics of debeaking of poultry, had difficulty identifying common external parasites like the common tick, and were unable to correctly describe the best time to harvest crops like ochroes, yams, rice and coffee.

Detailed comments on Paper 04 follow.

### Question 1

This question was intended to test candidates' knowledge and understanding of the physical properties of soil, and of the relation of this to the cultivation of crops.

Some candidates were able to identify the soil samples, based on the water retention or drainage characteristic, demonstrated in Part (a).

In Parts (b), (c) and (d) many candidates appeared to be unfamiliar with the limitations of the soil type for cultivation. Candidates should have stated that incorporation would render the soil more suitable for crop production.

Many candidates did not attempt this Part (d). It appears that they did not know the best soil type required for the growing of carrots.

### Question 2

This question was intended to test the candidates' ability to use weather records to make appropriate farming decisions.

Many candidates were able to accurately obtain information from the given histogram.

In Part (a) some candidates were unable to name the four-month period when bananas were most likely to be affected by leaf spot disease. They apparently disregarded the given data, and gave responses based on the real situation - as they knew it.

In response to Part (c), candidates should have given March - April as the best time for clearing drains and water courses.

### Question 3

This question was intended to test candidates' practical knowledge of the best stage for harvesting a given range of crops.

This question was not satisfactorily answered by the majority of the candidates.

Many candidates stated a time factor rather than the visual signs of readiness for harvesting. Some candidates incorrectly stated the stages of plant growth and development, choosing at random "vegetative stage, productive stage, senescent stage".

One incorrect response to (d) which was frequently repeated was that rice was ready for harvesting when "the paddy showed signs of rupture". This was so significant as to raise the suspicion that this was taught to them.

Candidates' responses to this question seem to suggest that candidates were not at all familiar with the practical activity of harvesting.

### Question 4

This question was intended to test the candidates' knowledge of the germination of a dicotyledonous seed (bean), and their understanding of the production of nitrates by these legumes.

Generally, about 60 per cent of the candidates answered this question satisfactorily. They were able to identify the parts of the germinating seed, though some candidates referred to the "cotyledon" as the "seed coat". Candidates also knew that the nodules in the roots were responsible for the production of nitrates.

In Part (e), some candidates did not know the correct plant nutrient, nitrates, so they listed "carbohydrates, proteins, calcium, manure".

### Question 5

This question was intended to test candidates' knowledge and understanding of how plants take in nutrients from the soil as demonstrated through an experiment on osmosis.

Most candidates recognised the experiment as one demonstrating the process of osmosis, and in Part (b), the purpose of the pin was to mark the height of the solution at the beginning of the experiment.

Many candidates were unable to explain that the height of the solution was above the pin because water was being drawn from the bowl into the depression in the potato, that is, from a region of higher concentration of water molecules to a region of lower concentration of water molecules.

Part (e) was particularly weak. Candidates were unable to describe two situations in farming, when osmosis would be harmful to crops. They should have described situations such as, when too much fertiliser is applied, concentrated fertilisers comes in contact with leaves, undercomposed pen manure is applied to plants and fertiliser is applied too close to the base of the plant.

### Question 6

This question was intended to test the extent to which candidates could identify the symptoms of foot and mouth disease, their knowledge of the cause and method of control.

Fifty-three per cent of the candidates answered this question satisfactorily.

Most candidates correctly identified the disease, and were able to name parts of the body, other than that shown in the diagram, affected by it.

Candidates were aware that the causative agent was a virus, but many were not clear as to the recommended procedure for dealing with affected animals, Part (d). Some candidates mentioned slaughtering, but they did not include burning of the carcase to complete the answer.

### Question 7

This question was intended to test candidates' knowledge and practical experience in the debeaking of chicks.

Most candidates were able to correctly identify the management practice carried out on A.S. 13 as debeaking, and to state the reason for this – to prevent cannibalism, or feather-pecking.

However, not many candidates were able to correctly state the earliest age at which this practice was carried out on poultry (day-old), how often it should be carried out on broilers (once), or that bleeding should be treated by cauterising the wound.

Many candidates did not specifically state that about 1/4 of the beak was cut off.

### Question 8

This question was intended to test candidates' ability to identify major external parasites, in this case, the tick, and the best methods of controlling this pest.

Sixty-two per cent of the candidates answered this question satisfactorily.

Most candidates were able to identify the pest as a tick, the livestock which it affects as cattle, goats, sheep, pigs and horses, and the best method of control as spraying or dipping.

Many candidates, responding to Part (c), did not know that hand-picking of ticks was not advisable because the heads break off and remain attached to the body of the host, later decompose and may be a source of infection to the livestock.

Few candidates were able to state that the group of chemicals used for destroying ticks, Part (e), was called acaricides.

#### Question 9

This question was intended to test candidates' practical knowledge of tools and equipment for bee-keeping.

Many candidates did not recognise the smoker, A.S. 16, and were unable to state that its main function was to pacify the bees.

In response to Part (d) many candidates correctly stated that if the equipment was not used the result would be:

- Bees would be excited causing the farmer to have difficulty completing his task
- Bees would attack and sting the farmer

#### Question 10

This question was intended to test candidates' knowledge of the main parts of a knapsack sprayer.

This question was satisfactorily answered by 93 per cent of the candidates.

Most candidates were able to identify the knapsack sprayer, its main parts, and their functions, though many were unable to state clearly that the function of the trigger was to release the liquid contents up through the lance, to the nozzle.

### **PAPER 05 – SCHOOL-BASED ASSESSMENT**

The School-Based Assessment is the practical component of the programme. It carries 25 per cent of the total marks of the examination, and a passing grade in this, is a requirement for success.

It consists of three elements, and these are performed by the candidates, at their schools and school farms, and assessed by their teachers in the field.

The three elements of the SBA are:-

- (i) Fifteen practical agricultural skills
- (ii) The preparation of 10 farm records and
- (iii) Diary entries of the practical agricultural activities engaged in, on the school farm.

Generally, candidates' performance in the School-Based Assessment component was very satisfactory.

### **RECOMMENDATIONS**

These recommendations are repeated again this year in the hope that all personnel involved in the preparation of candidates for future examinations, will redouble their efforts to raise performance levels.

1. Teachers should ensure that students engage in adequate, meaningful field activity, together with effective guidance in the techniques of observation.
2. During the learning / teaching exercise, there be more careful attention to specifics, and to relevant details.
3. There should be greater use of strategies that would ensure students understand ideas and concepts before attempting to memorise them.
4. Teachers should ensure that students receive adequate practice in identifying and responding to precisely what they are being asked in the questions before them.
5. Students should receive generous practice in responding to questions which request them to “explain”, “describe” or “discuss”.
6. Serious and continuous efforts should be made to assist students in improving their communication skills.
7. Every effort should be made to ensure full syllabus coverage by teachers and students.

**C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATION  
JUNE 2005**

**AGRICULTURAL SCIENCE  
(SINGLE- AWARD)**

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**AGRICULTURAL SCIENCE (SINGLE AWARD)**  
**GENERAL PROFICIENCY EXAMINATIONS**  
**JUNE 2005**

**GENERAL COMMENTS**

The Caribbean Examinations Council offered Agricultural Science (Single Award) General Proficiency Examination for the thirteenth year in 2005. The rationale for this offering in the area of agriculture is to make agricultural education available to a larger group of the secondary school population than is presently catered for by the Double Award. This increased exposure is desirable for improving attitudes to agriculture, promoting agriculture as a business, encouraging larger numbers of school leavers to enter fields related to agricultural endeavours, and for sustainability in selected agricultural commodities in the CARICOM region.

The examination is conducted with the assumption that there is compulsory exposure to the subject during the first three years of secondary education and a careful and systematic study of the requirements of the syllabus during the fourth and fifth years.

The 2005 examination was designed to provide a comprehensive test of candidates' knowledge and skills in all dimensions of the syllabus.

Specifically, the examination intended to test candidates'

- (a) knowledge and understanding of the content of the syllabus
- (b) grasp of fundamentals of Agricultural Science
- (c) ability to make precise links between Agricultural Science theory and practice
- (d) ability to perform a selected range of general agricultural skills from the core and the chosen option
- (e) ability to communicate knowledge and understanding in the approach to answering the questions and solving problems.

Candidates can choose from two options: Option A - Crops and Soils (C&S), Option B - Animal Science (AS). Candidates choose an option at the beginning of the first year and complete the SBA component for that option during the two years. They are examined on the core of the syllabus and write an essay paper based on the previously chosen option.

**Form of the Examination**

The examination comprised three written papers as described briefly below and a School-Based Assessment (SBA) component.

- (a) Paper 01                      Sixty Multiple-Choice items under the Knowledge and Comprehension Profile dimension and based on objectives on the core of the syllabus.
- (b) Paper 02                      Ten compulsory structured questions based on the objectives in the core of the syllabus under the two profile dimensions – Knowledge and Comprehension and Use of Knowledge.

- |                             |  |
|-----------------------------|--|
| (c) Paper 03                | Four essay-type questions set on each option: candidates were required to answer three questions from the option chosen. These were also tested under the Knowledge and Comprehension and Use of Knowledge profiles. |
| (d) School-Based Assessment | Candidates were assessed on a number of practical skill objectives, preparation of a Farm Diary and compilation of Farm Records.   |

## **SPECIFIC COMMENTS**

### **PAPER 01**

This paper consisted of 60 multiple-choice items distributed over the five units in the core of the syllabus.

### **PAPER 02**

#### **Question 1**

This question tested the candidates' knowledge of the outbreak of hibiscus pink mealy bug which destroyed agricultural crops in the Caribbean and the role played by local, regional and international institutions in managing such outbreak. The question further tested candidates' knowledge of global warming and its effects on crops and livestock production.

In Part (a), candidates' responses suggested that this question was not clearly understood. They named institutions at random and were unable to associate them within their correct headings. The roles played by these institutions were also not known. Part (b) indicated that candidates understood the concept of global warming but were unable to link its effects on crop and livestock production. The most popular answers were extreme heat causing heat stress to animals and permanent wilting of plants, flooding, droughts and death of livestock and crops. A large number of candidates were unfamiliar with this question and gave unrelated responses.

#### **Question 2**

This question required candidates to name four types of agricultural co-operatives that may be found in the Caribbean and discuss two benefits and one managerial problem that are associated with them.

Most candidates were unable to correctly name agricultural co-operatives in the Caribbean. In Part (b) however, candidates knowledge of the benefits of co-operatives indicated to a large extent that co-operatives provide loans, agricultural supplies, and education and advice to farmers.

Section (c) presented greatest difficulties to candidates who were confused with problems associated with the management of co-operatives, such as, infrequent elections leading to monopoly of the cooperatives, proper records not being kept, unwillingness to hire staff, thus inefficient programme.

#### **Question 3**

This was a two-part question. Part (a), which was focused on marketing, simply required candidates to identify major stages in the marketing chain. This part of the question was generally well done. However some common incorrect responses indicated that candidates had difficulty differentiating between "marketing" terms and "economic" terms. The correct responses should have included sorting, collecting, storage, grading, transportation, processing, pricing.

Part (b) of the question, which integrated marketing and economic concepts, provided greater difficulty for candidates. Some of them also displayed confusion at interpreting the question, so that correct responses, such

as, appropriate packaging, avoid damage to crops, harvest at the correct time, advertising, processing and grading, were not explained by the candidates.

#### **Question 4**

Question 4 was a two-part crops and soils question. Part (a) provided candidates with the names of six pieces of equipment/farm machinery commonly used in farming. A table listing four farming activities followed. Candidates were required to choose the most appropriate piece of equipment/farm machinery to carry out each farming activity named.

This part of the question was generally well done. The majority of candidates scored high marks in this part of the question.

Part (b) of the question provided candidates with a description of the appearance of tomato seedlings experiencing growth problems. Candidates were then required to provide plausible explanations for the poor growth.

As with Part (a), Part (b) of this question was also well done.

#### **Question 5**

This question tested candidates' knowledge and comprehension of soil forming factors along with their understanding and knowledge of a typical soil profile in terms of being able to recognize different horizons and their characteristics.

Responses to this question were fairly well done, with most candidates showing an understanding of soil forming factors, like parent material, climate, temperature, time and biotic factors.

In Part (b) candidates were required to identify from an illustration of a typical soil profile the horizon that was of importance to the farmer and give reasons for selecting the identified horizon. Most candidates were able to answer this question. Finally, most candidates were also able to correctly state that the removal of the vegetative cover for a prolonged period, will result in the erosion or reduction of Horizon A.

#### **Question 6**

This question tested candidates' knowledge of fertilizers used in crop production.

Part (i) required candidates to name the nutrient elements represented by the letters N,P, and K, and also to name an example of a NPK fertilizer.

Generally the responses to this part of the question were correct.

Part (ii) of the question required candidates to indicate the benefits plants derive from each of the nutrient elements named in Part (i). The responses to this part of the question were also good.

Of concern, however, is the realization that many candidates are unable to correctly spell terms in agriculture such as nitrogen, phosphorous, potassium, and nutrient. It is important for us to appreciate that all-round academic development of an individual is incomplete when that individual spells poorly, constructs sentences poorly, displays grammatical incompetence, and generally writes badly.

### **Question 7**

This question required candidates to list factors affecting soil fertility and also to explain measures that can be practised to reduce soil erosion on a hillside.

In Part (a), candidates demonstrated a good understanding that soil erosion can be caused due to climatic factors. However, other factors associated with soil erosion, for example, the physical conditions of the soil, chemical properties, biotic factors, soil management and crop management, were addressed by a limited number of candidates.

Part (b) of the question indicated that candidates had difficulties in explaining practices used to effectively control soil erosion.

Generally candidates responded to this question satisfactorily. In conclusion, therefore, it is necessary that agriculture content be reinforced by practical activities and thorough observations during candidates' instructional exercise.

### **Question 8**

The question was intended to test candidates' knowledge of the external and internal structure and function of plant stems. This question was poorly answered. In Part (a), candidates experienced difficulty in naming the labelled parts as epidermis, xylem, vascular bundle and phloem.

In Part (b), many candidates were unable to recall the structure of the xylem.

### **Question 9**

Part (a) of this question required candidates' knowledge of food groups. This part of the question was generally well done, with most candidates correctly listing the required number of essential food groups.

Part (b) of the question was more challenging, as it required candidates to discuss how "housing and equipment" could contribute to "proper management" of birds. Candidates struggled with the application of knowledge required by this question. That struggle manifested in the following ways:

- Many candidates mentioned a function of housing and equipment but were unable to relate it to the proper management of broilers. For example, poultry houses prevent the entry of rain and direct sunlight.
- Many candidates described housing and equipment as a single unit rather than describing the specific individual contributions to management of broilers.
- Some candidates mentioned management practices for layers rather than broilers, for example, use of battery cages and laying boxes.

### **Question 10**

Candidates were asked to name three kinds of bees found in a hive and to state the function of any one of the bees. Part (c) tested the candidates' knowledge of swarming. The positive and negative effects from the use of antibiotics were required in the final part of the question.

Part (a) was fairly well done with a high percentage of the candidates correctly naming the types of bees and identifying their functions. However, many candidates were unable to describe swarming of bees.

Part (c) was very poorly answered, as many candidates interpreted antibiotics to mean vaccination. Therefore, greater emphasis should be placed on explaining the term antibiotics and its functions.

### **PAPER 03**

#### **OPTION A - Crops and Soils**

##### **Question 1**

Part (a) of this question asked candidates to define the term asexual reproduction. It also required candidates to differentiate between the terms asexual and sexual reproduction and explain three advantages of propagating plants using vegetative methods. Part (b) of the question asked candidates to explain three managerial practices recommended for cultivating yams to obtain healthy growth and high yield. Candidates were guided by the following: Selection and preparation of planting material, planting of crop, cultural practices for management of the crop and storage of the crop.

Part (a) of the question was widely known by candidates, particularly Part (iii). However, candidates encountered difficulties responding to Part (b), which dealt with management practices.

Candidates were required to state that asexual reproduction is a plant propagation method using vegetative parts of plants rather than using one gamete or one partner as candidates incorrectly stated.

Candidates should be able to use similar features as they relate to both things when making comparisons. This was not manifested with competence in their responses and hence needs attention.

Emphasis should be placed on practices relating to the land management and also cultural practices associated with management of the crop.

Due to the amount of the non-scientific responses given by candidates in relation to storage, it is necessary that storage of individual crops must be dealt with separately throughout the candidates' instructional exercises.

##### **Question 2**

In Parts (a) and (b) of this question, candidates were asked to explain the benefits of using certified planting material in crop production and to identify planting material used in the production of sugar cane, sweet potato, banana/plantain and cucumbers. In Part (c), candidates were required to describe photoperiodism and to give an example. Part (d) required candidates to describe post-harvest management practices of sweet potato and tomato.

The response to this question was satisfactory. Many candidates confused 'planting materials' with tools, equipment, fertilizers and propagation techniques. The concept of photoperiodism was not understood by candidates even though the stimulus material was provided in the question asked. Photoperiodism is a plant's response to daylength.

Many candidates discussed the agronomy of sweet potato and tomato instead of post-harvest management practices for the crops.

It is evident that agricultural terms and examples need revisiting and candidates must be provided with the situation to understand and obtain relevant concepts.

##### **Question 3**

In Part (a) of this question, candidates were asked to describe three different field operations required to prepare the field for planting root and tuber crops. They were also required to state two benefits of land preparation for crop production. In Part (b), candidates were asked to discuss three benefits of cultivating crops

in soils with high organic matter content and the management practices that may be used to retain organic matter in the soil.

There was a satisfactory response to this question. Candidates knew that the first step was clearing the land but how it should be done, posed some level of difficulties.

On the other hand, difficulties emerged among candidates to explain how organic matter could be retained in the soil and they were unable to recognise that adding compost or organic matter is the same.

It is advisable that concepts relevant to this question, when taught theoretically, must be reinforced with a high level of practical activities.

#### **Question 4**

Parts (a) and (b) of this question required candidates to describe three ways in which soil may be eroded and list four ways in which water is lost from the soil. In Part (c), candidates were required to identify measures for soil conservation practices that can be applied to new farm lands in preparation for the cultivation of vegetables.

The responses obtained from candidates were generally good.

It is suggested that candidates must be made to understand the term water conservation and techniques used for conservation. On the other hand, distinguishing methods for water conservation and soil conservation need attention and must be adequately taught to candidates.

### **OPTION B - Animal Science**

#### **Question 1**

Part (a) (i) required candidates to name breeds of goats and breeds of sheep. Most candidates across the region were quite familiar with the common goat and sheep breeds reared in the Caribbean.

Part (a) (ii) of this question required candidates to describe desirable characteristics of the breeds named. This was poorly done. Many candidates described the physical features of the breed and the breed's country of origin, rather than describing the breed's milk and meat production potential, and adaptability to the tropics.

Part (b) (i) of the question, which required candidates to describe signs of heat in cows, was very well done. However, Part (b) (ii) which required candidates to provide a detailed description of management practices used to ensure the cow on heat becomes pregnant, was a bit more challenging for candidates. Actually, candidates had difficulty in describing either of the processes (artificial insemination or natural services) in detail.

Part (c) of the question required candidates to discuss management practices for rearing layers. This part of the question was poorly done also.

#### **Question 2**

Part (a) of the question provided a table with various species of livestock and common internal and external parasites that affect them. Candidates were required to indicate the symptoms of infestation as well as common control measures. This part of the question proved extremely challenging to candidates, and generally candidates' responses were mainly inaccurate.

Part (b) of the question was well done. This part of the question asked candidates to discuss common diseases that affect cattle in the Caribbean.

Part (c) was a question on aquaculture. Generally it was poorly done. Overall, this was a very low response question that was not properly answered.

### **Question 3**

Part (a) of the question required candidates to discuss the benefits, advantages and disadvantages of artificial insemination for reproduction in cattle. This topic was very popular with candidates from around the region. Not only did most candidates answer the question, but most also answered it well.

Part (b) of the question required candidates to discuss recommended practices for housing reproductive cows. This was also a very popular question with the candidates from around the region. However, the question definitely posed the greatest difficulty for candidates. Many candidates even misinterpreted the question and discussed management practices for farrowing rather than housing characteristics.

Part (c) of the question concerned castration in piglets. Some candidates were able to explain that castration at two weeks of age was better because the animal will heal faster and it is easier managed by one person.

### **Question 4**

The question required candidates to describe the structure and functions of parts of the digestive systems of poultry. In Part (b), candidates were required to name four local ingredients that could be used in the form of livestock feed. Candidates were also asked about the importance of plant quarantine and the final part of the question focused on candidates' knowledge of zero grazing.

Part (a) of this question was done fairly well by candidates. However, many candidates were unable to state the structure of the named parts of the digestive systems. In Part (b) candidates were unable to supply local ingredients, such as rice, corn, coconut meal, molasses, used in the formulation of livestock feed.

Part (c) of this question was done fairly well by candidates. In Part (d) of this question, many candidates gave the correct definition of zero grazing; however, many referred to the concept simply as continuous grazing and did not mention that grass was cut and taken to the animal. The advantages and disadvantages of zero grazing were fairly answered by the majority of candidates.

**CARIBBEAN EXAMINATIONS COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATIONS  
JUNE 2005**

**AGRICULTURAL SCIENCE  
(DOUBLE-AWARD)**

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## **AGRICULTURAL SCIENCE (DOUBLE AWARD)**

### **GENERAL PROFICIENCY EXAMINATION JUNE 2005**

This is a report on the Agricultural Science General Proficiency (Double Award) examination conducted by the Caribbean Examinations Council in May/June 2005.

The examination is intended to assess and evaluate the extent to which the syllabus objectives of the programme have been achieved.

Candidate performance is examined through four written papers, and a practical School-Based Assessment exercise conducted by the teachers themselves on the school farm. This last component carries 25 per cent of the total marks.

### **GENERAL COMMENTS**

The overall performance of the candidates in 2005 was fair and stable when compared with the results of 2004.

Hereunder are some comments on candidate performance in the four written papers.

#### **PAPER 01 – Multiple Choice**

The 60 Multiple Choice items, worth 60 marks, covered General and Specific Objectives distributed over the four profiles of the syllabus.

Candidates performed best in Crops and Soils and Agricultural Economics, but were weakest in Profile 3, Agricultural Mechanisation.

A comparison of the available statistics on the mean and standard deviation of the performances of the candidates of Year 2004 with Year 2005, shows that the general level of performance of the Year 2005 cohort was just marginally lower than that of 2004, while the statistics on the Equating items indicate that the difficulty level of Year 2005 items was very similar.

#### **PAPER 02 – Structured Questions**

##### **Question 1**

This question sought to determine the characteristics to be considered when spacing a crop, problems that may be encountered when plants are spaced too closely, and to determine the number of plants when the land area and spacing are given.

Candidates were able to score between two and four marks.

There appeared to be a general understanding of a few concepts as demonstrated by popular correct responses.

- Most candidates appreciated that the crop type and overall size of the matured plant had an influence on spacing.
- Most candidates realized that competition for sunlight and nutrients would have been increased.
- Very few candidates could correctly calculate the number of plants for the spacing specified.

Incorrect responses included the following:

- Space; soil type; spacing; root type; plant width.
- Overcrowding; less root room; damaged fruits; plants will not bear; not sufficient air spaces; space.
- Numerous incorrect calculations were done by candidates.

With regards to Part (c), it appears that teachers do not teach students when doing such calculations that the first and last rows should also be considered.

Examples of correct responses included:

- (a) Crop types; growth habit; topography; variety; and soil fertility.
- (b) Competition for nutrients/sunlight; increased incidence of pests and diseases; lower yields; photosynthesis may be hindered; reduced production.

## Question 2

This question tested candidates' knowledge of asexual reproduction. Candidates were required to identify the techniques used in asexually propagating a plant, explain the phenomenon where a grafted or budded plant bears a fruit other than what should be produced by the scion and to outline after-care procedures for budded and grafted plants.

Many candidates were able to score full marks in Part (a).

In Part (b), most candidates were unaware of the variety of rootstock used (sour orange), and seemed to think that sour orange resulted from the technique used.

Examples of incorrect responses:

- The scion came from another orange plant.
- The sour orange gene was dominant and the lime was recessive.
- Grafting and budding was not done well.
- The lime may have been pollinated with oranges.
- Graft an orange so it may be sour.

Examples of correct responses:

- Budding: grafting, simple layering; air layering; cuttings
- Shoot grew from the scion orange rootstock
- Cut off shoot from sour orange part of plant.

### Question 3

This question tested candidates' knowledge of photoperiodism. They were required to identify the groups into which plants are classified based on photoperiodism and explain the difference in the time of flowering of certain pigeon pea plants.

Parts (a) and (b) of this question were better answered than Part (c).

For Part (a), most candidates demonstrated an understanding of the concept of photoperiodism and were able to give correct responses.

Many candidates were able to give at least one of the following correct responses in Part (b): short-day plants, long-day plants, day-neutral or photo-insensitive plants.

In Part (c), candidates were unable to explain that some pigeon pea plants flower throughout the year because they are day neutral plants, and others start flowering in November because they are short-day plants.

### Question 4

The purpose of this question was to test candidates' knowledge of factors affecting the development of fertilizer programmes for a crop and methods of fertilizer application.

Many candidates scored well on the question with (a) and (b) being better answered than (c).

Examples of correct responses for Part (a), factors in developing a crop fertilizer programme are:

- Nutrient requirement
- Crop type
- Soil type
- Cost of fertilizer
- Availability of fertilizer

Some correct responses for Part (b), disadvantages of applying fertilizer in an unscientific manner are:

- Fertilizer wastage
- Environmental pollution
- Soil acidity
- Soil alkalinity
- Reduced fruit quality

Recommended methods of applying fertilisers to an orchard crop (Part (c)) are:

- Phosphorus – basal or direct application
- Nitrogen – ring application

### Question 5

This question tested candidates' knowledge of cross pollination of food plants.

Most candidates identified cross pollination as being responsible for the observed changes in Part (a).

Most candidates correctly identified the following as the best ways to avoid a recurrence of the problem in Part (b):

- Plant hot peppers and sweet peppers at different times of the year
- Plant hot peppers and sweet peppers in different fields/parts of the farm

### Question 6

This question tested candidates' knowledge of the management practices which must be carried out during the first four weeks in preparing a litter of piglets for the meat market. Candidates' ability to calculate "dressing percentage" was also tested.

This question was fairly well answered.

In Part (a), most candidates were able to identify management practices such as:

- Proper housing
- Weaning
- Feeding colostrum
- Supplying iron
- Castrating
- Cutting the umbilical cord and treating with iodine

### Question 7

The purpose of this question was to examine candidates' knowledge of formulation of a balanced ration for livestock and their knowledge of the nutrients in different types of feeds.

Most candidates were able to correctly identify the nutrients in the three feeds mentioned in Part (a).

In Part (b), many candidates were unable to give a full explanation for the ration not being balanced. Too many candidates limited their response to stating that the ration "did not contain all the nutrients needed for a balanced diet". Candidates should have stated that the ration would contain too much carbohydrate, while vitamins, minerals, fats and protein would be deficient.

Few candidates were able to give a correct ingredient needed to satisfy the requirements for a balanced diet in Part (c). Candidates should have named, among others, fish meal, soyabean meal, cotton seed meal.

### Question 8

This question tested candidates' knowledge of poultry management practices in relation to cannibalism, its causes and methods of prevention.

In Part (a), most candidates were able to state that "cannibalism" was the observed behaviour. Some candidates identified it as "scours", "animal in heat", and "feathering".

Candidates correctly identified the causes of the behaviour as "lack of debeaking" and "overcrowding" in Part (b), and that debeaking and proper space requirements were the correct management practices.

### Question 9

This question tested candidates' knowledge of the implications and importance of "day-old weaning" in dairy animals and the type of farming system to which this practice relates.

In terms of advantages in Part (a), many candidates were able to state that "more milk will be provided for the market". A few also mentioned the fact that "the cow was likely to come back on heat early". Correct responses which were mentioned by very few candidates were that this practice "assists in the planning of production" and "facilitates mechanization on the farm".

Incorrect responses in this section included: "calves will grow faster", "higher quality milk" and "better meat production".

In terms of disadvantages, popular correct responses in this section included the problem of lack of colostrum and its consequences in terms of the health of the calves. A less popular correct response was that "more time and attention would be required in the management of the calves".

Incorrect responses included: "lack of calcium", "calves may die", "mother not able to teach them the ropes".

In Part (b), many candidates were able to correctly identify the system associated with "day-old weaning" as "intensive system". Incorrect responses included: "Dairy farming", "livestock farming", "aquaculture" and "battery system".

Part (c) was the most poorly answered part of the question, with very few candidates being able to state correctly that intensive farming makes more use of available resources.

### Question 10

The purpose of this question was to test candidates' knowledge of artificial incubation and artificial brooding procedures.

A high percentage of candidates were able to determine the expected date the chicks will hatch, based on the information provided in the question. However, some candidates instead of giving a date as requested, gave a period, for example, three weeks. Others gave incorrect dates which showed they did not know the incubation period of a hen's eggs.

In Part (b), many candidates were able to identify two advantages of artificial incubation, namely, large batches of eggs can be incubated at the same time and there is less breakage of eggs. Some candidates were of the mistaken impression that with artificial incubation “the eggs hatch faster”.

In Part (c), a high percentage of candidates confused artificial incubation with artificial brooding. Very few candidates stated that it was important to

- keep the floor dry
- place newspaper on the floor for the first few days
- control draughts
- supply adequate heat
- supply adequate fresh water and feed
- keep out pests and predators.

### Question 11

This question focused on rabbit breeds and parturition in rabbits.

In Part (a), many of the candidates knew at least two meat breeds. The most well-known meat breeds mentioned were the New Zealand White and the Flemish Giant. Less well-known breeds were the Chinchilla, New Zealand Red and California White. Some candidates were creative and named breeds such as “Bush Rabbit” and “Hamshers”. Other candidates named breeds of other classes of animals such as British Alpine and Holstein. Very few candidates could correctly identify the Angora as a fur breed of rabbit.

Only some candidates were aware that the act of giving birth in rabbits is referred to as “kindling” (Part b).

Part (c) required candidates to identify peculiar behaviors of female rabbits in preparation for giving birth. The most popular correct responses were “remove bits of fur from her body” and she “goes off feed”. A less popular response was that she “became aggressive to the male”, and “she isolates herself”.

### Question 12

This question tested candidates’ knowledge of housing of goats with respect to siting, roofing, ventilation and flooring. Their knowledge of the advantages of housing goats was also tested.

For Part (a) (i), many candidates confused “siting” with “sitting”. This section of the question was poorly done. Some candidates were able to correctly identify “east-west alignment”, “site on well-drained soil”. However, some candidates stated incorrect responses such as “space required for the animal to sit” and “site far from homestead”.

Part (a) (ii) on roofing was better answered. Candidates were able to state that galvanized sheeting should be used, and the roof should be sloping. Some candidates gave vague responses such as “durable material should be used” and “the roof should be high enough”.

Part (a) (iii) was generally well answered. However, some students confused ventilation with spacing.

Part (a) (iv) was fairly well answered. Candidates were able to identify the type of material and flooring required for goats. Some stated that “floors should not be slippery or wet”. A very popular correct answer was that the flooring should be made of wooden slats. Some candidates seemed to think that the floor should be “made of dry mud”.

For Part (b), most candidates could correctly state at least one advantage of housing goats. Correct answers included “protection from predators” and “better control of pests and diseases”.

### Question 13

This question tested candidates’ knowledge of the application and type of equipment used in the preparation of land.

In Part (a), although candidates could have identified the equipment that was used for clearing (bulldozer, brush cutter), in many cases they could not correctly state their use.

In Part (b), candidates seemed to be confused by the term “cultivation”, and many could not correctly name equipment used in land cultivation. Expected responses included “plough/fork, rotavator/harrow”.

Expected answers for Part (c), equipment for preparation of ridges and furrows, included “ridgers, drainers and the mouldboard plough”.

### Question 14

This question sought to test candidates’ knowledge of the important marketing factors to consider in the production of mangoes for a developed market economy, and to recall the meaning of an agricultural marketing acronym and the role of the organization in the sugar industry.

For Part (a), many candidates were able to mention required market information such as “variety; market price; fruit quality; transportation; packaging requirements”. Incorrect responses included “grading and handling; storage”.

In Part (b), the acronym ISA appeared to be unfamiliar to most of the candidates. In fact, less than ten candidates in the entire cohort knew that it represented the International Sugar Agreement. No candidate could identify any of the purposes of the agreement, such as, to ensure enhanced cooperation relating to world sugar matters, to provide a forum for inter-governmental consultation on sugar, to facilitate trade by collecting and providing information on world sugar market and to encourage increased demand for sugar.

### Question 15

This question assessed candidates’ knowledge of the economic concepts of demand, supply and price. Their ability to use a graph to determine equilibrium quantity and price was also tested.

Part (a) was fairly well answered, as most candidates correctly identified the demand and supply curves, the equilibrium price and the quantity demanded at the equilibrium price.

For Part (b), candidates were able to sketch the curve to show an increase in demand to the right of the original demand curve, and to correctly state that an increase in the price of tomatoes would result.

### **PAPER 03 – Extended Response**

Candidates were required to respond to seven of ten essay-type questions based on three of the four profiles of the syllabus. The profile, Animal Mechanisation, is not tested in this paper.

Detailed comments on the questions of this paper follow.

#### **Question 1**

This question sought to ascertain candidates' knowledge and understanding of viral diseases in terms of (a) symptoms, (b) insect vectors, (c) other modes of infection and appropriate management practices.

Many candidates did not attempt this question.

In Part (a), candidates were able to state one typical symptom associated with viral diseases, such as stunted growth, yellowing of leaves, curling of leaves and leaf drop.

Most candidates who attempted the question could name one insect vector from the group, aphids, mites, mealy bugs, whiteflies. Mosquitoes, grasshoppers and bees were mentioned as vectors of plant viral diseases.

Candidates experienced difficulty in explaining two ways by which plant viral diseases are spread. Very few were able to identify even one way. Expected answers included transmission by means of infected tools and planting infected seeds.

In Part (d), candidates experienced difficulty in describing field sanitation practices such as the use of sanitized tools for pruning and harvesting, the use of clean ploughs and other implements, the removal, burning or burying of crop residue and infected plant material, and no smoking while conducting agricultural operations.

Other cultural practices required are rogueing, removal of weeds, crop rotation, removal of infected plant parts.

#### **Question 2**

The intent of the question was to ascertain candidates' ability to recognize quality standards, the correct stage for harvesting and proper post-harvest handling practices for fruits and vegetables.

This was a very popular question.

For (a), most candidates were able to mention size/weight of fruit, shape, uniformity, colour, absence of physical damage and correct stage of maturity as features used to determine the quality of fruits and vegetables.

For (b), most candidates scored above average marks in this section. Expected answers included cleaning, wiping, sorting, storage, and packaging. Incorrect answers given by candidates included processing and preservation.



Most candidates also scored above average in Part (c). Correct responses included: at correct stage of maturity; under cool conditions; avoid physical injury; use clean sharp knife; pack large heavy fruit in single layer. Incorrect responses included “drain soil; apply fertilizer and apply pesticide”.

Most candidates had difficulty answering Part (d) of the question. Most responses were related to time of harvest in terms of weeks and did not focus on the stage of maturity of the fruit or vegetable. For example, instead of stating that bananas should be harvested at the 3/4 full mature stage, candidates wrote “harvest fruits when yellow/ripe”. Field handling practices include placing fruits on a soft pad not bare ground, heavy fruits should be packed in single layers, well ventilated containers or baskets needed, fruits should be put in a cool dry place while awaiting transportation.

### Question 3

Candidates were required to demonstrate knowledge of soil components, fertility and management.

This was a high response question.

Most candidates were able to identify at least one soil component for Part (a).

In Part (b) many candidates could not explain the relationship between soil fertility and structure, pH and nutrient status of a soil. There was confusion between soil structure and soil texture. Many candidates were able to show how the nutrient status of the soil impacted on plant growth.

For Part (c), a high percentage of candidates were able to identify poor soil structure, soil crusting and soil compaction as possible problems, when water puddles over the surface of the soil. The candidates were generally able to identify at least one soil management practice in solving the problem under “soil cultivation”. However, candidates had some difficulty in understanding the concept of soil amendments namely, to apply organic matter and limestone to the soil.

### Question 4

This question tested the candidates’ knowledge of the care of seedlings and the problems associated with production of seedlings. They were also asked to identify correct management techniques to ensure the success of the crop.

The majority of candidates answered this question.

Generally marks scored in both sections of this question were above average.

In (a) most candidates were able to identify four likely causes of the problem. Correct responses included improper handling of seedlings, excess potassium, nitrogen deficiency. Incorrect responses included rich soil, sunlight, and spacing.

Responses to Part (b) were, for the most part, vague, for example, check the soil, nourish the soil and transplant at the right time.

### Question 5

This question sought to test candidates' knowledge of management of piglets and the methods and marketing with regards to marine fishing.

Only about one third of the candidates attempted this question.

In (a), most of the candidates who attempted the question were able to list at least two of the management practices related to piglets. Expected answers included: cut and treat umbilical cord, provide iron, allow each piglet to suckle to ensure they receive colostrum, clip needle teeth and castrate.

In (b), most of the candidates were able to correctly name two methods of marine fishing, especially hook and line, and seine. Incorrect responses included deep sea, off shore and aquaculture.

Most candidates were able to identify at least one problem associated with selling at roadside stalls and in the open market. The most common correct responses were spoilage of fish, unpleasant odour, loss of income to the vendor and insanitary conditions. Incorrect answers in this section included competition with one another and roadside accident.

### Question 6

This question tested candidates' knowledge of the approaches to rearing common/yard fowls and broilers and the advantages and disadvantages of each approach.

This question was generally well answered with candidates scoring fifty percent and above. Part (a) was better answered than (b). Some candidates stated that the common breed was more susceptible to diseases than broiler breeds. This was incorrect as even though common breeds are more exposed to pests and diseases they are less susceptible than broiler breeds.

### Question 7

This question tested candidates' knowledge of the management practices included in the rearing of honey bees. It also sought to test their knowledge of the social structure of a bee colony.

In (a), some candidates mistakenly interpreted the question to refer to bees in their natural habitat and not as being reared by a farmer. Most therefore gave general comments on the site rather than where the bees should be located but not on the physical structure of the hive.

Many candidates did not focus on feeding as a management practice carried out by the farmer in times of scarcity of nectar.

Candidates also had difficulty with pest and disease management, making general comments such as keep area clean, prevent insects and diseases. Foul brood disease was the most popular correct response.

Most candidates scored full marks on harvesting honey, with responses such as wear protective clothing, use a hive tool and a smoker being the most popular correct responses.

Most candidates were able to give the social structure of the hive and the functions of the queen, drone and worker. Some candidates were unable to name the drone as the male but were still able to give the correct function.

### Question 8

The purpose of this question was to test candidates' knowledge of trade recommendations to gain access to foreign markets, marketing strategies to gain profits and the possible resulting adverse effects on consumer health and the environment.

About fifty percent of the candidates attempted this question.

Part (a) was moderately well answered. Expected responses included adherence to international trade protocols/agreements, obtaining export license, reliable and timely supply of product, produce should meet the phytosanitary requirement of the market.

Most candidates were able to identify marketing strategies such as, advertising, attractive packaging, joining a producer's co-operative. Incorrect responses included, increase the price of ginger and proper fertilizing of crop.

For (c), many candidates were unable to identify ways in which pest management and fertilizer application could lead to adverse effects on the environment and have a negative impact on consumer health. Candidates responses should have included use of inappropriate pesticides, use of chemical method only, inappropriate method of application, and inappropriate disposal of excess chemicals.

### Question 9

The purpose of this question was to test candidates' knowledge and understanding of the role of agricultural co-operatives with reference to benefits to members, management structure and associated problems.

This was a very popular question and most candidates scored well.

One popular misconception, however, was that farmers obtained loans in the form of cash for co-operatives.

Management problems included financial mismanagement, failure of members to participate in meetings, lack of co-operative education among members, lack of trust among members, failure to hold meetings and improper use of government support.

### Question 10

The purpose of this question was to test candidates' ability to prepare an income and expenditure statement and calculate gross income, gross margin and profit.

Approximately fifty percent of the candidates attempted this question, and performance was average. Candidates must show all their working in questions of this nature. Gross margin refers to the income after the variable costs have been deducted.

### **PAPER 04 – Practical Paper**

This paper, a supporting element of Paper 05, the School-Based Assessment, is a substitute for a hands-on practical examination, and aims to assess the candidates' capability in the field / farm.

It attempts to transport actual and / or simulated agricultural field / farm situations indoors into the examination room, and then requires the candidates to make appropriate written responses to the stimuli presented.

Ten stations are set up, and the candidates are required to answer a given question on each.

All questions are compulsory, and the paper carries a total of 30 marks. Agricultural Economics is not tested in this paper.

Detailed comments on Paper 04 follow.

#### **Question 1**

This question tested candidates' ability to identify three insect pests of agricultural importance and to state their manner of feeding.

Most candidates were able to identify the pests as the mealy bug, mole-cricket and aphid respectively. Candidates, for the most part, were also able to state that mealy bug and aphids fed by piercing and sucking while the mole cricket fed by biting and chewing. Some candidates who could not correctly identify the pests by name were nevertheless able to state their method of feeding.

#### **Question 2**

This question required that candidates examine three drawings of patchoi plants used in a fertilizer experiment and answer questions based on the drawings.

Candidates did well on this question. However, some candidates gave general and vague responses such as "the plant looked better than the rest" and "the leaves were more upright".

#### **Question 3**

This question tested candidates' knowledge of symptoms of blossom-end rot, its causes, control measures required and crops which are prone to this condition.

The performance on this question was generally below average. The disease was variously identified as fruit rot, early blight, soft spot, among others.

#### Question 4

This question required that candidates classify the crop sugar cane, its by-products and use in livestock feed.

Candidates did very well in Parts (a) and (b) of the question. They generally had little difficulty in listing molasses, rum, juice, beverages and filter mud as by-products of sugar cane. Part (c) provided some difficulty as many candidates could not state the scientific name of sugar cane (Saccharum officinarum).

#### Question 5

This question tested “air layering” as a method of vegetative propagation, and the advantages and disadvantages of this method.

The response to Part (a) was good, about 60% of the candidates correctly named “air layering”. Parts (b) and (c) proved challenging with some candidates seeming to be unaware of the advantages and disadvantages of this practice.

Most candidates correctly named the material used as required by Part (c), that is, moss, soil, humus, a medium for plant growth.

#### Question 6

Here the extent to which candidates could recognise the conditions which cause foot rot in sheep was tested. It involved knowing the methods of prevention, treatment and the causative organism.

Most candidates demonstrated some knowledge of the conditions which lead to foot rot and thus how it can be prevented and treated. However, about 80% of them did not know the causative organism, some stated “virus”, “protozoa”, few correctly stated “fungus”.

#### Question 7

This question tested candidates’ knowledge of commercial production and grading of eggs.

Most identified the breed displayed as a layer and the system under which such birds must be raised for commercial egg production.

In excess of 90% of them know that weight is the factor used when grading eggs; few incorrectly stated “shape, colour and cracked shells”. These are factors used in the selection of eggs before grading is done.

### Question 8

In this question candidates' knowledge of "fresh-water fish" and the benefits of growing these commercially in the Caribbean was tested. Most correctly named the fish. They knew the correct terms used in in-land fishing, the techniques used in the harvesting of some and the benefits of in-land fishing. However, naming the young at various stages of their growth was challenging; some candidates wrote "larva, pupa, tadpoles, fishlets". "Fries" in (c) (i) and "fingerlings" in (c) (ii) were the accepted responses.

### Question 9

The candidates' knowledge of green succulent grass and hay was tested in this question, that is, the benefits of each as a feed and their suitability to livestock at various stages of growth.

Most candidates were able to identify the specimens, although some wrote "dry grass" for hay which is in fact dried grass. Also, they were unable to state correctly the conditions under which hay is produced and the benefits of this product. The methods used to encourage young animals to feed on hay also proved challenging.

### Question 10

This question tested whether candidates were able to identify the disc plough and its uses.

Most candidates were able to identify the plough but were unable to name the labelled parts. In addition, many seem not to know the soil type and conditions under which this plough is most effective. Some wrote "loams or virgin soils or clumpy soils", whereas disc ploughs are best suited to clay soils or soils which stick together easily. In naming the parts of the plough, the furrow wheel proved the easiest to be identified.

**CARIBBEAN EXAMINATIONS COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATION**

**JUNE 2006**

**AGRICULTURAL SCIENCE  
(SINGLE AWARD)**

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## **AGRICULTURAL SCIENCE (SINGLE AWARD)**

### **GENERAL PROFICIENCY EXAMINATIONS**

**JUNE 2006**

#### **GENERAL COMMENTS**

The Caribbean Examinations Council offered Agricultural Science (Single Award) General Proficiency Examination for the fourteenth year in 2006. The rationale for this offering in the area of agriculture is to make agricultural education available to a larger group of the secondary school population than is presently catered for by the Double Award. This increased exposure is desirable for improving attitudes to agriculture, promoting agriculture as a business, encouraging larger numbers of school leavers to enter fields related to agricultural endeavours, and for sustainability in selected agricultural commodities in the CARICOM region.

The examination is conducted with the assumption that there is compulsory exposure to the subject during the first three years of secondary education and a careful and systematic study of the requirements of the syllabus during the fourth and fifth years.

The 2006 examination was designed to provide a comprehensive test of candidates' knowledge and skills in all dimensions of the syllabus, such as:

- (a) knowledge and understanding of the content of the syllabus
- (b) fundamentals of Agricultural Science
- (c) ability to make precise links between Agricultural Science theory and practice
- (d) ability to perform a selected range of general agricultural skills from the core and the chosen option
- (e) ability to communicate knowledge and understanding in the approach to answering the questions and solving problems.

Candidates can choose from two options: Option A – Crops and Soils (C&S), Option B – Animal Science (AS). Candidates choose an option at the beginning of the first year and complete the SBA component for that option during the two years. They are examined on the core of the syllabus and write an essay paper based on the previously chosen option.

The Examining Committee is satisfied that the objectives of the examination were satisfactorily met and that the results reflect a valid discrimination among candidates, on the basis of their abilities to deal with the content of the syllabus.

#### **Form of the Examination**

The examination comprised three written papers as described briefly below and a School-based Assessment (SBA) component.

- (a) Paper 01      Sixty Multiple Choice items under the Knowledge and Comprehension Profile dimension and based on objectives on the core of the syllabus.
- (b) Paper 02      Ten compulsory structured questions based on the objectives in the core of the syllabus under the two profile dimensions – Knowledge and Comprehension, and Use of Knowledge



- |     |          |  |
|-----|----------|--|
| (c) | Paper 03 | Four essay-type questions set on each option: candidates are required to answer three questions from the option chosen. These were also tested under the Knowledge and Comprehension, and Use of Knowledge profiles. |
| (d) | SBA      | Candidates were assessed on a number of skill objectives, preparation of a Farm Diary and compilation of Farm Records.   |

## **SPECIFIC COMMENTS**

### **PAPER 01**

This paper consisted of 60 multiple-choice items distributed over the five units in the core of the syllabus.

### **PAPER 02**

#### **Question 1**

This question tested the candidates' knowledge of the benefits of increased food production and the negative impact of agricultural development in their country.

In Part (a), candidates' responses suggested that this question was clearly understood. One noticeable area of concern in the responses was that a significant number of candidates confused "factors of production" with "benefits of production."

Part (b) of the question proved a little more challenging. Most candidates, while identifying factors adversely affecting the development of agriculture in their country, were unable to properly discuss the factors identified.

Candidates who attempted the (b) part of the question responded poorly, while a substantial percentage of them did not respond.

#### **Question 2**

This question tested candidates' knowledge: (i) of farm income and how it is classified (ii) to precisely define a simple agricultural economics concept (iii) at interpreting information provided on a graph and (iv) of principles governing marketing of agricultural produce. The response to this question was good.

#### **Question 3**

This was a two-part question. Part (a), focused on simple equipment and machines used in every day agricultural activities. Candidates were provided with a list of agricultural equipment and machines and asked to match these equipment and machines to the agricultural activity for which they are used. This part of the question was generally well done, however some common incorrect responses indicated that some candidates did not properly interpret the question.

Part (b) of the question tested candidates' knowledge of the use and maintenance of milking machines for milking cows. Candidates' responses to this part of the question were also generally good.

#### **Question 4**

Part (a) tested candidates' knowledge of Caribbean soil types and factors affecting soil fertility.

This part of the question was generally well done. The majority of candidates scored high marks in this part of the question.

Part (b) of the question required candidates to discuss planting requirements necessary for the successful germination of beans. Some candidates provided confused responses to this part of the question in that they discussed the requirements for successful germination of beans.

#### **Question 5**

This question tested the candidates' knowledge and comprehension of the effects of weeds on plant growth as well as their understanding of the advantages and disadvantages of chemical weed control.

Responses to this question were fairly well done, with most candidates demonstrating an above average understanding of weeds and their effects on crop growth, as well as chemical weed control.

#### **Question 6**

This question tested candidates' knowledge of disease, causative agents, symptoms, affected crops and methods of controlling pest and disease.

Most candidates displayed competence on the parts of the question that dealt with methods of controlling pests and diseases. However, candidates found it challenging to name the pest and disease and name the crops affected by the disease.

Some common incorrect responses to the symptoms of nematode disease were fungus, earthworm, blight and virus.

#### **Question 7**

Candidates were required to:

- define the concepts "Feed Conversion Ratios" and "Balanced Ration"
- identify management information provided by the "Feed Conversion Ratio"
- select the group of animals with the best "Feed Conversion Ratio" from a given set of groups and
- explain the economic importance of the "Feed Conversion Ratio".

Generally candidates' responses to this question were very poor. Candidates displayed a lack of understanding of the specific technical content tested. In conclusion therefore, it is necessary that agriculture content must be reinforced by practical activities and thorough observations during candidates' instructional exercise.

#### **Question 8**

The question was a three-part question in which Parts (a) and (b) intended to test candidates' knowledge of aquaculture (fish farming) and Part (c) tested candidates' knowledge on care of broiler chicks.

Generally, the responses to the question were good especially Parts (b) and (c) .

Part (a) was not very well done because many candidates confused the concept of "aquaculture" with "apiculture".

### **Question 9**

This question provided candidates with a diagram of a poultry house. Part (a) of this question required the purpose of the house. Parts (b) and (c) tested candidates' basic knowledge on the roof of the house and Part (d) tested candidates' knowledge of the importance of the foot bath.

The question was a high response question indicating that candidates found the question interesting and generally provided correct responses.

Part (a) of the question proved most challenging to the candidates and there was general confusion as to the purpose of the house and the most suitable roof for broiler house.

### **Question 10**

Candidates were asked to define and differentiate the popular animal science terms namely: gestation, parturition, oestrus and oestrous cycle. Part (b) tested candidates' practical knowledge based on their experiences in the laboratory. Candidates were requested to name the food or feed fed; their observation and the results achieved after particular food tests were carried out in the laboratory.

Part (b) was fairly done with a high percentage of the candidates correctly responding to the question.

Part (a) was very poorly answered: oestrous cycle was confused with oesophagus, digestion and excretion; gestation was confused with digestion, fertilization and castration; parturition was confused with weaning.

## **PAPER 03**

### **OPTION A – Crops and Soils**

### **Question 1**

Part (a) of this question tested candidates knowledge of photoperiodism, and required them to give examples of plants which respond to it. Part (b) of the question asked candidates to describe two methods of fertilizer application to crops and for each method to give an example of crops to which fertilizer is applied. In Part (c) candidates were asked to explain three methods by which organic manure improves soil fertility; three ways in which soil fertility may be affected by waterlogged conditions and three benefits of applying lime to soil.

This was a high response question which candidates answered satisfactorily. In Part (a) of the question candidates' knowledge of photoperiodism was limited and candidates were unable to give a proper explanation. As a result examples cited were roughly guess work with correct example limited to sorrel.

It is evident that agricultural terms and examples need revisiting and candidates must be provided with the situation to understand and obtain relevant concepts.

Part (b) of the question was also well answered, as candidates were aware of fertiliser application. However, candidates experienced some difficulties in the identification of examples, especially when fertiliser was applied by the broadcasting method. This could be because as candidates did not understand the various application techniques to which they referred.

In Part (c), candidates failed to explain how soil fertility may be affected by waterlogged conditions. Many candidates confused waterlogged conditions with irrigation of crops. However, most candidates knew the benefits of organic manure in improving soil fertility, for example, by increasing soil water holding capacity, aeration of the soil and so on. In the case of the benefits of applying lime to soil many candidates were only aware that the application of lime improved soil acidity and very few knew that lime supplied calcium ions to the soil.

### **Question 2**

This question tested candidates' knowledge of vegetative propagation. Candidates were first required to list techniques used in the vegetative propagation of ornamental plants and then to describe advantages of vegetative propagation. The second part of the question asked candidates to advise to a farmer on inadequacies in (i) land preparation and (ii) selection and treatment of planting materials as they applied to the farmer who experienced poor yield for her yam crop.

Candidates had no difficulty in identifying the techniques required for vegetative propagation of anthuriums. Similarly, most candidates were able to give at least one advantage of vegetative propagation.

Part (b) was not well answered as most candidates responded using generalizations where specific advice was asked for in each case. The knowledge of land preparation techniques was adequate but there was marked inadequacy in the Use of Knowledge as it applied to the selection and treatment of planting materials.

### **Question 3**

In Part (a) of this question, candidates were asked to define the term 'land capability classes.' They were also required to list four land capability classes and describe one characteristic of each land capability class identified. In Part (b), candidates were asked to discuss three management practices that must be done during each of the following time periods: (i) January to May and (ii) June to September.

There was a satisfactory response to this question. Candidates were able to identify and/or describe the land capability classes. In a few cases candidates were confused by the term land capability classes.

On the other hand difficulties emerged among candidates to explain management practices that must be done especially for the period of June to September. Furthermore, candidates did not recognize specific crops best suited for a particular rainfall zone, and as such were unable to elaborate on the relevant associated practices for each rainfall zone.

The problem seemed to be one of comprehension. Candidates were unable to apply information which should have been adequately covered in the syllabus. The responses showed general confusion in farming practices to suit particular rainfall conditions.

### **Question 4**

Part (a) of this question required candidates to name four activities involved in the preparation of a seedbed for seedling production. Part (b) requested candidates to name two types of mediums used in the cultivation of anthuriums and to explain two benefits of the use of shade when cultivating anthuriums. In Part (c), candidates were required to discuss three types of insect damages and in Part (d), three ways in which farmers can reduce the use of chemical pesticides when cultivating crops.

The responses obtained from candidates were generally good. Parts (a) and (b) were widely known by candidates. Candidates were au courant with the activities involved in seedbed preparation and medium used in the cultivation of anthuriums and the benefit of shade in the cultivation of anthuriums.

Many candidates attempted Part (c) and the question was reasonably well answered with candidates correctly identifying methods of insect attacks as piercing and sucking; biting and chewing; boring and tunnelling. However, some very vague responses were received such as eating leaves and damaged stems.

## **OPTION B - Animal Science**

### **Question 1**

Part (a) (i) required candidates simply to define upgrading, culling and artificial insemination. Most candidates across the region were quite familiar with these terms and their performance was fair. Few candidates correctly gave the removal of unproductive animals as the definition for culling.

Part (b) of the question, which required candidates to name three breeds of dairy animals recommended for use in an artificial insemination programme was not very well done. Actually, candidates had difficulty in identifying at least one breed.

Part (c) (i) of the question required candidates to discuss three advantages to be derived from the use of artificial insemination. This part of the question was very well done. However, some candidates gave inappropriate disadvantages as it is expensive; poor heat detection meant that artificial insemination could not be done.

Part (c) (ii) required candidates to discuss three conditions necessary for the success of an artificial insemination programme. This part of the question was poorly answered as the candidates misinterpreted the question.

Overall candidates' performance on this question can be described as satisfactory.

### **Question 2**

Part (a) of the question provided a table with various classes of livestock. Candidates were required to indicate the length of gestation period of the animals. This part of the question proved challenging to some candidates. However, generally candidates' responses were mainly accurate.

Part (b) of the question was well done. This part of the question asked candidates to identify two characteristics of each grazing system used in rearing cattle in the Caribbean.

Part (c) of the question requested candidates to describe five principles governing the housing requirements for layers. Many candidates correctly stated the housing requirements for layers and their advice for rearing layers were accurate. However, some candidates did not read the question carefully and spoke about broiler production.

### **Question 3**

Parts (a) and (b) of the question required candidates to define the term 'apiculture' and to explain two ways in which bees are of economic importance to agriculture. This topic was very popular with candidates from around the region, not only did most answer the question, but most also answered it well.

Part (c) of the question required candidates to name three factors that must be considered in the marketing of honey. This was also a very popular question with the candidates. However, from the response given the question definitely posed the greatest difficulty for candidates. Many candidates even misinterpreted the question and discussed the production of honey.

Part (d) of the question concerned factors that must be considered in the selection of a site for the establishment of an apiary. Candidates were presented with a simple situation and were required to construct a response based on the situation presented. This topic was also popular with candidates and their performance in answering the question was average.

**Question 4**

The question required candidates to propose a model livestock industry which focuses on the production of healthy animals. The proposal should (i) outline two management practices considered critical to the health of animals and (ii) identify six signs that would suggest an animal is healthy. In Part (b), candidates were required to discuss five measures that can be used to improve the health of farm animals.

Part (a) of this question was done fairly well by candidates. Most candidates were able to identify sanitation, housing and feeding as important. Furthermore, candidates were very familiar with signs of ill-health and correctly listed weight loss, loss of appetite, diarrhoea, fever and constipation.

Part (b) of this question was done fairly well by candidates and many candidates were very familiar with this topic.

**C A R I B B E A N   E X A M I N A T I O N S   C O U N C I L**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATION**

**MAY/JUNE 2006**

**AGRICULTURAL SCIENCE  
(DOUBLE AWARD)**

## **AGRICULTURAL SCIENCE (DOUBLE AWARD)**

### **GENERAL PROFICIENCY EXAMINATION**

**JUNE 2006**

This is a report on the Agricultural Science General Proficiency (Double Award) examination conducted by the Caribbean Examinations Council in May/June 2006.

The examination is intended to assess and evaluate the extent to which the syllabus objectives of the programme have been achieved.

Candidate performance is examined through four written papers, and a practical School-Based Assessment exercise conducted by the teachers themselves on the school farm, and moderated by CXC moderators. This last component carries 25% of the total marks.

### **SPECIFIC COMMENTS**

#### **PAPER 01 – Multiple Choice**

The 60 Multiple Choice items, worth 60 marks, covered General and Specific objectives distributed over the four profiles of the syllabus.

The marks ranged from 0 – 54. There was no significant difference in the performance between Crops and Soils (56.06%), Animal Science (54.20%), and Agricultural Economics Profiles (55.20%), but candidates' performance in Agricultural Mechanization (38.12%) continues to be weak.

#### **PAPER 02 – Structured Questions**

This paper consisted of 15 questions with a maximum of 6 marks each.

There were many 'no responses', especially in the latter questions. The main reason for this could not be determined, but it is suspected that it may stem either from incomplete syllabus coverage, inadequate syllabus coverage or poor examination techniques. In many cases candidates took an everyday approach rather than a scientific approach to answering questions.

Comments on individual questions follow.

#### **Question 1**

This question sought to test candidates' knowledge of the use of pesticides and proper disposal of unused pesticide.

There appeared to be a general understanding of the concepts as most candidates were able to score marks in each section of the question. The greatest difficulty was experienced in Part (b), which focused on safe disposal of excess pesticide after a spraying operation.

Many candidates recognized that the possible reasons for the farmer ending up with an excess of pesticides after the operation were that (i) he had not calibrated the sprayer and as a result, mixed more chemical than he needed for the operation, (ii) he did not apply the chemical properly and (iii) he did not spray the entire area which should have been sprayed.



The safe disposal of the excess chemical provided the greatest challenge as few candidates stated that the farmer should identify an area away from water courses, dig a hole and dispose of the chemical, or store safely in a labeled container for later safe disposal. Many candidates advised the farmer to simply empty the excess pesticide down the drain, or dispose of it in an unused area of the farm.

Most candidates correctly identified the safety precautions the farmer was ignoring such as not wearing a respirator and spraying into the wind.

It is extremely important that students be exposed to the full range of practical activities required by the syllabus. It was obvious that most candidates had never been exposed to this aspect of the syllabus in a practical way.

### Question 2

This question required candidates to demonstrate knowledge of manual and chemical weed control measures, and to identify monocotyledonous and dicotyledonous plants from drawings. The performance on the question was average.

Most candidates were able to identify the control measure illustrated in the pictures as mechanical and chemical weed control.

Chemical control was correctly identified as the most suitable approach to control weeds on slopes as this minimizes the possibility of erosion.

Most candidates were not able to distinguish between monocotyledonous and dicotyledonous plants from the pictures provided in the question.

This emphasizes the need for students to understand and have knowledge of basic science before embarking on a course in Agricultural Science.

### Question 3

In this question candidates were required to demonstrate their knowledge of seed germination, and its relevance to seed viability.

The level of performance was below average.

Although Part (a) was the best answered part of the question, far too many candidates could not define seed viability as the “ability of a seed to germinate”. Many candidates listed parts of the seed instead of defining seed viability.

This was also the case in Part (b). The most popular correct responses included: planting seeds too deeply; lack of moisture, damage to seeds; suitable temperature; maturity of seed.

Teachers need to pay more attention to teaching this concept and provide opportunities for students to perform and record results of seed viability tests. They should also point out that the ability of a seed to germinate is mainly dependent on factors affecting the seed and not on soil conditions.

#### Question 4

The purpose of this question was to test candidates' knowledge of the production of hybrid plant varieties and the application of such knowledge in terms of advantages and disadvantages in a farming situation. The question was very poorly answered.

Many candidates could not correctly explain that hybrid plant varieties were produced by crossing two different purebred varieties. In most cases candidates did not seem to know that "purebred" varieties were required for such a cross. Some even expressed the view that hybrid varieties could be produced by budding and grafting.

Correctly listing advantages and disadvantages of hybrid varieties also proved to be challenging to candidates. Far too many candidates felt that hybridization always led to larger or bigger fruits. Some simply stated "better" fruits.

Very few candidates provided the expected responses such as: higher yields; increased resistance to diseases and pests, improved quality and earlier maturity

Expected answers for disadvantages included: higher costs for hybrid seeds; the seeds of hybrid varieties cannot be reused for establishing another crop; seeds may not breed true to type; important genes may be lost.

Examples of incorrect responses in terms of disadvantages included: when seeds are replanted lower yields result, and that specialized training is needed to grow hybrid crops.

#### Question 5

The intent of this question was to test candidates' knowledge of the characteristics of top soil and the common soil types in the Caribbean.

This question was fairly well answered.

Some candidates gave vague responses in Part (a) such as: top soil is identified by its colour without stating that it was dark in colour.

Most candidates gave correct reasons why topsoil is better for plant growth. Expected answers include: higher organic matter content; soil organisms are present and their activities improve soil aeration.

Some examples of incorrect responses in this section included: free of pests and diseases; has fertilizer added to it.

Almost all candidates correctly named two common soil types in the Caribbean.

#### Question 6

This question tested candidates' knowledge of simple genetic terms and principles. Candidates did not perform well on this question.

It was surprising that so many candidates could not define basic genetic terms such as "phenotype" and "recessive gene". The explanation of recessive gene was even more problematic than that for phenotype.

Incorrect responses to the explanation for recessive gene included: gene that is not active; gene that is dormant; gene from one parent; gene given by the mother.

The cross between two heterozygous parents should be common to students being prepared for this examination and so the expected 1:2:1 ratio should have been obtained by the candidates.

Teachers need to ensure that the basic concepts and principles of Genetics are taught as required by the syllabus.

#### Question 7

This question focused on livestock production and tested candidates' knowledge of forage conservation and feeding of forage to animals.

Candidate performance on this question was good with most students scoring fifty to sixty percent of the marks.

Most of the candidates correctly cited lack of nutrients, weight loss, and increased susceptibility to diseases. Also, producing hay and silage were correctly identified as methods of conserving forage.

Candidates were similarly knowledgeable with regards to supplemental food materials fed to livestock.

It was obvious that candidates were adequately prepared in the objectives tested by this question.

#### Question 8

The intent of this question was to test candidates' knowledge of the characteristic of the Barbados Blackbelly sheep which contributed to its importance as an animal breed in the Caribbean.

Performance on this question was average.

Most candidates were able to correctly list characteristics of the Barbados Blackbelly sheep with docility, hardiness and adaptation to local climatic conditions among the most popular correct responses.

In Part (b) of the question correct responses included the prevention of entry of exotic diseases and pests by examining the material for the presence of pests and diseases. Incorrect responses to this section included protecting animals from predators, checking for acclimatization of new breeds and for male animals to breed in peace.

Some candidates saw the superior breeding ram providing protection for the females from other rams, and that the farmer would save money since he would not need Artificial Insemination. Expected answers included: hybrid vigour, more prolific, increased production, upgrade of local herd.

This question again showed that students should be familiar with the fundamentals of science, for the previous question which dealt with the fundamentals of genetics was poorly answered, whereas its application on a farm situation was better understood.

#### Question 9

This question tested candidates' knowledge of the structure of the ruminant stomach and the functions of the rumen.

The performance on this question was fair.

Most candidates scored marks in Parts (a) and (c) by correctly identifying the parts on the diagram and naming two other ruminant animals

In some cases it was clear that candidates were not familiar with the diagram and thus parts were named as appendix, hepatic portal vein, cloaca and proventriculus.

#### Question 10

The practice of “culling” in animal production was tested by this question.

Some candidates were able to correctly state that culling is the removal of animals from the breeding or production herd or flock. However, candidates who did not have the knowledge required to give a correct answer made wild guesses, which included cutting of the tail of the animal, removing excess hair from the animal and removing the animal’s horn.

Those who knew what culling was were able to correctly list reasons why culling is done. Expected responses included preventing the spread of disease, increasing the average production per animal, with the overall goal of increasing profits.

Some candidates had difficulty with the concept that the farmer could gain an income from the culled animals, although many of them correctly stated that culled animals could be slaughtered and the meat sold, and that they could be sold for their hides (skin).

#### Question 11

This question tested candidates’ knowledge of the causative agent of mastitis in cattle, how the farmer can detect its presence in the herd and how the spread of the disease could be prevented.

Performance on the question was not satisfactory with most candidates scoring much less than fifty percent of the marks.

Many candidates correctly identified the causal agent as a bacterium and correctly described the strip-cup test as a means of confirming that the disease was present. Less popular correct responses focused on the increase in temperature of the udder, and hardness and swelling of the udder. The California Milking Test and the Milk Quality Test were also expected answers.

Candidates experienced the greatest difficulty in Part (c) where they were required to identify ways in which a farmer could prevent the spread of mastitis. Expected responses included the practice of good sanitation, washing the udder, milking infected cow last and milking infected quarter last. Popular incorrect answers to this part required that the farmer test the faeces and examine the animal’s blood for the organism. Vaccination as a means of control of mastitis was also proposed.

#### Question 12

This question was based on the Machinery aspect of the syllabus. The question was poorly answered.

The part of the question which presented the greatest difficulty to candidates was Part (b) which asked for two ways in which power is lost from an engine. Some candidates correctly focused on problems in the cooling, exhaust and lubrication systems. Other expected responses included faulty transmission and inadequate servicing.

Teachers are encouraged to pay more attention to this aspect of the syllabus as newer and smaller items of machinery are made available to farmers, and understanding the machines and performing self maintenance would be a great cost-cutting device.

#### Question 13

Candidates’ knowledge of using the tractor and ploughs for land preparation, and the safety measures to be employed when using a farm tractor were tested in this question.

The performance on this question was below average with many candidates scoring between 2 and 4 marks.

Many students could not state that PTO meant Power Take-off.

Most candidates could name two plough types apart from the rotary plough. The safety precautions to be observed when using a tractor for land preparation were also well known. Many candidates provided expected answers such as avoiding sharp turns when operating, ensuring that the PTO is disengaged when not in use, ensuring that the gear is in neutral when starting.

#### Question 14

This question tested candidates' knowledge of marketing cooperatives. This question was not well answered with many candidates obtaining between 0 – 3 marks.

Many candidates gave an adequate explanation of what an agricultural marketing cooperative is. However, a few thought that it was a place where people go and sell their goods in the market.

Part (b) proved the most challenging as many candidates could not correctly state the benefits farmers get from membership in a marketing cooperative. Expected responses included farmers benefiting from economies of scale, access to technical and financial services from other institutions. Too many candidates felt that the farmer could obtain loans from the marketing cooperative.

Part (c) was well answered, with many candidates correctly stating common problems faced by marketing cooperatives, identifying dishonesty among members, members not playing an active role and the infusion of politics in the business, as the major obstacles.

#### Question 15

This question was intended to test candidates' knowledge of the factors involved in production, avenues available to farmers for obtaining capital, and calculating straight line depreciation.

Performance on this question was fair.

Most candidates were able to list land, labour, capital and management as the factors involved in production, with land and labour being the two most commonly mentioned.

Some candidates could not correctly identify sources of capital for farmers as from the farmer's own savings, commercial and agricultural development banks and credit unions. Some expressed the misconception that farmers could obtain money from the Ministry of Agriculture.

Most candidates did not have a clue on the formula to calculate depreciation, or what is meant by salvage value. As depreciation is one of the most fundamental aspects of economics one would have to assume that poor response stemmed from the question coming as the last question of a long examination, rather than a lack of knowledge by the candidates.

### **PAPER 03 – Extended Response**

Candidates were required to respond to seven of ten essay-type questions based on three of the four profiles of the syllabus. The profile, Agricultural Mechanization, is not tested in this paper.

Detailed comments on candidate performance in this paper follow.

### Question 1

This question sought to ascertain candidates' knowledge of seasonal water management strategies, and seedling production practices. This was the most popular question in this paper. The question was fairly well answered. Many candidates obtained more than fifty percent of the marks, with a few candidates obtaining full marks in this question.

Many candidates correctly identified irrigation, mulching, and planting on flat beds as acceptable water management strategies for vegetable crop production in the dry season, whereas in the wet season suitable strategies include construction of proper drainage systems, formation of ridges and furrows, planting on mounds and raised beds. Quite a number of candidates erroneously suggested mulching in the wet season as a water management strategy.

Part (b) provided the greatest challenge with too many candidates seeming to think that seedlings wilted due to a loss of nutrients during transplanting. Good responses in this section included: root damage; seedlings not having been hardened and pest damage.

Many candidates focused on soil conditions such as inadequate drainage and irrigation.

Expected answers for Part (c) included carefully uprooting the seedling with soil around the root to avoid or minimize root damage; transplanting only well hardened seedlings, and reducing the transpiration rate of the newly transplanted seedlings by removing some of the leaves. Some candidates seemed to think that application of fertilizer reduced the chances of wilting by newly transplanted seedlings.

### Question 2

This question intended to test candidates' knowledge of the steps in land preparation to achieve high crop yields and to explain the importance of land preparation. Part (b) required candidates to list the steps in preparing virgin land and to explain how the steps listed contribute to favourable crop growth and development.

The question was the second most popular, and candidates' performance was just below average.

Part (a) was very well done with most candidates being able to correctly list at least three of the four factors, and many of them knowing the importance of the factors named.

Part (b) was poorly answered as candidates had no concept of virgin land, and many of them mentioned applying fertilizers, seeking capital and use of soil amendments.

### Question 3

This question tested candidates' knowledge of the stages of plant growth, how these stages related to commercial food production and the advantages and disadvantages of intercropping.

Performance in this question was fair with many candidates obtaining more than fifty percent of the marks.

Part (a) was well done by most candidates, as they correctly identified the stages of plant growth as germination/seedling, vegetative, reproductive and senescence.

Part (c) was the most challenging part of the question. Far too many candidates could not identify two advantages and two disadvantages of intercropping. Popular misconceptions were that intercropping caused a loss in soil fertility and required more skilled labour than other cropping systems.

Expected answers in terms of benefits of intercropping included increased soil fertility, spreading of risk, less chance of erosion, and legumes providing nitrogen for leaf crops.

Limitations candidates were expected to list included the difficulty in using machinery for harvesting due to different harvesting times of crops and difficulty in pest and disease control as different chemicals are required.

#### Question 4

In this question, candidates were required to relate the role of soil colour in determining soil fertility, and to identify green manures and their use in improving crop production.

This was not a high response questions, and the candidates who attempted the question performed poorly.

Most candidates were familiar with the positive aspects of a 'black' coloured soil, for example containing humus and organic matter. Very few, however, were able to discuss the negative effects of 'black' soils. This may be due to the fact that 'poor black soils' are only found in small pockets in a few of the islands. The main reason for 'black' soils in the Caribbean is the presence of stagnant water, and not oil spills or erosion as mentioned by a few candidates.

Part (b) was very well answered as most candidates knew of the concept of green manuring, that is, to plough a legume back into the soil to enrich the soil. Candidates could not identify legumes used as green manures, nor list advantages of green manuring over pen manure.

#### Question 5

This question focused on forages and grazing systems used in cattle production. The question was fairly well answered with many candidates obtaining more than fifty percent of the marks.

Part (a) provided little difficulty to candidates and most of them could correctly name three forages used in grazing systems for cattle and list advantages of using forage as a livestock feed. Expected answers for Part (a) (ii) included; readily digestible; cheap source of feed, readily available.

In Part (b) (i), some incorrect responses included: occasional grazing, shifting grazing, and mixed farming. Expected responses were rotational, zero and free grazing. In Part (b) (ii), most candidates who correctly named the grazing systems could list at least one advantage and disadvantage. It was noted that some candidates knew of the grazing systems but did not name them correctly.

#### Question 6

Candidates were required in Parts (a) and (b) to list reasons and procedures for cleaning and for not washing table eggs. In part (c), guidelines for the care and handling of hatching eggs were sought. Response to this question was slightly above average.

Almost all candidates knew that table eggs are cleaned to remove dirt and bacteria and to make eggs more attractive for sale. A few of them, however, stated that it was a good practice. Most candidates knew that using a damp cloth with disinfectant is the proper procedure, and that eggs should not be washed.

Part (c) of the question was the most troublesome, as most candidates had no idea of guidelines in the care and handling of hatching eggs. Although many candidates knew that temperature and humidity were important when handling hatching eggs, few knew the correct conditions under which hatching eggs are kept.

#### Question 7

In this question candidates were required to trace and describe the journey of swill through a pig's digestive tract, naming the parts of the tract, and the processes that take place in each part. Responses were above average.

Most candidates were able to identify some parts of the digestive tract of the pig, with some being able to separate the small intestines into the duodenum, jejunum and ileum, and the large intestines into the cecum and colon. A few candidates mistakenly named the parts of a ruminant animal – rumen, reticulum, omasum.

Confusion arose in describing the processes, for many of the candidates were able to describe the processes but ascribed them to the wrong part, for example, many stated that absorption took place in the stomach.

#### Question 8

This question was intended to test the candidates' understanding of the problems associated with the marketing of seasonal orchard crops, and the strategies that can be implemented to improve and maximize the returns from the marketing of these crops. The question was poorly done.

Many candidates were able to identify the need for seasonal labour, seasonal income and off-season expenditure as major problems. A few however mentioned low income, and pest and diseases as marketing problems. Some candidates associated seasonal with climate/weather, stating that irrigation may help with off-season production.

Candidates were aware of strategies to maximize returns including processing, preservation of fruit, securing new markets and efficient distribution network. In this section, some candidates also showed that they did not understand the nature of orchard crops, as they stated – plant in phases so that harvesting could be done at different times of the year.

Candidates were aware of advertising, pricing and assembling strategies, but very few were familiar with market research.

#### Question 9

The benefits of keeping farm records, the components of an inventory of farm machinery and equipment and the application of a straight line method of depreciation were required of candidates in this question. The responses were poor.

Part (a) was very well done, with many candidates being able to list some benefits, for example, obtain useful information for farm planning and budgeting, assess the viability of an enterprise, facilitates loan applications. Others, however erroneously listed types of records rather than listing benefits or listed events one would record in a farm diary or journal as a record.

Candidates knew the important components of an inventory – date, number in stock, date taken from stores, date returned to stores. Some however stuck to financial aspects – initial cost, depreciation, receipt number – these are accounting and not inventory records.

Depreciation proved to be difficult for many candidates. Many stated how it worked but wrote a wrong formula. Others wrote the right formula with the right figures but were wrong in their calculations. Students need to understand the formula for depreciation and more importantly how to apply the formula, that is, the basic mathematical operations.

#### Question 10

This question examined the candidates' understanding of the necessity for a partial budget, ability to identify and calculate fixed cost, variable cost and net profit, and finally to identify the differences between a whole farm budget and a cash flow budget. The question was poorly done.



Candidates were familiar with the reasons for a partial budget – to increase the size of the operation, to substitute one input for another or to substitute one enterprise for another. Some candidates mistakenly listed – to show a profit or loss, to show income and expenses – as reasons.

Part (b) was poorly done as most candidates could not differentiate between fixed cost and variable cost, many listing taxes and insurance as variable cost, and repairs as fixed cost. As a result many got the correct answer for the calculation, but those who gave the formula were given credit.

#### **PAPER 04 – Practical Paper**

This paper, a supporting element of Paper 05, the School-Based Assessment, is a substitute for a hands-on practical examination, and aims to assess the candidates' ability in the field/farm.

It attempts to transport actual and/or simulated agricultural field/farm situations into the examination room, and then requires the candidates to answer a given question on each.

Ten stations are set up, and candidates are required to answer questions at each station. The paper carries a total of 30 marks, and Agricultural Economics is not tested in this paper.

Performance in the paper showed that there was inadequate exposure to field activities in many cases. It was obvious that candidates could not recognize the different types of planting materials used in food and root crops, nor were they familiar with the preparation of planting material other than seeds. Although the candidates were familiar with common grasses, legumes and weeds, botanical names posed a problem. Questions with a laboratory component were well answered.

##### **Question 1**

Candidates were asked to calculate the amount of water retained by 2 different soil types, and to account for the difference in water retention. The question was fairly well done.

The responses showed that candidates were familiar with the content area of the syllabus, for candidates knew that soils with a higher percent of clay had smaller pore spaces and retained more water than soils with a higher percent of sand. Some candidates merely repeated the question by stating that one soil drained faster than the other.

##### **Question 2**

This question tested candidates' knowledge of food crops -vegetative propagation, identification of food nutrients with simple tests to confirm the nutrient identified and features of postharvest life of the crops. The question was poorly done.

The specimen provided was cassava, and many candidates did not know how cassava is propagated. In order to avoid penalizing candidates, if the answer to identifying the crop was wrong, but the correct method of propagation was named in (b) candidates were credited. This did not happen too often. Candidates did not identify starch/carbohydrate as the main food nutrient of root crops, many of them naming proteins, minerals, vitamins or iron. Those who identified the nutrient correctly also knew that the iodine test was used to detect its presence. Candidates were not familiar with the concept of postharvest life of crops, and one would assume that this is a neglected part of the syllabus.

### Question 3

Candidates were exposed to a short stem of the sugar cane plant with the 'eyes' (buds) on the nodes removed, and were required to give the botanical name of the plant together with its family. They were also asked to comment on its suitability for use in propagation, and its usefulness as a livestock feed. The response was just below average.

Many candidates knew sugarcane is a member of the grass family, and a fair number had the botanical name correct *Saccharium officinarum*, but apparently due to examination pressure the stalk was not examined properly, and only a few were able to notice that the buds were missing. A significant number of candidates were familiar with the uses of sugarcane as a livestock feed, correctly recognizing the cane tops, molasses, comfith, sugar, chopping, and grinding as material/method in which sugarcane is used in livestock feeding.

### Question 4

In this question, candidates were required to identify a common weed of the Caribbean, both by its common and botanical names, to describe its means of spreading and to state two methods of prevention/control. The question was reasonably well done.

Many candidates recognized nut grass, but only a few recalled its scientific name – *Cyperus rotundus*. A few, however, thought that it was a pasture grass naming elephant, pangola, and para grass. Students should be taught the difference between sedges and grasses by an examination of the stems. Its method of spread was fairly well known, but some candidates mentioned 'pollen' when they meant seeds. Methods of eradication/control were also well known with candidates appreciating the need for removal or destruction of the stolons for complete control.

### Question 5

Candidates were required to distinguish between three types of banana suckers and to identify the one that would be best as planting material. They were then asked to explain how it is prepared for planting. This question was very poorly done.

This question was a clear indication of the lack of practical knowledge, as many candidates did not identify the different types of banana suckers presented. Some candidates even identified the water sucker as sugarcane or dasheen. Candidates were obviously never exposed to the suckers. In the final part of the question, instead of preparing the material for planting by cleaning off dead material and treating with a chemical, candidates described 'how the material is planted' describing land preparation methods..

### Question 6

Candidates were presented with samples of a weedicide, iron supplement, copper sulphate solution, bleach, vermicide and oyster shells and were asked to identify the primary use of each. The question was well done.

Almost all of the candidates were correctly able to link the weedicide, copper sulphate and oyster shells to their correct function. Many of them, however, were unable to identify the use of the vermicide, and instead of its use as for the treatment of intestinal worms, stated that it could be used to control weeds or in the treatment of anaemia.

### Question 7

Candidates were shown a picture of eggs in an incubator, and questioned on its use, suitability over brooding hens, days to hatching, suitable temperature and criteria used for hatching egg selection. Response was below average.

Candidates had little difficulty with the first part of the question, correctly stating advantages of using an incubator – less costly, more eggs can be incubated at the same time and better control of hatching conditions. A common incorrect response was that eggs hatched faster. Many candidates did not know that incubation period for eggs (18-21 days), the temperature range (37 -39°C) nor the process of candling to determine if eggs were fertile. Criteria for selecting hatching eggs also posed problems for candidates. Many candidates chose colour, grading or cleaning eggs as a criteria for selection of hatching eggs rather than looking for cracks, well shaped eggs, fertile eggs, length of storage among others.

#### Question 8

Candidates were presented with drawings of ectoparasites of livestock (lice and ticks). They were required to identify the parasite, name its host, and suggest methods of control. Response was below average.

Identification of the parasites was simple for a significant number of candidates. Many of them however were unable to link the parasite with the infested animal; rather than confining the lice with poultry they were associated with ruminants and the larger animals. Similarly the ticks were associated with the wrong animals. Correct control practices were listed – dusting, spraying, dipping, good sanitation and rotational grazing. A few candidates wrongly mentioned hand picking, or the use of internal medications.

#### Question 9

Samples of forage grasses (pangola or bermuda and elephant) were on display, and candidates had to name the one most suitable for grazing, and for cutting. They were then required to list the benefits of chopping material before being fed to animals, and to list a forage legume. The question was well done.

Candidates were able to distinguish between grazing (pangola, bermuda) and soiling (elephant) grasses, and to correctly state that forages are chopped before feeding to reduce wastage, to increase intake and digestibility. Candidates were not able to identify forage legumes, however, listing lettuce, corn, edoe or cabbage instead of kudzu, centrosema, giliricidia, albizia or leucaena.

#### Question 10

This question required the candidates to identify the effort, load and fulcrum of a wheelbarrow, name the type of machine and to identify two simple machines. The question was reasonably well answered.

Although many candidates were able to correctly identify the load, fulcrum and effort, others simply engaged in guess work. Few candidates recognized the type of machine as a lever, calling it a wedge, pulley, hammer or plough. A few candidates listed other types of simple machines, for example, pulley, screw, wedge and axle. Most of them listed farm machinery as simple machines.

### **PAPER 05 – School-Based Assessment**

The School-Based Assessment (SBA) is the practical component of the programme. It accounts for 25 per cent of the total marks of the examination, and a passing grade is a requirement for success

It consists of three elements, and these are performed by the candidates, at their schools and school farms, and assessed by their teachers in the field. The teachers assessment are moderated by a CXC moderator, and the final mark submitted by a prescribed date.

The three elements of the SBA are:

- (i) Fifteen (15) practical agricultural skills
- (ii) The preparation of 10 farm records
- (iii) Diary entries of the practical activities engaged in, on the school farm.

Candidates' performance in the SBA was very satisfactory. These results suggest that many candidates cannot relate 'practical to theory'.

### **RECOMMENDATIONS**

1. Agriculture is a science, and this must be foremost in the teachers' thinking when preparing students for the examination. Students must be exposed to and become familiar with botanical names and scientific concepts along with the local names.
2. Teachers should ensure that students engage in adequate, meaningful field activity together with careful guidance in the techniques of observation and to relate practical activities to theory.
3. During the learning/teaching exercise, there be more careful attention to specifics, and to relevant details.
4. There should be greater use of strategies that would ensure students understand ideas and concepts before attempting to memorize them.
5. Teachers should ensure that students receive adequate practice in identifying and responding to precisely what they are being asked in the questions before them.
6. Serious and continuous effort should be made to assist students in improving their communication skills.
7. Every effort should be made to ensure full coverage of the syllabus by both teachers and students.

**CARIBBEAN EXAMINATIONS COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATION**

**MAY/JUNE 2007**

**AGRICULTURAL SCIENCE  
(SINGLE AWARD)**

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**AGRICULTURAL SCIENCE (SINGLE AWARD)  
GENERAL PROFICIENCY EXAMINATION  
MAY/JUNE 2007**

**GENERAL COMMENTS**

The 2007 Agricultural Science Single Award examination was the 15<sup>th</sup> sitting of the examination offered by the Caribbean Examinations Council. The rationale for this subject offering is the continued promotion of agricultural education in the region, as well as to contribute to the development of broad-based professionals at all levels from among our peoples in the region. The increased exposure to agricultural science is deemed necessary for improving attitudes to agriculture, promoting agriculture as a business, and for general sustainability of food security within the region.

It is assumed that all candidates entered for this subject would have been exposed to compulsory studies in general agriculture during their first through third years of secondary education, and would have meticulously followed the Agricultural Science Single Award syllabus during their fourth and fifth years of secondary education.

The 2007 examination was designed to provide a comprehensive test of the syllabus, with emphasis on such areas as:

- (i) knowledge and understanding of basic agricultural concepts covered in the syllabus
- (ii) candidates' competence in applying theoretical and practical concepts covered in real world situations
- (iii) candidates' competence in organizing knowledge and structuring plausible solutions to real life problems.

Agricultural Science Single Award offers the Caribbean student a choice between two options. Option A caters to the Crops and Soils sections of the syllabus, while Option B caters to the Animal Science sections of the syllabus. The Single Award examination is structured to meet the demands of the various options.

**Form of the Examination**

The examination comprised three written papers and a practical component called the School-Based Assessment (SBA).

Paper 01 comprised sixty multiple choice items.

Paper 02 comprised ten compulsory structured type questions.

Paper 03 presented two papers, one for each option. Each paper comprised four essay type questions, of which candidates were required to answer any three.

SBA: conducted in the school and the school farm environment, candidates were tested on a number of skill objectives set out in the syllabus. The Farm Diary

and the Farm Record Book, two compulsory records, were also assessed under this component.

## **SPECIFIC COMMENTS**

### **Paper 01**

Candidate performance was slightly lower in 2007 for both Options. For candidates writing the Animal Science Option, the following topics presented challenges:

- The difference between the xylem and phloem vessels of monocotyledons and dicotyledons;
- Benefits of brooding;
- Factors responsible for the presence of organic matter in horizon A of a soil profile.

In addition to the above topics, the following topics presented difficulties for the candidates writing the Crop Science Option:

- The part of the reproductive system of a fowl in which the ovum begins to develop;
- The tool required to remove a wing nut when dismantling a knapsack sprayer.

### **Paper 02**

#### **Question 1**

Part (a) of this question tested candidates' knowledge of the role and function of agricultural professionals. A list of names of specialized careers was given and candidates were required to correctly match those careers to the specific field of work in agriculture. Part (b) of the question tested candidates' understanding of the concept "global warming" and required them to briefly explain its effects on crop and livestock production in the Caribbean.

Part (a) of the question was generally fairly well done. Some candidates, however, named careers not given in the list of options which clearly indicated that many candidates did not read the question properly.

In Part (b), some of the candidates generalized on the causes and effects of global warming rather than provide responses specific to the effect of global warming on crop and livestock production. Two particularly common incorrect responses to this part of the question therefore were:

- (i) release of greenhouse gases increased carbon dioxide (CO<sub>2</sub>) emission into the atmosphere
- (ii) destruction of ozone layer.

Generally, however, candidates understood the question and focused their discussion on the effects of global warming on crop and livestock production.

## **Question 2**

Part (a) of this question tested candidates' knowledge and understanding of activities carried out on the school farm. The question specifically required candidates to create the synergy between practical activities conducted on the school farm and records made in the farm diary. Part (b) of the question tested candidates' understanding of the fundamental concepts of "supply and demand", their importance in agricultural economics and their usefulness to farm business.

Part (a) of the question was generally well done. However, some candidates' listed different types of records kept, rather than activities carried out on the school farm.

Part (b) (i) was generally well done. Most candidates correctly identified the supply and demand curves and the point of equilibrium.

Part (b) (ii) posed the greatest challenges to candidates and the majority of them were unable to provide satisfactory reasons to explain the inward shift of the demand curve.

## **Question 3**

Parts (a) and (b) of this question tested candidates' understanding of farm accounting. In those two parts of the question candidates were required to perform simple calculations of gross margin and depreciation. Part (b) also required candidates to classify depreciation in terms of cost type (fixed, variable or capital). Part (c) of the question required candidates to identify risk factors that can accompany the expansion of a farm.

The responses to Part (a) were generally very poor. Only a few candidates accurately calculated the gross margin from the income and expenditure statement provided. A common inaccuracy in the calculation of gross margin was to subtract total expenses from total income. Some candidates used the sum of total income and total expenses as the gross margin.

Part (b) (i) of the question was fairly well done and on average a fair number of the respondents accurately calculated the depreciation from the information provided in the problem. Many candidates gave detailed step-by-step calculations for depreciation while others were quite concise in their response. Part (b) (ii) was, however, not well done and too many candidates were confused between the concepts "fixed cost" and "variable cost".

The responses to Part (c) of the question were generally poor. A very small per cent of the candidates correctly identified at least two risk factors while an even smaller per cent of them correctly identified at least three risk factors to be considered when expanding a farm. Some of the common incorrect responses to this part of the question included soil fertility, soil type, and good drainage.

## **Question 4**

This question tested candidates' knowledge and understanding of weed and insect control and their importance to vegetable production. Part (a) of the question simply required candidates to name methods of controlling weeds, other than by use of chemicals. Part (b) (i) focused on the equipment used in weed and insect control (the knapsack sprayer). The question tested candidates' understanding of the importance of its care and maintenance. Part (b) (ii) required candidates to apply knowledge of the properties of weedicides and insecticides to a given field condition.



Part (a) of the question was fairly well done. Quite a large number of the candidates correctly listed four methods of weed control without the use of chemicals. Some candidates had difficulty naming four different methods, and quite a few named one method four times, for example, manual, hand pulling, weeding and removing the roots from the ground. Some other common incorrect responses were Integrated Pest Management, biological control and burning.

The responses to Part (b) (i) were generally fairly good. A large number of candidates correctly listed four procedures to follow in the care and maintenance of the knapsack sprayer. In some responses candidates included some safety practices when handling chemicals, for example, wear protective clothing, and read labels before mixing chemicals. This was additional information which did not answer the question asked, and although it showed candidates had a good grasp of the subject matter, candidates are being reminded that for good time management in an examination and by extension for gaining maximum possible marks, they should restrict themselves to responding to the question asked.

The responses to Part (b) (ii) were generally poor. The majority of the candidates indicated that mixing the weedicide and insecticide would damage the knapsack sprayer. Candidates generally failed to associate this practice as harmful to the crop in that it will kill both the insects and the crop. Some candidates did, however, correctly state that they are both used for two different purposes, that is, weedicides kill weeds and insecticides kill insects.

### **Question 5**

Part (a) of this question tested the candidates' knowledge of factors affecting soil fertility. The responses to this part of the question were generally inconsistent. While quite a few of the candidates provided correct responses, still a significant number of them provided incorrect responses. The most popular correct responses given were 'climatic factors, soil erosion, parent material, mulching, soil acidity and lack of organic matter', while the most common incorrect responses included "time, human influences, overgrazing, burning and factors of production".

Part (b) of the question required candidates to discuss practices vegetable farmers use to conserve water on their farms. The responses to this part of the question were generally poor, with the majority of candidates discussing general water conservation and storage practices. The result was a very high frequency of the following incorrect responses; "dry farming, store water in tanks, ponds and ditches, turn off pipes properly to avoid leakage, use watering cans or buckets".

### **Question 6**

This was a three-part question in which Parts (a) and (b) were recall questions and Part (c) required application of knowledge.

Part (a) tested candidates' knowledge of irrigation systems used in the Caribbean. The responses were generally good and a large number of the candidates provided correct responses. There were a few common noteworthy incorrect responses and these included "surface irrigation, subsurface irrigation, flood/flooding, and using a spray can and hose".

Part (b) tested candidates' knowledge of the major plant nutrients. The responses were also generally good with quite a large number of the candidates providing correct responses. The importance of specificity in response to questions asked is to be emphasized, since many respondents stated 'nitrates' as opposed to nitrogen and 'phosphates' as opposed to phosphorus.

Part (c) tested candidates' understanding of seed box management, particularly with respect to sowing seeds and care of seedlings. Some candidates confused the concepts "seeds" and "seedlings" while other candidates used the term "seedbed" when describing the "seedbox". This part of the question was generally not well done.

### **Question 7**

Part (a) of this question tested candidates' knowledge of soil erosion. It was a two-part completion-type question in which the correct responses were given in lists of probable responses. The responses were generally very good.

Part (b) tested candidates' knowledge of management practices used to control soil erosion. The question also required candidates to explain how the named practices aid in the control of soil erosion. Again responses were fairly good.

Part (c) of the question was specific to the role of forests in water conservation. The responses to this part of the question were generally fairly poor. Quite a number of candidates misread the question and provided responses on the role of forests in soil conservation rather than the role of forests in water conservation. As such quite a number of candidates did not answer the question asked.

### **Question 8**

Part (a) of the question tested candidates' knowledge of the internal structure of monocotyledon and dicotyledonous stems. The question required candidates to carefully examine diagrammatic cross-sections of the two types of stems and to name labelled parts. Generally, the responses to this question were extremely poor. The trend in the responses indicated that candidates were generally unfamiliar with the internal organs of plants. A problem of reading and understanding questions also surfaced, since in quite a number of responses the named organs were not those of a plant. Additionally a high number of candidates did not respond to the question.

Part (b) of the question required candidates to explain benefits of organic farming. Responses were extremely weak and in most cases candidates were uncertain as to what the concept "organic farming" entails. Additionally, most of the responses were quite general to farming and failed to address the specialized practice "organic farming". This further convinced the examiners that candidates were generally confused and uncertain.

### **Question 9**

Part (a) (i) of this question provided candidates with a well-labelled diagram of the avian digestive system. Candidates were required to carefully study the diagram and then name two farm animals with that type of digestive system. The responses were generally fairly good.

Part (a) (ii) tested candidates' knowledge of the function of selected parts of the avian digestive system. The responses to this question were also generally fairly good. The majority of

candidates were familiar with the functions of the parts tested, namely the ‘crop’ and the ‘gizzard’.

Part (b) tested candidates’ knowledge of management practices required for the care of young chicks. Most candidates correctly identified two common management practices. Some candidates were not familiar with the specific name given to some management practices and rather described the practice. For example, instead of ‘Brooding’ some candidates wrote “use of light source to provide heat for baby chicks”.

Part (c) required candidates to explain the importance of one of the management practices named in (b). Consistent with the other parts of Question 9, most of the responses were fairly good.

### **Question 10**

Part (a) of this question tested candidates’ knowledge of scientific work conducted in the Caribbean region. Specifically the question required candidates to name ‘breeds’ of livestock developed in the Caribbean and to state the purpose for which named breeds are reared. Many candidates misread and/or misinterpreted this question and named breeds reared in the Caribbean rather than breeds developed in the Caribbean. With respect to the purpose for which the named breed was developed, few of the candidates were sufficiently familiar with the purpose.

Not only were the responses to this part of the question generally very poor, but quite a high percentage of candidates failed to provide a response.

Part (b) of the question required candidates to use their knowledge to address a specific situation with respect to the housing of broilers. In response, many candidates did not clearly identify the principles concerned, but rather wrote generally on housing for chicks. This indicated either a misunderstanding of the question asked, or a general lack of requisite knowledge to address the situation presented.

## **PAPER 03**

### **OPTION A - Crops & Soils**

#### **Question 1**

This question was designed to test candidates’ knowledge and understanding of the usefulness of marketing cooperatives, as well as harvesting and postharvesting techniques.

Part (a) presented candidates with three tree crops and one vegetable crop and requested them to provide the specific name of the part of the plant that is harvested. The responses to this part of the question were generally poor. A significant number of candidates named the ‘leaf, stem and root’ as the plant parts harvested rather than the specific names ‘ear, pod, tuber and hand’.

Part (b) requested candidates to list some benefits to farmers of forming marketing co-operatives. The responses to this part of the question were generally very good. Some candidates

however misread the question and provided responses on the general benefits of cooperatives rather than tailor their responses to the specific benefits of marketing cooperatives.

Part (c) (i) required candidates to explain the importance of recommended harvesting practices to vegetable crops. Generally, the responses to this part of the question were good, with most of the candidates scoring the maximum marks allotted for this part.

Part (c) (ii) required candidates to explain recommended practices farmers can employ to reduce postharvest losses in the four crops tested in Part (a). Candidates confused agronomic and preharvesting practices with postharvesting practices. Candidates also did not demonstrate sufficient knowledge of postharvest practices that help reduce postharvest losses in any of the crops questioned. The result was that the responses to this part of the question were generally very poor. Examples of some very common incorrect responses were fertilizing, irrigating or watering, pest control, use of tools and equipment for harvesting crops.

In conclusion, this question was so poorly done that the majority of candidates were unable to score fifty per cent (50%) of the marks allocated. No single candidate attained the maximum mark of twenty-five.

## **Question 2**

This question was designed to test candidates' knowledge and understanding of the following:

- (i) The importance of water to a named vegetable crop
- (ii) Basic instruments used to measure conditions in the natural environment critical to farming namely, temperature, wind speed, rainfall and pressure
- (iii) Management practices necessary for land preparation and planting for the cultivation of a named vegetable crop.
- (iv) Methods used to control pests common to a named vegetable crop.

Part (a) (i) required candidates to provide reasons to justify the importance of water to a sweet potato crop. Most candidates provided correct reasons to justify the importance of water, and many were very explicit in linking the usefulness of water to proper crop growth and development. This part of the question was extremely well done and many candidates scored the full marks allocated.

In Part (a) (ii), candidates were required to name the instruments used to measure temperature, wind speed, rainfall and pressure. Despite the fact that most of the candidates correctly named at least two instruments, generally the responses to this part of the question were disappointing. There was clear evidence that candidates were not familiar with the names of these instruments. Some common incorrect responses were "wind gauge", "wind mill", "wind cup", "rain meter" and "pressure gauge".

Part (b) (i) required candidates to discuss three management practices each under the headings 'land preparation' and 'planting', commonly carried out for a sweet potato crop. The responses to this part of the question were generally very good. A common misconception, however, led to many respondents stating "use disease-free seeds" as planting material, during their discussion under the heading 'planting'.

Part (b) (ii), which required candidates to describe measures used to control a common pest of sweet potato, was the most candidate-friendly part of this question. Generally the responses were excellent, with the majority of respondents gaining the full marks allocated for this part.

### **Question 3**

This question tested candidates' knowledge and understanding of the following concepts and their impact on crop production:

- (i) Diseases and their causal agents
- (ii) Plant quarantine
- (iii) Tissue culture
- (iv) Budding

In Part (a) of this question, candidates were presented a list of five crops, three tree crops and two vegetable crops. Candidates were required to name a disease known to affect each of these crops as well as the causal agent of each named disease. As a guide, the question provided an example for the candidates. The responses to this question were generally extremely poor. Candidates were unable to name the diseases or their causal agents. Candidates' knowledge of this concept was so deficient that the majority of them named pests instead of diseases.

Part (b) required candidates to explain the importance of quarantine to a country's agriculture. Generally, this part of the question was well done and most candidates understood that quarantine entails excluding entry of pests and diseases and protecting crops and livestock from pests and diseases. Some candidates, however, confused the concept quarantine with methods of pest and disease control.

Part (c) required candidates to explain the advantages of tissue culture. Candidates seemed very confused with respect to this concept, especially the specific advantages of tissue culture as against other methods of asexual propagation.

Part (d) of the question requested candidates to describe the 'inverted T' method of budding. The responses to this part of the question were generally good. Most candidates displayed comprehensive knowledge of the process of budding in citrus.

### **Question 4**

This question tested the candidates' knowledge and understanding of the concepts soil erosion, soil conservation and water conservation, together with their understanding of the agronomic practices suitable to hillside vegetable cultivation.

Part (a) (i) requested candidates to state some negative effects of soil erosion on agriculture, while in Part (a) (ii) candidates were required to state the agents of soil erosion. Part (a) of this question provided little challenge for candidates and the majority of them were quite knowledgeable on the agents of soil erosion and the negative impact of soil erosion on agriculture. Generally the majority of responses were very good to excellent.

Part (b) required candidates to discuss soil conservation and water conservation techniques used to control soil erosion. The responses to this part of the question were generally good. However, a few candidates confused soil conservation and water conservation techniques.

Part (c) (i) required candidates to discuss cropping systems suitable to the cultivation of vegetables on a hillside. The majority of responses were satisfactory. However, many candidates correctly named cropping systems but were unable to describe the cropping system they named. Part (c) (ii) required candidates to discuss factors that should be considered before selecting the crop to be cultivated. The responses to this part of the question were generally poor. The factors expected to be discussed were factors a farmer should consider before establishing a farm business, namely, land suitability, labour availability and market considerations. Candidates seemed to misunderstand the question asked and the majority fashioned responses that focused on factors affecting crop production.

In Part (c) (iii), candidates were required to explain the beneficial effects that controlling water run-off will provide to hillside vegetable cultivation. The majority of responses to this part of the question were fairly good. Some candidates, however, discussed methods used in the prevention of water run-off rather than the effect reduction of water run-off can have on crop cultivation.

### **Paper 03**

#### **Option B - Animal Science**

##### **Question 1**

This question tested candidates' knowledge of the following concepts:

- Grazing systems
- Gestation period of selected farm animals
- Signs of oestrus in cattle.

The question also tested candidates' understanding of the

- advantages of the grazing systems, and
- disadvantages of the grazing systems.

Part (a) of the question required candidates to name some grazing systems used by farmers in the Caribbean. The responses to this part of the question were generally good. Quite a number of candidates named the grazing systems by terms commonly used in their community. Terms such as 'free range, paddock, open, pasture, pastoral and nomadic' were used, rather than the scientifically correct terms 'strip grazing, continuous grazing, zero grazing and rotational grazing'. A few candidates confused grazing systems with cropping/farming systems.

Part (b) required candidates to select two of the grazing systems named in Part (a) and explain some advantages of each, while Part (c) required candidates to select one of the grazing systems and explain a disadvantage. The responses to Part (b) of the question were good. However, candidates had difficulty precisely explaining the disadvantages. Many of the candidates mixed guessing with imagination in their responses to Part (c), and as such some very common incorrect responses to that part of the question were 'animals will lack exercise' for zero grazing,

‘soil will lose fertility’ for rotational grazing, and ‘land will be exposed and left to the elements’ for continuous grazing. Some of the very common correct responses included ‘increase in external and internal pests’ for continuous grazing, ‘labour intensive’ for zero grazing and ‘high cost of fencing’ for rotational grazing.

Part (d) required candidates to state the gestation period for some selected classes of livestock. The responses to this part of the question were generally very good. Quite a number of candidates correctly stated the gestation period for all four classes of livestock and the majority provided correct responses for at least three classes.

Part (e) required candidates to state some signs of oestrus or heat in cattle. The responses to this part of the question were excellent. As would be expected with a question of this type candidates may confuse signs of heat with signs of other physiological conditions they would have studied. This occurred as expected and as such some very common incorrect responses were redness of the vulva, loss of appetite, and swaying of tails.

## **Question 2**

This question tested candidates on their

- (i) knowledge of the importance of a balanced ration to livestock and the nutrients present in balanced rations;
- (ii) understanding of the structure and function of the digestive systems of cattle and poultry;
- (iii) understanding of the benefits of integrated farming, and
- (iv) knowledge of aquaculture.

Part (a) of the question required candidates to explain the importance of a balanced ration to livestock and to state two nutrients found in balanced rations. The responses to this part of the question were very good. Many candidates correctly stated that balanced rations are important for growth, production (meat, eggs) and maintenance. Most candidates also correctly named the nutrients present in a balanced ration for layers. However, there was a high occurrence of incorrect responses such as water, nitrogen, fibre and fat.

In Part (b), candidates were required to compare the digestive systems of poultry and cattle, being careful to explain the differences in structure and function of the two systems. Most candidates had little difficulty with their knowledge of the structure and function of the digestive systems of cattle and poultry, and many correctly explained the make-up of the systems, as well as the functions of most of the composite parts. Some candidates were, however, quite uncertain with respect to the functions of some parts and as such some common incorrect responses were ‘the crop of a fowl is used for grinding/crushing food’, and ‘the beak is used for crushing food’.

In Part (c) (i), a situation was described in which a farmer reared ducks above the water surface of a tilapia pond. Candidates were then required to explain benefits of such an integrated farming system. The responses to this part of the question were poor. Quite a few candidates indicated that ducks will eat the tilapia which suggested that the term “benefit” was not

understood. Despite the general poor quality of the responses a small number of candidates recognized that duck faeces provide nutrients for algae growth.

Part (c) (ii) requested candidates to explain some factors the farmer in (c) (i) should consider in establishing the aquaculture unit. Again the responses to this part were poor. Candidates' knowledge base on what is required in the establishment of an aquaculture unit seemed gravely deficient. A few candidates stated that the farmer should plant trees/shrubs around the pond to provide shade, and that the soil should be clay or a soil with a good water holding capacity.

### **Question 3**

This was a two-part question to which the responses were generally weak. It was also a fairly low response question.

Part (a) tested candidates' knowledge and understanding of some basic concepts related to slaughtered animals, namely 'dressing percentage' and 'carcass weight'. Part (a) (i) requested candidates to define the term 'dressing percentage'. The responses to this part of the question were generally poor. Some of the most common incorrect responses were

- dead weight for carcass weight
- the dressing percentage of the meat by marketing
- the amount of pigs prepared to be sold.

Very few of the candidates stated that dressing percentage is the carcass weight expressed as a percentage of the live weight.

In Part (a) (ii), candidates were required to write the formula for calculating 'dressing percentage' and 'carcass weight'. Similar to Part (a) (i) the responses to this part of the question were poor.

The correct response should have been

- Live weight x dressing percentage (%)

It should be noted that no candidate gave a complete correct response to this part of the question.

Part (a) (iii) required candidates to name some factors that affect dressing percentage. Similar to the other two parts of this question the responses were weak. Some of the very common incorrect responses were

- feed conversion ratio
- weight
- type of ration
- type of livestock.

Correct responses included

- sex
- breed
- age
- pregnancy status.



Part (b) tested candidates' understanding of the management practices necessary for successful farrowing and for the care of piglets. In Part (b) (i), candidates were required to describe management practices necessary for successful farrowing. The responses to this part of the question were also weak. Some of the very common incorrect responses were

- proper ventilation
- animal should be fed more
- placed in a separate pen
- provide water.

Some examples of correct responses were

- de-worm sow to improve health
- place sow in farrowing pen one week before farrowing
- reduce feed to prevent constipation.

In Part (b) (ii), candidates were required to discuss management practices necessary for the care of piglets. The responses to this part of the question generally followed the trend of responses to the earlier parts of the question in that they were weak. Some very common incorrect responses were

- provide litter/bedding
- vaccinate and immunize for health
- castrate piglets
- de-worm piglets.

Some examples of correct responses were

- clip navel and treat with iodine
- remove eye teeth
- provide warmth
- give iron supplements either as injection or coat the mother's nipple with ferrous sulphate
- ensure piglet can nurse/suck from mother.

#### **Question 4**

This question tested candidates' knowledge of the following concepts

- (i) diseases of poultry
- (ii) symptoms of poultry diseases and
- (iii) measures used to control poultry diseases.

The question also tested candidates' understanding of apiary management.

Part (a) asked candidates to name some major diseases affecting poultry in the Caribbean. The responses to this part of the question were generally good. Many of the candidates correctly named the three diseases requested and most correctly named at least two. An interesting observation was that quite a few candidates named bird flu. However this response was not awarded since the question specifically asked candidates to name 'diseases affecting poultry in the Caribbean'.

Part (b) (i) required candidates to select one of the diseases named in (a) and to state symptoms of the disease. The responses to this part of the question were generally poor. Most of the responses lacked specificity. Candidates gave symptoms of general ill health rather than symptoms specific to the disease named. Part (b) (ii) required candidates to state a measure for controlling the disease. The responses to this part of the question were fairly good. A large number of candidates correctly mentioned 'vaccination', 'killing/destroying affected birds' and 'proper sanitation'. Two very popular incorrect responses were 'quarantine' and 'the use of antibiotics'.

Part (c) of the question requested candidates to list factors to be considered in selecting a suitable site to establish an apiary. The responses to this part of the question were weak. Candidates were confused, some wrote on the actual construction of hive boxes rather than on site selection, others were misled by the term 'factor' in the question and wrote on factors of production (land, labor and capital), and still others seemed totally unfamiliar with the term 'apiary' and rather fashioned responses related to poultry. Some examples of the correct responses being sought were, 'nearness to water source', 'orientation of hive boxes', 'nearness to flowering plants' and 'nearness to farmer's home for easy management'.

In this part of the question, candidates were required to discuss how the factors listed in Part (c) contribute to successful management of an apiary. The responses to this part of the question were also poor. Additionally, many candidates demonstrated an inability to apply knowledge and to link related facts. For example, candidates who correctly stated in (c) that an apiary should be sited near to flowers, went on in Part (d) to write about the importance being to pollinate flowers as opposed to the collection of pollen and nectar for honey production. Again, candidates who also correctly stated that hives should be located away from populated areas in Part (c), went on to write in Part (d) that it will prevent praedial larceny rather than discuss the hazards to humans when bees are close.

**CARIBBEAN EXAMINATIONS COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATION**

**MAY/JUNE 2007**

**AGRICULTURAL SCIENCE  
(DOUBLE AWARD)**

## **AGRICULTURAL SCIENCE (DOUBLE AWARD)**

### **GENERAL PROFICIENCY EXAMINATION**

**JUNE 2007**

This is a report on the Agricultural Science General Proficiency (Double Award) Examination conducted by the Caribbean Examinations Council in May 2007.

The examination is intended to assess and evaluate the extent to which the syllabus objectives of the programme have been achieved.

Candidate performance is examined through four written papers, and a practical School-Based Assessment exercise conducted by the teachers themselves on the school farm, and moderated by CXC moderators. This last component carries 25% of the total marks.

### **SPECIFIC COMMENTS**

#### **PAPER 01 – Multiple Choice**

The 60 Multiple Choice items, worth 60 marks, covered General and Specific objectives distributed over the four profiles of the syllabus.

Performance on this paper was fair. Candidates experienced difficulties with items which tested:

- The close association of the hibiscus pink mealy bug with ants
- Ridging as the process for preparing beds for planting tuber crops
- Reason for a sow not conceiving after mating
- Calculation of profit given total income and variable expenses.

#### **PAPER 02 - Structured Questions**

This paper consisted of 15 questions for a maximum of 90 marks.

In some questions there were “no responses”, with the highest number in relation to Question 10. The main reason for this could not be determined, but it is suspected that it may stem either from incomplete syllabus coverage or poor examination techniques. In many cases candidates took an everyday approach rather than a scientific approach to answering questions.

#### **Question 1**

This question tested candidates’ knowledge of a mixed (NPK) fertilizer in terms of calculating the total percentage of nutrients in NPK fertilizer, other components of this type of fertilizer and the functions of such components.

This question was generally well answered.

Part (a) was the best answered part of the question with many candidates correctly naming nitrogen, phosphorus and potassium respectively as the nutrients represented by the numbers.

In Part (b), many candidates correctly identified the total percentage of plant nutrients in a 16:4:6 fertilizer as 26%.

In Parts (c) and (d), candidates were able to identify carrier and filler as other materials apart from nutrients in this fertilizer. However, many of them could not state the function of these materials in fertilizers.

### Question 2

This question tested candidates' knowledge of practices that would improve the fertility of soils low in organic matter content, conditions which facilitate decomposition of organic matter, and the disadvantages of cultivating soils immediately after adding fresh poultry litter.

Part (a) was generally well answered with many candidates identifying crop rotation, green manuring, and addition of organic matter as methods of improving soil fertility. Less popular correct answers included: fallowing, minimum tillage, addition of lime, and reducing erosion.

In Part (b), once again many candidates were able to correctly identify aeration, moisture and the presence of bacteria, as conditions which contributed to decomposition in a compost heap. Optimum C:N ratio and adequate depth of mass were correct responses that did not appear in scripts. Incorrect responses included sunlight and shade.

Candidates encountered the greatest difficulty in Part (c). Common incorrect responses included: litter makes the soil too acidic, and litter destroys the soil's nutritive value. Expected responses included: heat generated will burn the plant; ammonia produced will burn the plant; nutrients are not immediately available for plant use.

### Question 3

This question required candidates to demonstrate their knowledge of the relationship between flower structure, method of pollination and functions of flower parts.

This question was very poorly answered. A surprising number of candidates did not attempt this question even though all the questions in this paper are compulsory. Also, many candidates who attempted the question were unable to score marks or got very low scores.

Far too many candidates could not determine that the pollination method of the flower illustrated would be insect pollination based on the fact that the petals were large/conspicuous; stigma was not feathery and did not protrude; stamens were short and did not protrude. Incorrect responses included: artificial pollination, natural pollination and transpiration.

In Part (c), many candidates correctly identified the anther/stamen as the part of the flower which must be removed to prevent self-pollination.

The ovule and ovary as the parts of the flower which develop into the seeds and fruit respectively were correctly identified by candidates.

#### Question 4

Candidates were required to demonstrate knowledge of photoperiodism and the response of certain plants to varying periods of day length.

This question was reasonably well answered.

Many candidates correctly identified photoperiodic as the term used to describe plants affected by day length and could give at least one correct example of such a plant.

However, in Part (c), many candidates were unable to associate photoperiodism with flowering of plants in response to day length.

#### Question 5

This question tested candidates' knowledge of Mendellian inheritance and terms related to genetics.

This question was fairly well answered.

Many candidates were able to correctly define the terms genotype and phenotype. In Part (b), candidates were generally able to carry out the crosses with the resultant correct ratios in the F<sub>1</sub> generation. However, instead of stating their answer in Part (c) in percentage as requested by the question, they gave their answers as fractions.

#### Question 6

In this question candidates were required to define the terms, oestrous cycle and gestation period, associated with animal reproduction and state the oestrous cycle and gestation period of cows and pigs.

Many candidates were able to correctly define the term "gestation period" as the period between conception and parturition but encountered great difficulty in defining the "oestrous cycle" as the interval between two heat periods.

In many cases the definition of the oestrous cycle was confused with oestrous or heat. The length of the oestrous cycle and gestation period for cows and pigs were generally well known.

### Question 7

The intent of this question was to test candidates' knowledge of the term quarantine with respect to animals imported into a country in terms of what quarantine is, reasons why it is important and routine practices at a quarantine station.

Performance on this question was satisfactory with many candidates scoring at least fifty percent of the marks allocated.

However, too many candidates did not focus on the fact that when animals are quarantined, they are kept in isolation.

In Part (b), many candidates correctly identified the following reasons for quarantining animals: required by law, screening for known and exotic diseases, preventing the introduction and/or reintroduction of pest and disease organisms, as well as internal and external parasites.

Part (c) was the best answered part of the question with a fairly large percentage of the candidates correctly identifying at least two routine practices at a quarantine station.

### Question 8

This question required candidates to define the term apiculture, name products derived from apiculture, the relationship between apiculture and the farmer's earnings from fruit-crop farming, and two functions of the queen bee.

A large number of candidates could not correctly define apiculture. In Part (b), a large number of candidates correctly listed honey, royal jelly, honey comb and wax as products of apiculture.

In Part (c), a fairly large number of candidates correctly connected the presence of the bees with increase in pollination leading to increased fruit production, resulting in higher farm income.

The functions of the queen bee were generally well known.

### Question 9

The intent of this question was to test candidates' knowledge of the digestive system of ruminant and non-ruminant animals.

In Part (a), many candidates were able to correctly name one animal whose digestive system was represented by the diagrams given in the question. However, some candidates incorrectly identified Figure 2 as the digestive system of a fowl and Figure 3 as that of a rabbit or goat.

In Part (b), almost all candidates correctly labelled A as the stomach and B as the abomasum. Incorrect answers for A included rumen and omasum and for Part B, gizzard.

Many candidates were able to correctly state one function of C and D. Several candidates, however, gave storage of food as a function of C and D. The most popular correct response for C was

absorption of food. Some candidates also correctly mentioned digestion of fats, carbohydrates and proteins.

The most popular correct response for D was the store function. A less popular correct response was assisting in the digestion of cellulose/grass.

#### Question 10

This question sought to test candidates' knowledge of the dressing percentage of livestock with specific focus on poultry in one part of the question.

Although all the questions in this paper are compulsory a large number of candidates did not attempt this question.

In attempting to define dressing percentage many candidates ignored the "percentage" aspect of the definition and referred to dressed weight instead. Some candidates presented the formula correctly while many of them reversed the numerator and denominator.

There was some misinterpretation of the question with some candidates focusing on dressing of wounds and covering the animal's body.

In many cases candidates could not list two factors which influence dressing percentage. Expected answers included: amount of stomach and intestinal contents, degree of muscling, and genetic make-up.

Too many candidates could not state that the dressing percentage for poultry is between 70% and 73 %. Answers included anywhere from 50% to 100%.

Part (d) was well answered by most candidates. Many correctly identified not feeding the animal prior to slaughtering as a pre-slaughter factor affecting carcass quality. Expected answers which were less popular included: ante-mortem examination, carry out ante-mortem examination, ensure that animals are well rested and avoid stress or agitation during transport. Incorrect answers in this section included the age and size of the animal and the animal's body weight.

#### Question 11

This question tested candidates' knowledge of mastitis, a common disease of livestock.

Candidates performed well on this question. Most candidates correctly defined mastitis as the inflammation of the udder usually caused by bacteria.

The most common correct responses to Part (b) included swelling of the udder and blood or flakes in the milk. Less common correct responses included sudden decrease in milk production and high temperature of the udder. Some incorrect responses were redness of the udder and blood oozing from the udder.



The use of the Strip cup to detect mastitis was well known. Candidates were also aware of the California Milking Test (CMT) as a means of detecting mastitis.

There was some confusion in Part (d). Some candidates suggested preventative instead of treatment/curative measures. Injection instead of infusion of anti-biotic into the udder was stated in some cases. Stripping of infected quarter and milking of infected animals last were correct responses which were well known.

#### Question 12

The intent of this question was to test candidates' knowledge of irrigation and selection of irrigation methods based on crop type.

This question was fairly well answered. Many candidates correctly defined irrigation as the application of water by artificial means. A few candidates seemed to think that irrigation and drainage were synonymous terms.

Flood irrigation was correctly linked to cultivation of pasture grass and rice, while use of overhead/sprinkler was correctly identified as appropriate for pasture and citrus cultivation. Drip and channel/furrow were expected as appropriate for citrus cultivation.

#### Question 13

This question sought to ascertain candidates' knowledge of the uses of the farm tractor, safety precautions when using the tractor and tractor maintenance practices.

This question was fairly well answered with many candidates scoring marks in all sections of the question.

The following is an example of a correct response:

- (a) - land preparation (ploughing, harrowing)
  - transportation
- (b) - investigate irregular sounds
  - look out for obstacles
- (c) - replace worn parts
  - general maintenance (grease, change oil).

#### Question 14

This question tested candidates' knowledge of the marketing chain, benefits of grading farm produce and demand and supply.

This question was fairly well answered with candidates scoring marks in each section of the question.

In Part (a), most candidates were able to place the terms correctly in the marketing chain. Popular correct responses in Part (b) included identifying and discarding diseased fruit, identifying and discarding bruised or damaged fruit and selecting fruit which would be more attractive to consumers. The concept of the relationship between pricing and grading was also well understood.

Most candidates could correctly label the Demand and Supply curves. However for some candidates there was difficulty in stating the equilibrium price as 3 000 kg.

### Question 15

This question sought to test candidates' ability to differentiate between items of fixed and variable costs.

The question was very well answered.

The following is an example of a correct response:

Fixed costs:

- construction of pen
- feeders, waterers
- electricity and water
- farm insurance
- rental of land
- salary
- tractor

Variable costs:

- litter (wood shavings)
- feed
- baby chicks
- medication
- other fuel

## **PAPER 03 – Extended Response**

Candidates were required to respond to seven of ten essay-type questions based on three of the four profiles of the syllabus. The profile Agricultural Mechanization is not tested in this paper.

### Question 1

This question tested candidates' knowledge and understanding of the types of erosion caused by water and appropriate erosion control measures for hilly terrain in the cultivation of vegetable and tree crops. Many candidates attempted this question, but it was very poorly answered with approximately fifty percent scoring three marks or less.

Many candidates could not correctly name raindrop/splash, rill, sheet and gully erosion as types of water erosion. Incorrect responses included plant erosion. Candidates also encountered problems in describing types of water erosion.

In Part (b), some candidates were able to correctly identify erosion control measures appropriate for hilly terrain, with terracing, and crop rotation being the most common. Other correct responses less frequently mentioned were crop rotation, contour farming/cropping, ridging, and buffer strip cropping. Cover cropping, intercropping, mulching and the use of grass barriers should be noted by teachers as important erosion control measures for tree crop farmers operating on hilly terrain.

## Question 2

Candidates were required to demonstrate knowledge of the cultivation of sweet potatoes for the market and its utilization.

This was a high response question but the performance of candidates was below average.

Part (a) did not provide too much difficulty as many candidates were able to state the expected land preparation practices for sweet potato which included the making of ridges 40-60 cm high and 75-90 cm apart.

Part (b) provided more challenge to candidates and was less well answered than Part (a). There was evidence that some candidates misinterpreted planting material to mean tools and equipment. However, some candidates were able to correctly state that tuber or vine cuttings could be used as planting material and that planting material should be free from pests and diseases. Other correct responses which were less popular was that the use of setts derived from tubers is not recommended because yields are low and that vine cuttings give better yields than setts.

Many candidates were unable to provide the desired responses to Part (c). Incorrect responses included planting at the start of the rainy season; spacing of 1½ ft along the rows. Also, times to harvest were suggested without respect to variety.

Most candidates scored marks in Part (d) with the use of the sweet potato for food as the most popular correct response. Other expected response which were less frequently offered included processing into chips or canned or starch for industrial use, and used as livestock feed.

The following is an example of a correct response:

- (a) Clear, plough and harrow the land. Make mound for planting.
- (b) Plant tubers or stem cuttings which are disease free.
- (c) Plant vines 25-30 cm in rows and 60-75 cm between ridges. Harvest in 3-4 months depending on the variety. Dig soil around the tuber with a fork being careful not to damage tuber. Harvest when most of the leaves have dried.
- (d) Sweet potato can be cooked or fed to animals.

### Question 3

This question tested candidates' knowledge of the effects of improper use of pesticides on the environment and factors that affected pesticide usage. Candidates' knowledge and understanding of integrated pest management was also tested.

Parts (a) and (b) were fairly well done while Part (c) posed some difficulty to candidates.

Some good responses in Part (a) were: contamination of land, air and water, which leads to death of aquatic life and beneficial organisms. Air and water pollution also results. Some examples of poor responses were: eutrophication; pesticides kill off the nutrients in the soil; pesticides destroy the ozone layer.

Expected responses to Part (b) included selection of pesticides based on the level of infestation, stage of development of crop, and should be pest specific. In terms of application, correct answers included using the correct dosage, application at correct time of day and avoiding application under windy conditions were the most popular. Popular correct answers in terms of storage included storing under cool conditions, proper labeling of containers, and out of reach of children.

Some candidates correctly stated that Integrated Pest Management involves the use of biological, physical and cultural pest control, before the use of chemical. An example of a poor response in this section was that Integrated Pest Management involved the increase of pests and the management of both pests and weeds.

### Question 4

This question intended to test candidates' knowledge of biodiversity as it relates to ecosystems and natural mutation. Candidates understanding of natural mutation and the effects of genetically modified plants on biodiversity were also tested.

This was not a popular question with the worst performance recorded in Parts (a) and (d). In Part (a), candidates were expected to identify plant parts such as flower, fruit, leaf and seed as characteristics used to identify plants in their natural habitat. Examples of incorrect responses were root system, male and female organs and monocotyledons and dicotyledons.

Common correct responses in Part (b) included reducing the chances of extinction, helping to ensure survival of the species, and increasing variation. Incorrect responses included healthy living, tourist attraction, increased income and soil fertility.

Expected responses to Part (c) included development of new strains and resistance to pests and diseases. Incorrect responses included leaching, mulching, shorter life period and global warming.

Many candidates could not state that genetically modified plants affected biodiversity by introducing non-plant genes, competing with naturally occurring species, possibility of human health hazards, and possible undesirable mutagenic effects. Some candidates seemed to think that genetic modification of plants automatically resulted in higher yields and increased production.

### Question 5

This question tested candidate's knowledge of sanitary practices to be observed when hand-milking cows.

It was attempted by a large number of candidates and responses were mostly good.

The most popular correct responses in Part (a) were washing and disinfecting of floors. The washing and disinfecting of walls was also expected as part of the response to this section. Other correct responses less frequently mentioned included the use of fly bait or fly traps, rough floor to prevent slipping and the absence of petroleum products or other substances that would taint the milk.

Many candidates correctly stated that the utensils should preferably be of stainless steel and need to be clean, sterilized and washed with detergent. Other expected responses included damaged or dented utensils should not be used and that utensils should be allowed to drain rather than wiped dry. Some candidates felt that utensils should be kept in a cupboard and that glass utensils should be used.

Many candidates also did well in describing sanitary practices involving the milking cow. Most candidates knew that the udder should be washed and sterilized and each teat should be checked for mastitis and that the teat should be dipped in iodine solution after milking. Incorrect answers included the spraying of the cows for ticks and tying down the cow properly.

Part (d) was also well answered with most candidates stating that farmers should wash and disinfect their hands properly before starting to milk the animals and their clothes should be clean. Other expected answers included the fact that the farmer should have a food handler's certificate, should be tested once per year for tuberculosis, and no one should be allowed to cough or sneeze in the milking area.

### Question 6

This question sought to determine whether candidates could relate common animal diseases to specific classes of livestock, identify the causative agent of each disease and suggest preventative /control measures.

This question was not attempted by many candidates, but those who did attempt it did fairly well.

Answers indicated that candidates were aware that the foot-and-mouth disease and coccidiosis affected cattle, sheep, goats and pigs, and that coccidiosis also affected poultry. They were also aware that the first three listed diseases were caused by viruses, but had some difficulty with identifying a protozoan as the causal agent of coccidiosis.

Preventive and control measures were generally well known. Poor responses in this section included use of copper sulphate for foot-and-mouth disease, oral drops and disinfectant for control of Newcastle, good management for control of swine fever and antibiotics and injection for coccidiosis.

Most candidates could correctly list four signs of healthy animals and four signs that an animal was sick.

### Question 7

This question tested candidates' knowledge of reasons for cleaning eggs, reasons why eggs should not be washed, appropriate management practices in care and handling of hatching eggs and the process of artificially incubating eggs.

This was a very popular question and Parts (a) and (b) were much better done than Parts (c) and (d).

In Part (a), many candidates could correctly state that cleaning of eggs makes them more attractive to consumers, prevents them from sticking together, allows for easy handling, reduces risk of spoilage, reduces the risk of disease transmission, and facilitates the identification and removal of cracked, deformed and thin-shelled eggs.

Part (b) was also well done, with popular correct answers being removal of the protective cuticle, encourages spoilage and makes the shell porous. Most candidates were aware that the eggs should be wiped with a damp cloth dipped in disinfectant. A few candidates also mentioned that fine sandpaper could be used for removing grit.

Some difficulty was encountered in Part (c) with candidates focusing on incubation practices rather than management practices in the care and handling of hatching eggs as required by the question. Expected answers included: do not store for longer than seven days, keep at a temperature of 12 °C to 18 °C, and avoid excessive agitation during storage.

Difficulty was also encountered in Part (d). Expected answers included placing eggs in trays, maintaining an incubation temperature of 38.3° C in the first two weeks, and 39 °C.

The humidity should be about 60%. One sentiment expressed was that incubation causes infertile eggs to hatch.

### Question 8

This question required candidates to display knowledge of the law of diminishing returns and how the law relates to the production function.

This was a popular question and it was well answered by most candidates.

Many candidates were able to state that the graph shown represented the law of diminishing returns, as well as explain what the relationship between the units of fertilizer applied and the yield of cabbage in each stage. Most candidates were also able to identify Stage B as the stage at which the farmer gets the best returns for his fertilizer input.

Part (b) was also well done with many candidates obtaining at least 90 % of the marks.

### Question 9

This question focused on marketing of agricultural products by Caribbean farmers, the required marketing research and marketing strategies, and the benefits of the International Sugar Agreement, and Caribbean Single Market and Economy.

This question was also attempted by a large number of candidates.

In Part (a), most candidates were able to identify at least two types of essential marketing information required to penetrate new markets. Common correct answers included information on the demand for the product, price, quality or grades required by the market, and price of substitutes.

Candidates were generally able to explain the importance of aspects of market information they had identified in Part (a).

Marketing strategies were also reasonably well known and common responses included use of advertising, questionnaires, and ensuring high quality produce.

Quite a number of candidates were able to state that ISA referred to the International Sugar Agreement and CSME referred to Caribbean Single Market and Economy, with the latter more well known. The trade function of the CSME was better known than the free movement of labour aspect.

#### Question 10

This question focused on local and regional institutions concerned with agriculture and their functions. Candidates were also required to display knowledge of deficiencies in services provided by the Ministry of Agriculture as perceived by farmers and the relationship of the terms farm machinery, infrastructure and farm inputs as they relate to the establishment of a sugarcane plantation on virgin forest land.

This was a popular question and was fairly well answered.

Most candidates were able to identify local and regional agricultural institutions and the role each played in agriculture at the relevant level. However, in some cases international agricultural organizations such as FAO, CIDA and PAHO were often mentioned.

In Part (b), most candidates concentrated on problems associated with farming in general and not on perceived deficiencies of the Ministry of Agriculture. As a result the most common answers presented were lack of funding, obtaining credit and material and equipment.

Part (c) was the best answered part of the question and candidates scored the most marks in this section. Even though some candidates were not able to explain the meaning of the terms, they were able to correctly list three items in each category. Some candidates ignored the fact that the items to be listed should relate to establishing a sugarcane farm. Incorrect answers included animal pens, office buildings and incubators.

### **PAPER 04 – Practical Paper**

This paper, a supporting element of Paper 05, the School-Based Assessment, is a substitute for a hands-on practical examination, and aims to assess the candidates' ability in the field/farm.

It attempts to transport actual and/or simulated agricultural field/farm situations into the examination room, and then requires the candidates to answer a given question on each.

Ten stations are set up, and candidates are required to answer questions at each station. This paper carries a total 30 marks, and Agricultural Economics is not tested in this paper.

### Question 1

This question tested candidates' knowledge of a rain gauge, their skill in interpreting a rainfall graph, and knowledge of the characteristics of clayey and sandy soils.

Many candidates correctly identified the rain gauge. Some, however, stated barometer, hydrometer, thermometer and histogram. Many candidates were able to identify from the graph that flooding, hurricane or storms were likely to occur in July. Some incorrectly stated soil erosion, global warming and sunshine.

Irrigation, watering plants and mulching were correctly identified as water management practices in relation to planting vegetables in the dry season. Incorrect responses included – monocropping, soil profile and providing shade.

Many candidates did not name the two consecutive months where there is the likelihood of fungal diseases. This was probably due to the lack of an understanding of the word 'consecutive'.

### Question 2

The tools for obtaining a soil sample, the correct depth for taking a soil sample and the procedure to follow were required of candidates in this question.

From the responses, apparently many candidates misread the question, and instead of listing tools required for 'soil sampling', listed apparatus required for 'soil testing'. Thus, many candidates stated beakers, test tubes, measuring cylinders.

In Part (b) of the question, most candidates guessed the response giving figures ranging from top soil to 1 km deep. Very few gave the correct response of 10-15 cm.

Part (c) was poorly done as soil testing procedures were given and not soil sampling.

### Question 3

Candidates were required to identify different parts of the pineapple plant and explain the function of the parts identified.

Most candidates correctly identified the plant and the crown, but had difficulty in identifying the basal sucker. Candidates who correctly identified the crown and basal suckers also knew that they were both used for planting, and that the crown matured quicker than the basal sucker.

Candidates who did not identify the suckers, gave responses such as 'supplies nutrients to the plant', 'one is from the top and one is from the bottom', 'one is the old part and one is the new part'.



#### Question 4

This question required candidates to identify a number of agricultural products, state their nutrient content and to demonstrate knowledge in how they are propagated and harvested.

Most candidates were able to identify all the products as well as to state the major nutrient in the legume (protein/nitrogen), how sweet potato is propagated and when it is ready to be harvested. Candidates, however, had problems with the time of harvest for corn, giving dates ranging from one month to one year.

#### Question 5

This question sought to determine whether candidates were familiar with the suitability of forage specimens for preservation, the steps involved in the preservation of these specimens and the reason for such preservation.

Most candidates attempted the question and it was fairly well done.

Parts (a) and (b) were well answered with most candidates correctly identifying AS 7 as being more suitable for preservation for display as it was a complete plant with inflorescent and roots.

The steps required for the preservation of plant specimens were also fairly well-known. An example of a correct answer follows: collect, clean/wash, fold in newspaper, label.

Expected reasons for preserving plants included identification for classification, preservation for future reference or sale, and for use as a teaching aid.

Candidates with the wrong response confused preservation with conservation.

#### Question 6

This question was based on livestock rations and required candidates to state the main nutrient present in a sample of copra meal (AS 9), one function of the said nutrient and to identify the possible consequences of a deficiency of the nutrient in livestock feed.

Most of the candidates knew that the main nutrient supplied by the specimen was protein but some were not aware that it was required by animals for growth and development in terms of building muscles and tissues, or that prolonged exposure would result in spoilage of the specimen.

Less than fifty percent of the candidates knew that the test represented a positive result for the presence of protein in the livestock ration tested. A large number of candidates could not correctly name feedstuffs of plant or animal origin. However, correct responses in this section included milk, bone meal and blood meal as feedstuff of animal origin and legumes and coconut meal as feeds of plant origin.

#### Question 7

This question tested candidates' knowledge of the age and weight at slaughter for different classes of livestock.

Candidates generally knew the weight and age at slaughter for poultry and beef animals, but were clueless about rabbits. Some candidates confused slaughter age with gestation period, and others gave extremely exaggerated weights, for example, 100 kg for poultry, 1300 kg for rabbits and 30 kg for beef cattle.

Some candidates did not include a unit under the age column, and also gave exaggerated ages of up to one year for poultry and rabbits and nine years for cattle.

#### Question 8

This question required candidates to identify a teeth clipper and to state conditions prevented if used correctly, and consequences of not using the tool.

From the responses it could be assumed that very few candidates had ever seen a teeth clipper. The responses were mostly guess work, as many of them did not know that it was used for clipping the teeth of piglets to prevent damage to the teat of the sow, thus affecting milk production leading to unthrifty piglets.

#### Question 9

This question was based on the fishing industry in the Caribbean and candidates were tested on their knowledge on the types of fishing illustrated on the question paper, the type of fish caught at different depths and marine fishing methods commonly used in the Caribbean.

Many candidates correctly identified the fishing displayed in AS 13 and AS 14 as long line or deep water fishing and trolling or coastal fishing respectively. Incorrect responses included anchor fishing, expert fishing and lazy man fishing for AS 13 and cultural fishing, close fishing and shore fishing for AS 14.

In part (b) most candidates gave the correct response to AS 13 as kingfish and AS 14 as snapper. Some candidates did not recognize that cascadura / hassar was a fresh-water and not a marine fish.

Section (d) was very poorly answered. Expected responses included seine, drift netting, trawling. Some incorrect responses were commercial fishing, domestic fishing and pond fishing.

#### Question 10

This question tested candidates' ability to identify primary and secondary cultivation equipment, their general functions and the function of specific parts.

Surprisingly, very few candidates could correctly identify AS 15 as a disc plough and AS 16 as a disc harrow. Also, not many could identify the part of AS 15 labelled X as the coulter nor state that the function of the part of AS 16 labelled Y is to prevent soil from sticking to the blades of the harrow.

Incorrect answers to the identification of AS 15 were weather station, incubator and gliding machine. AS 16 was variously referred to as lawn mower, roller coaster and rotavator. Also, many students could not explain that the function of the plough was to cut and invert the soil.

**CARIBBEAN EXAMINATIONS COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATION**

**MAY/JUNE 2008**

**AGRICULTURAL SCIENCE  
SINGLE AWARD AND DOUBLE AWARD**

**AGRICULTURAL SCIENCE  
SINGLE AWARD AND DOUBLE AWARD  
GENERAL PROFICIENCY EXAMINATION  
JUNE 2008**

The Structure of the Examination

The Agricultural Science syllabuses, Single Award and Double Award, were revised effective for examination from June 2008. The extensive revision led to the re-organization of the content as follows (for both Single and Double Award):

- A – The Business of Farming
- B – Crop Production
- C – Animal Production

The Double Award syllabus includes two additional units of work:

- D – Horticulture
- E – Animal Husbandry

The emphasis of the revised syllabuses is on the business of agriculture. Hence, for the Single Awards, the Options (Crop Science and Animal Science) have been removed. Students are expected to acquire competencies in both crop and animal production, and to apply the concepts learnt in A (the Business of Farming) to the practical business of crop and animal production.

The examination consisted of two external papers for Single Award. Paper 01 consisted of 60 Multiple Choice items, 20 each from A, B and C of the syllabus. These content units are also the Profile for the Agricultural Science syllabus. Paper 02 consisted of six structured questions, two from each Profile, and three essay questions, one from each Profile. The structured questions were worth four marks each, and the essay questions were worth 12 marks each. All questions were compulsory.

Paper 03 was the School-Based Assessment worth 80 marks. This consisted of two cost analyses, one each on Crop Production and Animal Production, and ten practical skills based on field work.

The contribution of these papers to the overall examination was as follows:

- Paper 01 – 30 %
- Paper 02 – 30 %
- Paper 03 – 40 %

The Double Award consisted of Paper 01 and Paper 02, common papers for the Double Award and Single Award, and Paper 03, an essay paper based on Section D and E of the syllabus. Paper 03 consisted of two essay questions on D and two essay questions on E. each worth 15 marks. All questions were compulsory. Paper 04 was the School-Based Assessments worth 120 marks. It consisted of three cost analysis, ten practical skills and a research project.

The contribution of these papers to the overall Double Award examination was as follows:

- Paper 01 – 20%
- Paper 02 – 20%
- Paper 03 – 20%
- Paper 04 – 40%

## GENERAL COMMENTS

A total of 7,630 candidates were entered for the examination, 6,006 for Single Award, and 1,624 for Double Award.

Candidate overall performance was good. Approximately 84% of the candidates achieved acceptable grades, Grade I to III for Single Award, and 84% for Double Award. Performance on Paper 01 declined slightly for the Single Award, and improved slightly for the Double Award. Performance on Paper 02 for the Single Award was modest. Performance on Paper 02 for the Double Award was better than for the Single Award. The Double Award candidates also had acceptable performance on Paper 03, the essay paper.

## DETAILED COMMENTS

### PAPER 01 – Multiple Choice

This paper consisted of 60 Multiple Choice items distributed over the three units in the core of the syllabus as follows:

Business of Agriculture	20
Crops and Soils	20
Animals Science	20

Table 1 shows the number of questions per unit, the difficulty index, mean and standard deviation (SD) for candidates for the Single and Double Awards.

#### Performance of Candidates in the Multiple Choice Paper by Units

UNITS	Number of Question	Difficulty Index	
		Single Award	Double Award
Business of Agriculture	20	.64	.65
Crops and Soils	20	.62	.64
Animal Science	20	.52	.55
<b>TOTAL</b>	<b>60</b>	<b>.52</b>	<b>.55</b>
OTHER PARAMETERS – Paper 01			
MEAN		38.24	40.18
STD. DEV		8.39	8.71
MEAN %		63.73	66.97
MODE		43	44
RANGE		10-57	8-58

The Single Award candidates experienced difficulties with the following topics:

- The role of Extension Services in agriculture
- Record keeping
- Interest as the cost of using money borrowed from a bank
- Rotavating as the final operation is seed bed preparation
- Soil amendment required for soil of pH 5.0
- Genetic cross
- Orientation of a poultry pen

The Double Award candidates experienced difficulties with the following topics:

- The role of Extension Services in agriculture
- Record keeping
- Interest as the cost of using money borrowed from a bank
- Rotavating as the final operation in seed bed preparation

### **PAPER 02 – Structured Essay Questions**

Section A consists of six questions, each worth four marks.

#### **Question 1**

	Mean	Mode	s.d.
Single Award	1.17	1	1.01
Double Award	1.50	1	1.12

This question tested candidates' knowledge on concepts specific to food safety. This topic was being tested for the first time since it is new to the syllabus. However, increased emphasis on food safety internationally makes the topic very relevant.

Generally, the responses were poor with a great number of candidates failing to attempt various parts of the question.

Part (a) (i) tested candidates' familiarity with the concept 'HACCP', Hazard Analysis Critical Control Point. The responses were generally poor.

Part (a) (ii) required candidates to identify and list benefits of HACCP to agriculture. Despite the general unfamiliarity with the concept, many candidates correctly stated one benefit. It is recognized that some of the benefits of HACCP to agriculture overlap with recommended practices in export agriculture. Many candidates were able to draw on the previous knowledge.

Part (b) required candidates to advise on principles of HACCP a farmer can adopt to get his/her produce to acceptable export standards. Generally, the responses to this part of the question were poor and many candidates did not attempt this question altogether. Candidates should have written: a hazard analysis, determine critical points, establish control limits, monitoring procedures, connective actions, verification procedures.

#### **Question 2**

	Mean	Mode	s.d.
Single Award	1.55	1	1.12
Double Award	1.85	2	1.12

This was an agricultural economics question that tested:

- candidates' knowledge of the factors of production
- candidates' knowledge of the concept 'capital'
- candidates' ability to use their knowledge of the previously mentioned concept and apply that knowledge to solve problems of profitability on a farm.

Parts (a) and (b) required candidates to state a factor of production and to name one type of capital. Generally, the responses to these parts of the question were excellent. One observation of note, however, is that quite a few candidates incorrectly stated 'marketing' as a factor of production.

Part (c) of the question required candidates to use their knowledge and understanding of the concept 'capital' and explain how that capital can be used to improve farm profitability. The responses to this part of the question generally lacked depth. Many candidates simply listed uses of capital such as purchase of inputs, rather than explain that by expanding the farm, total output will be increased at lower unit cost, thereby improving profitability.

The concept 'economies of scale' which was expected to serve as a stimulus to lead candidates to the correct responses, apparently was not a familiar concept.

### Question 3

	Mean	Mode	s.d.
Single Award	0.87	0	0.87
Double Award	0.99	1	0.92

Part (a) of this question tested candidates' knowledge of the inorganic composition of a typical soil. Candidates were required to:

- name the smallest inorganic component of soil and
- name one other inorganic component of soil.

The responses to this part of the question were mixed, in that while candidates were generally unable to correctly name the smallest inorganic component of soil, most candidates correctly named one other inorganic of soil.

Part (b) presented candidates with a two-column table with information on the composition of a typical sample of soil. The percentage composition was given in the left-hand column with the corresponding particle size in millimeters in the right-hand column. Candidates were required to study the information provided in the table and then:

- name the soil type, and
- suggest one method of managing the soil to improve productivity.

Many candidates were unable to name the soil type showing unfamiliarity with particle sizes in soils. Most candidates correctly named one method of managing the soil. However, many candidates were unable to discuss an acceptable reason for using the method to improve productivity of the soil. When assessed as a complete question the responses were considered to be barely satisfactory.

### Question 4

	Mean	Mode	s.d.
Single Award	1.26	1	1.09
Double Award	1.42	1	1.17

Part (a) of the question presented candidates with a diagram showing the cross-section of the stem of a monocotyledon. Two structures on the diagram were labeled, A and B and candidates were required to identify and name the labelled structures. The responses to this part of the question were generally good.

Part (b) presented two scenarios. Scenario one dealt with the importance of sunlight to the process of photosynthesis in plants. Scenario two related to the simple test for starch in plants. Candidates were required to read, internalize and interpret the information provided in each scenario and then answer two questions. The first question asked candidates to provide a reason for placing the plant in a dark cupboard. The responses to this part of the question were generally good. The second question required candidates to state the expected results of the test for starch on the leaves. This question required candidates to apply their knowledge and understanding of the starch test to answer a question related to a specific circumstance. The responses to this part of the question were generally poor.

#### Question 5

	Mean	Mode	s.d.
Single Award	1.99	2	1.11
Double Award	2.37	2	1.12

This question was specific to the egg, requiring candidates to:

- name one component of the egg
- state the function of the named component, and
- explain the effect of any named shell defect on the shelf life of eggs.

The responses to this question were generally good. It was quite evident from the quality of responses that not only was the topic fully explored in classrooms across the region, but students generally grasped the concepts and had a sufficient functional understanding of most related material.

In Part (a), almost all candidates correctly named one component of the egg. However, quite a number of candidates struggled to provide a correct function of the named component.

The responses to Part (b) of the question, shell defects, were generally good.

#### Question 6

	Mean	Mode	s.d.
Single Award	2.67	3	1.15
Double Award	3.07	4	1.04

This question was directly related to aquaculture in the Caribbean. It was a three-part question with Part (a) (i) and (ii) being recall type question and Part (b) testing application of knowledge to a particular farm situation.

Part (a) (i) required candidates to name one species of freshwater fish reared in the Caribbean. The accuracy of the responses to this question was generally mixed. Many candidates correctly named a freshwater species. However, many other candidates confused freshwater species with salt water species, thereby providing incorrect responses.

Part (a) (ii) required candidates to name one method used to harvest fish in aquaculture. Generally candidates provided correct responses.

Part (b) provided a scenario explaining how the water from the pond of an aquaculture unit was drying up and fish yields were negatively impacted. Candidates were required to apply their



understanding of water supply to an aquaculture unit to advise that farmer on steps to correct the problem. The responses to this part of the question were generally good.

#### Question 7

	Mean	Mode	s.d.
Single Award	4.79	6	2.95
Double Award	6.09	7	2.99

Part (a) of the question required candidates to define and explain the following concepts; 'gross farm income', 'gross margin' and 'net profit'. Most candidates achieved the majority of marks allotted in this part of the question. However, it should be noted that most definitions and/or explanations lacked accuracy. For example, many candidates defined 'income', instead of 'gross farm income' and 'profit' instead of 'net profit'. Of the three concepts tested, candidates generally had difficulty defining 'gross margin'. Many candidates also did not convey an understanding that the terms 'gross' and 'total' are synonyms and this fact impacted the accuracy of definitions. Gross margin = gross income – variable cost.

In Part (b) candidates were provided a two-column table. The left-hand column listed some farm activities, input items and items of expenditure while the right-hand column listed each corresponding cash value. In Part (i) of the question, candidates were required to categorize each item listed on the table under the correct headings: 'fixed cost', 'variable costs', 'farm income'. The responses to this part of the question were generally excellent. However, a very common mistake saw candidates categorizing 'Farm Managers' salary' as 'farm income' rather than a cost to the farm business.

In Part (ii), candidates were required to use the information provided in the table to calculate gross farm income and net farm income. The responses to this part of the question were generally poor. The mistakes alluded to earlier were responsible for the incorrect responses in this part. However a very worrying reality was the prevalence of very simple mistakes in computation.

#### Question 8

	Mean	Mode	s.d.
Single Award	2.97	1	2.44
Double Award	3.67	3	2.76

This question required candidates to do the following:

- explain the concepts 'mixed farming' and 'mixed cropping'
- list some advantages of monoculture
- provide reasons to support intercropping papaya with pumpkin
- discuss methods of organic farming making specific reference to its contribution to soil fertility.

When considered as a complete question the responses were barely satisfactory. Some important general observations were:

1. Candidates entered for the Double Award generally performed better than candidates entered for the Single Award.
2. Candidates showing a propensity to express themselves scored better than candidates with a low propensity for good expression.

3. Candidates who scored poorly generally lacked the knowledge to correctly treat with the specific demands of the question.

Comments specific to candidates' responses were:

In Part (a), the weaker candidates were unable to correctly define mixed farming. Some common incorrect responses were:

- rearing a variety of animals
- planting a variety of crops
- mixing a variety of soil
- different farmers utilizing the same farm.

In Part (b) of the question, many candidates listed advantages and not disadvantages. This indicated that candidates did not read the question properly. Many candidates also listed one disadvantage instead of two, this again suggested that candidates did not read the question properly or in this specific case were just unable to list two disadvantages.

The responses to Part (c) of this question were generally poor. Most candidates indicated that papaya and pumpkin belong to the same family, and one crop adds nutrients which the other crop will take up. Such responses were indicative of a lack of understanding of the agronomy of the crop, a deficiency that seemed to be endemic to the region.

The responses to Part (d) of the question were mixed. Many candidates provided responses that were correct. However, many candidates provided incorrect responses. Additionally, rather than answer the question asked, many incorrect respondents discussed benefits of organic farming.

#### Question 9

	Mean	Mode	s.d.
Single Award	5.73	6	2.75
Double Award	6.50	8	2.68

Part (a) required candidates to provide a reason for using litter in broiler production and to name two materials suitable for use as litter material in poultry pens. The responses to this part of the question were generally good and they covered the range of responses listed in the mark scheme.

In Part (b), candidates were presented a situation in which chick in a broiler unit showed signs of listlessness and their faeces contained streaks of blood. Candidates were required to conduct a situational analysis to determine the following:

- a name of the disease affecting the chicks
- one other symptom of the named disease
- treatment for the disease
- measures to be taken to avoid a reoccurrence of the disease.

A general evaluation of the responses to this part of the question revealed;

1. Most candidates were unable to name the disease although they were given the symptoms of the disease in the situation described; candidates were also unable to name one other symptom of the disease.

2. Most candidates were unable to correctly explain a method of treating the chicks to overcome the disease.
3. Most candidates correctly suggested at least one measure that can be used to avoid a reoccurrence of the disease, many correctly suggested at least two measures, while only a few correctly suggested three measures.

Part (c) of the question was specific to rabbits. A situation was presented in which the eventual end was the death of rabbits. Candidates were expected to explain a possible cause of death. The responses to this part of the question were generally very poor. Candidates seem to be confused by/did not understand that situation described in the question.

### **PAPER 03 – Essay Type Questions (Double Awards Only)**

#### **General Comments**

This Paper consisted of four essay type questions, two from Section D – Horticulture, and two from Section E – Animal Husbandry.

#### Question 1

	Mean	Mode	s.d.
Horticulture	5.06	4	2.86

This question was divided into two parts. Part (a) tested candidates' knowledge of growing citrus and orchard cultivation. Specifically the question demanded candidates to:

- name the method of propagating citrus
- name one method of applying fertilizer to citrus trees being grown in an orchard
- identify and name the causative organism of Tristeza disease, which affects citrus
- briefly explain how the Tristeza disease is spread from tree to tree
- name one symptom of Tristeza disease.

Part (b) was related to the golden apple plant. The question tested candidates' ability to compare and contrast, evaluate and explain, and discuss. Specifically the question demanded candidates to:

- compare the miniature golden tree to the traditional tree
- discuss the benefits of using the miniature golden apple for commercial production.

Generally, overall performance in the question was poor. In Part (a) (i), the responses were generally mixed, while quite a few candidates correctly stated budding as the method by which citrus is propagated, just as many candidates incorrectly stated grafting. This suggested that while candidates were acquainted with the processes 'budding' and 'grafting', they were uncertain with respect to which plants are budded and which are grafted.

Part (a) (ii) was the best answered part of this question. Most candidates correctly named an appropriate method of applying fertilizer to citrus trees.

The responses to Part (a) (iii) and (iv) were generally very poor. Some common incorrect responses to Part (iii) were organisms, bees, slugs, nematodes and fungus. Some common incorrect responses to Part (iv) were wind, vectors, animals and trees planted too close. Generally, candidates did not know that the organism which causes Tristeza disease is a virus and that the virus is carried by the citrus aphid which spread disease from tree to tree.

The responses to Part (b) of the question were extremely poor generally. Many candidates were not acquainted with the golden apple tree and the use of neither the scientific nor the common name in the question was helpful to candidates. Candidates were also not acquainted with some terms used in the question, particularly 'determinate type' and 'indeterminate type'.

### Question 2

	Mean	Mode	s.d.
Horticulture	7.16	8	3.01

This question was specific to grasses. However, there was a shift in the specific content tested. Usually a question on grasses tests grass species used as forage. However, this question tested species used for lawn, a very encouraging development since the agro-tourism linkage is introduced at the CSEC level.

The specific content tested by this question was:

- characteristics of grasses suitable to establishing lawns
- lawn grass species adaptable to the dry and wet conditions of the Caribbean
- quality characteristics of a good lawn grass
- problems specific to lawn grass management and suggestions for correcting such problems.

Part (a) (i) of the question asked candidates to list three desirable characteristics of grasses one should consider when establishing a lawn. The responses were generally weak. Candidates were uncomfortable with the concept 'characteristics of grasses' and rather provided responses which spoke to conditions necessary for growth of the grass. Some very popular incorrect responses included:

- leaves must be green and beautiful
- leaves must not be dry, and
- grass must be pleasant to look at.

Candidates' responses should have included: easy to propagate, easy to establish, ability to withstand mowing, tolerant to climate conditions, tolerant to pests and diseases, low compact growth habit, fine leaf texture.

The responses to Part (a) (ii) were extremely poor generally. Candidates seemed not acquainted with grass species used for lawn development and as such most named species used for forage/pasture development. Some very popular incorrect responses therefore include Para grass, Bamboo grass, Tanner grass and Nut grass, rather than correct responses like Savannah grass and Bermuda grass.

Part (b) provided candidates with a drawing of an unhealthy lawn. Candidates were required to study the drawing and:

- identify and name two problems with the lawn, and
- suggest two possible causes of each named problem and explain how each problem can be corrected.

Generally the responses to Part (b) were good. The drawing was very clear and most candidates correctly named two problems of the lawn as seen on the drawing. Candidates also used their knowledge of management of grass species for pasture and provided correct responses to this question.

Overall, the responses were satisfactory with quite a majority of candidates scoring fifty percent or more of the marks allocated for this question.

### Question 3

	Mean	Mode	s.d.
Horticulture	6.01	4	2.86

The focus of this question was the dairy industry and the dairy cow. Part (a) simply asked candidates to explain why is milk a perishable product. The responses to this question were generally poor. Quite surprisingly most candidates were not familiar with the concept ‘perishability’ and actually interpreted the question as asking them to describe the nutritional qualities of milk. Some very common incorrect responses, therefore, included:

- milk is rich in proteins and calcium
- milk is necessary for the development of strong bones and teeth, and
- milk is good for human consumption,

A good response should have been that milk contains bacteria which multiply rapidly at room temperature and cause spoilage.

Part (a) (ii) of the question requested candidates to name two processes other than pasteurization by which milk can be preserved. The responses to this part of the question were generally excellent. Most candidates correctly named at least one process.

In Part (a) (iii), candidates were asked to describe the process of pasteurization. Many candidates described the process correctly. However, many candidates described pasteurization as a drying process rather than a heating and cooling process. Some candidates who were clearly not acquainted with the process described pasteurization as milking the cow in the pasture.

Part (b) described a situation in which while milking, the farmer observed drops of milk with streaks of blood on the floor, and the farmer’s milk production was also low. Candidates were required to read the situation described, analyze it and then discuss five management practices the farmer can implement to solve the problems described.

The responses to this part of the question were generally good. Candidates understood the situation described and most discussed at least three management practices. The most popular practices discussed were:

- general sanitation (washing hands, hind quarter to the cow and udder before milking)
- use of the strip cup test for mastitis
- feed animals during milking to keep cow quiet and enhance milk letdown.

### Question 4

	Mean	Mode	s.d.
Animal Husbandry	7.59	9	3.13

Part (a) of the question required students to state a recommended method of impregnating sows rather than using a boar, and to give an advantage of the method named. Part (b) dealt with upgrading a piggery through cross-breeding with a local sow and two exotic breeds. Part (c) concentrated on management practices to improve the weaning percentage of a ten sow unit, and Part (d) introduced another new section of the syllabus, the use of biogas and renewable resources.

Part (a) of the question was very well done with almost all candidates recognizing that artificial insemination was a recommended method, and a few mentioned embryo transfer. Most of them stated a correct advantage of the method used.

In Part (b), many realized that in upgrading, the female is usually the scrub or local breed and the male is the exotic or imported breed.

Part (c) was problematic for many candidates since they did not relate the stem of the question to the response. The fact that weaning weights were small, 20% of his piglets died and there was a scouring problem should have pointed to a management problem. The responses were barely adequate, for candidates who recognized the problems just stated that there were management problems without identifying any specific practice.

Part (d) was poorly done, as students have not fully grasped the environmental and reusable resources concepts. A few mentioned the conversion of the faeces to biogas, and using energy efficient devices on the farm, but some included increasing the selling price of this stock, sell stock from the farm to reduce transport cost, and using a fireside for cooking as alternatives.

### RECOMMENDATIONS TO TEACHERS

Based on its assessment of the candidates' performance during the 2008 Examination, the Examining Committee wishes to make the following recommendations to teachers preparing candidates for future examinations.

#### General Recommendations

1. In preparing students for the examination, teachers should ensure that the **range of topics** outlined in the syllabus is dealt with adequately.
2. Teachers should constantly seek to provide opportunities for exposing students to practical exercises and demonstrations to enhance their abilities to make appropriate links between theory and practical agriculture.
3. Teacher should venture outside the standard textbooks, and relate examples cited with everyday situation to assist in forging the links referred to in (2) above, especially with regard to new objectives in the syllabus.
4. Teachers should encourage students to **read questions carefully and follow all directions** before answering them, and to try to be direct in their answers.
5. Teachers should encourage students to be observant on field trips and take relevant notes. **It is important for Teachers to conduct pre-field trip activities, to outline specific objectives, and to brief the host of the ability of the class and the reason for the field trip. Postmortems should also be held after a field trip, and misconceptions cleared up immediately.**
6. Teachers should encourage personnel from Regional and International Agricultural Organisations/Agencies to visit schools and interact with their students to broaden their horizons.
7. Teachers should grasp the opportunity to obtain as many free agricultural publications as possible from both regional (for example, CARDI) and international (for example, CTA-Spore) institutions for use in the classroom.

8. Teachers are reminded of the new additions to the syllabus, and should expose students through mechanisms mentioned above. For example, 'Global Warming, Gender Issues, Biodiversity, urban and peri-unban farming, organic farming are new ares to the syllabus.

#### Specific Recommendations

1. Teachers should concentrate on teaching the objectives as outlined in the syllabus. There is, however, the need to **amplify the content around objectives** to avoid limiting students' knowledge and understanding of essential content.
2. Continuous efforts should continue to be made to improve the communication skills of students; Candidates' performance was limited in many cases by their inability to adequately express themselves.
3. Ample opportunities must be afforded students to practise answering essay type questions, to provide them with the opportunity for problem solving, to enhance their skills of expression and to make use of knowledge to adequately interpret data.
4. Teachers are encouraged to teach students widely accepted technical terms, and not rely solely on terms of local origin. The use of agricultural rather than colloquial term needs to be addressed, and more attention should be paid to the correct spelling of these terms.
5. Students should also be encouraged to improve their expressive ability and language skills, as although providing correct responses at times, their expressions are poor.
6. Teachers are encouraged to follow the guidelines as outlined in the new syllabus – page 40 – with respect to students' preparation of farm records. These MUST show evidence of: **“single entry accounting”, “budgeting exercises”, “production project” and “records for the use in making predictions and decisions”.**
7. **Candidates entered for the Double Award should be exposed to the format for the research project (new syllabus pgs. 42 and 43) as early as possible in the course so that it could be internalized by the time the project is undertaken.**

**CARIBBEAN EXAMINATIONS COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATION**

**MAY/JUNE 2009**

**AGRICULTURAL SCIENCE  
SINGLE AWARD AND DOUBLE AWARD**



**AGRICULTURAL SCIENCE  
SINGLE AWARD AND DOUBLE AWARD  
GENERAL PROFICIENCY EXAMINATION  
JUNE 2009**

**The Structure of the Examination**

The Agricultural Science syllabus comprises the Single Award and the Double Award. Three Units of the content are common for both Awards, namely:

- A – The Business of Farming
- B – Crop Production
- C – Animal Production.

The Double Award consists of two additional Units:

- D – Horticulture
- E – Animal Husbandry

The examination consisted of two external papers for the Single Award. Paper 01 consisted of 60 Multiple Choice items, 20 each from Units A, B and C of the syllabus. Paper 02 consisted of six structured questions, two from each Unit, and three extended essay questions, one from each Unit. The structured questions were worth 4 marks each and the extended essay questions were worth 12 marks each. All questions were compulsory.

Paper 03 was the School-Based Assessment, worth 80 marks. This consisted of two cost analyses, one each on Crop Production and Animal Production, and 10 practical skills based on field work.

The Double Award consisted of Paper 01 and Paper 02, common papers for the Double Award and the Single Award. Paper 03 consisted of two compulsory extended essay questions based on Section D and two compulsory extended essay questions based on Section E of the syllabus. Each question was worth 15 marks.

Paper 04 was the School-Based Assessment worth 120 marks. It consisted of three cost analyses, 10 practical skills, and a research project.

**GENERAL COMMENTS**

A total of 7,522 candidates were entered for the examination, 5,712 for the Single Award, and 1,811 for the Double Award.

Candidate overall performance was good. Approximately 87 per cent of the candidates achieved acceptable grades, Grades I – III for the Single Award, and 89 per cent for the Double Award. Performance on Paper 01 remained steady for the Single Award, and improved for the Double Award. Performance on Paper 02 and Paper 03 was acceptable.

## DETAILED COMMENTS

### **PAPER 01 – Multiple Choice**

This paper consisted of 60 Multiple Choice items distributed as follows:

Business of Agriculture	20
Crops and Soils	20
Animal Science	20

Table 1 shows the number of questions per unit, the difficulty index, mean and standard deviation (SD) for candidates for the Single and Double Awards.

#### **Performance of Candidates in the Multiple Choice Paper by Units**

UNITS	Number of Question	Difficulty Index	
		Single Award	Double Award
Business of Agriculture	20	.64	.65
Crops and Soils	20	.62	.64
Animal Science	20	.52	.55
<b>TOTAL</b>	<b>60</b>	<b>.52</b>	<b>.55</b>
OTHER PARAMETERS – Paper 01			
MEAN		38.24	40.18
STD. DEV		8.39	8.71
MEAN %		63.73	66.97
MODE		43	44
RANGE		10-57	8-58

The Single Award and Double Award candidates experienced difficulties with the following topics:

- Organic farming
- Materials used for mulch
- Causative agent of mosaic disease
- Meaning of 'phenotype'

### **Paper 02 – Structured and Extended Essay Questions**

Section A consisted of six questions, each worth four marks.

#### Question 1

	Mean	Std .dev.
Single Award	1.09	1.00
Double Award	1.26	1.05

This question tested candidates' knowledge and understanding of non-conventional farming systems when faced with difficult situations, and the advantages associated with the use of these methods.

Responses to Part (a) were generally good with many candidates identifying container planting and hydroponics as alternatives to the farmer who was interested in home gardening and had soil that was rocky and unsuitable for growing crops around her home. Correct but less popular responses were grow box and trough culture. Some candidates seemed to have misinterpreted the question and incorrectly stated, "ploughing", "mulching", "crop rotation", and "sexual/asexual reproduction", answers which were inappropriate as methods used to grow crops.

For Part (b), many candidates identified the method but were not able to correctly identify an advantage. Some good responses to Part (b) included "better control of pests and diseases", "reduced leaching of plant nutrients", "easier weed control" and "better control of availability of plant nutrients". Poor responses to this part of the question included "planting indoors", "closer to home" and "moving around pots".

Students could benefit from a problem-solving approach that would allow them to apply their acquired knowledge to practical situations in agriculture. Even though many candidates could identify a suitable alternative to conventional gardening several did not consider the "rocky" nature of the soil in identifying an advantage of the chosen method.

## Question 2

	Mean	Std. Dev.
Single Award	2.06	1.18
Double Award	2.34	1.13

This question focused on candidates' knowledge of constraints to Caribbean Agriculture and their ability to make practical suggestions to overcome these constraints.

Part (a) required the naming of two constraints to Caribbean Agriculture, apart from marketing and rural infrastructure. This question was generally well answered.

Good responses to Part (a) included "praedial larceny", "climatic conditions", "land tenure", "availability of labour", "topography" and "obtaining credit". Other acceptable but less popular responses were "trade barriers" and "accessibility of land". Some poor responses included "CARDI", "RADA", "CARICOM", and "technology".

Part (b) required that candidates suggest two ways in which a farmer could overcome a problem of getting farm workers. Candidates were credited for responses such as "cultivate crops that were less labour intensive", "get machinery", "cultivate small areas that she could manage by herself at any one time", "get assistance from family members", "increase wages offered", "advertise for workers" and "join a co-operative". Asking government for assistance was an incorrect response that was very popular in this section.

### Question 3

	Mean	Std. Dev.
Single Award	1.37	1.12
Double Award	1.72	1.08

This question tested candidates' understanding of the pH scale as it relates to soil acidity, the identification of one amendment applied to an acid soil and how the selected amendment could be applied.

Part (a) required that candidates identify the pH range that would indicate that the soil was acid. Too many candidates included pH 7 in the range they suggested. All pH values under pH 7 were credited.

In Part (b), the most popular correct response was "add limestone" to correct the soil acidity. Some candidates were able to name specific liming materials such as calcium carbonate, calcium oxide and calcium hydroxide. A few candidates correctly identified "filter press mud" a by-product of the sugar industry as a suitable liming material. Some responses that were not credited were "lime juice", "sodium chloride", "urea" and "fertilizer".

Part (c) was the most poorly done section of the question. The expected response was to either broadcast (scatter) or incorporate (mix in) the liming material in the soil. Some candidates, even though they correctly identified a liming material in Part (b), stated that it should be dissolved and applied to the soil in liquid form.

Candidates' responses indicated some level of coverage of this aspect of the syllabus. However, teachers need to pay attention to detail in terms of the method of application of soil amendments.

### Question 4

	Mean	Std. Dev.
Single Award	1.80	0.97
Double Award	2.09	1.04

This question required that candidates identify common machinery and equipment used on the farm and explain their benefits to crop production. The question was generally well done.

Part (a) required that candidates identify from photographs a disc plough and a hand sprayer. Many candidates had difficulty identifying the disc plough but most were able to correctly identify the sprayer. Some candidates recognized the equipment as a plough but could not specify its type and were not credited. Other responses that were not credited were "digger", "backhoe", "bulldozer",

In Part (b), candidates' knowledge of how the use of the disc plough contributed positively to crop production was sought. Candidates' responses indicated the use of machinery in general and not the use of the disc plough. Responses credited were "increases soil aeration", "breaks up or loosens soil for roots to grow deeper", "more water enters the soil/infiltration better and better movement of water

down the soil profile/better percolation”. Responses that were not credited included “reduces labour costs”, “fewer workers needed”, and “land prepared faster”.

In cases where schools do not have certain equipment as part of their agricultural programme, students should be exposed to such equipment by means of field trips to farms or agricultural stations. Teachers can also use the Internet to provide photographs or give students projects which require that they do relevant research. Also, focus should be placed on accepted names for specific equipment, and not just the names given to them locally.

#### Question 5

	Mean	Std. Dev.
Single Award	1.54	1.03
Double Award	1.94	1.08

This question focused on objectives related to digestion and nutrient requirements of mono gastric and ruminant animals. Most candidates were able to score at least 50 per cent of the marks allocated to this question.

Part (a) required that candidates name the enzyme responsible for protein breakdown in the proventriculus. However, many candidates could not correctly identify pepsin as the required answer. Incorrect responses included saliva, chime, and amylase.

In Part (b), candidates were asked to name one function of the rumen. This part of the question was well answered by most candidates, as answers such as storage of food and microbial fermentation were given by many candidates. Answers that were not credited in this section included digest food, absorption of water and excrete faeces.

Part (c) (i) was well answered as most candidates could correctly name a ruminant animal as an animal which would best utilize the feed (grass silage supplemented with wheat middling and molasses urea blocks). Some candidates,

Double Award

2.19

0.95

This question tested candidates' knowledge of the design of poultry pens as related to heat build-up and security. Most candidates were able to score at least 50 percent of the marks allocated. Candidates were presented with a labelled diagram of a poultry house and were required to answer the questions based on the diagram.

Part (a) (i) asked candidates to suggest one way of improving the design of the pen to reduce the build-up of heat in the pen. Many candidates were able to score the mark allocated to this part of the question by suggesting that the design of the pen could be improved by providing longer eaves, raising the roof higher, increasing the slope of the roof or insulating the roof. Some incorrect responses included suggestions to make holes in the roof, use a thatched roof, providing electric fans and even putting sprinklers on the roof.

Part (b) required candidates to prepare a complete budget for a poultry farm by using the projected income and expenditure figures provided. In preparing the budget candidates were asked to identify the two types of costs from the information provided. Some candidates obtained most of the marks for the budget preparation, whereas others obtained low scores because they did not identify which of the costs were fixed and which were variable. Problems in computation (addition and subtraction) were also evident.

The concepts of fixed and variable costs should be clearly understood before proceeding to the actual preparation of the budget, if it is to be prepared correctly. The layout or format of the budget should be emphasized, as this not only allows candidates to take an organized approach to preparing the budget but it also facilitates the computational aspect and reduces the computational errors made.

#### Question 8

	Mean	Std. Dev.
Single Award	3.11	2.28
Double Award	3.58	2.38

This question focused on the cultivation of a root crop (sweet potato) and a leaf crop (lettuce). Candidates were expected to demonstrate an understanding of the differences in land preparation, harvesting and post harvest handling of these two crops. They were also expected to demonstrate knowledge of the parts of each plant used for propagation and name one variety of sweet potato recommended for planting in the Caribbean.

In Part (a) (i), candidates were required to suggest the changes the farmer would have to make to his land preparation method if he switched from lettuce to sweet potato cultivation. This part of the question was fairly well done. Most candidates were able to identify such changes as converting flat top beds for lettuce to ridges and furrows for sweet potatoes, greater tilling depth for sweet potatoes than lettuce and the fact that the soil texture for sweet potato did not need to be as fine as for lettuce.

Part (a) (ii) required candidates to outline the difference in harvesting method. This part of the question was fairly well done also. Many candidates correctly stated that the harvesting of the sweet potato would take longer than the harvesting of the lettuce, and that digging of sweet potato tubers would be required instead of cutting of the stem as for lettuce. Additionally, the harvesting implement for lettuce is a knife, whereas it is a fork for the sweet potato; sweet potato could be harvested at any time of the day instead of early morning or late afternoon as for lettuce.

Changes in post-harvest handling were addressed by Part (a) (iii). This part was not as well done as the two previous sections. Candidates were expected to point out that potato tubers could be air-dried instead of washed as is required for lettuce leaves and that sweet potato could be stored at room temperature instead of under cool conditions as required for lettuce. Many candidates stated that the sweet potato tubers needed to be washed.

Part (b) required that candidates demonstrate knowledge of the parts of the sweet potato used for propagation. Most candidates correctly identified the sweet potato stem and root tuber as parts used for propagation. The most popular incorrect answer was stem tuber.

In Part (c), candidates were generally able to score the mark given for naming a sweet potato variety recommended for planting in the Caribbean.

When crop production is being taught, it should be emphasized that even though there are aspects of cultivation practices that are common to most crops, difference also exist. Once generalities have been addressed, factors specific to crop types (for example, root, fruit, leaf) should become the focus of preparing candidates.

#### Question 9

	Mean	Std. Dev.
Single Award	3.15	1.78
Double Award	3.84	1.86

This question tested candidates' ability to identify equipment used in beekeeping (a smoker and a honey extractor), state the appropriate feed for one-day-old broilers, explain the term "feed conversion ratio" and calculate the feed conversion ratio of two groups of poultry. It also tested candidates' knowledge of disease control in poultry and maintaining feed quality in poultry rations.

In Part (a), more candidates correctly identified the smoker than the honey extractor.

In Part (b) (i), most candidates could correctly identify broiler starter as an appropriate feed for day-old broilers. Incorrect responses included colostrums, yolk, molasses and sugar water.

For Part (b) (ii) a), most candidates could not correctly define the term 'feed conversion ratio'.

Part (b) (ii) b) was also poorly done. Most candidates could not calculate the feed conversion ratios of the individual pens from the information given. The expected calculations were:

Feed Conversion Ratio (FCR) Formula

$FCR = \text{Total Feed Consumed} / \text{Total Live weight}$

Feed Conversion Ratio – Pen A

$550 \text{ kg} / 100 \text{ chickens} \times 2.2 \text{ kg}$

$= 2.5:1$

Feed Conversion Ratio – Pen B

$850 \text{ kg} / 200 \text{ chickens} \times 2.2 \text{ kg}$

$= 1.93:1$

From the above calculations, the pen with the better feed conversion ratio is Pen B.

Part (b) (iii) required that candidates recommend measures which a farmer could adopt to minimize the effects of bronchitis on the performance of chickens. This section was poorly answered.

Part (b) (iv) required that candidates recommend two measures that could be used to overcome a problem in the inconsistency of the protein quality of feed between batches of feed. This section was



not well understood as very few candidates attempted this section, and although they recognized that protein was important, many did not know of a solution for a poor quality feed.

Candidate performance in this question signals the need for opportunities to demonstrate understanding of concepts by exposure to practice.

### **PAPER 03 – Extended Essay Questions (Double Award Only)**

This paper consisted of four essay-type questions, two questions from Section D (Horticulture) and two from Section E (Animal Husbandry).

#### Question 1

Mean	Std. Dev.
7.37	3.13

This question tested candidates' knowledge of horticulture with specific relevance to cut flower production, and its importance in Caribbean tourism.

In Part (a), candidates were simply required to define the term “horticulture” and name one example. Most candidates were correct in their definition of horticulture and had suitable examples, “establishment”, “care and maintenance”, “harvesting” and “postharvest treatment” of plants were some of the correct responses given. Vague answers like “the study of plants”, “the use of plants” or “the work of a horticulturist” was not accepted.

Part (b) required that candidates relate their knowledge of horticulture to how it could benefit the tourism industry in the Caribbean. This section was also well done, with many candidates recognizing its value as a foreign exchange earner, and also the therapeutic value of some horticulture plants.

Part (c) required candidates to identify the characteristics that should be used to select high-quality flowers for decorative purposes. This section was fairly well done, with candidates recognizing qualities such as “flower colour”, “firmness”, “length of pedicel” and “absence of blemishes and disease”.

Part (d) focused on recommended harvesting and post-harvesting operations to ensure high-quality flowers. This section posed some difficulty for candidates, as many of them could not distinguish between management practices, harvesting and post-harvesting. Those who were correct recognized the need for sharp harvesting instruments, maturity, specific time of the day for harvesting, and grading, proper storage conditions and careful handling for post-harvest practices. Many candidates, however, included irrigation, fertilizing, and preparing the land under the two categories.

#### Question 2

Mean	Std. Dev.
7.02	2.85

This question required candidates to demonstrate and apply knowledge with regard to citrus production from budded plants, as compared to propagation from seeds and the cultivation of citrus plants on sloping land in terms of varieties, land preparation, planting time, planting and spacing, and weed control.

Part (a) asked candidates to list three problems that could arise from the use of seeds to propagate citrus plants. The better candidates provided the correct responses, namely, variability in fruit, longer time to bear, and variability in trees. Some candidates gave general responses not related to the question, for example, “seed planted too deep”, “lack of nutrients”, and “water washed away the seeds”.

Part (b) required the identification of two methods of asexual propagation other than budding; many candidates gave correct responses, namely, tissue culture, air layering and stem cuttings. Incorrect responses included “inverted T budding” and “artificial insemination”.

Part (c) required recommendations for the cultivation of a citrus orchard on sloping land. Many candidates gave recommendations rather than direct answers to the question. Candidates did not know the names of specific varieties, listing “sweet”, “juicy”, and “strong rooted oranges” as varieties. Candidates also struggled to give acceptable responses to the section dealing with land preparation. Some correct responses included “contour planting”, “planting on terraces”, and “practising minimum tillage”. Incorrect responses included “clear the land of all weeds”, “ploughing the land” and “incorporating manure into the land”. Few candidates responded to planting time, and many responded poorly regarding spacing requirements, confusing the metric and imperial systems, with examples ranging from trees “100 metres apart” to “trees one inch apart”. Weed control was the best answered part of this section, with all candidates giving at least one correct response.

### Question 3

Mean	Std. Dev.
7.50	2.76

The question focused on the production of sheep and goats in the Caribbean, with emphasis on the Barbados Black Belly breed of sheep.

Part (a) (i) tested candidates’ knowledge of the origins of the Barbados Black Belly with regard to the breeds or breed types from which it was derived. This part was very poorly done, as most candidates did not know that the Barbados Black Belly was a cross between a hair sheep and a wool breed. The weaker candidates incorrectly stated other breeds of animals, for example, Landrace, Golden Comet, Anglo Nubian and Saanen.

Part (a) (ii) tested candidates’ knowledge of the physical characteristics of this breed of sheep. This section was fairly well done with many candidates correctly identifying its physical characteristics. The weaker candidates, however, confused physical characteristics with production characteristics. Correct responses for the physical characteristics included brown coat colour, black under belly, hair sheep, and polled.

Part (a) (iii) focused on candidates’ knowledge of the production characteristics that makes this breed suitable for the tropics. Good meat production, prolific, good mothering ability and disease resistant were some of the correct responses given.

Part (b) (i) tested candidates’ knowledge of practices which could lead to parasite (internal) infestation of goats. Most candidates correctly listed reasons why infestation persisted on a farm, for example, resistance by parasite, lack of a de-worming programme and unsanitary conditions.

Part (b) (ii) tested candidates' practical knowledge and understanding of procedures to control internal parasites in goats. The response was satisfactory in this section, with many candidates identifying deworming the animals, sanitation and proper pasture management as possible answers. Some candidates, however, referred to worm medication as antibiotics.

#### Question 4

Mean	Std. Dev.
6.77	3.93

This question tested one of the new areas added to the syllabus, that of biotechnology, and consisted of four parts. The potential difficulty that could arise from a new area in the syllabus led to the question having key points to assist candidates in their answers.

Part (a) required a definition or explanation of the term 'biotechnology'. This was well done, as most candidates seemed to have encountered the term before and most were able to offer a simple definition.

Part (b) asked candidates to name two biotechnological processes other than embryo transfer. The example in the stem led candidates to suggest similar or related response. Some candidates, however, wrote "embryo transplant" which was similar to "embryo transfer" given in the stem.

Part (c) asked candidates to identify one value-added product obtained from animal waste other than biogas. Candidates also had little difficulty in this section because of the hint given in the stem.

Part (d) (i) tested candidates' knowledge and understanding of the advantages of biotechnology in animal production. Many candidates could not explain the use of biotechnology in animal production, with many of them giving the advantages of artificial Insemination, or listing the advantages of biotechnology in plants.

Part (d) (ii) sought candidates' understanding of how the movement of genetically engineered products could be monitored in the Caribbean. Many candidates did not know this topic, although it is around us all the time – legislation, quarantine, testing products, and traceability. This clearly shows the inability of candidates to relate real world events to concepts and content encountered in the school curriculum.

### **RECOMMENDATIONS TO TEACHERS**

Based on its assessment of the candidates' performance during the 2009 examination, the Examining Committee wishes to make the following recommendations to teachers preparing students for future examinations.

- The emphasis in the new syllabus is on agriculture as a business, teachers should therefore place emphasis on methods that would add value to products, for example, harvesting and post-harvesting of crops and efficient production of livestock.
- Teachers should clearly distinguish between biotechnology and traditional techniques.
- Teachers should note that practice is necessary in aspects of the syllabus where students are required to perform calculations.

**CARIBBEAN EXAMINATIONS COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE**

**MAY/JUNE 2010**

**AGRICULTURAL SCIENCE  
SINGLE AND DOUBLE AWARD**

**GENERAL PROFICIENCY**

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## GENERAL COMMENTS

The Agricultural Science syllabus comprises the Single Award and the Double Award. Three units of the content are common for both awards, namely:

- A – The Business of Farming
- B – Crop Production
- C – Animal Production

The Double Award consists of two additional units:

- D – Horticulture
- E – Animal Husbandry

The examination consisted of two external papers for the Single Award. Paper 01 consisted of 60 Multiple Choice items, 20 each from Units A, B and C of the syllabus. Paper 02 consisted of six structured questions, two from each unit, and three extended essay questions, one from each unit. The structured questions were each worth four marks and the extended essay questions were worth 12 marks each. All questions were compulsory.

Paper 03 was the School-Based Assessment, worth 80 marks. This consisted of two cost analyses, one each on Crop Production and Animal Production, and ten practical skills based on field work.

The Double Award consisted of Paper 01 and Paper 02, common papers for the Double and Single Awards. Paper 03 consisted of two compulsory extended essay questions based on Section D and two compulsory extended essay questions based on Section E of the syllabus. Each question was worth 15 marks.

Paper 04 was the School-Based Assessment, worth 120 marks. It consisted of three cost analyses, ten practical skills and a research project.

A total of 8,998 candidates were entered for the examination, 6,935 for the Single Award, and 2,063 for the Double Award. This represented an increase of approximately 16 per cent for the Single Award and 11 per cent for the Double Award.

Overall, candidates' performance was good. Approximately 91 per cent of the candidates achieved acceptable grades, Grades I – III, for the Single Award, while 90 per cent achieved similar grades for the Double Award. Performance improved on the three papers for the Single Award, while for the Double Award, performance improved on Paper 01 and Paper 02 but declined significantly on Paper 03, the essay paper.

## DETAILED COMMENTS

### Paper 01 – Multiple Choice

This paper consisted of 60 Multiple Choice items distributed as follows:

Business of Agriculture	20
Crops and Soils	20
Animal Science	20

Table 1 shows the number of questions per unit, the difficulty index, mean and standard deviation (SD) for candidates for the Single and Double Awards.

**Table 1: Performance of Candidates in the Multiple Choice Paper by Units**

UNITS	Number of Questions	Difficulty Index	
		Single Award	Double Award
Business of Agriculture	20	0.52	0.63
Crops and Soils	20	0.53	0.60
Animal Science	20	0.57	0.64
<b>Overall Difficulty Index</b>		<b>0.55</b>	<b>0.63</b>
OTHER PARAMETERS – Paper 01			
MEAN		32.66	37.44
STD. DEV		7.55	7.22
MEAN %		54.43	62.40
MODE		32	39
RANGE		1–54	11–57

For both awards, candidates experienced difficulties with the following topics:

- Guaranteed price as a means of price support
- Benefits of a cooperative
- The guard cells as the structures that regulate water loss in a leaf
- The most appropriate tool for pruning tomato plants (the secateurs)
- Drying and canning as two techniques in processing tomato (not chilling)
- The symptoms of foul brood in a hive

## Paper 02 – Structured and Extended Essay Questions

Section I consisted of six compulsory questions, each worth four marks.

### Question 1

	Mean	Standard deviation
Single Award	0.78	0.73
Double Award	0.91	0.80

Part (a) tested candidates' knowledge of the ways in which governments offer incentives to farmers. The question provided a stimulus by naming one type of incentive and asked candidates to list two others. Most candidates correctly named two other incentives such as guaranteed markets, easy repayment for credit and providing land security through ownership.

Part (b) tested candidates' understanding of the concept of 'sustainable agriculture'. Candidates performed poorly, with most providing responses that were correct for 'agriculture' as presently practised in the region while not capturing those principles important to 'sustainable agriculture'. A correct response could have been:

*Sustainable agriculture promotes conservation and preservation, so that resources are replenished and remain available to future generations. It reduces pollution, supports biodiversity and is socially just.*

### Question 2

	Mean	Standard deviation
Single Award	2.86	1.02
Double Award	3.12	0.89

Part (a) required candidates to list contributions made by the agriculture sector to the national economy. Performance was unsatisfactory. It is believed that many candidates misunderstood the question and as such provided the names of local and regional agricultural institutions such as the Caribbean Agricultural Research and Development Institute (CARDI) and the Inter-American Institute for Co-operation in Agriculture (IICA) as responses. Examples of contributions are *employment, reduction in rural poverty, contribution to GDP and food security*.

Part (b) required candidates to suggest ways in which the Ministry of Agriculture can support young people involved in agricultural production. All candidates attempted this question and most of the responses were good. Candidates who performed well identified areas of support such as provision of subsidies/inputs, for example, tools and equipment, access to land, credit/loans; provision of extension services; opportunities for education/training; assisting farmers with marketing of produce through provision of transportation and promoting agricultural tours and competitions that target young people. The most popular incorrect response was that the Ministry of Agriculture should offer more job opportunities to young people.

Question 3

	Mean	Standard deviation
Single Award	2.25	1.34
Double Award	2.53	1.25

In Part (a) candidates were required to explain how water causes soil erosion. This part of the question was generally very well done. Candidates who performed well correctly stated that water washes away the top soil.

Part (b) required candidates to name conservation techniques to reduce soil erosion. Candidates were able to suggest contour tillage and drains, terraces, addition of organic matter, to name a few.

Question 4

	Mean	Standard deviation
Single Award	1.48	1.06
Double Award	1.63	1.06

Part (a) assessed candidates' knowledge of factors affecting seed germination. Most candidates could not list correct answers such as lack of oxygen (poor soil aeration), inadequate moisture (drought), and less than optimal temperature.

Part (b) provided information about germination under two different conditions. For the first part of the question, candidates could not deduce that the old trays may have been affected with diseased organism, thus affecting the growth of the seedlings. However, for the second part of the question, they were able to correctly state sanitation as a means of solving the problem.

Question 5

	Mean	Standard deviation
Single Award	1.42	1.13
Double Award	1.83	1.21

The focus of this question was digestion in poultry and ruminants. In Part (a) candidates were given diagrams of the two digestive systems and asked to name the parts labelled. The responses were excellent.

For Part (b), candidates were required to apply their knowledge of the functions of the digestive systems. In many cases, the candidates correctly mentioned that food materials were broken down in the rumen, but they were not as detailed in identifying that microbes were responsible for this breakdown, neither did they indicate that energy was produced from the digestion of grass/cellulose/fibre.



Question 6

	Mean	Standard deviation
Single Award	1.36	1.13
Double Award	1.83	1.21

This was a two-part question that tested candidates' knowledge and understanding of forage production, forages and their importance in milk production.

Part (a) presented candidates with a list of forages and requested them to name one legume and one grass from that list. Most candidates correctly named a legume (stylosanthes or kudzu) and a grass (para or antelope). A few provided names of grasses and legumes that were not given in the list.

Part (b) presented a situation in which milk production decreased as a result of a decrease in forage production; candidates were required to advise on measures that can be implemented to correct that problem. The responses were generally poor and in many instances it appeared that candidates may have misinterpreted the question. Too many candidates gave responses that were appropriate for conservation and provision of water rather than addressing the forage production problem, such as forage conservation (silage, hay), fertilize native pastures and introduce intensive or semi-intensive rearing systems.

Section II consisted of three compulsory extended response questions, each worth 12 marks

Question 7

	Mean	Standard deviation
Single Award	3.95	2.47
Double Award	5.14	2.60

Demand and supply and the law of diminishing returns were the concepts being assessed in this question. Generally, candidates' performance was poor.

Two graphs were given — a supply graph and a demand graph. Each graph was appropriately labelled and the Price and Quantity axes were also fully labelled. Part (a) asked candidates to explain what occurs at a particular point on the demand curve. The stimulus given in the question specifically asked candidates to provide their explanations relative to Price and Quantity. The correct response expected was: *At Price \$2.00, a quantity of 200 kg of tomato would be demanded.*

Part (b) required candidates to interpret directly from the graphs and to determine the likely responses of the farmers and consumers when the price of tomato increased. The majority of candidates correctly read from the graph and provided the correct response to that part of the question. However, when candidates were asked to suggest ways by which the consumers and farmers would most likely respond to an increase in price, the responses were varied.

Many candidates received full or partial credit for correctly suggesting that *the consumer would purchase less, demand would decrease, consumer would use alternatives/substitutes/seek a cheaper source or consumers would grow their own tomato*. However, candidates were unable to say that the farmers would respond by offering more for sale and by increasing production.

Part (c) required candidates to suggest measures which Caribbean governments could take to prevent the scarcity of tomato. The responses were generally good. The most popular correct responses were *import tomatoes; encourage farmers to increase production of produce year round; remove taxes and offer subsidies on inputs*.

Part (d) assessed candidates' knowledge of the law of diminishing returns, using an example of a crop on a farm. Most candidates could not apply their knowledge to a crop.

Generally, candidates performed poorly on this question. Most demonstrated knowledge of the concepts 'Supply' and 'Demand' but showed an inability to interpret information provided on the graphs.

#### Question 8

	Mean	Standard deviation
Single Award	4.55	2.05
Double Award	5.11	2.08

This question tested candidates' knowledge of weeds and how they affect crop growth, development and production. It also tested candidates' knowledge of weed control.

Generally, candidate performance on this question was very good. Part (a) asked candidates to list ways in which weeds can affect crop growth and yield. Most candidates gave correct answers such as *competition for nutrients, sunlight, water and space*.

Part (b) was an application of knowledge question based on a scenario. For Part (i), candidates were able to identify chemical weed control. However, for Part (ii), they had difficulty formulating reasons for the persistence of weeds. They were expected to say that *weeds developed resistance to the chemicals* and that *a selective herbicide was used*.

Also creating some challenge was Part (iii) — cultural practices to control weeds. Candidates could have said flood fallowing, mulching, intercropping, high planting density or ploughing before planting.

Question 9

	Mean	Standard deviation
Single Award	3.06	2.14
Double Award	4.10	2.24

Knowledge of poultry production was required here. In Part (a), many candidates did not seem to know that the incubation period for broiler eggs is 21 days. The purpose of candling hatching eggs — to check the stage of development of the embryo — was also not known, neither was the ration (laying) to be fed to laying hens.

Part (b) provided a diagram of a brooding pen and asked candidates to identify the problem in the pen and state how the problem could be corrected. Generally, the responses provided were extremely poor. Almost all the candidates failed to correctly identify the problem as too much heat from the heat source and therefore, could not offer a solution to the problem.

Part (c) focused on the management of birds during the brooding period and tested candidates' ability to apply theoretical knowledge to the practical management of birds on a farm. The question also required candidates to focus their responses on feed management practices and management of litter quality. The responses were generally satisfactory, with some candidates correctly advising that the feed should be

- free from mould
- from a reputable company
- broiler starter or a high protein feed.

Candidates also advised that the litter should be clean and dry.

Part (d) of the question assessed candidates' ability to identify the disease coccidiosis, from the symptoms given, and to provide management practices to correct the problem.

Most candidates identified the disease but could not give management practices specific to coccidiosis, such as *use coccidiostats and ensure clean, dry litter*.

**Paper 03 – Extended Essay Questions (Double Award Only)**

This paper consisted of four essay-type questions, two questions from Section D (Horticulture) and two from Section E (Animal Husbandry). Each question was worth 15 marks.

Question 1

	Mean	Standard deviation
	3.59	1.92

Knowledge of banana cultivation was required in this question. Performance was poor.

In Part (a), candidates were given a drawing from which they were to name the cropping system and state the advantages and disadvantages of the system. Many candidates correctly named intercropping. Some were able to state advantages such as *higher yields, year round production* and *reduction in erosion*; and disadvantages such as *difficult to mechanize and to control pests and diseases*.

Part (b) (i) asked candidates to name a cultivar of banana suitable for export and to provide a reason why the named variety is suitable for the export market. The responses to this question were generally fair.

In Part (b) (ii), candidates were given a diagram to identify the planting material. The responses were poor. Candidates could not identify A as a sword sucker, B as a maiden sucker and C as a bullhead or corm.

Part (b) (iii) required candidates to discuss management practices used in the selection and preparation of planting material for the establishment of a banana crop. The responses to this question were mixed; while many candidates correctly identified 'resistant varieties' and 'high yielding varieties', too many candidates misinterpreted the question and identified land preparation practices.

In Part (b) (iv), candidates were given a diagram depicting a common cultural practice used to produce high quality bananas and asked to identify three other cultural practices specific to the management of the banana bunch which contribute to high quality banana. Most could not identify the following:

- Remove the male bud at the end of the bunch
- Remove the lower hand of the bunch
- Sleeve or cover the bunch
- Stake the plant to prevent it from toppling over

## Question 2

Mean	Standard deviation
3.27	2.28

This question tested candidates' knowledge of the following:

- Cultivars or varieties of anthurium flowers grown in the Caribbean region
- Characteristics of high quality anthurium flowers
- Methods of propagating anthurium flowers

The question also tested candidates' ability to apply their knowledge of the production process for anthuriums in the areas of site selection, shed design, harvesting and postharvesting practices and grading and packaging. Candidate performance was poor.

Part (a) (i) required candidates to name two varieties of anthuriums grown in the Caribbean and some candidates correctly named Caribbean Pink, Fla-red, Fla-king and Tropical. Some of the characteristics of high quality anthurium flowers correctly listed were *well-shaped flower, free from*

*pests and diseases* and *minimum peduncle length*. Most candidates did not know methods of propagating anthuriums such as adventitious shoots, suckers, seeds and tissue culture.

Part (b) proved more challenging for candidates and this may have been because the questions were more specific to management practices carried out during production.

For Part (b) (i), many candidates presented answers based on soil type rather than on site selection and for Parts (b) (ii) and (iii), they confused harvesting and postharvesting practices with grading and packaging practices.

A noticeable trend in responses to this question was that in instances where specificity was required the responses of candidates were very vague and meaningless. A few examples of such responses were:

- Temperature should be right
- Shed should be well placed
- Packaging should be well done.

### Question 3

Mean	Standard deviation
4.08	2.67

This question was a four-part one in which the principal focus was swine production.

Parts (a) (i) and (ii) required candidates to name breeds of pigs with good mothering ability and good meat production. While the majority of candidates correctly named one breed each, only a few candidates correctly named two breeds each.

Part (b) required candidates to state the gestation period of sows. The majority of candidates responded correctly by stating 114 days.

In Part (c), candidates were required to discuss management practices that can be used to correct the problems of scouring and crushing of piglets by the mother. For scouring, the majority of candidates adequately discussed one practice such as *sanitation* or *vaccination* or *medication*. However, only a few candidates discussed two management practices to correct scouring.

The responses to the management practice for crushing were generally weak. However, a few candidates correctly discussed practices such as providing adequate spacing in pen, separating piglets from sow, installing farrowing crates. For the incorrect responses received, many candidates viewed 'crushing' as a disease, and as such discussed practices such as vaccination and consulting the veterinarian.

Part (d) required candidates to discuss three management practices that could be used to increase litter size. The responses were generally poor. Special mention must be made of those candidates who discussed management practices that were correct, as the responses were wide ranging and covered practices such as:

- Use of superior sires
- Embryo transfer
- Artificial insemination
- Use of fertility drugs
- Use of superior sows and gilts with high prolificacy

#### Question 4

Mean	Standard deviation
7.17	2.74

The question tested candidates' knowledge of the following:

- Processing and quality of meat and milk products
- Handling and storage of milk and milk products
- Biotechnology and artificial insemination

Generally, candidate performance was average.

Part (a) (i) required candidates to name one processed food from chicken. The response to this question was excellent. Part (a) (ii) required candidates to state two characteristics which contribute to the quality of meat. Many candidates were able to name *colour*, *marbling*, *flavour* and *aroma*.

Part (b) provided candidates with a labelled diagram of a pig and asked candidates to name two of the labelled parts. The responses were generally satisfactory with the majority of candidates naming either the shoulder or the loin.

Part (c) presented a scenario on the spoilage of milk. In Part (c) (i), candidates were asked to name the organism which causes milk spoilage. Most candidates provided a correct response to that question. For Part (c) (ii), candidates were required to suggest a reason for the presence of the organism in the milk. This question proved very challenging and most candidates were unable to suggest that

- the milk was not refrigerated after the carton was opened
- the glass was dirty hence contaminating the milk that was poured back in the box.

Part (c) (iii) asked candidates to suggest two ways to prevent spoilage of milk. Generally, the responses were good.

Part (d) dealt with the use of biotechnology in animal production. Generally, the responses provided were satisfactory.

### **CONCLUDING COMMENTS**

A glaring deficiency this year was the general inability of candidates across the region to correctly define key terms and concepts. Failure to correctly define key concepts and terms led to responses that lacked scientific soundness, were inaccurate and were generally poor. This report, therefore,

appeals to teachers to give particular attention to the definition of concepts and terms and to ensure that students master them.

The report concludes by providing a Glossary of Terms that were critical to success in the 2010 examination. Kindly note that the glossary which follows is in no way exhaustive, but simply serves to remind teachers that correctly defining key terms and concepts is important to students' success in Agricultural Science.

### **RECOMMENDATIONS TO TEACHERS**

Based on its assessment of candidates' performance during the 2010 examination, the examining committee wishes to make the following recommendations to teachers preparing students for future examinations.

- The emphasis in the new syllabus is on agriculture as a business. Teachers should therefore place emphasis on methods that would add value to products, for example, harvesting and postharvesting of crops and efficient production of livestock.
- Teachers should clearly distinguish between biotechnology and traditional techniques.
- Teachers should note that practice is necessary in aspects of the syllabus where students are required to perform calculations.

### GLOSSARY OF TERMS

Concept or Term	Definition
Afforestation	Planting of seeds or trees to make a forest of land which was never a forest or has not been a forest recently.
Agriculture	The production of food and other goods through farming.
Antibiotic	A substance or compound that either kills bacteria or inhibits the growth of bacteria.
Artificial Insemination	The process by which sperm from a male is placed into the reproductive tract of a female for the purpose of impregnating the female by using methods other than sexual intercourse.
Biodiversity	The variation of life forms that cohabit or exist within a given ecosystem, biome or on the entire earth.
Boar	A male swine (pig) that is not castrated.
Candling eggs	Incubated eggs are candled to determine whether they are fertile and if fertile, to check the growth and development of the embryo.
Cavendish banana	A cultivar of banana grown in the Caribbean primarily for export.
Chlorophyll	A green pigment found in all plants.
Climate	The average weather of a given region over a long period of time, commonly thirty years. Climate includes statistics of temperature, humidity, atmospheric pressure, wind and rainfall.
Coccidiosis	A parasitic disease of the intestinal tract of animals; it is caused by the coccidian protozoa.
Coccidiostat	An antiprotozoal agent that acts upon coccidian parasites.
Cover crops	Crops used as sustainable tools to manage soil fertility, soil quality, soil water, weeds, pests, diseases, diversity and wildlife, in agroecosystems.



Concept or Term	Definition
Crop rotation	The practice of growing a series of crops of different families in sequential seasons for various benefits. These benefits include, avoiding the buildup of pathogens and pests that often occurs when one species is continuously cropped; and to balance the fertility demands of various crops to avoid excessive depletion of soil nutrients.
Demand	The ability and willingness to buy a particular commodity at a given point in time at a given price.
Digestion	The mechanical and chemical breakdown of food into smaller components that can be absorbed into the blood stream.
Disease	An abnormal condition affecting an organism.
Drought	An extended period of time (months or years) during which a region records a deficiency in water supply. This occurs when the affected region receives below average precipitation.
Ecosystem	The total of all organisms living in a particular area, together with all the non-living, physical components of the environment with which the organisms interact. The physical components include air, soil, water and sunlight.
Erosion	The natural process of weathering and transport of solids (rocks, soil, sediments and other particles) from one place in their natural environment, to be deposited elsewhere.
Farrowing	The act of giving birth to a litter of piglets.
Feed	Food given to livestock.
Feed Conversion Ratio	A measure of an animals' efficiency in converting feed mass into increased body mass. It is calculated using the formula: food eaten divided by body mass gain.

Concept or Term	Definition
Food	Any substance or material eaten to provide nutritional support for the body. It is usually of plant or animal origin and contains essential nutrients such as carbohydrates, fats, proteins, vitamins or minerals.
Forage	Plant material, mainly plant leaves and stems, eaten by grazing livestock.
Germination	The process by which a plant or fungus emerges from a seed or spore and begins growth.
Gestation	The carrying of an embryo or foetus inside a female mammal.
Gros Michel	A cultivar of banana grown in the Caribbean primarily for export.
Gross Domestic Product	A measure of a country's overall official economic output. It is the market value of all final goods and services officially made within the borders of a country in a year.
Gross National Product	The total dollar value of all final goods and services produced for consumption by a country during a particular period of time. This includes those goods and services produced outside the borders of a country.
Harvesting	The process of gathering crop from the field.
Incentive	Any factor, financial or non-financial, that enables or motivates a particular course of action in respect to taking a specific choice over competing alternatives.
Infrastructure	The basic physical and organizational structures needed for the operation of a society or enterprise. The term is usually used to refer to technical structures such as roads, water supply, sewers, power grids and telecommunications.
Intercropping	The practice of growing two or more crops in close proximity in the same field. One usually matures before the other.

Concept or Term	Definition
Law of diminishing returns	The progressive decrease in the marginal production of a factor of production as that factor is increased. For example, in a farm production system with fixed and variable inputs, each additional unit of variable input, such as labour, leads to smaller and smaller increases in output. This also indicates that each workers' mean productivity is decreased.
Leaching	The loss of water-soluble plant nutrients from the soil due to excess irrigation.
Marginal product	<p>The extra output (Y) produced by the addition of one more unit of input (X). Put another way, it is the difference in output when the farm firms' labour is increased from five to six.</p> <p>The marginal product holds under the assumption that no other inputs to production change and it is defined mathematically as <math>MP = \Delta Y / \Delta X</math>.</p>
Market	Any one of a variety of different systems, institutions, procedures, social relations and infrastructures where persons trade, and goods and services are exchanged.
Masticate	To crush and grind food by the teeth. To masticate is to chew.
Mastitis	Inflammation of the breast tissue.
Mulch	A protective cover placed over the soil to retain moisture, reduce erosion, suppress weed growth and seed germination, and provide nutrients as they rot or decay.
National economy	This consists of the economic system of a country. This includes the labour, capital and land resources and the economic agents that socially participate in the production, exchange, distribution and consumption of goods and services of that country.

Concept or Term	Definition
Oestrus	The condition of being in sexual arousal, the term is applied particularly to the female.
Ovulation	The process in the female by which a mature ovarian follicle ruptures and discharges an ovum (also known as an oocyte, female gamete or egg).
Parturition	The action or process of giving birth to offspring.
Pasture	Land with vegetation cover used for grazing of livestock as part of a farm or in ranching, or any other unenclosed pastoral system used by wild animals for grazing or browsing.
Price	The quantity of payment or compensation given by one party to another in return for goods and services.
Price support	Either a subsidy or a price control, both with the intended effect of keeping the market price of a good or service higher than the competitive equilibrium.
Production	The act of manufacturing or making goods and services.
Quantity demanded	The total amount of goods and/or services that consumers demand at a particular price.
Quantity supplied	The total amount of goods and/or services that producers supply at a given market price.
Reforestation	The restocking of existing forests and woodlands which have been depleted.
Soil	A natural body consisting of layers (soil horizons) of mineral constituents of variable thickness, which differ from the parent material in their morphological, physical, chemical and mineralogical characteristics.
Soil conservation	A set of management strategies for prevention of soil being eroded from the earths' surface or becoming chemically altered by overuse, acidification, salinization or other chemical soil contaminants.

Concept or Term	Definition
Soil pH	A measure of the soil acidity or soil alkalinity.
Stomata	A pore found in the epidermis of the leaf and the stem of a plant; it is used for gaseous exchange.
Subsidy	A form of financial assistance paid to a business or economic sector such as the farm firm.
Supply	The amount of a good or service that is made available to consumers.
Sustainable agriculture	Sustainable refers to the capacity to endure. In agriculture, it describes how a production system can remain diverse and productive over time.
Tariff	A tax levied on imports and exports.
Tax	A financial charge imposed upon a taxpayer by a state or the functional equivalent of a state such that failure to pay the tax is punishable by law.
Temperature	A measure of the average kinetic energy of the particles in a substance. It tells how hot or how cold the substance is.
Terrace	A structure designed to prevent or slow down the rapid run off of irrigation water from sloping land.
Waterlogged	Soaked or saturated with water, as in waterlogged soil.
Weather	The state of the atmosphere over a particular region measured as hot or cold, wet or dry, calm or stormy, clear or cloudy.
Weathering	The breaking down of the earth's rocks, soils and minerals through direct contact with the planet's atmosphere.
Wind breaks	A plantation usually made up of one or more rows of trees or shrubs planted in such a manner as to provide shelter from the wind and to protect soil from wind erosion.

**CARIBBEAN EXAMINATION COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATION**

**MAY/JUNE 2011**

**AGRICULTURAL SCIENCE  
GENERAL PROFICIENCY EXAMINATION**

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## **GENERAL COMMENTS**

Agricultural Science offers the Caribbean student a choice between two options, the Single Award (SA) and the Double Award (DA) option.

The examination comprised two written papers for the Single Award and three written papers for the Double Award, as well as a practical component called the School-Based Assessment (SBA), for both the SA and DA.

Paper 01 comprised 60 multiple-choices items. Paper 02 comprised nine compulsory structured-type questions. These two papers were common to the SA and DA. Paper 03, written by Double Award candidates only, was a compulsory paper with four structured essay questions. The SBA component was conducted in the school and the school farm environment. Candidates were tested on a number of skill objectives set out in the syllabus, and on cost analyses based on their crop and animal production activities. The DA required candidates to conduct a research project, in addition to the other SBA requirements.

This report outlines candidates' overall achievements and achievement on content profiles, namely:

Profile 1 – The Business of Farming

Profile 2 – Crop Production

Profile 3 – Animal Production

## **DETAILED COMMENTS**

### **Paper 01 – Multiple Choice**

This paper consisted of 60 multiple-choice items, each worth one mark. Candidate performance was good, with a mean of 64 per cent for the DA and 56 per cent for the SA.

Candidates had difficulty with questions that were based on the following topics:

- Produce consumed by the farm family being considered as an income
- Identifying a partial budget from the information given
- The function of potassium in plants
- The use of a chisel plough
- Spraying crops with a knapsack sprayer should be done in the direction of the prevailing wind
- Plant tissue culture
- Characteristics of zero-grazing
- Embryo transfer
- Day-old chicks should be kept at a temperature of 36.7 °C

### **Paper 02 – Structured Questions**

This paper consisted of two sections. Section I comprised six questions, each worth four marks. Section II comprised three longer response questions, each worth 12 marks.

#### Question 1

Candidates were informed that a farmer obtained ten hectares of arable land for the purpose of Agriculture.

Part (a) required that candidates state two factors of production that this farmer must consider. This part of the question was well answered with responses such as *labour*, *capital* and *management*. However, some candidates offered 'land' as a response even though it was stated in the stem of the question.

Part (b) informed candidates that the farmer completed a loan application form, but was unsuccessful in obtaining the loan. They were required to suggest two criteria that are necessary to obtain a loan. Candidates responded well to this part and many of them scored maximum marks. Some correct responses included *collateral*, *ability to repay*, *records and project proposal*. Some poor responses that were not credited were 'possession of an ID card', 'be a member of a farmers' group' and 'farmers must be educated'.

### Question 2

The preamble to this question stated that Caribbean agriculture is affected by many constraints (challenges) one of which is a negative attitude towards agriculture. Many candidates failed to offer any response, while a few candidates failed to score any mark even though they responded to both sections.

Part (a) required candidates to name two other constraints that affect agriculture in the Caribbean. Some candidates responded well and scored maximum marks. However, some candidates suggested 'negative attitude towards agriculture', even though this was stated in the question. Popular correct responses included *praedial larceny*, *capital* and *land tenure*.

Part (b) asked candidates to provide two arguments to convince their fellow students to become involved in agriculture. Some candidates misinterpreted the word *arguments* and presented dialogues as their response. A few candidates offered a definition of the word agriculture and as such this response was not credited.

Responses that were considered too vague included 'GDP', 'provide for basic needs' and 'decrease, global warming'. Those candidates who gained marks gave responses such as *agriculture provides for wide range of career options, leisure activities, a source of income, a source of food and a foreign exchange earner*.

It is suggested that teachers make use of correct terminology (*challenges*, *constraints*, and *arguments*) as outlined in the syllabus so that students may be more exposed to these terms and can interpret them correctly.

### Question 3

This question tested candidates' knowledge of crop rotation. The opening statement mentioned the fact that crop rotation is often recommended to farmers because it reduces levels of pests and diseases. Performance was less than average.

Part (a) asked candidates to briefly explain how crop rotation reduced pests and diseases. Responses were satisfactory. Many candidates made the link between the different families of crops and the reduction in pests and diseases.

Part (b) indicated that a farmer wanted to grow corn, sweet potato, beans and lettuce. It was necessary that candidates complete a crop rotation sequence as given in the diagram, starting with corn. Responses were fair with many candidates demonstrating a good knowledge of the sequencing of crops in a rotation, and in particular that a leaf crop should follow the legume crop.



#### Question 4

This question dealt with soil compaction on tuber production of yam.

Part (a) required that candidates name the part of the plant that is used for propagating yam. The most common correct responses were *head*, *stem*, *tuber*, *bud* and *eye*. The most common incorrect response was the 'use of roots'.

Part (b) stated that the plot of yam became heavily infested with weeds. Candidates were required to state one effect that situation was likely to have on the production of yam. This was fairly well done with the common responses being *lack of/ competition for nutrients*, *reduction in quality and quantity of tubers*.

Part (c) showed a table demonstrating the effect of soil compaction on tuber yield in yam. This was not well done. Some candidates saw the inverse relationship between soil compaction and tuber yield but could not express that information properly, while others were simply unable to interpret the table.

Part (d) sought to test candidates' knowledge of the removal of soil compaction. Candidates were asked to recommend one piece of tillage equipment that could be used to break up the compacted layer of soil. Few candidates knew the correct response – *subsoiler* or *chisel plough*. Many candidates stated 'disc plough', 'fork, hoe' or 'tractor'; some of them even suggested wetting the soil, for which no marks were awarded.

#### Question 5

This question dealt with rabbit production. Candidates performed poorly.

Part (a) required candidates to state two breeding methods used in rabbit production. This was poorly answered by most candidates. Incorrect responses included 'artificial insemination', 'natural and artificial breeding', 'self-mating', 'genetic engineering'. Correct responses included *line breeding*, *pure breeding*, *upgrading* and *cross breeding*.

In Part (b), candidates were asked to suggest two qualities or traits, other than high growth rates, in the selection of rabbits to improve production. Performance was slightly better with some candidates being able to suggest desirable traits like *healthy animals*, *pedigree*, *conformation* and *performance*, *good FCR/DP*. Incorrect responses included 'location of the farm', 'improved housing', 'good eating habits', 'good sanitation' and 'wool and fur production'.

#### Question 6

This was a two-part question that tested candidates' knowledge and understanding of the structure of a ruminant and non-ruminant digestive tract and water conservation in a pond.

Part (a) showed two diagrams, one with the digestive tract of a goat and another with the digestive tract of a broiler bird, with a part labelled X on the goat and a part labelled Y on the broiler. Candidates were asked to identify the structures labelled X and Y. Most of them were able to correctly identify the *rumen* and the *proventriculus*. However, candidates had difficulty spelling these terms correctly.

Part (b) informed candidates that a farmer dug a shallow pond on a clayey soil. After filling the pond, the water almost completely drained out. Candidates were required to suggest the most likely cause of the problem and to recommend one solution to the problem. While many candidates were able to suggest that there might have been cracks in the pond, or that it was poorly compacted, several candidates were unable to offer correct responses.

Most candidates could not offer a solution such as *dig a deeper pond* or *line the pond with polythene*.

#### Question 7

This question tested concepts and skills critical to the business of farming, in particular the importance of keeping records and financial accounts. Candidate performance was average.

Part (a) presented an incomplete table showing the breeding record of a Doe. Candidates were required to fill in the missing data in the correct order using the information supplied. Most of them were able to give correct responses and so scored the maximum number of marks. The correct response was *Date mated, Date Kindled, Date Weaned*, in that order.

In Part (b), there was a table showing the financial accounts of a mixed farm. Part (b) (i) required candidates to list variable and fixed costs. Some listed the items, some stated the value and some did both items and value. The correct responses for variable costs were: *cost of seeds = \$5 000; cost of feed = \$50 000; casual labour = \$10 000; replacement does = \$55 000*. For fixed costs, the correct responses were: *housing and equipment = \$100 000; farm operator salary = \$20 000*. Most candidates were able to identify two variable costs and at least one fixed cost.

Part (b) (ii) required candidates to calculate the gross income and net income, showing all working. This was poorly done. Many candidates added the expenditure items to the income items to get the gross income and net income, which was incorrect. Most candidates failed to recognize subsidy as an income item. The correct responses were: *gross income was the total income from the sale of goats and corn, as well as the subsidy; net income was determined by the gross income minus total costs*.

In Part (b) (iii), candidates were asked to state whether or not the farmer's business was successful and to explain their answer. Most of the responses were correct in that candidates saw the link between income, expenditure and profit, and so responded with *yes, the business was successful because it made a profit*.

#### Question 8

This question tested candidates' knowledge of fertilizers, mulch and cultivation practices of a leaf and a root crop. Candidates performed poorly.

Part (a) (i) asked candidates to state two effects that the overuse of fertilizers may have on the environment. Good responses included *burn the plants, pollution, soil acidity*.

Part (a) (ii) required candidates to state one benefit of mulching. Most candidates responded correctly to this part of the question. Correct responses included *reduces water loss; adds nutrients to the soil; controls weeds*.

Part (b) required candidates to compare (similarities and differences) the cultivation practices of a leaf crop and a root crop on flat land under the headings *land preparation, fertilizer application, and harvest and postharvest handling*. This was most challenging for candidates. They demonstrated some knowledge of the agronomy of the different crops but failed to compare the two crops.

For land preparation, correct responses were: *removing weeds and tilling the soil to a fine tilth, for both crops; make flat top beds for leaf crop, and ridges and furrows for root crop*.

For fertilizer application, *adding organic matter and nitrogenous fertilizer for leafy crop* (and in the early stages of growth for root crop), *and mixed fertilizer for root crop* were good responses.

*Harvesting and postharvesting.* Many candidates knew that the method of harvesting a leafy crop is by the use of a knife, and a fork or digging tool is used for a root crop. They also knew that the leafy crop is reaped earlier than the root crop. Some candidates, however, simply mentioned that when the crop is ready it should be harvested, which earned them no marks.

#### Question 9

This question assessed candidates' knowledge of breeds of animals, and diets and diseases of rabbits. Candidate performance was poor.

In Part (a), candidates were required to name a meat breed for each of the following classes of livestock: pig, goat and rabbit. Many candidates gave examples of classes and types of livestock and frequently, the names of any breed of livestock. Some correct responses included *Landrace and Large White (pig)*, *Anglo Nubian and British Alpine (goat)*, and *Flemish Giant and New Zealand White (rabbit)*. However, most of the incorrect responses given were 'pork', 'bacon', 'Jersey' and 'Saanen'.

Part (b) presented a table on a feeding experiment on rabbits. This experiment was carried out over a four-week period to evaluate the performance of rabbits on a forage diet and on a concentrate diet. In Part (b) (i), candidates were asked on which of the diets the rabbits gained more weight. The correct response was *concentrate diet*. In Part (b) (ii), candidates were required to calculate the increase in average weight of the rabbits on the concentrate diet. The correct response was 1 kg which was found by using the formula,  $1.4\text{kg} - 0.4\text{kg}$ .

In Part (b) (iii), candidates were informed that at the end of four weeks, an average of 4.2 kg of feed was consumed by each rabbit. Candidates were required to calculate the Feed Conversion Ratio on the concentrate diet, using the data presented in the table. Performance was poor. The correct response was 3, calculated by dividing 4.2 kg by 1.4 kg.

Part (b) (iv) required candidates to explain the importance of Feed Conversion Ratio in livestock production. Most candidates attempted this part and were able to give a correct answer, such as *to inform farmers of how well the rabbits were performing/converting food to meat*.

Part (c) stated that one rabbit in the experiment showed the following signs: frequent shaking of its head, scabs in the ear, and a foul-smelling substance oozing from the ear. Candidates were asked to suggest the likely cause of the condition and to state two methods of control. Candidates' ability to answer this question which required application of knowledge proved to be challenging. Most of the responses such as 'diseases', 'mastitis' and 'nutritional disorders' were incorrect. The correct response should have indicated an *ear infection*.

Because of the incorrect answers given above, the responses for the treatment followed the same pattern, for instance, 'take the animal to the VET', 'kill the animal', and 'administer antibiotics'. The correct response included *proper sanitation, use of acaricides and vegetable oil*.

### **Paper 03 – Structured Essay**

This paper consisted of four compulsory structured essay questions, two from Section D (Horticulture) and two from Section E (Animal Husbandry) of the syllabus. Only candidates taking the Double Award option were required to write this paper.

#### Question 1

Knowledge of the cultivation of oranges was being assessed by this question. Candidate performance was average.

Part (a) required knowledge of the popular varieties of oranges in the Caribbean and two features that make them popular. Many of the candidates were able to address the first part correctly and most were able to identify the characteristics. The most popular variety named was *Valencia* and characteristics were *colour*, *size* and *juiciness*. Incorrect responses included different kinds of citrus, for example, 'lime', 'grapefruit and tangerine', and even 'sour' or 'sweet' oranges.

Part (b) tested the candidates' knowledge of the features of the oranges that would indicate that they were mature and ready for marketing. *Maturity*, *colour* and *size* were the most popular correct responses, while 'smell' and 'acidity' were popular incorrect responses.

In Part (c), candidates were given a diagram that indicated a farmer cultivating oranges on the windward side of a steep mountain. They were required to discuss two constraints (challenges) that the farmer was likely to encounter in cultivating oranges on that hillside and to suggest one strategy that he could use to overcome each constraint. Many candidates were able to correctly give the constraint but not the corresponding strategy. The most popular correct answers were *erosion*, *damage to trees* and *difficulty in transport*. For strategies, *contour farming*, *windbreaks* and *the use of animal transport* were accepted. Other correct responses included *lack of water*, *management difficulties* and *irrigation*.

Part (d) challenged candidates to describe how the farmer can improve the quality of his oranges for the market, through proper techniques of harvesting and transportation. Many candidates were able to give two correct responses for each of the techniques. The most popular were *hand picking*, *packing containers*, *harvesting at the right stage of maturity* and *during the cool periods of the day*.

## Question 2

Establishing and managing a lawn was the focus of this question. Candidates did not perform very well.

Part (a) (i) asked candidates to identify three grasses which were recommended for establishing lawns in the Caribbean. Many candidates responded correctly with grasses such as *Bermuda* and *Turf*. In many instances, though, candidates suggested pasture grasses such as 'Elephant' and 'Pangola'.

Part (a) (ii) required candidates to identify two other methods of establishing a lawn except by the use of sod. Many candidates were able to identify correctly at least one method used, such as *seeds*, *cuttings* and *sprigs*.

For Part (b), candidates had to discuss the techniques of lawn establishment and maintenance on sandy soils under the following headings: *land preparation*; *planting and establishing*; *fertilizer* and *irrigation*; *pest and weed control*; and *mowing*.

For land preparation, most candidates had some knowledge of the operations involved. Some of the correct responses were *clear the land*, *till*, *incorporate organic matter*, *level* and *grade*.

For planting and establishing, correct responses included *prepare planting material*, *transport*, *dig holes/disperse seeds* and *irrigate*.

For fertilizer and irrigation, there was some confusion, as candidates interchanged drainage with irrigation, and suggested that deep drains should be dug to get rid of excess water. The fact that the soil was sandy seemed to escape candidates and thus led to their false suggestion that it must not be irrigated regularly since it cannot hold water. Some of the correct responses were *incorporate high phosphorus fertilizer at planting time*, *apply high Nitrogen fertilizer at monthly intervals*, *irrigate immediately after planting*.

For pest and weed control, practices such as *identify the pests and weeds, use pesticides at recommended rates* and *integrated pest management (IPM)* were credited.

For mowing, most candidates correctly identified the use of the lawn mower but failed to mention the critical aspects of *height, regularity* and *removal of clippings*.

### Question 3

Knowledge of dairy production was assessed by this question. Performance was below average.

In Part (a) (i), candidates were asked to identify two breeds of dairy cattle reared in the Caribbean. Accurate responses included *Jersey, Jamaica Hope* and *Holstein*. Some inaccurate responses were 'breeds of swine', 'sheep' and 'goat'.

Part (a) (ii) required candidates to identify three characteristics of a good dairy breed. Accurate responses included *wedge shape, high milk yield, docile and well-developed udder*.

Part (b) indicated that a cow died immediately after giving birth to a calf. Candidates were required to explain two management practices in caring for the calf up to weaning. Some correct responses included *use of artificial or substitute colostrums, bottle feed, fostering, isolate the calf*. However, candidates had difficulty explaining the practices.

Part (c) informed candidates that a cow on pasture showed signs of scouring, had a ruffled coat and distended abdomen. Candidates were asked to identify the organism that most likely caused the condition and to explain three management practices to prevent and control that condition. Few candidates were able to respond with the correct answer — roundworms. The most common incorrect answer given by the majority was 'bacteria'. Acceptable responses for the treatment and control of roundworms were *deworming, rotational grazing* and *proper sanitation*.

Part (d) stated that embryo transplant was a new technology being used in the dairy industry. Candidates were required to suggest two benefits of using that technology. Some candidates were able to respond with at least one benefit, such as *upgrading the herd* and *reducing the transfer of sexually transmitted infections*. Some candidates confused the process with artificial insemination.

### Question 4

This question assessed candidates' practical knowledge of rearing poultry. Candidate performance was average.

Part (a) showed a diagram of the reproductive system of a hen with the infundibulum, shell gland and cloaca labelled, and two unidentified parts labelled X and Y. For Part (a) (i), candidates were required to label X and Y. The correct answers were *X as the ovary and Y as the magnum*.

Part (ii) required one function of each of the following parts: infundibulum (funnel), isthmus, and uterus. Candidates had difficulty stating the function of the parts. *The infundibulum is the site for fertilization, the isthmus is the site for shell membrane formation, and the uterus is the site for shell formation*. The reproductive tract was mistakenly identified as the digestive tract of the hen, hence, candidates named the parts of the reproductive tract as the proventriculus, duodenum and gizzard.

In Part (b) (i), candidates were asked to recommend an appropriate feeding regime for layers from day old to the time of laying. Correct responses were *starter from 1 to 6 weeks, grower from 6 to 17 weeks* and *layer ration after 17 weeks*.

Part (b) (ii) stated that some of the hens on the farm produced eggs with thin, soft shells. Candidates were required to suggest one way that that condition could be corrected. Correct responses were *add oyster shells or increase the calcium content of the feed*.

Part (b) (iii) required candidates to state the term used to describe *feather pecking* and to explain two management practices that could be used to correct it. Cannibalism was mistaken for the disease Coccidiosis. The management practices required for cannibalism were *adequate spacing, debeaking, proper ventilation* and *vision inhibitors*.

Part (c) showed a diagram of an egg grader and a diagram of a basket of eggs with the weight of each egg shown. Candidates were asked to identify the total number of eggs for each of the following categories: small, medium and large. Most candidates were able to use the egg grader to grade the eggs.

**CARIBBEAN EXAMINATIONS COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION**

**MAY/JUNE 2012**

**AGRICULTURAL SCIENCE  
GENERAL PROFICIENCY EXAMINATION**

## **GENERAL COMMENTS**

Agricultural Science offers the Caribbean student a choice between two options, the Single Award (SA) and the Double Award (DA).

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This report outlines candidates' overall achievement on content profiles, namely:

Profile 1 – The Business of Farming

Profile 2 – Crop Production

Profile 3 – Animal Production

## **DETAILED COMMENTS**

### **Paper 01 – Multiple Choice**

Although performance on this paper was good, there was a decline when compared with 2011. Candidates had difficulties with:

- Defining the term *interest* as it relates to a loan
- Benefits of a cooperative
- Soil pH
- Leaf structures that regulate water loss
- Pasteurization of milk

### **Paper 02 – Structured Questions**

This paper consisted of two sections. Section I comprised six questions, each worth four marks. Section II included three longer response questions, each worth 12 marks.

#### **Section I**

##### Question 1

This question tested candidates' knowledge and understanding of agricultural careers pertaining to crops and livestock. Candidates were also required to apply their knowledge of biotechnology for the improvement of crops and livestock production. Part (a) (i), required candidates to identify agricultural careers associated with crop and livestock management, while Part (a) (ii) tested candidates' knowledge of careers related to diseases in livestock.



For Part (a) (i), the majority of candidates responded well and scored maximum marks. However, some candidates suggested incorrect careers/terms such as agronomist, horticulturist, entomologist, and even agricultural engineer. Popular correct responses were *extension officer*, *field officer* and *agricultural officer*.

For Part (a) (ii), careers such as pathologist, livestock farmer, nutritionist and animal scientist were incorrect answers. Popular correct responses were *veterinarian* or *veterinary assistant*.

Part (b) required candidates to suggest one way in which biotechnology could improve (i) crop production and (ii) livestock production. Several candidates may have misunderstood the concept of biotechnology, and as such this part was poorly answered. Incorrect responses were: regional islands trading for goods, government could hire people to plant more/produce more, they would have to get more land, encouraging greenhouse farming/hydroponics. Popular correct responses were *more nutritious*, *resistance to disease/drought*, *new varieties* and *increase yield*.

Correct responses for Part (b) (ii) were: *DNA can be modified to make animals with desirable traits*; *genetic engineering can be used to create crops which have higher yield/are more resistant to diseases*; *creating new and improved feeds for livestock*; *can aid in the creation of vaccines*.

### Question 2

This question tested candidates' knowledge of the demand curve, equilibrium point and strategies that can be used by farmers to make money from surplus crop.

Part (a) was fairly well done. Candidates were required to identify X and Y from the diagram. However, many candidates named the letters but in the wrong order. Many candidates gave numerical values for X and Y. The correct responses for X were *the demand curve*, *demand*, or *quantity demanded*. Accepted responses for Y were *equilibrium* or *equilibrium point*.

In Part (b), most candidates correctly identified two strategies that could be used to make money from surplus crop. Some candidates seemed to have misunderstood the word *surplus*, thus giving incorrect responses such as produce best quality, plant early, change the time of planting, plant another crop and crop rotation. They should have said *reduce the price*, *make a by-product of sorrel and sell it*, *store it for a later time when there is a high demand* or *export the sorrel*.

### Question 3

This question tested candidates' knowledge of acid and alkaline soils, reasons for differences in pH and what could be done to improve an acidic piece of land.

For Part (a), most candidates did not obtain their marks because they failed to use the words *acidity* and *alkalinity*; instead they used words such as phosphorous, hydrogen, acid, alkaline. For Part (b), many candidates did not know to read the pH scale properly which resulted in incorrect responses. The correct response was *Ramesh's plot was more acidic*.

In Part (c), candidates were required to suggest one reason for the difference in pH between the two soils. Good responses included: *types of fertilizers*, *water logging*, *improve drainage*, *topography* and *use of soil amendments*.

In Part (d), the candidates misinterpreted the word *productivity*. Some of the incorrect responses included addition of urea/inorganic fertilizers, ammonium, farming system, leaching, decrease in acid and increase in alkaline and plant citrus crops. Correct responses were *addition of lime, calcium carbonate, tillage, mulching, crop rotation, organic fertilizer, and organic matter*.

#### Question 4

This question tested candidates' knowledge and understanding of the causes of soil erosion, the relationship between burning the land and erosion, as well as soil management practices used to prevent soil erosion.

Part (a) was generally well done but some candidates faltered by confusing soil erosion with weathering. Correct responses were *washing away of soil* and *removal of soil by water or wind*. Many candidates gave partial responses for Part (b), with many being unable to analyse the data given in the table. The correct response was *more burning, more erosion/less burning, less erosion*. Incorrect responses were burning destroys the nutrients and burning causes erosion.

In Part (c), most candidates answered correctly — *mulching, proper drainage, planting trees and cover crops* — although some of them interpreted soil management practices as anything that is done to the soil or not burning garbage on the soil.

#### Question 5

This question sought to test candidates' knowledge of two aspects of rearing broilers, namely feeding and brooder temperature control. Few candidates were able to obtain maximum credit. Several candidates failed to score any mark, while some did not offer any response. There were candidates who seemed to have clearly misunderstood the management practices associated with broilers.

Part (a) asked candidates to name the feed that is fed to the chicks at: (i) two weeks of age and at (ii) five weeks of age. The correct responses were *starter ration* at two weeks of age, and *broiler finisher* at five weeks of age.

In Part (b), a diagram of two different situations in a brooder was presented. Candidates were asked to suggest a reason for the difference in the way the chicks were distributed. This part allowed for comparisons to be made in relation to two brooding systems, A and B, and to conclude the differences in each. It was poorly answered. For A, accepted responses included *the brooder was at the correct temperature and the chicks displayed normal feeding habits*. Several candidates gave incorrect responses such as chicks were overcrowded, have a higher feed conversion ratio, not enough room to move about, and feed disturbed all over the brooder. For B, the correct answer should have been the *brooder temperature was too high so chicks were away from heat source, chicks were uncomfortable or the heat source was too low*.

#### Question 6

This question was based on artificial insemination (AI) and oestrus synchronization.

In Part (a), candidates were required to state two advantages of AI in farm animals. Unaccepted responses included AI works faster; AI is reliable; less sperms wasted and increased fertility. Common correct responses were: *it prevented inbreeding, the upgrading of local stock, reduction in the spread of diseases and the storage of semen*.

For Part (b), a table was presented that compared the two reproductive techniques of artificial insemination and oestrus synchronization. Candidates were required to deduce which was the better technique and to give one reason for the response given. The correct response given by many candidates was oestrus synchronization, accepted reasons being *better management of pregnant and lactating animals, more offspring and more sales*.

## Section II

### Question 7

Part (a) required a definition for each of *working capital, fixed capital and subsidy*.

For *working capital*, candidates were awarded marks for *money invested to meet recurrent expenditure*. Examples of working capital were also accepted, as well as *money to run the business*. *Fixed capital* is defined as *money invested on buildings and other permanent structures that cannot be changed easily*. Examples were also accepted. Correct responses for *subsidy* were *money, items or services given by sponsors to assist in agricultural activities*. Examples were also accepted.

For Part (b) (i), candidates were informed that a rural community was given a tractor by the government to assist them in agricultural production. They were asked for three benefits that the tractor would bring to the rural community. Correct responses included *saved money, allowed for ease in agricultural production, reduced labour cost and increased earnings*.

Part (b) (ii) sought to have candidates identify three additional incentives the government could provide to further improve agriculture in the community. Poor responses included establishment of greenhouses/green belt areas, employment, capital, machinery, and provision of money. Correct responses were: *tax exemption, loans at reduced rate and price support*.

In Part (c), candidates had to complete a loan application form by writing three requirements that a farmer needed in order to qualify for a loan from a commercial bank. Some incorrect answers were liability, subsidy by government and CXC qualifications. Some candidates wrote a letter instead of pointing out the requirements. They should have written *ability to repay the loan, land title, project proposal and collateral*.

### Question 8

For Part (a), candidates were required to describe three given methods of pest and disease control in agriculture. Accepted for manual method, Part (a) (i), were *done by hand, hoeing and forking*. The mechanical method, Part (a) (ii), involves *the use of traps, machinery and ploughing*. Many candidates had difficulty distinguishing between manual and mechanical methods and as such offered statements such as manual control employed the use of the hand to apply chemicals while mechanical control employed the use of manpower and a sprayer.

For Part (a) (iii), most candidates were able to correctly describe chemical method as *the use of chemicals such as insecticides, herbicides and fungicides*. Examples of chemicals were also accepted.

Part (b) dealt with the control of white flies using sticky traps and insecticides given data in a table. For Part (b) (i), candidates were to give three conclusions that could be drawn from the information. Some candidates merely reproduced the information as their response. They should have said *that the best treatment was a combination of sticky traps and insecticides; the worst treatment was the use of sticky traps only; and that insecticides gave better results than sticky traps*.

In Part (b) (ii), candidates were to state three other methods that could be used to control white flies in tomato production. This part was not well done as candidates did not take heed of the word *other* and as such responses such as traps and pesticides were reproduced. Accepted responses were *pest predators, sterile male, the use of biopesticides, mulching and crop rotation*.

In Part (c), candidates were informed that a new forage legume from Africa was to be introduced into a Caribbean country. The seeds arrived at the airport but were destroyed by the Plant Quarantine Officer. Candidates were expected to suggest three reasons why the seeds had to be destroyed, such as *import procedures not followed, no import certificate, pests and diseases detected and seeds considered an invasive species*.

### Question 9

Candidates were required to name three ingredients used in making livestock feeds, for Part (a). Correct responses included *rice bran, bone meal, coconut meal and peelings*. Many candidates responded incorrectly by stating carbohydrates, proteins, iron and sand.

In Part (b), a situation was presented to the candidates whereby a farmer wanted to know if rearing broilers on sand was better than rearing them on wood shavings litter. A table was presented that showed the effect of sand and wood shavings litter on feed conversion ratio (FCR) over four weeks.

For Part (b) (i), candidates were expected to calculate the average FCR over the four weeks on the sand and wood shavings litter systems. Most candidates did the computation correctly.

For Part (b) (ii), candidates were asked to name the better system of rearing broilers and to suggest one reason for the answer. The correct response was *wood shavings litter*, the reason being the *lower FCR*. Many candidates stated sand and simply gave the reason as 'it is better'.

Part (b) (iii) required candidates to explain the effect of each of the two systems on the health of the broilers. Acceptable responses were *sand has wetter faeces than wood shavings and so more breathing problems; wood shavings reduce flies and the spread of diseases*. Some candidates incorrectly stated that sand will trap heat and cause bacteria to grow.

Part (b) (iv) asked candidates to suggest three other management practices that could affect the performance of broilers up to market age. The response to this part was quite good in that many candidates stated *proper feeding of starter, good ventilation, ensure footbath and vaccination*.

## **Paper 03 – Structured Essay**

This paper was made up of two sections and consisted of four compulsory structured essay questions, two from Section D (Horticulture) and two from Section E (Animal Husbandry) of the syllabus. Only candidates sitting the Double Award option were required to write this paper.

### **Section I**

#### Question 1

This question tested candidates' knowledge of banana production and a method of composting. Performance was below average.

Part (a) (i), required candidates to name two varieties of banana recommended for the fresh fruit market. Most candidates were able to correctly identify *Lacatan*, *Gros Michel*, *Apple* and *Cayenne*. Incorrect examples were plantain, fig and Valencia.

Characteristics of high quality banana planting material (Part (ii)), such as *high-yielding planting material*, *uniformity of planting material* and *pest and disease free* were the correct answers given. A few candidates named the best planting material as sword sucker/maiden head, instead of characteristics of the planting material. Some examples of incorrect responses included long-stem large sucker, large corm size, low maturity period, and material must be cleaned and well sanitized. Some candidates focused on the preparation of suckers for planting, not the characteristics.

For Part (a) (iii), candidates had to identify the recommended stage for harvesting banana intended for the fresh fruit market. The recommended stage of harvesting bananas is *three-quarter green*, *mature stage* or *slightly turning/yellow*. This was not expressed by most candidates. Incorrect responses included three-quarter ripe, half-ripe, green, hard and firm. Many candidates stated the time to harvest rather than describe the stage at harvest.

Part (b) started with the statement that a farmer planted banana at a spacing of 1.5 m by 1.5 m rather than the recommended spacing of 3 m by 3 m. Candidates were required to explain how closer spacing was likely to affect the cultivation and production of banana in terms of (i) number of suckers per stool and (ii) marketable yield.

For Part (b) (i), candidates' responses indicated a lack of knowledge of the term *stool*. Correct responses should have been *competition for sunlight and nutrients resulting in less suckers per stool*; *more pests and diseases caused less number per stool*; *less space, less root room resulting in a lower yield*.

For Part (b) (ii), most candidates realized that there would be a reduction in marketable yield due to reduced spacing. However, they were not able to provide an explanation, namely *reduced spacing can result in smaller finger size*, *reduction in bunch size*, or *diseased bananas resulting in lower marketable yield*.

Part (c) required candidates to describe four measures that were likely to increase the composting process in a compost heap where banana leaves and stems were placed. Performance was below average leading to the conclusion that candidates were not exposed to practical work. Some examples of correct responses included *add manure*, *and add microorganism/earth worms as decomposers*; few candidates knew about *turning the heap*, *keeping it damp*, and *adding limestone*. Some incorrect responses were cover the heap, expose it to sunlight and rainfall, maintain optimum or suitable temperature, and add soil to the heap.

## Question 2

The performance of candidates on this question was average.

In Part (a), candidates had to explain tissue culture, state the benefits of tissue culture and a technique which is used to produce new varieties of anthurium. Most candidates were unable to correctly define tissue culture as a method of vegetative propagation using plant tissues. The benefits of tissue culture – *large number of plants produced in a short space of time*, *uniformity of planting material* and *reduction in cost of plantlets* – were stated. The majority of the candidates could not *identify genetic engineering*, *cross pollination* and *biotechnology* as techniques for producing new varieties of anthurium.

In Part (b), candidates had to discuss the prevention and management of pests and diseases of an ornamental plant. They were able to score at least 50 per cent of the marks allocated by correctly identifying pest and disease prevention methods such as *disinfect tools*, *minimize the presence of visitors*, *no smoking* and *install footbath*. However, many candidates used the term ‘pesticide’ rather than be specific with chemical control.

Part (c) focused on the effect of light intensities on the flowering characteristics of anthurium plants. A table was presented showing varying light intensities and the effect on spathe width, petiole length and flowering interval.

Candidates were asked to describe the relationship between the percentage of light and flowering interval, for Part (c) (i). Many responded with the correct interpretation – *as the shade levels increase flowering interval decreases*.

For Part (c) (ii), candidates had to predict the likely effect of full sunlight on petiole length and offer a reason for the answer. Many were able to say that there was a reduction in petiole length.

Candidates were challenged by the final part of the question which required knowledge of the practical use of the information in the table. They should have said that the information could assist farmers to *capture market share*, *meet specific requirements* and *increase production by decreasing the light intensity*.

## **Section II**

### Question 3

This question tested candidates’ knowledge and understanding of pig production. Performance was average.

Knowledge of breeds of pigs, and by-products of the pig industry were required for Part (a). Candidates could not differentiate between breeds for pork and breeds for bacon. However, by-products could be named.

Most candidates described the castration process in pigs (Part b). The procedure *involved the cutting of the scrotum and scraping the spermatic cord until it is separated from the body. Iodine is then applied*.

Part (c) required candidates to calculate dressing percentage, and to discuss the importance of dressing percentage in the pig industry. Performance was good.

Part (d) informed candidates that a farmer fed her pigs solely on a rice diet and candidates had to explain how this diet may be modified to be suitable for weaners and for pregnant sows. It was evident from the information given by candidates that they were not able to correctly analyse the statement. Expression was poor, they were unable to say what modification should be done and why. Correct responses were: *For weaners – add crude protein to reduce protein deficiency and boil the rice to increase digestibility. For the pregnant sow – add crude protein to reduce protein deficiency and for production of colostrum*.

### Question 4

Part (a) required the name of a milk breed and a meat breed of goats. Most candidates responded correctly.

In Part (b) (i), candidates were informed that a farmer decided to rear goats using both an indoor and an outdoor system of management. Candidates were asked to name three systems of grazing that the farmer can use. Most were able to name *continuous*, *rotational*, and *zero grazing*. Incorrect responses given were overgrazing and undergrazing.

Part (b) (ii) informed the candidates that bamboo grass (*Paspalum* spp) was found in local pastures but was not well liked by goats. Candidates were asked to suggest three ways to improve the consumption of this grass by goats. Many candidates were of the view that the animals were to be force-fed and their responses reflected that. Acceptable responses were *the use of a mixture of grasses*, *inclusion of legumes*, *addition of concentrates* and *production of silage*.

In Part (b) (iii), candidates were required to explain two ways by which increased consumption of bamboo grass could improve production. Correct responses included *more milk or meat*, *healthier animals*, *better growth* and *improved rumen digestion*.

Part (c) focused on embryo transfer. Candidates were required to suggest advantages of using a donor mother and a recipient mother. Many candidates responded well to this part and as such gained full marks. Unacceptable responses included: large sums of money would be involved and the production of a new breed. Accepted responses for advantages of using a donor mother included: *breed improvement to the herd*, *reduction in the transmission of diseases* and *higher-priced offspring*.

Correct responses for advantages of the recipient mother included *better adapted to heat stress*, *better tick resistance* and *less likely to transfer exotic disease*

**C A R I B B E A N E X A M I N A T I O N C O U N C I L**

**REPORT ON CANDIDATES' WORK IN THE  
SECONDARY EDUCATION CERTIFICATE EXAMINATION**

**MAY/JUNE 2013**

**AGRICULTURAL SCIENCE  
GENERAL PROFICIENCY EXAMINATION**



## **GENERAL COMMENTS**

Agricultural Science offers the Caribbean student a choice between two options, the Single Award (SA) and the Double Award (DA) option.

The examination comprised two written papers for the Single Award and three written papers for the Double Award, as well as a practical component called the School-Based Assessment (SBA), for both the SA and DA.

Paper 01 comprised 60 multiple-choices items. Paper 02 comprised nine compulsory structured-type questions. These two papers were common to the SA and DA. Paper 03, written by Double Award candidates only, was a compulsory paper with four structured essay questions. The SBA component was conducted in the school and the school farm environment. Candidates were tested on a number of skill objectives set out in the syllabus, and on cost analyses based on their crop and animal production activities. The DA required candidates to conduct a research project, in addition to the other SBA requirements.

This report outlines candidates' overall achievements and achievement on content profiles, namely:

- Profile 1 – The Business of Farming
- Profile 2 – Crop Production
- Profile 3 – Animal Production

## **DETAILED COMMENTS**

### **Paper 01 - Multiple Choice**

This paper consisted of 60 multiple-choice items—20 items each on Profile 1, Profile 2 and Profile 3—and was written by both the SA and DA candidates. Performance on Paper 01 was fair. Approximately sixty-five percent of the candidates for the SA scored at least 50 percent of the available marks on this paper. The mean score on the overall paper was 32.9 or 55 per cent of the total marks. For each profile, the average score was slightly in excess of 50 per cent.

For the DA, approximately sixty-three per cent of the candidates scored at least 50 percent of the available marks on this paper. The mean score on the overall paper was 37.82 or 63% of the total marks. For each profile, the average score was slightly in excess of 60 per cent.

### **Paper 02 - Structured Questions**

This paper consisted of two sections. Section I comprised six questions, each worth four marks. Section II included three questions requiring longer responses, each worth twelve marks.

#### **Question 1**

This question tested the candidates' knowledge and understanding of food security in the Caribbean and good agricultural practices (obj. A 2.2; 2.3), using the example of supplying high quality eggs that were safe to consume. There was a moderate response to this question with about 30 per cent of the candidates scoring three out of the maximum four marks, 30 per cent scoring two marks while 40 per cent scored a mark of one or zero out of 4. The two marks were mainly attained in the part of the question that tested recall and not in the application of concepts.

Part (a) required candidates to state two factors that might affect food security in the Caribbean. Most of the candidates responded fairly good to this section. Popular correct responses were praedial larceny, natural disasters, pests and diseases, trade barriers and lack of, or improper storage facilities. Some incorrect responses included climate, topography, lack of trust, HACCP factors and use of chemicals.

Part (b) required the candidates to suggest two good agricultural practices that farmers should follow to supply a hotel, with high-quality eggs that were safe to consume. The response to this section was

satisfactory. Correct responses included that the eggs should be sorted to remove cracked or leaking eggs, cleaned and packed in clean crates, and stored in cool conditions. Unaccepted responses included that the eggs should be graded, collected properly, good feeding practices should be employed, layer pens should be cleaned and the eggs incubated.

### Question 2

The two parts of the question tested factors of production and total product curve interpretation namely objectives A 4.3; 4.4. The question called into focus the candidates' ability to solve a problem confronting a farmer's inability to harvest corn by himself and to suggest two ways to solve the problem. Candidates were also asked to describe the effect of fertilizer application on the yield of corn during Stages I and II of the output-input relationship of a production cycle.

Most candidates responded correctly to Part (a) with about 80 per cent scoring the allotted two marks. Many candidates encountered some difficulty in Part (b) and as such offered poor responses. In general the responses to this part of the question were moderately good in this section.

In Part (a), most candidates responded exceedingly well by stating the correct responses such as "employ labour", "use family labour and machinery". Incorrect responses presented were "the farmer should reduce the size of plot that he is cultivating", "do not plant what he cannot harvest" and "to harvest on different days by himself".

Part (b) showed a graph of the effect of adding various quantities of fertilizer to the yield of a crop of corn. Candidates were required to describe the effect on yield of adding increasing quantities of fertilizers during Stage I and Stage II of the total product curve. Many candidates did not understand the graph to represent an output-input relationship. They were familiar with what occurred at the first stage as opposed to the second stage of the output-input relationship (obj. A 4.4). Examples of correct answers were that in Stage I the yield was increasing, or increasing at an increasing rate; and in Stage II, the yield was increasing at a decreasing rate or it increased and reached its maximum. Examples of wrong responses included "because you added more fertilizers in Stage I than in Stage II, the yield increased" or "the yield increased in Stage II".

### Question 3

The question tested soil horizons and soil fertility (objective B 1.2, 1.8). Candidates were presented with two profiles of two different soils. The question sought to test the candidates' ability to identify the layers and to offer a reasoned response as to which of the two soils was more fertile. Most candidates had a good grasp of this question and the responses were very good, which resulted in many obtaining fairly good marks.

Part (a) required the candidates to identify the layers labelled A and B. Most candidates responded positively to this section and as such scored maximum marks. The correct response was: A – topsoil, B – subsoil. Incorrect responses were: A – Humus, subsoil, soil and silt. B – midsoil, parent rock, weathered rock and loam.

In Part (b) candidates had to identify which of the two soils, X or Y, was likely to be more fertile and to give one reason for their response. The correct response was X, with the reason being because it had a thicker layer of leaf litter and top soil. Unacceptable responses for choosing X were: Soil X – because it contains a better mixture of soil, it has more moisture, an even amount of everything and a high percentage of each soil. Those candidates who opted for soil Y mentioned that it was more fertile because the lower you go the more fertile the soil or it was thicker than X.

### Question 4

The question sought to test safety in the use of tools and the use of weather records to make crop production decisions, which are objectives B 2.8; 2.4. There was an average response to this question with over 80 per cent of the candidates scoring two marks and below out of a possible four marks.

This question sought to elicit from candidates the protective clothing that should be worn when using a knapsack sprayer. A monthly rainfall graph was also presented with the attendant problem of wilting of sweet pepper plants. Candidates were required to deduce in which month this wilting was most likely to occur and to suggest one way in which this occurrence (wilting) could affect the yield of the crop.

Most candidates attempted this question, with many obtaining maximum marks. Examples of correct responses were goggles, respirator, overalls and tall boots. Incorrect responses included shoes, protective face wear and a shirt.

#### Question 5

The question tested artificial insemination (AI) and advantages of AI (objectives C 4.7; 4.8). Candidates were presented with a drawing of a procedure commonly used in animal reproduction, especially in cows. They were required to identify and describe the technique and to suggest two reasons why it was highly recommended.

Most candidates attempted this question, with many obtaining full marks in Parts (a) and (c). Many candidates encountered problems with Part (b) where they had to describe the technique.

In Part (a), candidates had to identify the technique shown. Many candidates offered the correct response as artificial insemination. Some incorrect responses included, someone injecting a cow, testing the gender of the animal, insemination and gestation.

Part (b) required the candidates to describe the technique identified in Part (a). Many candidates offered incorrect responses such as, to maintain good health, to vaccinate the animal, to introduce the sperms into the ovary of the cow and to identify its gender. The correct response was a technique that deposits semen into the cow's reproductive tract using an insemination device.

Candidates had to suggest two reasons why this technique was highly recommended. Some correct responses included that it was lower cost than a bull, less dangerous, less transmission of diseases and the production of superior calves. Incorrect responses included that the technique is not fatal to the cow, the cows do not want the bull to jump them, it produces more young and it gives assurance of fertilization.

#### Question 6

This question tested the candidates' knowledge and understanding of the term 'balanced ration' (objectives C 2.2; 2.3). Most of the candidates responded to this question, with many scoring maximum marks. Some candidates obtained half the available marks while even fewer earned just one mark.

Part (a) required the candidates to give the meaning of the term 'balanced ration'. Many responded with the correct statement, that is, feed that contains the required nutrients in the correct proportion. Another response that merited one mark was, "all the nutrients required by the animal". Some poor responses were, "not too much or too little but just the right amount of feed", "the amount of feed that is required to give to farm animals over a period of time" and "the right amount of nutrients or minerals".

In Part (b) candidates were told that a farmer had two rations, one contained 10 per cent crude protein and the other, 20 per cent crude protein. Candidates had to suggest, with a reason, which crude protein level was most likely to be present in a starter ration.

The responses to this part were good with many candidates offering the correct response, (which was 20 per cent) and the reason, which was that it was higher in protein. Some incorrect reasons given for choosing 20 per cent were "because they need to get weight": "it is better": "to obtain proper growth": and "because the more protein the healthier the animal".

Some candidates mistakenly opted for 16 per cent and offered inappropriate reasons such as, “so that they would not get overweight”: “because 20 per cent crude protein will be too much for them”: and “because it is the lowest level and things normally start from its lowest”.

## SECTION II

### Question 7

This question, which tested objectives A 6.2; 6.3; 7.3, was divided into two parts, (a) and (b). Part (a) presented the problem of the rising price of wheat and the consequent increases in the price of flour in a Caribbean island. This situation led to the particular government deciding to substitute 20 per cent of wheat flour with cassava flour. The question was fairly well done. With the data indicating that many candidates obtained between 5 and 11 marks out of a possible 12 marks.

In Part (b) a farmer who produced sweet potato on 10 hectares of land decided to purchase a tractor to assist in the clearing of the land instead of using a hired tractor at \$110 per hectare.

Part (a) asked the candidates to state three subsidies or incentives that the government could provide to the farmers to encourage the expansion of cassava production. Most candidates responded well to this part with many obtaining full or most of the marks. Candidates seemed to have a good grasp as to what was required and this was confirmed by the correct responses presented, such as that governments could provide materials/inputs, price support, tax exemptions, technical support/training and land. Some erroneous responses were providing negotiable salaries, raising the price of cassava flour and growing more food.

In Part (b) a budget projection for a tractor was given. Based on this budget, there were five subsections to which candidates had to respond.

Part (b) (i) required the candidates to identify the type of budget the farmer should prepare for the change in her plans, that was, to buy a tractor instead of hiring one. Many candidates were on target with the correct response, which was “partial budget”. However, some candidates’ inaccurate responses were “expenditure budget”, “complete budget”, “fixed and annual budgets”.

In Part (b) (ii) candidates were asked to identify two fixed costs and two variable costs in the budget. Most candidates were able to score maximum marks in this section by offering correct responses for fixed costs, such as the cost of the tractor, depreciation and interest on the loan. Few candidates submitted incorrect responses such as repairs and fuel. Labour, fuel and repairs were popular correct responses for variable expenses.

In Part (b) (iii) candidates were asked to calculate the annual depreciation on the tractor by using the given formula:

$$\frac{\text{Cost of tractor} - \text{net disposable value of tractor}}{5} = \text{Depreciation}$$

Many candidates were able to substitute the correct figures in the formula and as a result, obtained the depreciation amount as \$1,800 and so earned the maximum mark.

Part (iv) informed the candidates that the farmer decided that she would rent her tractor at a cost of \$100 per hectare to other farmers who farm on a total of 50 hectares. Candidates were required to calculate the additional income that the farmer would gain from renting the tractor. Most candidates were able to show the calculation  $50 \times \$100 = \$5000$  and so gained full credit.

Part (v) proved to be more challenging to some candidates. They were asked to calculate the net change in profit or loss by using the formula:

$$\frac{\text{Net change in profit}}{\text{loss}} = \text{Additional Income} - \text{Additional Costs}$$

(calculated in (iv)) (shown in table)

Many candidates knew the additional income but were challenged to find the additional costs. As such, many candidates failed to obtain any marks in this section. Some candidates simply added  $200 + 400 + 1000 + 100 + 300$  without adding the 1,800 which represented the annual depreciation and this would have given the correct amount of \$1,200.

### Question 8

Question 8 (objectives B 5.8; 5.1) was divided into two parts, (a) and (b). There were two parts to (a) (i) and (ii) and two parts to (b) (i) and (ii). Candidates demonstrated a poor knowledge of the concept of IPM and its benefits and this resulted in many obtaining low scores. The general response to this question can be described as satisfactory.

Part (a) informed the candidates that IPM meant integrated pest management. Part (a) (i) asked the candidates to explain the concept of IPM. Candidates were knowledgeable of the various pests control strategies but failed to show the connection amongst them when they are integrated. Consequently, many candidates did not respond correctly to this part of the question. Incorrect responses included, “this is the way in which farmers manage weeds and pests to prevent them from destroying crops”, “it is an organization which controls or manage the pests on farmers farm”, “the use of chemicals or equipment to control weeds which are affecting the crops” and “this is a management that you can use to manage pests on your crop”. The correct response was that IPM uses a combination of pest control strategies such as cultural, mechanical, biological and chemical measures with chemical being used only as a last resort.

Part (a) (ii) required the candidates to state one advantage of IPM. Many responded poorly to this section. Some incorrect responses were that it controls pests, it destroys crops and pests, healthier crops are obtained and farmers must work hard. Correct responses included that it is environmentally friendly, cost effective and it reduces the buildup of resistance to pesticides.

Part (b) (i) presented the candidates with a situation in which a farmer practised monocropping on a one-hectare plot of land but his cabbage crop was not growing well because of a high level of weed infestation. Candidates were required to suggest three different IPM measures (other than chemical)-which this farmer could use to control weeds and for each measure, explain how it would lead to a reduction in weed infestation. Many candidates offered partially correct responses and few candidates obtained full marks in this section even though methods or examples of the methods were accepted.

Correct responses included mechanical methods, for example, hand pulling, hoeing, tilling, and burning, with the explanation that these methods physically disrupt the growth and development cycle of weeds leading to a reduction in weed infestation. Also relevant were cultural practices, for example, high-density planting, crop rotation and mulching. These methods reduce the level of light, water and nutrients for weed and weed seed growth. Relevant as well was-biological control, for example, use of parasites to feed on weeds and weed seeds, reducing the potential for weed infestation.

Part (b) (ii) asked the candidates to suggest a cropping system other than monocropping that would lead to a reduction in weed infestation in the farmer’s plot and briefly explain how it would lead to a reduction in weed growth. Some candidates were able to suggest an appropriate cropping system but failed to show how that system would lead to a reduction in weed growth. Other candidates even erroneously suggested responses such as mixed farming, dicropping, organic farming and hydroponics.

### Question 9

This question (objectives: C3.2, 3.3; 5.11, 5.12) had three parts, a, b and c. The responses to this question ranged from poor to fair, with most candidates scoring around 50 per cent.

Part (a) required the candidates to state three daily or weekly practices that a farmer must carry out at her apiary. Many candidates obtained one or two marks with few gaining the maximum three. There was some confusion with regard to the setting up of the apiary and its management. Incorrect responses were—that she should put on protective clothing, clean the apiary, plant trees and flowers and provide sweetness and check the bees. The correct responses included the checking of bees for pests/diseases, providing sugar solution, harvesting of honey, checking of frames for capping and marketing of products.

Part (b) showed a table with data on growth of hand-sexed male and hormone-treated male tilapia. There were better responses to this part with many candidates obtaining at least two marks.

Part (b) (i) required the candidates to compare hand-sexed males and hormone-treated males with respect to growth and FCR. Correct responses included that growth at six months was better in hormone-treated males than that in hand-sexed males or weight at six months was heavier in hormone-treated males and growth at four months was better in hand-sexed males than in hormone-treated males. The FCR is better in hormone-treated males than in hand-sexed males or FCR is poorer in hand-sexed males than hormone-treated males. Many candidates failed to make the comparison, with some repeating the information from the table. An unaccepted response for growth was that hormone-treated males grow faster than hand-sexed males and have more weight. Hand-sexed males used 2.5 lbs of feed while the hormone-treated males used 1.5lbs was given for FCR.

Part (b) (ii) informed the candidates that after successive grow-out periods of using male and female tilapia species, it was noticed that the fish at harvest was stunted in growth. Candidates had to suggest three reasons for the poor growth of the tilapia. The response was poor and as such many candidates obtained 1 or 2 marks. Correct responses included low protein content of feed, poor water quality, high stocking density, inadequate feeding and inbreeding. Incorrect responses were poor sanitation, FCR low, old fishes and genetic traits passed down.

Part (c) was well answered by candidates as indicated by the scores gained. This part informed the candidates that aquaculture farmers in a Caribbean country were facing several problems in the marketing of their produce. Candidates had to suggest THREE possible ways that the farmers and the government agencies could assist in the marketing of tilapia. Correct responses included to sell at a lower price, for government to provide incentives, better access to credit, niche markets, promotions and to create value added products. Some incorrect responses included to build more/larger ponds, provide better quality feed, better quality fish, feed the fish better and rear a small amount.

### **Paper 03 – Essay Questions**

This paper was made up of two sections and consisted of four compulsory structured essay questions, two from Section D (Horticulture) and two from Section E (Animal Husbandry) of the syllabus. Each question was worth 15 marks. Only candidates sitting the Double Award option were required to write this paper.

### **SECTION I**

#### Question 1

This question [objectives: D3 (a) to (g)] was divided into two parts (a) and (b). The response to this question was fair with the majority of the candidates scoring between 5 and 10 marks.

In Part (a) a table entitled “AGRONOMIC PRACTICES FOR BANANA AND CITRUS” was presented as shown:

Agronomic practices	Banana	Citrus
Site selection	<u>A</u>	Sunny area
Propagation	Suckers	<u>D</u>
Spacing	<u>B</u>	6m × 6m
Weed control	<u>C</u>	Mechanical method
Stage of harvesting	$\frac{3}{4}$ mature stage	<u>E</u>

Candidates had to fill in the missing spaces as indicated by the letters A, B, C, D and E.

A - areas sheltered from high winds. This was poorly answered with many candidates offering incorrect responses such as rainy areas, damp areas, sunny and humid, and sunny and rainy areas.

B - 1.5m-3m × 1.5m-3m or 5ft-10 ft × 5 ft — 10 ft. Most candidates responded correctly to this. Few candidates were well off target with responses such as 6m × 6 m or 10 m × 10 m.

C - chemical/mechanical/cultural or one example for method stated. Most candidates responded correctly to this also.

D - grafted/budded plants. Most responded correctly with some citing incorrectly the use of seeds.

E - fully mature/ripe stage. Many responded accurately but some offered incorrect responses such as  $\frac{3}{4}$  ripe,  $\frac{3}{4}$  mature and 16 weeks.

In Part (b) the candidates were told that a farmer wanted to establish a banana crop to supply organic produce to a health food store. Candidates had to explain an organic farming approach to EACH of the following practices:

- (a) Land clearing
- (b) Soil nutrient management
- (c) Weed control
- (d) Packaging

(i) Land clearing

Many candidates were knowledgeable about land clearing methods consistent with organic farming and so offered correct responses such as mechanical or cultural methods or examples of these. Some went on to explain how the methods were implemented and as such were credited with full marks.

Some candidates incorrectly wrote about land selection and drainage and others seemed to confuse land preparation with land clearing by stating practices such as ploughing, rotavating and the addition of organic matter.

(ii) Soil nutrient management

Many candidates earned high scores in this part because they were knowledgeable of the fact that to increase the nutrient content of the soil it was necessary to add manure or compost and emphatically stated that no chemical fertilizer should be used. Some candidates mentioned the addition of different types of soil which gained no credit.

(iii) Weed control

Cultural, mechanical and biological methods or examples of the methods were correctly stated by many candidates and some went on to clarify how they were done. Few candidates wrongly mentioned chemical control.

(iv) Pest and Disease control

A popular correct response was the use of natural predators. Some candidates offered other correct responses such as hand picking, use of trap crops and the use of organic pesticides. To state that the farmer should simply spray the pests was not accepted as a correct response.

Some candidates appeared to confuse weed control with pest and disease control and gave similar responses.

(v) Packaging

Many candidates failed to obtain full marks because they only mentioned 'pack in boxes or cartons' without stating that they should be biodegradable. No credit was not given to responses such as packing to avoid damage, use of plastic bags, place in a cool dry place and it should be presentable.

Question 2

Question 2 (objectives: C6.4; 6.5 D6) consisted of 3 parts, (a) (b) and (c), with various subsections. This question was fairly well done with most candidates obtaining between 5 and 10 marks. Part (a) was better done than Part (c).

Part (a) informed the candidates that a landscaper wanted to establish a lawn around a commercial building. Candidates were asked the following:

- (i) Name ONE grass species that is used for growing lawns.

Most candidates gained the full mark by correctly naming grasses such as lawn grass, Bermuda grass, dube grass and savannah grass. A few candidates confused forages with species of lawn grass and so gave wrong responses such as Pangola grass and guinea grass. Some even mentioned weeds.

- (ii) Give TWO characteristics which make this grass suitable for lawns.

Many candidates offered correct responses such as quick regrowth, ability to withstand the dry season and soft. Some candidates erroneously mentioned the attractiveness of the grass; that it is easy to take care of and does not grow bushy.

- (iii) State TWO ways of propagating this grass species.

This was well done by most candidates who submitted responses such as the use of seeds, sprigs, sods and plugs. Some wrong responses included air layering and artificial vegetative propagation.

Part (b) asked the candidates how the landscaper would establish the lawn using the following headings:

- (i) Land preparation

Many candidates had a good knowledge of land preparation methods and so scored the maximum marks. Correct responses included clear the land of bush/debris, till, refine, level and add manure.

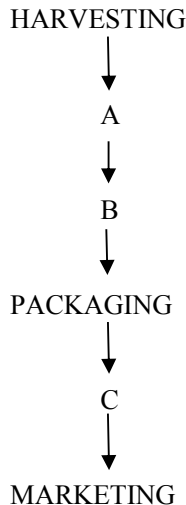
- (ii) Planting and spacing



Those candidates who opted for the use of seeds were on target when they mentioned that the landscaper should evenly scatter/distribute the seeds over the land. The candidates who used other methods did not go on to fully explain how they were done and so failed to obtain the maximum marks. An acceptable response would have been:

- dig holes at 25 cm × 25 cm
- place sprigs into holes
- cover and press soil around the roots
- water

Part (c) showed a flow chart entitled, “Steps in harvesting and postharvest handling of mango”.



Candidates were asked to identify the postharvest steps which were omitted in A, B and C and explain how each of these steps was likely to affect the quality of the mango.

This Part was poorly done. The evidence suggested that most of the candidates had a good knowledge of the steps involved in the marketing process. However, the application of the concept in identifying the correct steps that should be taken following the harvest of mangoes within the marketing channel was lacking. Confusion reigned in the selection of the activity at the appropriate step. The final, accepted sequence of events was as follows:

A – collecting/transporting/cleaning

- Collecting at a central point for easy transport and cleaning
- Transporting to get to consumers/market
- Cleaning to get rid of dirt/bacteria/fungi

B – grading/sorting/selecting

- Grading into size/colour/to get best prices
- Sorting to remove damaged fruits/unwanted fruits/separate varieties/to prevent spoilage.

C – Storing/advertising/pricing.

- Storing is done because all cannot be sold at the same time. Storing in a manner (correct temperature/humidity) to maintain a long shelf life/. Because there is no immediate buyer/because transportation or some other essential facility is not available.
- Advertise to alert possible customers/beat your competition/spread sales.
- Price in a way to make your product competitive and make a profit.

## SECTION II

### Question 3

This question, which focused on objectives: A 2.3; C6; E 2 E5; 1 (v) had four parts, (a), (b), (c) and (d). Generally well done with many candidates obtaining between 5 and 10 marks. Part (b) proved to be fairly challenging to some candidates. Many candidates could only offer responses to the first part of Part (c) without the correct explanation. Candidates encountered the same problem in Part (d).

Part (a) asked the candidates to name THREE products sold from a rabbitry. Many candidates responded positively and obtained full marks. Correct responses included meat, manure and kittens. Some candidates incorrectly stated feet, tail and liver even though they initially stated meat.

In Part (b) candidates had to give the meanings of the acronyms HACCP and GMP as they relate to food safety. Very few candidates gave the correct responses and in many instances there were no responses:

HACCP – Hazard Analysis Critical Control Points

GMP<sup>S</sup> – Good Manufacturing Practices

Some incorrect responses included:-

HACCP – Good Harvesting Agricultural Crop Customs Practices,  
– Harvesting Agricultural Crop Customs Practices  
– Have Acceptable Products

GMP<sup>S</sup> – Genetically Modified Product  
– Government Ministry Production  
– Good Management Practices

Part (c) presented a certain situation to the candidates. Mr Khan bought some meat (steak) that was at room temperature on a wooden shelf in a supermarket. He prepared a rare (undercooked) steak and after eating it he got severe diarrhoea. Candidates had to describe TWO meat practices (at slaughter and/or storage) that should have been carried out to prevent that situation and explain the reason for EACH practice. Many candidates tendered both practice and reason and obtained full marks but some candidates gave practices but failed to go on to provide a reason and so earned only one mark. Popular correct responses included: inspect meat to check for disease/spoilage, store in a refrigerator after slaughter to prevent the growth of bacteria, package and store at a low temperature to prevent contamination and spoilage. Incorrect responses included: make sure the meat has a right amount of temperature, supermarket owners should ensure they have storage facilities, salt the meat and always ask questions before buying meat.

In Part (d) candidates were informed that a rabbit farmer recorded a high percentage of sick rabbits in his rabbitry. His rabbitry was built with used materials from another rabbitry. He also purchased new rabbits on a regular basis. Candidates had to suggest THREE management practices the farmer should have used to prevent his rabbits from getting sick and explain how those practices prevent diseases.

Many candidates seemed to have fallen short in their responses to this part. Some gave the three practices but explanations for only two practices others gave three practices but no explanations and in some instances where an explanation was given it was not relevant to the practice. However, many candidates gave correct practices and excellent explanations.

Some correct responses were to isolate sick rabbits to prevent the spread of diseases in the rabbitry, feed clean food so that rabbits would not get sick, clean and disinfect pens/rabbitry to eliminate or prevent any spread of disease organisms and that hutches should have been constructed with new materials to prevent the introduction of disease organisms from the old materials.

#### Question 4

This question (objectives E1 (1) C4.3; 4.4) had four parts, (a), (b), (c) and (d). It was generally well done with some candidates achieving over 10 marks, some between 6 and 9 marks and a few under 5 marks.

Part (a) asked the candidates to state the length of the gestation period in EACH of the following classes of animals:

- (i) Cattle
- (ii) Pigs

Many candidates gave the accepted responses of:

Cattle – 282 days or 9 months

Pigs – 114 days or 3 months 3 weeks 3 days

Some incorrect responses were 173-180 days, 3 years, 30 weeks and 72 hours.

In Part (b) candidates had to identify THREE signs of heat in cattle. The response to this section was good with many candidates obtaining full marks. Some correct responses were: restlessness, slightly swollen vulva, loss of appetite and bellowing.

Males follow them around, more insects tend to follow them and they experience bleeding were incorrect responses.

Part (c) presented a problem to the candidates. A farmer noticed that after several years of breeding his cattle within the same genetic stock, his animals were producing less milk, less meat and fewer offspring. Candidates had to explain THREE breeding methods that the farmer could use to improve the performance of his dairy animals. Many candidates were familiar with at least two methods and how to implement them, while some knew all three. Correct responses included cross-breeding to produce hybrid vigour, upgrading through AI and genetic engineering to produce new species.

Part (d) (i) produced certain information to the candidates. A farmer decided to improve milk production in his dairy herd. He mated two animals, each with the Mm gene for milk production. Candidates had to complete the following Punnett square.

GAMETES	M	m
M		
m		

Many candidates offered the correct response to this. The correct response was:

GAMETES	M	m
M	MM	Mm
m	Mm	mm

In Part (d) (ii), candidates had to identify the percentage of cows in the F1 generation that was:

- (a) homozygous for milk production
- (b) heterozygous for milk production

Many candidates responded with 2 or 50 per cent which was correct for both.

**CARIBBEAN EXAMINATIONS COUNCIL**

**REPORT ON CANDIDATES' WORK IN THE  
CARIBBEAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION**

**MAY/JUNE 2014**

**AGRICULTURAL SCIENCE  
GENERAL PROFICIENCY EXAMINATION**

## **GENERAL COMMENTS**

Agricultural Science offers the Caribbean student a choice between two options, the Single Award (SA) and the Double Award (DA).

Paper 01 was comprised of 60 Multiple-choice items, with 20 questions each from the three profiles outlined in the syllabus for the SA and DA, that is, Profile 1 — The Business of Farming, Profile 2 — Crop Production, and Profile 3 — Animal Production. Performance on this paper for SA and DA candidates was fairly good.

Paper 02 was comprised of nine compulsory structured-type questions from Profiles 1, 2 and 3. These two papers were common to the SA and DA. Performance on this paper for SA candidates was poor, while that of DA candidates was fair.

Paper 03, written by DA candidates only, was a compulsory paper with four structured essay questions. Two essay-type questions were set on Horticulture and Animal Management, respectively. Performance on this paper by candidates was poor.

The SBA component was conducted in the school and the school farm environment by SA and DA candidates. Candidates were tested on a number of skill objectives set out in the syllabus, and on cost analyses based on their crop and animal production activities. The DA also required candidates to conduct a research project on an agricultural problem, in addition to the other SBA requirements. Performance on the SBA component for SA and DA candidates was very good, continuing the trend from previous years.

### **General Observations**

With respect to Paper 02 (SA and DA), most candidates demonstrated adequate knowledge of important concepts and their application in the following areas:

- Importance of farm records;
- Secondary tillage implements;
- Use of biotechnology in plant improvement;
- Digestion in poultry and rabbits;
- Organic farming;
- Use of Income and Expenditure statements in decision making;
- Soil conservation practices;
- Advantages and disadvantages of grazing;
- Swarming in a beehive.

Some of the factors that contributed to unsatisfactory performance of SA and DA candidates were:

- Limited understanding of basic concepts relating to Good Agricultural Practices, Hazard Analysis Critical Control Point, fertilizer, composting, animal nutrition, partial budget, harvest and post-harvest activities and candling;
- Lack of understanding as it related to the requirements of questions, especially where candidates were asked to explain the difference between two concepts;
- Careless arithmetical errors;
- Challenges with the application of information in tables to the question; and
- Answers not being commensurate with the marks allocated for some questions.

With respect to Paper 03 (DA), most candidates demonstrated adequate knowledge of important concepts and their application in the following areas:

- Characteristics of breeds of livestock;
- Food safety practices and food handling;

- Use of biotechnology in animal production;
- By-products of pig meat; and
- Management practices to control mastitis.

Some of the factors that contributed to unsatisfactory performance of DA candidates were:

- Unfamiliarity with practical aspects of the syllabus such as management of citrus orchards, and lawn establishment and management;
- Lack of understanding as to the requirements of questions; and
- Answers not being commensurate with the marks allocated for some questions.

### **Recommendations**

- Candidates should be instructed on how to answer questions. Too many candidates are writing irrelevant information instead of focusing on what is required.
- Candidates must be encouraged to read their questions well, since many of them misinterpret what is asked.
- Concepts should be taught with examples, and where possible, the students be exposed to the practical aspects to concretize these areas.
- There needs to be greater emphasis on the revision of concepts taught earlier in the programme to remind students of the importance of reviewing them before the examination.
- Candidates must be equipped to perform basic arithmetical functions in the examination.

## **DETAILED COMMENTS**

### **Paper 01 — Multiple Choice**

This paper consisted of 60 Multiple-choice items — 20 items each on Profile 1, Profile 2 and Profile 3 — and was written by both the SA and DA candidates. Performance on this paper was fairly good. Approximately 41 per cent of the candidates for the SA scored at least 50 per cent of the available marks on this paper. The mean score on the overall paper was 28.21 or 47 per cent of the total marks. The average score was 47.65 per cent for Profile 1, 44.6 per cent for Profile 2 and 48.85 per cent for Profile 3.

For the DA, approximately 62.26 per cent of the candidates scored at least 50 per cent of the available marks on this paper. The mean score on the overall paper was 32.22 or 53.7 per cent of the total marks. The average score was 54.55 per cent for Profile 1, 50.15 per cent for Profile 2 and 55.05 per cent for Profile 3.

### **Paper 02 — Structured Questions**

This paper consisted of two sections. Section I comprised six questions, each worth four marks. Section II included three questions requiring longer responses, each worth twelve marks.

## **SECTION I**

### Question 1

This question examined candidates' knowledge of two main concepts, Good Agricultural Practices' (GAP) and 'Hazard Analysis Critical Control Point' (HACCP) and application of the CARICOM Single Market and Economy. Overall, approximately 30.75 (SA) per cent (23.26 per cent, DA) of the candidates scored zero or one mark, 43.04 (SA) per cent, two marks (41.21 per cent, DA), while 21.05 per cent scored three marks (26.98 per cent, DA). Only 5.16 per cent of candidates (8.55 per cent, DA) scored full marks.

Part (a) of this question tested candidates' ability to distinguish between *GAP* and *HACCP*. Many candidates seemed to be unfamiliar with both concepts, and as such, could not differentiate clearly between them. Others managed to associate GAP with on-farm production systems and HACCP with food safety.

Generally, candidates were able to gain at least one mark from this part of the question, by citing an explanation for GAP.

Correct responses to GAP included: *promote environmentally friendly practices; focused on workers' safety; and promote good soil management practices*. However, some incorrect responses included: *ensure the products are safely kept; the necessary and right way of managing the land; and a technique used in controlling the amount inputs in the production process*.

Correct responses to HACCP included: *a preventative approach to food safety; identifies potential food safety hazards; identification, prevention and control of food borne diseases*.

Unacceptable responses were: *use to control any pest or parasites in the soil; a point in which hazards to agriculture have been identified and brought about a solution; and when practices are done that are hazardous to the environment*.

In Part (b), candidates were asked to select two appropriate responses from a given list to complete the sentence on the CARICOM Single Market and Economy. Many candidates were able to score at least one mark in this section by giving one of the two correct responses, *goods or services*. However, many candidates gave *human resources* and *money* as incorrect responses.

## Question 2

This question tested candidates' knowledge and application of farm records. Overall, approximately 34.37 per cent of the candidates (21.69 per cent, DA) scored zero or one mark, 44.33 per cent, two marks (43.51 per cent, DA), while 15.53 per cent scored three marks (24.08 per cent, DA). Only 5.77 per cent of candidates (10.72 per cent, DA) scored full marks.

Part (a) tested candidates' knowledge of the purpose of farm records by requiring them to state two advantages of keeping them. Most candidates were generally able to correctly identify at least one advantage of keeping records. Correct responses included: *enables a farmer to get a loan; provides information to plan a budget; know if you are making a profit or loss; and enables a farmer to implement remedial measures*. Incorrect responses included: *improve your services on the farm; keep information; and they are easily accessible and accurate*.

Part (b) asked candidates to observe a specimen labour record and identify two bits of information that were lacking in the record. Many of the candidates were unable to identify missing information in the labour record presented to them. Correct responses included: *name of farm enterprise; number of workers; and wages paid per day*. Incorrect responses: *cost of machinery used; expected amount of money to be spent; and the quality of the work*.

## Question 3

This question tested candidates' knowledge of fertilizers, calculation of fertilizer ratios and application of composting. Overall, approximately 75.37 per cent (62.52, DA) of the candidates scored zero or one mark, 15.38 per cent (21.25, DA), two marks, while 6.44 per cent (10.38, DA) scored three marks. Only 2.82 per cent (5.85, DA) of candidates scored full marks.

Part (a) (i) of this question required candidates to identify the type of fertilizer stated. Some candidates were able to correctly identify the type fertilizer, with correct answers including: *mixed fertilizer; compound fertilizer; and NPK fertilizer*. Incorrect responses included: *plant fertilizer; potassium; and organic fertilizer*.

Part (a) (ii) required candidates to calculate the nitrogen to phosphorus ratio in the same fertilizer. Most candidates were not able to calculate this ratio due to poor arithmetical skills. Therefore a few candidates were able to arrive at the correct answer, that is, *a nitrogen to phosphorus ratio of 1:2*. Incorrect answers included ratios of *4:8* and *8:16*.

Part (b) required candidates to suggest, with explanation, one way of reducing the composting period for a compost heap. Some candidates were aware of composting and applied their knowledge to the question correctly. However, most candidates showed a lack of knowledge of the composting process and were therefore unable to answer the question correctly.

Correct responses included: *add manure/starter material as it will introduce microorganisms to the compost heap; add nitrogen fertilizer to provide a source of nutrient for microbes; and add limestone to reduce the soil acidity*. Some incorrect responses were: *dig a hole as temperature is hotter underground; make small heaps as larger heap takes a longer time; and reduce the amount of water/bacteria function better under dry conditions*.

#### Question 4

This question tested candidates' knowledge of secondary tillage implements and application of genetic engineering. Overall, approximately 54.67 per cent (39.95, DA) of the candidates scored zero or one mark, 27.5 per cent (32.53, DA), two marks, while 13.21 per cent (32.53, DA) scored three marks. Only 4.62 per cent (8.72, DA) of candidates scored full marks.

Part (a) of this question required candidates to identify two secondary tillage implements that could be used in the preparation of a seedbed to sow spinach seeds. Generally, candidates were able to identify at least one secondary tillage implement, although some included primary implements in their responses. Some correct responses were *rotavator, hoe, and rake*. Incorrect responses included *fork and spade*.

Part (b) required that candidates suggest two advantages of using genetically modified plants. The question was attempted by most candidates, who provided satisfactory responses. Correct responses to the use of genetically modified plants were: *improved fruit quality; improved yield; and improved resistance to diseases*. Some incorrect responses were: *plants would be stronger; it is cheaper; a good way to earn an income*.

#### Question 5

This question tested candidates' knowledge of digestion, with respect to poultry and its application in rabbits. Overall, approximately 56 per cent of the candidates (45.56, DA) scored zero or one mark, 27.47 per cent ((32.92, DA), two marks, while 13.57 per cent (18.05, DA) scored three marks. Only 2.96 per cent of candidates (3.47, DA) scored full marks.

Part (a) (i) required candidates to state one function of the gizzard during digestion in poultry. Most candidates were successful in identifying the correct response, which included: *grinds the food; makes the food easier to digest; and break up the food*. However some candidates offered incorrect responses, such as: *stores the food; digest the food; moistens the food; and stores undigested food*.

Part (a) (ii) required candidates to identify one material that could be added to a poultry diet to aid in digestion. Some candidates were able to identify the correct response, while others showed that they had little knowledge of digestion in poultry. Popular correct responses were *grit and small stones*. Incorrect responses included: *add lime; add fiber; and add water*.

Part (b) required candidates to explain two benefits of rabbits eating their soft faeces at night. Most candidates were able to identify at least one benefit of the rabbit eating their faeces. Correct responses included: *encourages digestion in the caecum; recycles food; and more nutrients are obtained from enzyme digestion*. Some incorrect responses were: *it helps to harden the faeces; it works as a medication; it is a natural habit; and a meal was provided to the rabbit though it was not fed*.



### Question 6

This question tested candidates' knowledge and application of animal nutrition, through definition of the concept, '*balanced ration*' and analysis of the labels of two bags of poultry feed. Overall, approximately 75 per cent (62 per cent, DA) of the candidates scored zero or one mark, 15 per cent (22, DA), two marks, while 7 per cent (12 per cent, DA) scored three marks. Only 2 per cent (4 per cent, DA) of candidates scored full marks.

Part (a) of the question required candidates to explain the term 'balanced ration'. Overall, responses showed that candidates were struggling to define the term, despite it being tested in 2013. Some examples of incorrect responses were: *the proportion of feed an animal needs to fulfill its daily diet*; *the feed eaten is equal to the weight gained*; and *a balanced diet*. The accepted response was "*a ration which contains all the essential nutrients in the correct proportion for growth and development*".

Part (b) presented a table which showed the information from the label of two poultry feeds. The table outlined the percentage constituents of crude protein, fats, fibre, phosphorous and calcium.

Part (b) (i) required candidates to indicate which of the two feeds was better for broiler birds at 4–6 weeks of age. Most candidates failed to identify the correct feed, which points to a lack of knowledge of feeds for broiler birds at the various stages of growth outlined in the syllabus. Candidates also incorrectly gave the constituents of the feeds as the answer to the question. Hence, incorrect responses included: *Feed B*, *crude fibre* and *crude protein*. The correct answer was '*Feed A*'.

Part (b) (ii) required candidates to explain why fibre was an important component in both feeds. Candidates also responded poorly in this section, indicating that the role of fibre in digestion was not clearly understood. Correct responses were: *prevent constipation*; *aids in digestion*; and *formation of faeces*. Some incorrect responses were: *it builds the tissues*; *helps the bird to grow*; and *it gives protein*.

## SECTION II

### Question 7

This question tested candidates' knowledge on organic farming and the economic operations of a farm. This question was generally well done by candidates with 37 per cent gaining scores between six and ten marks (55 per cent, DA). Six candidates for the SA and 2 for the DA had perfect scores of twelve. Few candidates (4 per cent, SA and 1 per cent, DA) scored zero on this question.

Part (a) (i) of the question required candidates to give the meaning of organic farming. Most candidates had the concept that it only dealt with farming without the use of artificial/inorganic fertilizers, and did not know that other inorganic chemicals such as pesticides, herbicides and plant growth regulators were also not allowed. Most candidates were able to identify one aspect of organic farming, which was expressed mainly as farming without the use of chemicals or fertilizers. Others commonly stated that it was farming using compost or manure. To be able to obtain full marks for the question, students should have outlined both aspects of organic farming in their answers.

Some correct responses were: *farming without the use of chemicals, instead, using organic matter, organic manure, compost*; and *the act of growing crops by adding animal manure to the soil, not using inorganic fertilizer*. Incorrect responses included: *growing of crops on fertile piece of land*; and *it is an integrated management*.

Part (a) (ii) required candidates to state how organic farming affected farm income. Many candidates answered correctly by identifying factors that would reduce the cost of production or that the produce would fetch a higher price. However, a number of candidates incorrectly stated that '*the produce is healthy and consumers will buy more*', focusing on the health aspect rather than the higher income to be derived because it fetches a premium price.

Some correct responses were: *less expensive than buying chemicals; do not have to buy chemicals; and the produce from organic farming is costly/price is high*. Some incorrect responses were: *goods are not infected with harmful chemicals; it grows faster; it sustains growth; and people prefer to buy produce that has not been affected by chemicals*.

Part (a) (iii) tested candidates' knowledge of certification of organic farms. Most candidates were able to give at least one reason why the farm described in the stem of the question could not be certified. Correct responses were: *Suriya's inorganic pesticides will contaminate his field; he is not farming long enough; and soil has residue of inorganic substances*. Incorrect responses included: *has no knowledge of organic farming; when using organic manure, there is no special method to use; and it is natural for farming*.

Part (b) dealt with a farm which cultivated cauliflower and eggplant and the farmer was supplying the output to a hotel, and seeking to expand its operations.

In Part (b) (i), candidates were asked to identify the budget needed to assist in the expansion. Quite a few candidates were able to give the correct response, *partial budget*. Incorrect responses were *complete/whole farm budget, projected budget, actual budget and cash flow budget*.

Part (b) (ii) gave a projection of the farm's income and expenditure statement for cauliflower and eggplant for two hectares. In Part (b) (ii) (a), candidates were asked to give two reasons why the farm should be expanded. The majority of candidates were able to score at least one of the two marks allocated. Some correct responses were: *she made a profit; her income increased; business is profitable; and she has a good income*. Incorrect responses included: *farming more on land; more good quality; and products fresh and good*.

Part (b) (ii) (b) asked candidates to give ways as to how the farmer can improve her profitability if the price she receives does not change. Most candidates scored well on this part of the question. Several correct responses stated: *produce more cauliflower and less eggplant; reduce her expenses; produce a different crop; and use machinery*. Incorrect responses included: *raising the selling price; rent her farm to different farmers; and provide more space to plant*.

Part (c) tested candidates' knowledge on depreciation of a tractor on the farm. The majority of candidates obtained the correct answer as they were able to substitute the figures correctly and also calculate correctly.

Correct responses:

- $1000 \times 10\% \times 5 = 500$
- $100 \times 10 / 100 = 100 \times 5 = 500$

Some incorrect responses:

- $1000 \times 10 \times 5 = 50,000 - 100 = 49,900$
- $1000 \times 10 / 100 \times 12$

### Question 8

This question dealt with the knowledge and application of harvest and post-harvest activities and soil-management practices. Generally, this question was not well done by candidates; with 16 per cent (30 per cent, DA) gaining scores from 6 to 12 marks.

Part (a) of this question required candidates to identify the differences between harvest and post-harvest operations. Some candidates correctly differentiated between harvest and post-harvest operations, with more of them gaining marks for correctly describing post-harvest operations. Incredibly, some candidates associated post-harvest with sending crops to another country. Many candidates substituted **reaping** for harvesting and this was not credited.

With respect to harvest, the correct response was '*the act of **removal** from the **plant** or from the **field***'. Responses such as '*is during the crop season*' and '*when the crop is ready to eat*' were not accepted.

The postharvest process was better explained. This involved the different activities **after** the harvesting process, but before marketing. Many candidates offered the various activities such as *sorting, grading, and cleaning* and were credited. Others offered incorrect responses such as: *storage and preservation methods after harvest; after the crops are picked, preparing the ground/bed for the next harvest period; and what you have done after you reap the crop*.

In Part (a) (ii), candidates were presented with information that outlined the poor practices in the harvesting and post-harvest operations of a cabbage farmer. Many candidates were able to score at least 2 marks out of a possible 4 marks by offering a poor practice and a possible solution to that practice, or two poor practices based on their application of the stem to the question.

Accepted responses included: *transporting in an open tray truck (practice)/truck should be covered (solution); cabbages were not cleaned before transportation (practice)/crop cleaned and excess leaves trimmed (solution); cabbages harvested too early (practice)/should be harvested when heads are firm (solution)*.

Part (b) required that candidates explain three environmentally friendly soil-management practices that a farmer could use to prevent the soil particles from blowing away during the preparation of the soil for planting. The question was fairly well done with candidates at least being able to state one soil management practice. However, in order to obtain two marks for each practice, an explanation was required for each soil management practice stated.

Correct responses included: *add organic matter to the soil/binds the soil; apply a mulch/covers the soil; and reduce the level of secondary tillage/decrease crumbling*. Incorrect responses included: *allow the land to rest for a short time; use manual labour instead of machines; addition of lime; add clay soil; and terracing*.

### Question 9

This question tested candidates on several aspects of animal production. Generally, this question was not well done by candidates, with 16 per cent (33 per cent, DA) gaining scores from 6 to 12 marks.

In Part (a), candidates were questioned on the advantages and disadvantages of the communal grazing of goats. This section was well answered, with many candidates obtaining at least two of the three marks. Some correct responses for advantages were: *easy access; variety in the diet; and cheaper*. Some incorrect responses for advantages were: *grows very healthy; goats get plenty of food; and animals get sufficient land to stay on*. Correct responses for disadvantages were: *some forage may be toxic; more prone to praedial larceny; and overgrazing*. Incorrect responses for disadvantages included: *grass lacks time to grow; continuous grazing of grass is being eaten in one area; and faeces left by goat will stink*.

Part (b) (i) required the identification of a diagram depicting a **Candler**. Most candidates were not able to identify this Candler. Incorrect responses included *incubator, egg fertility box, egg machine, brooder, charger, nesting box and egg separator*.

Part (b) (ii) required an explanation of how the candler was used to separate fertile from infertile eggs. Most candidates by their expression, showed knowledge of the operation of the Candler, despite not being able to name it in (b) (i). However many did not gain marks, as they failed to properly explain what was expected to be seen and why that was so. As such incorrect responses were given, such as: *fertile eggs will appear dark; and infertile eggs will be shown as clear*. Correct responses included: *fertile eggs appear dark due to the presence of the embryo; and infertile eggs appear clear due to the absence of the embryo*.

Part (c) focused on the swarming of bees, management practices to prevent swarming and the advantage of swarming to the beekeeper. Candidates performed fairly well on this section, demonstrating knowledge and application of swarming of bees.

Part (c) (i) asked candidates to identify three reasons why bees had swarmed. Some correct responses were: *presence of another queen; overcrowding in the hive; and lack of food*. Incorrect responses offered were: *so as to gather food; to mate; and to be out of harm's way*.

Part (c) (ii) asked candidates to explain one management practice to prevent swarming. Correct answers included: *provide more food closer to the hive; build more hives for bees to nest; make more room in the hive by adding more supers; and reduce numbers in the hives*. Incorrect answers were: *separate workers from the queen bee; use a smoker to stunt the bees and harvest their royal jelly, thereby no more queens are formed; and whisper to the bees*.

Part (c) (iii) asked candidates to suggest one advantage of swarming to the beekeeper. Correct answers included *more honey/hives/bees*. Incorrect answers were: *beekeeper has healthy bees; attract more bees; and makes honey*.

### Paper 03 — Essay Questions

This paper was made up of two sections and consisted of four compulsory structured essay questions, two from Section D (Horticulture) and two from Section E (Animal Husbandry) of the syllabus. Each question was worth 15 marks. Only candidates sitting the Double Award option were required to write this paper.

## SECTION I

### Question 1

This question dealt with citrus propagation and rehabilitation of a citrus estate. Generally, this question was fairly well done by candidates, with 42 per cent gaining scores between 5 and 14 marks.

Part (a) required candidates to describe the 'inverted T' method for propagating new citrus plants. In general, candidates showed knowledge of citrus propagation, but some struggled to properly describe the '**inverted T**' method. Correct responses were: *choose a healthy root stock; choose a bud from a mature stem; remove the bud with a sharp knife; insert bud from the base of the 'inverted T', with the eye facing upward; tape the bud unto the stock, starting at the top and using the 'eye' exposed; and wrap using plastic*. **Unacceptable responses were:** *inserting the stock into the scion; use a cord to tie around the cut; select a bud from a stem; and use a hormone in the union*.

In Part (b), candidates were informed that the farmer budded some citrus plants, but all of the buds died and they were asked to suggest two reasons why the unions were not successful. Most candidates responded well to this section, again demonstrating their knowledge of citrus propagation. Accepted responses were: *bud not properly inserted; exposure of budded area; and unsanitary conditions*. Incorrect responses included: *the presence of undesirable characteristics; the buds were not cared for properly; and enough nutrients were not present*.

In Part (c), candidates were asked to advise a farmer on the steps that he should take to rehabilitate an existing citrus estate which had been previously neglected. They were further informed that some plants died and those which survived had dead and diseased branches. The trees were infested with parasitic plants and produced little or no fruits.

Part (c) (i) required candidates to advise the farmer on land preparation. Many candidates obtained at least one mark in this section because of applying general knowledge about land preparation to the question. However, it was clear that specific knowledge pertaining to land preparation for citrus was lacking by at least half of the candidates. Correct responses included: *clear the land; dig the holes; and add manure*. Incorrect responses were: *plough the land; keep soil moist; and spray the land with a fungicide*.

Part (c) (ii) required candidates to advise the farmer on control of parasitic plants. Candidates appeared to have confused general treatment for weed control in the field with control of parasitic plants on the branches of the citrus trees. Hence, popular incorrect responses were the *use of herbicides, spraying or weeding*. However, the correct responses were *removing manually by hand or by use of a disinfected cutting tool; and remove/burn parasitic plants*.

Part (c) (iii) required candidates to advise the farmer on how to control dead and diseased branches. Correct answers included: *cut off branches with a clean tool; and cut as close to the trunk of the tree as possible*. Incorrect answers included: *spraying of branches with chemical; and save diseased branches*.

## Question 2

This question tested candidates' understanding of the agronomic practices of land preparation for lawn grass. Generally, this question was fairly well done by candidates, with 24 per cent gaining scores between 5 and 11 marks.

Part (a) of the question required candidates to describe the seed method for establishing a lawn. Most candidates were able to perform well on this aspect of the question, showing knowledge of land preparation for lawn establishment. Though not desirable, others were able to apply general land preparation principles to secure marks. Popular correct responses were: *clear the land; plough/till; and distribute/scatter seeds*. Incorrect responses included: *select a flat topography; sandy loam is required; fine tilth is needed; and make rows*.

Part (b) required candidates to study the diagrams showing two methods of lawn establishment. Part (b) (i) asked them to identify the method for lawn establishment shown by both diagrams. This question was poorly done and showed candidates' lack of knowledge of lawn establishment methods. Some incorrect responses were *artificial vegetative propagation, grass cultivation, lawn cultivation, hydroponics, transplanting, and layering*. The correct method was *sodding*.

Part (b) (ii) required candidates to suggest two advantages of establishing a lawn by Method A and three advantages by Method B. This part of the question was answered very poorly. Responses for method A were confused with method B resulting in most candidates being unable to gain marks awarded for the question. Correct responses to **Method A** were: *can be used in small area; can be used on irregular areas; and good for replanting*. Some incorrect responses were: *pest infestation may be easily controlled; weaker plants can be removed; and the grass can be protected from harmful organisms*. Correct responses for **Method B** were: *can be used in large areas; a faster process; and less chance of bare patches*. Incorrect responses included: *you can move the grass when you want; it would be nice under your feet; and grass would grow within less time*.

Part (c) required candidates to suggest with reason, which soil type was suitable to grow Bermuda grass (*Cynodon dactylon*) and Savannah grass (*Axonopus compressus*), respectively. The answer to this section was poor, as many candidates were not able to identify the soil types that were suitable for establishing the grasses. Other candidates were able to identify the soil type, but gave an incorrect reason. Correct responses were: **Bermuda grass** — *suited for sandy soil/has a horizontal root growth and will establish itself easily*; and **Savannah grass** — *suited for clayey soils/stolon root growth*. Examples of incorrect response were: **Bermuda grass** — *Loamy soil/it is not easily waterlogged*; and **Savannah grass** — *silt soil/water retention is low*.

## SECTION II

### Question 3

This question tested candidates' knowledge and application of livestock breeds, animal nutrition and food safety and food handling. Generally, this question was well done by candidates, with 71 per cent gaining scores between 5 and 15 marks.

Part (a) required candidates to state one characteristic each of five breeds of livestock, namely, Saanen goat, Barbados Black Belly sheep, Rhode Island Red fowl, Large White pig and Buffalypso. Candidates were able to correctly identify characteristics of at least three of these breeds. Some correct responses were: Saanen goat — *sensitive to excessive sunlight, high quality milk and cream/white in colour*; Barbados Black Belly sheep — *hardy/heat tolerant, high number of twins and brown with black underside*; Rhode Island Red fowl — *brown/red in colour, dual purpose and males may be aggressive*; Large White pig — *white/pink skin, upright ears and good for bacon/meat/pork*; Buffalypso — *black/grey in colour, meat/work/milk and hardy*.

Incorrect responses included: Saanen goat- *used for meat, small in size and big ears*; Barbados Black Belly sheep — *good for wool, very furry and resembles a goat*; Rhode Island Red fowl — *big, used for meat and reared for both milk and egg*; Large White pig — *thick, well-built and body is long*; Buffalypso — *large in size, hump on back and mix between water buffalo and cattle*.

In Part (b), candidates were required to identify two nutrients that a feed mixture may have been lacking and to suggest one way to prevent night blindness and fragile bones, respectively. Many gained at least half of the marks in this section by being able to identify the nutrient lacking. In addition, better candidates were able to identify at least one preventative measure. Some correct responses were:

SYMPTOM	NUTRIENT LACKING	SOLUTION
(i) Night blindness	Vitamin A	Addition of green, leafy vegetables, carrots and Vitamin A supplements.
(ii) Fragile bones	Calcium/Phosphorus	Calcium/phosphorus supplements and crushed oyster shells.

Incorrect responses included:

SYMPTOM	NUTRIENT LACKING	SOLUTION
(i) Night blindness	Carbohydrates, Vitamin B, Vitamin C	Do not feed your goats fish meal and feed animals with balance ration.
(ii) Fragile bones	Protein, Vitamins, Nutrients	Coco pods and consume enough carbohydrates.

In Part (c), candidates were informed that the people in a farm community were experiencing frequent diarrhea as a result of the chickens they consumed from the village poultry shop and outlined the dressing process undertaken by the vendor.

Part (c) (i) required candidates to explain two steps in the dressing process used by the vendor that may have contributed to the diarrhoea. Candidates were able to obtain most of the marks since the response was implicit in the stem. Hence, the **correct responses** were: *wash all in the same container of water/infection from one bird can be passed on to others*; *birds kept at room temperature/this would increase the growth of spoilage organisms*; and *birds placed on shelf/could lead to contamination from the shelf and flies*. Incorrect responses included: *vendor plucks the bird the wrong way*; *chickens may not have consumed the right type of feed/chickens gained diseases*; and *chicken was not vaccinated*.

Part (c) (ii) required candidates to suggest one way by which the consumers may have contributed to the diarrhoea. Many candidates responded correctly to the question, showing knowledge of proper food handling practices. Correct answers included: *poor preparation of meat before cooking*; *insufficient cooking*; and *delay in transportation to the home*. Popular **incorrect** responses were: *the consumer knew the dressing process was poor but they still purchased the chicken*; *consumers not watching what they are purchasing*; and *consumers not asking questions*.

#### Question 4

This question tested candidates' knowledge of biotechnology, animal by-products and disease management in cattle.

In Part (a), candidates were required to describe two techniques that could be used in biotechnology to improve animal production. Many candidates were able to give the two techniques, but failed to offer correct explanations, which resulted in them obtaining only half of the allocated marks.

Correct responses included:

TECHNIQUE	EXPLANATION
(i) Genetic Engineering	Changing the traits of an organism by inserting genetic material from another organism.
(ii) Artificial Insemination	The introduction of sperms into the uterus by the use of instruments.
(iii) Embryo transplant	Done from in vitro fertilization for the characteristics required.

Incorrect responses included:

TECHNIQUE	EXPLANATION
(i) Embryo development	Done by introducing hormones into the animal
(ii) Hybrid breeding	Used to get hybrid animals with high quality
(iii) Injections	To speed up the time to give birth

Part (b) required candidates to name one product other than fresh meat that could be derived from pig meat. Most candidates offered **correct** responses such as *bacon/sausage/ham, offals* and *bristles*. Incorrect responses included *pork* and *make-up*.

In Part (c), candidates were told that a dairy cattle farmer noticed that he was getting fewer calves every year from the use of Artificial Insemination (AI). They were presented with a table that recorded the number of times his cows were inseminated by two different AI technicians before the cows became pregnant.

Part (c) (i) required candidates to state which of the two technicians, I or II, was more successful at the AI technique? Many candidates offered the correct response, *Technician 1*, to this question.

Part (c) (ii) then asked candidates to suggest two reasons why the cows did not conceive, assuming that they were healthy and fed properly. Many candidates were able to offer correct responses to this section. Correct responses tendered were: *incorrect procedure by technician resulting in the sperms being placed in the wrong place for conception; heat was not detected on time; and the animal was too young/old*. Incorrect responses included: *AI might not be a good thing for getting cows pregnant; numerous times the farmer does the AI and this prevent the cows from conceiving; and sperm was there for a long time causing it to become weak*.

In Part (d), candidates were advised that the farmer washed the cows' udders with water from a nearby pond before milking them, and used an automated system of milking. From time to time the cows' udders became hard and there were clots in the milk.

Part (d) (i) asked candidates to identify the disease that affected the cows' udders. *Mastitis* was the **correct** response offered by most candidates. Incorrect responses included *manigma, cow udder disease, and radiation of the machine*.

Part (d) (ii) asked candidates to explain two management practices that the farmer should use to control mastitis. In this section many candidates offered the reason without the explanation. Many candidates who did not identify mastitis as the disease affecting the cows' udders were still able to gain at least two marks by naming the management practices, some with explanation and others without the correct explanation.

Some correct management practices given were: *wash the udder with clean water as dirty water introduces bacteria to the teat; use a teat dip after milking to reduce infection; and use a long acting antibiotic in the dry period to reduce subclinical mastitis.* Incorrect responses were: *hand milk the animals; ensure the pasture is clean; massage the udder; and make sure there is a lot of calcium in the cow's diet.*



**C A R I B B E A N E X A M I N A T I O N C O U N C I L**

**REPORT ON CANDIDATES' WORK IN THE  
CARIBBERAN SECONDARY EDUCATION CERTIFICATE® EXAMINATION**

**MAY/JUNE 2015**

**AGRICULTURAL SCIENCE  
GENERAL PROFICIENCY EXAMINATION**

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## **GENERAL COMMENTS**

Agricultural Science offers Caribbean students a choice between two options, the Single Award (SA) and the Double Award (DA).

Paper 01 comprised 60 multiple-choice items, with 20 questions each from the three profiles outlined in the syllabus for the SA and DA, that is, Profile 1 – The Business of Farming, Profile 2 – Crop Production, and Profile 3 – Animal Production. Performance on this paper for SA and DA candidates was fairly good.

Paper 02 comprised nine compulsory structured questions from Profiles 1, 2 and 3. These two papers were common to the SA and DA. Performance on this paper for the SA candidates was poor, while that of the DA candidates was fair.

Paper 03, written by DA candidates only, was a compulsory paper with four structured essay questions. Two essay-type questions each were set on Horticulture and Animal Management, respectively. Performance on this paper was poor.

The School-Based Assessment (SBA) component was conducted in the school and the school farm environment by SA and DA candidates. Students were tested on a number of skill objectives set out in the syllabus, and on cost analyses based on their crop and animal production activities. The DA also required students to conduct a research project on an agricultural problem, in addition to the other SBA requirements. Performance on the SBA component for SA and DA candidates was very good, continuing the trend from previous years.

With respect to Paper 02 (SA and DA), most candidates demonstrated adequate knowledge of important concepts and their application in the following areas:

- Container planting
- Soil pH
- Effect of nutrient deficiency on crop production
- Sexual propagation of plants
- Relationship between bee population and fruit production
- Identification of parts of a hen's egg
- Management of layers for quality of egg shell
- Feed conversion ratio of broiler breeds
- Fixed and variable costs, income and net profit
- Soil cultivation practices
- Pest control
- Pasture irrigation systems
- Bee keeping

Some of the factors that contributed to the unsatisfactory performance by SA and DA candidates were:

- Incorrect or poor interpretation of the questions asked, resulting in answers that were irrelevant.

- Inadequate preparation for the examination as evidenced by answers that were totally inappropriate. This demonstrated that candidates had no knowledge of the topic and were simply guessing.
- Careless arithmetical errors; difficulty with simple calculations.
- Challenges with the application of information in tables presented in questions.
- Answers not being commensurate with the marks allocated for some questions.

With respect to Paper 03 (DA), most candidates demonstrated adequate knowledge of important concepts and their application in the following areas:

- Cultivation practices relevant to ornamentals (ginger lily)
- Caribbean avocado varieties and cultivation practices
- Meat processing
- Food safety
- Use of biotechnology in animal production
- Dairy and beef cattle breeds
- Relationship between cattle housing and oestrus
- Management of dairy calves

Some of the factors that contributed to unsatisfactory performance of DA candidates were:

- Unfamiliarity with some aspects of the syllabus tested in the examination
- Lack of understanding regarding the requirements of questions

### **Recommendations**

- Candidates should be instructed on how to answer questions. Too many candidates are writing irrelevant information instead of focusing on what is required.
- Candidates must be encouraged to read their questions well, since many of them misinterpret what is asked.
- Concepts should be taught with examples, and where possible, students be exposed to the practical aspects to concretize these areas.
- There needs to be greater emphasis on the revision of concepts taught earlier in the programme to remind students of the importance of reviewing them before the examination.
- Use of scaffolding so that concepts and information previously taught can be reinforced and built upon as teachers and students progress through the syllabus.
- Candidates must be equipped to perform basic arithmetical functions in the examination.
- Teachers should timeframe the syllabus and monitor their progress to ensure that they not only cover all the topics in the syllabus, but that they do so in a manner that adequately prepares students to be successful in the examination.
- The Agricultural Science syllabus has advice on how candidates can be guided in their answers by the wording of questions and teachers should use this information to assist them in preparing their students for the examination.
- The CXC® website provides copies of subject reports for several years and these can be used by teachers and their students in preparation for the examination.

## DETAILED COMMENTS

### Paper 01 – Multiple Choice

This paper consisted of 60 multiple-choice items — 20 items each on Profile 1, Profile 2 and Profile 3 — and was written by both the SA and DA candidates. Performance on this paper was fairly good. Approximately 49.1 per cent of the candidates for the SA scored at least 50 per cent of the available marks on this paper. The mean score on the overall paper was 29.62 or 49.4 per cent of the total marks. The average score was 49.95 per cent for Profile 1, 48.1 per cent for Profile 2 and 50.05 per cent for Profile 3.

For the DA, approximately 74.5 per cent of the candidates scored at least 50 per cent of the available marks on this paper. The mean score on the overall paper was 34.58 or 57.63 per cent of the total marks. The average score was 58.6 per cent for Profile 1, 56 per cent for Profile 2 and 58.4 per cent for Profile 3.

### Paper 02 – Structured Questions

This paper consisted of two sections. Section I comprised six questions, each worth four marks. Section II included three questions requiring longer responses, each worth twelve marks.

#### Section I

##### Question 1

This question tested candidates' knowledge of the advantages of the grow box system to cultivate vegetable crops, and the characteristics of an efficient hydroponic system. Overall, for the SA, approximately 43.55 per cent of the candidates scored zero or one mark, 50.67 per cent, two marks, while 5.87 per cent scored three marks. Only 0.23 per cent of candidates scored full marks. For the DA, approximately 72.34 per cent of the candidates scored zero or one mark, 24.62 per cent, two marks, while 2.82 per cent scored three marks. No candidate scored full marks.

Part (a) tested candidates' knowledge of a simple grow box system used to cultivate vegetable crops. Candidates' performance was fair with most of them gaining one or two marks. Candidates were asked to give two advantages of using a grow box system. Correct responses included *crops can be cultivated where soil conditions are poor; better weed control; better pest and disease control*. Incorrect responses included *easy to obtain nutrients; faster germination*.

In Part (b), candidates were given a labelled diagram of a hydroponic system and required to suggest two ways in which the system could be modified to make it more efficient. Most candidates did not demonstrate an understanding of hydroponics.

The correct answer that was most popular was *reduced spacing between plants so more lettuce could be planted*. Expected responses which were not given by candidates were: *use of an automated system to fill the containers; drainage holes at the bottom of the inner part of box to prevent waterlogging of the growing medium; include aerator in the tank; and use circular pipes with holes to reduce evaporation*.

## Question 2

This question tested candidates' knowledge of agricultural co-operatives and was generally well answered. Overall, the mean score was 37 per cent for the SA and 54 per cent for the DA.

Part (a) tested candidates' knowledge of how being a member of an agricultural co-operative can be advantageous to a farmer and the criteria that need to be met to obtain a loan from a credit union. Surprisingly, some candidates did not attempt this part of the question. The most popular correct answer was *low interest rates on loan*. Other correct responses included *co-operatives help find markets for farmers*; *farmers get cheaper inputs*. Some incorrect responses were 'farmers did not have to pay back money loaned to them' and 'to ensure that farmers are doing the right thing'.

Part (b) tested candidates' knowledge of the criteria for a farmer to obtain a bank loan, based on a farmer's vegetable production records which indicated that her farm was failing. Most candidates scored marks in this section with correct answers which included *it would be difficult for her to get the loan because her farm is operating at a loss, she will not be able to repay the loan*, and *poor credit rating*.

## Question 3

This question tested candidates' knowledge of major and minor plant nutrients and the consequences to plant growth if magnesium is deficient in the soil. Overall, the mean score was 34.75 per cent for the SA and 43 per cent for the DA.

Part (a) required that candidates define the terms *major and minor nutrients*. Many candidates were able to score the marks for this part of the question. Some candidates offered erroneous responses with some citing examples of the nutrients as explanations. This was not credited.

Correct answers included *Major nutrients are needed by plants in large amounts. Minor nutrients are needed by plants in small amounts*. Incorrect answers included 'Major nutrients are high in quality'; 'Major nutrients have everything the plant needs'; 'Major nutrients is where you will find the most nutrients'; 'nutrients do not have all the necessary nutrients needed for growth'; 'Minor nutrients are nutrients lost and only a small amount left'.

The question sought to elicit from candidates the link amongst magnesium, chlorophyll formation, photosynthesis and reduced yield. That was a two mark situation in which any two points forming a coherent response was credited. Unfortunately, many candidates offered only a partial response and so earned only one mark. Correct responses included *less photosynthesis*; *stunted growth*; *reduced yield*. Some incorrect responses were 'leaves would turn brown'; 'no nutrients and water allowed around the plant'.

## Question 4

This question tested candidates' knowledge and understanding of vegetative propagation and required that they apply their knowledge of beekeeping to fruit production. Overall, the mean score was 36.75 per cent for the SA and 43.75 per cent for the DA.

This question was presented in two parts with Part (a) having two subsections. Part (a) (i) required candidates to state what is meant by the term *asexual propagation*.

Part (a) (i) was attempted by most candidates with about 50 per cent of them giving the correct response. However, many candidates tendered incorrect and in some instances amusing responses.

Some incorrect responses included *part of a plant, either male or female combined on one plant, a method used to join two plants, a process in which plants form new seedlings, planting from seeds, and when the sperm is used to impregnate the recessive female*.

Accepted responses were *propagation of plants by vegetative means, when the plant is able to reproduce without pollination, no gametes to produce a new plant, and using plant parts other than seeds*.

Part (a) (ii) sought to find out the asexual propagation method used to produce citrus plants. There was only one correct response here — *budding*. However, a variety of incorrect responses were quoted by many candidates; such responses included ‘layering’, ‘cutting’, ‘grafting’ and ‘joining’.

In Part (b), candidates were told that there was a decrease in the bee population in the Caribbean. They were asked how that was likely to affect fruit production and to give a reason for the response.

Many candidates made the connection between pollination and fruit production. As such accepted responses included *fruit production will decrease because bees are insects that help in pollination to help plants produce their fruits, the bees, which are the main pollinators, will not be pollinating the plants, and fewer flowers will be fertilized and less fruits will grow*.

In this part of the question there was also the situation of partial responses, which meant that candidates only scored half of the allotted marks. Some of those responses included *bees are needed to carry pollen, fruit production will decrease, and it would affect fruit production in the blossoming period when pollination occurs*.

### Question 5

This question tested candidates’ knowledge of parts of a hen’s egg, and their ability to apply knowledge of genetically modified corn to the quality of a hen’s egg. Overall, the mean score was 30.25 per cent for the SA and 40 per cent for the DA.

Part (a) (i) required candidates to label two parts of the diagram of a hen’s egg. The correct answers were *air space* and *albumen*. Incorrect responses included ‘shell’, ‘thin white skin’ and ‘thin white shell’. Some candidates did not attempt a response.

Part (b) required that candidates give two reasons why feeding genetically modified corn to layers can improve the quality of the egg. Correct answers given were: *Genetically modified corn has more calcium* and *has more protein*. Incorrect responses included ‘eggs will be larger’; and ‘eggs would have longer shelf life’.

### Question 6

This question tested candidates' knowledge and application of the dressing percentage of pigs. Overall, the mean score was 39 per cent for the SA and 51 per cent for the DA.

Part (a) required that candidates define *dressing percentage*. Many candidates were unable to provide the correct answer: *the percentage of meat remaining after an animal is slaughtered and cleaned*. Evidence of an incomplete understanding of the concept was demonstrated by incorrect answers such as 'unused parts removed and weighed', and 'weight left after the animal has been killed'.

Part (b) required candidates to calculate the dressing percentage of a pig breed using information provided in a table. Many candidates did not arrive at the correct answer of 60%. A simple, straightforward calculation using the formula  $\text{Dressed weight} / \text{Live weight} \times 100$  was required but candidates' inability to find the correct answer indicates that they did not understand the concept of dressing percentage and did not know the formula they needed to use.

In Part (c), candidates were required to give two reasons for the difference between the dressing percentages of two breeds of pigs based on information presented in the stem of the question. There were indications of guessing as many candidates who correctly identified the breed of pig with the higher dressing percentage could not give an acceptable reason for the difference in dressing percentages. Correct answers included *stage of growth*, *type of feed*, *amount of fat*, *breed of animal* and *health of animal*.

## **Section II**

### Question 7

This question tested candidates' knowledge of complete and partial budgets. Overall, the mean score was 41 per cent for the SA and 44.75 per cent for the DA.

For Part (a) (i), candidates had to define the term *budget*. Most candidates gave correct responses such as *a plan which shows income and expenditure over a period of time*. Incorrect responses included 'how to spend money'. In Part (a) (ii), candidates were required to compare two characteristics of a complete budget and a partial budget. Candidates' correct responses included the following.

<b>Complete Budget</b>	<b>Partial Budget</b>
<i>Both fixed and variable costs are considered.</i>	<i>Is used when there is a change on the farm. Only variable costs are considered.</i>

Incorrect responses included the following.

<b>Complete Budget</b>	<b>Partial Budget</b>
Both crops and livestock are considered	Crops alone are considered.
Fixed costs are used.	Variable costs are considered.

Using the information in the table, candidates had to calculate the total fixed costs. The correct answer was \$1100. Correct total variable cost was \$2500.

For Part (b) (i), candidates were presented with a table showing information on a 1000 unit broiler farm. Using the information provided in the table, candidates had to calculate total revenue. Correct responses from candidates showed that they were able to give the correct formula, that is, *total number of birds*  $\times$  *average weight per bird*  $\times$  *selling price per bird*. Also, candidates made the correct substitution, that is,  $1000 \times 2 \times 10 = \$20000$ . Incorrect responses from candidates included *income - expenditure*.

Using the information in the table, candidates had to identify the fixed costs and variable costs for Part (b) (ii). Candidates correctly identified the following as fixed costs: *Insurance, taxes, interest on loan and depreciation*. Variable costs included *litter, water, feed, labour, baby chicks and electricity*. Incorrect fixed costs given by candidates included 'labour', 'water', 'baby chicks'. Incorrect variable costs given by candidates included 'taxes' and 'insurance'.

Using the information in the table, candidates had to calculate the gross margin for Part (b) (iii). Some candidates correctly gave the correct formula that is, *Gross margin = Total income – Total variable costs*. They also correctly substituted the correct numbers which gave the correct answer, that is,  $\$20000 - \$2500 = \$17500$ .

### Question 8

This question tested candidates' knowledge and their ability to apply knowledge of mulching, organic and inorganic mulches. They were also required to identify pest damage on a crop and the components and advantages of a drip irrigation system. Overall, the mean score was 34.58 per cent for the SA and 42.58 per cent for the DA.

Part (a) (i) required that candidates define the term *mulching* which means *the application of organic/inorganic materials on the soil surface*. Some candidates were able to answer correctly. However, others were not specific in their answers, stating that, 'mulching is using organic or inorganic materials to cover a plot or area', and 'is putting dry grass around the plant', and were not credited with the mark.

Part (a) (ii) asked candidates to distinguish between *organic* and *inorganic mulches*. Some candidates were able to distinguish between both terms, while others stated only one term correctly.

The correct response is that *organic mulches are derived from plant materials while inorganic mulches are derived from non-living things*. Examples of organic and inorganic mulches were also accepted.

The main incorrect responses for organic mulch were 'use of fertilizer', 'fertilizing of plants with organic matter', and 'use of natural resources'. Incorrect responses for inorganic mulches were 'use of dry grass', 'use of chemicals', 'fertilizing of plants with inorganic matter', and 'use of humus'.

Part (b) presented a picture of a young damaged cabbage plant. In Part (b) (i), candidates were required to identify two possible causes of this damage. Candidates were generally able to identify one cause, *pest* or *caterpillar*. Other correct responses were *larvae, worm, leaf cutting insect, and flea beetle*. Incorrect responses were 'lack of right nutrients'; 'not spraying with pesticides'; 'disease infestation' and 'poor management practices'.



Part (b) (ii) required that candidates explain the effects this damage would have on yield. Some candidates were able to give at least one correct response, but most were not able to relate their answer to a reduction in yield, which was necessary to gain full marks.

Correct responses were *reduction in leaf area, decreased photosynthesis, reduction in yields, damaged leaves, affect the quality of produce, lower marketable yields*.

Incorrect responses were ‘nutrition value of cabbage decrease’, ‘plant would not be able to produce’, ‘reduce growth and development of plant’, ‘plant will die’, ‘plant will not be able to bear anymore’.

Part (c) (i) required candidates to state one advantage of using a drip irrigation system for watering a tomato crop. Most candidates were able to correctly identify one advantage of using the drip irrigation system, with responses including *less water used to irrigate the crop, less time spent on watering, more efficient use of water*.

Incorrect answers included ‘improves the quality of tomatoes produced’, ‘gives plants water all the time’, ‘do not have to water crops’, ‘plant will not get too much water’.

Part (c) (ii) required candidates to sketch and label a drip irrigation system. Most candidates were able to gain at least one mark by either sketching and/or labelling key parts of the system. These were *tank, pump, emitters, main line, laterals, feeding tube, connector, elbow and collar*.

#### Question 9

This question tested candidates on several aspects of animal production. Overall, the mean score was 19.92 per cent for the SA and 21.5 per cent for the DA.

The question sought to test candidates’ knowledge of certain beekeeping equipment and its uses, the factors that should be considered in siting an apiary, the handling of honey and the effects of and the control of mites.

For Part (a), candidates were asked to identify the diagram of a tool used in beekeeping and to state two uses of the tool. This tool was the *hive tool*. Another accepted response was the *hive knife*. Some unacceptable responses were *bee cutter, wax blade, cutlass and machete*. Part (b) had two subsections. A situation was presented whereby a beekeeper, having established an apiary in his backyard in the town where he lived, harvested poor quality honey.

In Part (b) (i), candidates were asked to suggest three factors the beekeeper should have considered in siting his apiary to get better quality honey. Many candidates scored at least two marks in this section. Popular correct responses given were *protection from parasites, exposed to full sunlight, source of fresh water, and a source of food/nectar*.

Some incorrect responses included ‘get better bees’, ‘ensure there is adequate space’, ‘keep the bees in a warm place’, ‘have proper equipment’, ‘do research on bees’.

In Part (b) (ii), candidates were informed that a beekeeper extracted honey by pressing the honey combs followed by boiling and straining the honey. An explanation was elicited as to why that method produced honey of poor quality.

There were many poor responses in this section resulting in many candidates scoring only one mark. There appeared to be some confusion or misinterpretation of what was required in the response. The stem informed candidates of the practices performed by the farmer yet a regular incorrect response was 'because of his boiling and straining the honey was of poor quality'. Another poor response was 'too much processing'.

The most popular correct response was the umbrella term *it is denatured*. This included *taste, texture, colour and nutrients*. Other correct responses were *contamination by pieces of comb or dead larvae*, and *the pressing of the comb would crush the larvae*.

In Part (c), candidates were told that a bee farmer noticed that many of his bees were dying of a mite infestation. Candidates were required to describe two ways in which the mite infestation caused the death of the bees and to suggest one method that the beekeeper could use to control the mites.

Most candidates offered only one reason and were credited with one mark. Few gave two correct responses. Correct responses included *the mites could spread a disease*, *the mites feed on the larvae*, and *the mites feed on the bees*.

Some of the incorrect responses suggested were 'the mites occupy the space of the bees so killing them', 'the infestation is very effective so killing them out', and 'the mites eat all the honey so killing the bees'.

The responses to the control method of the mites were quite ingenious but sadly incorrect. Some of these responses included but were not limited to 'clear the area', 'call pest control', 'vaccinate and sanitize', 'introduce a biological pest'.

Some of the correct responses were *the use of vegetable oil*; *use of formic acid*; and *use of a selective insecticide/chemical*.

### **Paper 03 – Essay Questions**

This paper was made up of two sections and consisted of four compulsory structured essay questions, two from Section D (Horticulture) and two from Section E (Animal Husbandry) of the syllabus. Each question was worth 15 marks. Only candidates sitting the Double Award option were required to write this paper.

#### **Section I**

##### Question 1

This question dealt with citrus propagation and rehabilitation of a citrus estate.

Generally, this question was done poorly by candidates, with a mean score of only 18.8 per cent. Scores ranged from zero to 13 marks.

Candidates had to state a method by which ginger lily is propagated in Part (a) (i). Correct responses given by candidates included *side shoots, plantlets*. Incorrect responses included ‘seeds’, ‘cuttings’.

For Part (a) (ii), candidates were required to list two advantages and two disadvantages of using the method of propagation named in Part (a) (i). Correct advantages included *plants will flower in a shorter time, more plants reproduced faster*. Incorrect responses given by candidates included ‘plants will grow taller’, ‘flowers will be bigger’. Correct answers for disadvantages included *plants get diseases easy, low reproductive ability only if tissue culture is used*. Incorrect answers provided for disadvantages included ‘plants take longer to flower’, ‘flowers do not look like those from parent plant’.

For Part (b), candidates had to discuss the growing of ginger lily under five headings: site selection, selection and preparation of planting material, planting, fertilizer application and harvesting.

For site selection, correct responses given by candidates included *the area should be sheltered from strong winds, the soil should be well drained*. Incorrect responses from candidates included ‘swampy soil’, ‘clay soil’.

For seed selection and preparation of planting materials, correct responses given by candidates included *collect rhizomes and cut off rotten parts, do not use diseased plants*. Incorrect responses included ‘soak seeds before planting’.

For planting, correct responses from candidates included *mix organic manure in hole with soil before planting rhizome, water hole after planting*. Incorrect responses given by candidates include ‘soak seeds before planting’.

For fertilizer application, correct responses given by candidates included *apply fertilizer based on soil test, use fertilizer rich in nitrogen*. Incorrect responses given by candidates included ‘use NPK fertilizers monthly’.

For harvesting, correct responses given by candidates included *harvest flowers in the cool of the day, place flower stalk in a bucket with clean water*. Incorrect responses given by candidates included ‘harvest flower when fully open’.

## Question 2

This question tested candidates’ knowledge of the agronomy of avocado. Generally, candidates’ performance on this question was satisfactory, with the mean score being 33.07 per cent.

There were two parts, (a) and (b), with (a) having two subsections and Part (b) divided into five parts. In Part (a), candidates were informed that avocado, a tropical fruit which was widely grown in the Caribbean, was unable to penetrate the export market.

Part (a) (i) required candidates to name two cultivars of avocado grown in the Caribbean that were suitable for the export market. Most candidates were able to name at least one cultivar. About 20 per cent of them gave two examples. Popular correct responses included *Pollock, Lula and Hass*.

*Collinsten* and *Shepherd* were also accepted. There were, however, some incorrect responses such as 'Green skin', 'Purple skin' and 'Chinese'.

Part (a) (ii) asked candidates to state three characteristics of the named cultivar in Part (a) (i) that made it suitable for the export market. Most candidates gave two characteristics. Few candidates obtained full marks in this section. Accepted responses included *fruit size, shape, colour, and flesh thickness*.

As a result of some misinterpretation, erroneous responses were offered. Apparently candidates considered the tree rather than the fruit. Responses such as 'free from pest and disease', 'not difficult to maintain' and 'high yield' were given.

For Part (b), candidates were given five headings under which to explain two management practices a farmer should adopt to establish an avocado orchard on sandy soil.

#### Land Preparation

Most candidates had a good knowledge of general land preparation and as such were able to score at least the allotted two marks. Credited responses were *clear, plough, add organic matter and dig drains*.

There were the occasional odd responses such as 'get a big piece of land and ensure the land is well prepared', 'observe the land and ask questions' and 'use mulch since it is sandy'.

#### Planting

There was a total lack of knowledge about what was required in this section. Of those candidate who attempted this section, none came up with the correct procedure. Candidates mentioned incorrect responses such as 'the use of seeds', and 'grafting for the actual plant'. With regard to spacing, they mentioned 'use a large space' and 'plant far apart' and used arbitrary measurements such as '1 m by 1 m'.

What was expected were practices such as *digging a hole about twice the size of the root ball, spacing should be around  $7.5 \times 7.5$  m; place plant in hole and heap soil around the plant and stake it*.

#### Water Management

Most candidates scored at least one mark in this area. They were able to show that water was necessary for growth in a sandy soil. However, little progress was made beyond that since the topic was water management and not simply 'watering'. Responses such as *control weeds, the establishment of ponds and mulching* were expected.

Some incorrect responses included 'make sure the soil is not waterlogged' and 'sandy soils do not need drains'.

#### Weed Control

This was also an area where candidates did well. Most suggested correctly, *manual, mechanical or chemical control*. Few stated *mulching*.

There were spurious responses such as ‘make sure there were no weeds’ and ‘take a look daily at the weed growth’ or ‘weeds should be cleared’.

### Harvesting

Most candidates knew that the *avocados should not be reaped at the ripe stage but when they are mature*. They also recognized that *damage or bruising should be avoided* hence their *recommendation of the use of crates*. Few candidates stated that *harvesting should be done by hand early in the morning*.

## **Section II**

### Question 3

This question tested candidates’ knowledge of livestock breeds, animal nutrition and food safety, and food handling. Generally, candidates’ performance on this question was satisfactory, with the mean score being 33.27 per cent of the total marks for the question. Part (a) (i) required candidates to identify two cuts of pork used in ham production. Some candidates offered correct responses, namely, *shoulder, leg, and hind quarter*. However, there were candidates who were not aware of the cuts used for ham and offered incorrect responses such as *long cut, neck, picnic, bacon, jerk, loin, ham, fillet, large white* and *landrace*.

Part (a) (ii) required candidates to identify two characteristics of the cuts of pork identified in Part (a) (i) that makes them suitable for the production of ham. A few candidates were able to score two marks, but most identified one correct response, which included *colour pale pink to pink, more flesh, good marbling, leanness or little fat*. Incorrect responses were varied and included ‘allow for bacteria fighting substances such as salt to enter the meat easily’, ‘gets heat to the deeper part of the meat when coated’, ‘fatty/large amount of fat’, ‘have the right amount of pork’, ‘high nutritive value’.

In Part (b), candidates were given the scenario of a meat processing facility wishing to export pork, but first having to meet food safety requirements. Candidates were required to discuss how the facility could improve its food safety practices under two headings, namely, personal hygiene and plant and equipment.

Some correct responses for personal hygiene included *clean and properly secured apron/coverall/overall/jumpsuit/protective shoes to be worn to prevent contamination of food; hairnets must be worn at all times in the plant to prevent hair from falling in the food; gloves must be worn at all times in the plant to prevent transmission of pathogens or microbes to the food; jewellery must be removed or not be worn to prevent it from falling into food; persons working in the food handling area must wash their hands frequently and after use of the bathroom to prevent transmission of germs/bacteria to food*. Some incorrect responses were ‘make sure products are properly packaged’, ‘good cleaning of produce’, ‘keep surroundings clean and sanitized’, ‘ventilated area’, ‘practice proper sanitation’, and descriptions of the procedure for slaughtering pigs.

Correct responses for plant and equipment included *all utensils and machinery are to be washed and sanitized before use to remove any bacteria or pathogen; all utensils must be stored in a sanitary*

*condition when not in use; use stainless steel and no rusty tools; facility design is to provide completely separate areas for raw product and processed product to prevent cross-contamination; proper ventilation in exposed product packaging rooms; use of footbaths at entrance to remove pathogens or possible contaminants.* Some incorrect responses included ‘proper use of equipment’, ‘proper maintenance of equipment’, ‘make sure the plant is not affected by any bacteria’, ‘plant should have a spaced out working area so workers can have enough space among themselves’, ‘plants should be pruned’, ‘Integrated Pest Management’.

Part (c) (i) required candidates to define *biotechnology*. Some candidates were able explain the concept by referring to *improving animal genes to bring about desired characteristics* or *using the genetic material in cells to produce products with desirable characteristics*. Other candidates did not understand the concept and gave incorrect responses that included ‘plant cells’, ‘animal cells and microorganisms which are used for useful substances’, ‘scientific method used to increase and improve the reproduction of animals in agriculture’, ‘improvement of plants and animals using science and human intervention’, ‘upgrading of the animal to be resistant to disease and strong’.

Part (c) (ii) required candidates to name two reproductive bio techniques that could be used to improve litter size. Most candidates were able to identify at least one technique which included *artificial insemination, embryo transfer, in vitro fertilization of embryos, semen and embryo sexing, gene splicing, gene cloning, use of transgenic animals, and genetic engineering*. Some incorrect responses were ‘adding more feed for the pig to eat’, ‘manual transfer of sperm to the egg by mechanical methods’, ‘back breeding’, ‘genetic trait’, ‘in-breeding’, and ‘cross breeding’.

#### Question 4

This question tested candidates’ knowledge of dairy and beef cattle breeds in the Caribbean and cattle management practices relevant to reproduction. Generally, this question was done fairly well by candidates, with the mean score being 43.4 per cent of the total marks.

In Part (a) (i), candidates were required to name one dairy cattle breed and one beef cattle breed. Breeds correctly named by many candidates included *Holstein–Friesian, Holstein, Jamaica Hope, Jersey* and *Sahiwal*. Beef breeds correctly named by candidates included *Santa Gertrudis, Jamaica Red, Jamaica Black, Charolais, Chambray, Zebu Cattle, Aberdeen Angus, and Buffalypso*. Incorrect answers for dairy breed included ‘cow’, ‘female’, ‘Jersey Shore’ and incorrect answers for beef breed included ‘bull’ and ‘zebra’.

In Part (a) (ii), candidates were asked to list three signs of heat in a cow. Many candidates were able to obtain at least one mark in this section with answers which included *cows stand to be mounted by other cows, mucus discharge from the vulva, swollen and red vulva, bellowing, and restlessness*. Incorrect answers included ‘patchy skin’, ‘loss of hair’, ‘less yield’ and ‘change of skin’.

Part (b) (i) provided candidates with a table showing the relationship between the onset of heat, time period (day/night), and the floor of the pen (dirt/concrete), and asked them to provide one reason why more cows show signs of heat during the night. Based on the information in the table, expected answers included *cows are not distracted by daily farm activities for example, feeding, milking, cleaning, and cows express silent heat better at night because of cooler temperatures*. Incorrect answers included ‘because cows have thick skin’, ‘at night they produce more heat from their bodies’, ‘because it is night’ and ‘the cows get cold’.

In Part (b) (ii), candidates were asked to give one reason why more cows conceive on dirt floors. Many candidates gained a mark in this section for stating that *the animals have more stability on a dirt floor and could stand for mounting during mating*. Another expected answer (that could have been derived from the table), that was not popular was that *since more cows were in heat on a dirt floor then chances were that more cows would conceive on this type of floor*. Incorrect answers included ‘because the concrete floor is harder’, ‘the cows’ feet are more relaxed and warm on the dirt floor’.

Part (c) was very well answered with most candidates obtaining the maximum mark possible. Candidates were presented with the following scenario: A dairy farmer separated ten calves from their dam at birth, put them in a dirty pen and provided them with limited feed. Shortly after, he observed that five of the calves showed signs of extreme diarrhoea, and these signs were eventually observed in all ten of the calves.

Candidates were asked to supply three reasons why the calves suffered from diarrhoea. Popular correct answers included *calves did not suckle colostrum from their dams, the pen was overcrowded and caused the infection to spread and calves were poorly fed/nourished*. An example of an incorrect response included ‘because they were separated from their parents’.