



CARIBBEAN  
EXAMINATIONS  
COUNCIL

Caribbean Secondary  
Education Certificate®

# SYLLABUS

# AGRICULTURAL SCIENCE

CXC 07/G/SYLL 16

Effective for examinations from May–June 2018

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## NOTE TO TEACHERS AND LEARNERS

The Agricultural Science Syllabus (CXC 07/G/SYLL 16) was revised in 2016 for first examination in 2019.

Teaching is expected to commence on the revised syllabus in September 2018.

First Published in 1978  
Revised in 1990, 1999, 2006 and 2016  
Amended 2013  
*Revised 2018*



### PLEASE NOTE

This icon is used throughout the syllabus to represent key features which teachers and learners may find useful.

# 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.*

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<sup>1</sup> CVQ\* 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   |
|    |            |   | (ii) Broilers – 50 to 100, once per term  |
|    |            |   | (b) rabbits   |
|    |            |   | OR guinea pigs  |
|    |            |   | OR agouti   |
|    |            |   | (c) pigs  |
|    |            |   | (i) 3 does; 1 buck  |
|    |            |   | 10 females; 1 male  |
|    |            |   | (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                 |     | access to science laboratory:  |



- simple balances
- microscopes
- hand lenses (one per student)
- glassware including crucibles, beakers, test tubes
- chemicals
- lamps
- 1 potometer
- 1 desiccator
- 1 set of sieves
- measuring instruments: tapes, rulers, measuring cylinder, indicator paper, pH meter, soil test kits

4. Visual Aids

access to:

- multimedia projector
- models
- charts and diagrams
- computer with relevant software and internet access
  - camera
  - flip charts

## ◆ 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.

*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.*

**Paper 04**  
(SBA)

*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**

PROFILE	PAPER 01 Multiple Choice	PAPER 02 Structured/ Essay	PAPER 03 (SBA)	TOTAL MARKS (%)	
<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**

Skills	PAPER 01 Multiple Choice	PAPER 02 Structured/ Essay	PAPER 03 (SBA)	TOTAL MARKS
<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**

Profile	Number of Questions			
	Paper 01	Paper 02	Paper 03 (SBA)	Total Marks
BF	20 (1 mark each) (14KC, 6A marks)	2 (3KC, 7A marks each)	2 Cost Analyses (10 marks each)	60
CP	20 (1 mark each) (14KC, 6A marks)	2 (3KC, 7A marks each)	5 practical skills (4 marks each) 1 investigation/project (10 marks)	70
AP	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	(33½%)
Crop Production (CP)	20	20	20	40	100	(33½%)
Animal Production (AP)	20	20	20	40	100	(33½%)
<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 two years immediately following their first attempt.*

*SBA scores can be carried forward only ONCE and only during the year immediately following the first sitting. In order to assist candidates in making decisions about whether or not to reuse a moderated SBA score, the Council will continue to indicate on the preliminary results if a candidate's moderated SBA score is less than 50 per cent in a particular subject.*

*Candidates re-using SBA scores should register as "Re-sit candidates" and must provide the previous candidate number when registering.*

*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. Agricultural Science and Agriculture</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	<i>discuss the importance of agriculture in national, regional and international economies;</i>	<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	<i>describe types of agricultural enterprises; and,</i>	<i>Brief description of the scope and scale of agricultural operations from input suppliers, production, processing and marketing.</i>	
2.3	<i>state the functions of the local, regional and international institutions.</i>	<i>Local:</i> (a) <i>Ministries of Agriculture (MA); and,</i> (b) <i>Development Banks.</i>	

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

<b>SPECIFIC OBJECTIVES</b>	<b>CONTENT</b>	<b>SUGGESTED PRACTICAL ACTIVITIES</b>
<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.	<i>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.</i>	

### 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	<i>explain the uses of plants in agriculture;</i>	<i>Food, feed fibre, fuel, medicine, industrial uses and amenity (ornamental and recreational) uses.</i>
1.2	<i>describe the external and internal structure of plants;</i>	<i>External and internal structures of monocotyledonous and dicotyledonous plants. Structure of cells, tissues and organs – seeds, stems roots, leaves, flowers and fruits. Relate structures to uses.</i>
1.3	<i>describe the physiological functions of plants;</i>	<i>Role of photosynthesis, respiration, transpiration, water and nutrient uptake, translocation, photoperiodism and phototropism. Relate structures to functions.</i>
		<i>Laboratory practical exercises, line drawings. Use microscopes to view plant structures.</i>
		<i>Select plants of agricultural and horticultural importance.</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>	<p><i>Techniques and technologies in plant nurseries, for example, seed planting, setting seeds, artificial plant propagation techniques.</i></p>	<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.	<p>Germination: hypogeal and epigeal growth, <i>conditions necessary for germination, growing of seedlings and vegetative propagation</i>; nursery environment; stages of plant growth.</p>	<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;	<i>Appropriate area for planting in relation to environmental factors (aerial and soil).</i>  <i>Aerial: climate, temperature and sunlight, rainfall, wind, relative humidity.</i> <i>Soil: Type and fertility.</i> <i>Climate change.</i>	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;	Inorganic – sand, silt, clay particles, <i>water and air</i> .  Organic – humus, soil organisms.	Collect soil sample and identify components by mechanical analysis.
2.5 describe the physical and chemical properties of soil types;	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.  Chemical properties of soils: <i>pH, nutrient content, organic matter content</i> .  Soil types: sand, <i>silt</i> and clay ( <i>loam</i> ).	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>explain the <i>causes and effects</i> of soil erosion;</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>state the importance of major nutrients used in crop production;</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>explain the factors affecting soil fertility;</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>explain how soil fertility can be maintained; and,</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>	The importance of germplasm to maintain biodiversity.  Heredity and environment (genotype and phenotype).  Simple monohybrid crosses: homozygous and heterozygous conditions; dominance and recessiveness; hybridisation.  Purpose of selection and breeding: objectives of increased yields and resistant varieties; issues involved.	Field trips to observe germplasm collections.  Varietal trials: growing and making observations on the growth and production of different varieties of a given crop.  Laboratory exercises.
3.3 explain the nature and purpose of biotechnology in plant improvement.	The significance of genetically engineered crops (artificial alteration of the genetic composition of the organisms); benefits and concerns.  <i>Genetically Modified Organisms (GMOs)</i>  <i>Mutation breeding.</i>	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</i> functions 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	<i>identify when crops are ready to for harvesting;</i>	<i>Appropriate stages of maturity: Cucumber, tomato, bean, sweet pepper, cassava, sweet potato, yam, okra, lettuce, cabbage.</i>
6.2	recommend the appropriate harvesting methods for crops;	
6.3	<i>explain post-harvest handling procedures for various crops; and,</i>	<i>Root crops. Fruit crops. Leafy vegetables. 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;	<p><u>Cattle Dairy:</u> Jersey Jamaica Hope, Holstein.</p> <p><u>Beef:</u> Jamaica Black, Charolaes, Zebu, Buffalypso.</p>	
1.2 state the purpose for which the different breeds of animals are reared; and,	<p><u>Pigs:</u> Landrace, Large White, Duroc, Hampshire, Tamworth.</p> <p><u>Goats:</u> British Alpine, Anglo Nubian, Saanen, Toggenburg.</p> <p><u>Sheep:</u> Barbados Black Belly, Black Head Persian, West African, Virgin Island White.</p>	

## 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. Structure, anatomy and physiology</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	
<b>Structure, anatomy and physiology (cont'd)</b>			
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.	
<b>3. Animal nutrition and management</b>			
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. Minimise waste. 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.
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
<b>Animal nutrition and management (cont'd)</b>		
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
<b>Animal nutrition and management (cont'd)</b>		
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,	Egg production, milk processing and preservation, honey production, wax, bee bread and royal jelly.  Importance of fish as a source of protein for human nutrition and livestock feed.  Eggs – dried eggs, shell as fertiliser, handicraft, calcium supplements for bird.  Meat – cured meat (sausage, ham, bologna).  Milk – cheese, yogurt.  Manure – biogas.	Identification of meat cuts and carcass quality.  Visit to milk processing facility.
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.*

- Have students create a scrap book containing pictures of the various classes and breeds of livestock in the Caribbean.*
- 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,	Plotting of demand and supply curves.
	<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.	
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;	
	Collateral, credit history, budget, employment status, business plan (project proposal).	
	<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 <i>discuss the role of marketing in agricultural production;</i>	<i>Identification of different market segments for agricultural products.</i>  <i>Use of market information in production decisions.</i>	<i>Visit supermarkets, hotels, and other buyers.</i>  <i>Administer questionnaires/ conduct interviews.</i>
4.2 <i>identify the steps of marketing;</i>	<i>Pricing, advertising, labelling and distribution, assembling, sorting and grading, processing, packaging, storage and transportation.</i>	<i>Research samples of marketing plans on the internet.</i>  <i>Critique labelling samples.</i>

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

### 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.<br/><br/>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	<i>design a suitable cropping system for production of a crop under conditions of environmental stress using appropriate techniques and technologies;</i>	<i>Cropping systems and environmental stress-abiotic and biotic including spacing and plant arrangement; time of planting.</i>
3.4	<i>recommend appropriate strategies for water and nutrition management;</i>	<i>Water and nutrient management strategies; factors influencing choice.</i>  <i>Use of data to determine crop nutrient and water needs, including calculations (quantities and rates).</i>
3.5	<i>demonstrate the use of simple water and nutrition management technologies;</i>	<i>Irrigation technologies.</i>  <i>Nutrition application technologies – organic and inorganic.</i>
3.6	<i>design an integrated pest management programme;</i>	<i>Concept of integrated pest management. Components of an IPM programme.</i>
3.7	<i>demonstrate the use of pest management technologies; and,</i>	<i>Biological (including compost teas), cultural, chemical technologies.</i>  <i>Calculations – rates, quantities.</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>		
Students should be able to:		
3.8 apply other required crop management strategies.	Staking, size management, pruning.  Opportunity for careers and entrepreneurship.	
<b>4. Management practices for livestock</b>		
Students should be able to:		
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;	Maturity indices.	Display samples of various crops at acceptable stages of maturity.
5.2 recommend appropriate harvesting procedures;	Harvesting procedures: time of day, manual versus mechanical harvesting methods, removal of the crop, concern for harvested portion and plant.	
5.3 use appropriate harvesting technology;	Techniques in manual harvesting and the use of harvesting aids to minimise damage, choice and handling of containers.	
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>	
5.5 implement proper post-harvesting procedures; and,	<p>Differences in crop requirements.</p> <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;	<i>Plant nursery, greenhouse structures, post-production facilities, machinery shed, compost shed, worker's facilities.</i>	<i>Make models, visit farms.</i>
7.2 recommend suitable materials for use in farm buildings;	<i>Types of materials. Advantages and disadvantages. Proper maintenance.</i>	
7.3 demonstrate the safety precautions in the operation of tools, machinery and equipment;	<i>Occupational health and safety in the workplace. Certification. Proper use and disposal of agricultural chemicals and containers.</i>	
7.4 describe the use and operation of mechanical systems in farm equipment; and,	<i>Transmission systems, pulleys, levers, gears, engines, wheels and axle.</i>	<i>Visit to a mechanical shop or the engineering department of a farm or a school, trade shows or agricultural exhibition.</i>
7.5 demonstrate the appropriate care and maintenance of simple tools and equipment.	<i>The care and maintenance of knapsack sprayer, simple tools, mist blower, weed trimmer, irrigation pumps or equipment. Defeathering machines, debeakers, clippers, milking machine</i>	

## 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	<i>discuss the concept of entrepreneurship;</i>	<p><i>Definition of entrepreneurship and the entrepreneur.</i></p> <p><i>Types of entrepreneurs (opportunity based entrepreneur and necessity based entrepreneur).</i></p> <p><i>Reasons for starting a business (desire for financial independence, self-fulfilment, self-actualisation).</i></p> <p><i>Characteristics of an entrepreneur (innovative, creative, risk taker, visionary, dynamic, persistent, achievement-oriented).</i></p>
1.2	<i>discuss the forms of business organisations and arrangements;</i>	<p><i>Characteristics of the sole trader, partnerships, cooperatives, limited company, franchises, state-owned corporations and non-government organisations.</i></p> <p><i>Advantages and disadvantages of each.</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>Entrepreneurship in agriculture (cont'd)</b>		
<i>Students should be able to:</i>		
1.3 explain the steps in the establishing an agricultural enterprise;	<p><i>Identification of business opportunities (research).</i></p> <p><i>Feasibility analysis (management, operational, financial and marketing).</i></p> <p><i>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).</i></p> <p><i>Determination of resources (land, human, financial, material).</i></p> <p><i>Acquiring resources: sources of capital, savings, equity and debt; land – lease, family owned, purchase, rent.</i></p> <p><i>Management of the operations of the enterprise.</i></p>	<p><i>Prepare a business and marketing plan.</i></p> <p><i>Make oral presentation, utilising relevant communication tools on potential new business.</i></p>
1.4 discuss the importance of Strengths, Weaknesses, Opportunities, Threats (SWOT) analysis in decision making for agricultural enterprises;	<p><i>Examples of SWOT analysis for different types of agricultural enterprises.</i></p>	<p><i>Develop a SWOT analysis with students based on current trends.</i></p>

**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.	<p><i>Purpose and interpretation of: profit and loss account; balance sheet; and, cash flow.</i></p>	<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>		
Students should be able to:		
2.1 describe the various channels of communication used in agricultural enterprises;	<p>Channels of Communication:</p> <p>(a) Directional formal/official; informal/unofficial.</p> <p>(b) Oral face to face; interviews; meetings and conferences; radio and television; telephone; intercom.</p> <p>(c) 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.</p> <p>(d) Written letters; memoranda; agendas, notices of meetings; reports, minutes; questionnaires; itineraries; notices, press releases; advertisements.</p> <p>(e) Visual pictures, charts, graphs; signs; multi-media presentations; body language; brochures, posters, flyers.</p>	<p>Create blogs, posters, jingles for 'local eat what you grow' campaign.</p> <p>Create five-minute PowerPoint presentations to 'potential investors' or bankers of business idea using graphics.</p> <p>Create one-minute advertisement to promote products produced by agricultural enterprise.</p> <p>Create labels for products or produce.</p> <p>Use social media to promote products produced by enterprise.</p> <p>Create a logo and slogan for a product from an agricultural enterprise.</p>



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

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
<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) <i>degree of urgency;</i></li> <li>(b) <i>genre (oral, written, electronic, visual);</i></li> <li>(c) <i>level of confidentiality, privacy;</i></li> <li>(d) <i>location and distance, time zones;</i></li> <li>(f) <i>cost, efficiency, effectiveness; and,</i></li> <li>(g) <i>audience size.</i></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) <i>perceptual, cultural and personal bias;</i></li> <li>(b) <i>semantics;</i></li> <li>(c) <i>language;</i></li> <li>(d) <i>literacy skills; and,</i></li> <li>(e) <i>Internal, external barriers.</i></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,	<p><i>Speaking, writing, photography skills. Presentation tools – Microsoft PowerPoint, Prezi. Use of the internet in communication – emails, blogs, social media. Etiquette.</i></p>	

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

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

### 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. *Students are encouraged to work in groups.*

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. *Students are encouraged to work in groups.* The students 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 candidates exceed 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 candidates achieve on the project. On the candidates' script, the teacher should clearly indicate the candidates' original score – that is, the score before the deduction is made – the marks which are to be deducted, and the final score that the candidates receive 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 students and the results must be based on the students' 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**

Item	Descriptor		Marks	
			Total	Awarded
<b>Introduction (2)</b>	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	
<b>Methodology (6)</b>	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		
<b>Results (4)</b>	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		
<b>Discussion (3)</b>	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	
<b>Conclusion, Limitation and Recommendations (3)</b>	Conclusion		1	
	Limitations		1	
	Recommendations for improvement		1	
<b>Presentation (1)</b>	Less than 5 spelling and grammatical errors contained in the report		1	
<b>References (1)</b>	At least 2 references properly cited		1	
<b>TOTAL (Technical Report)</b>			<b>20 ÷ 2 = 10</b>	<b>..... ÷ 2 = .....</b>
<b>Cost Analysis</b>	Complete Budget	Projected Income – output, price, total	1	
		Projected Expenditure – inputs, price, total	1	
		Surplus/Shortfall correctly calculated	1	
	Actual Income and Expenditure	Income/Sale of Produce – quantity, price, total	1	
		Expenditure – quantity, price, total	1	
		Surplus/Shortfall correctly calculated	1	

	Comparison of Projected and Actual - Income - Expenditure - Surplus/shortfall	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 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> <li>- Slaughtering of birds</li> </ul>	<b>6 marks</b>

	<ul style="list-style-type: none"> <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 and 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>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). <b>(3 marks each)</b></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>After each budget is completed, an analysis/comparison of the projected and actual income, expenditure and profit/loss (surplus/shortfall) must be done. <b>(4 marks)</b></p> <p>For each of the <b>three</b> parameters listed above:</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>
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**Sample of Actual Income and Expenditure Statement**

<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.

**Total Cost Analysis**

**10 marks**

**Additional Guidelines:**

1. The candidates name, registration numbers, 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, 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® 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. *Students are encouraged to work in groups.*

**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 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 students and the results must be based on the students' 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 candidates achieves on the project. On the candidates' script, the teacher should clearly indicate the candidates' original score – that is, the score before the deduction is made – the marks which are to be deducted, and the final score that the candidates receive after the deduction has been made. Only the final score is to be indicated on the record sheets which are submitted to CXC®. 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® moderator.

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

### Rubric for the Business Plan

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



<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>	<i>Describe two main features of products and/ or services are that will be offered (1 mark)</i>	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>	- Discuss the various promotional strategies used by the business (advertising, sales promotion, after sales services, public relations, personal selling, promotional pricing) Any two (1 mark each)	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>	- Outline number of persons to be employed and their duties or functions (2 marks)	2 marks
<i>Use of technology to enhance efficiency of the business</i>	Outline how at least two technologies will be used to enhance the efficiency of the business operations (2 marks)	2 marks
<b>Financial Plan</b>		
<i>Projected Performance</i>	Projected Profit and Loss Account depicting profitability of business (3 marks)  Projected Balance Sheet showing fixed assets, variable assets, capital and liability (3 marks)	6 marks
<i>Sources of Finance</i>	- Determine and justify sources of capital for the business (2 marks)	2 marks
<b>Communication</b>		
<i>Communication of information in a logical manner using correct grammar</i>	Good to Excellent command of English Language (2 marks)  Fair command of English Language (1 mark)	2 marks
<i>Effective use of communication tools</i>	Use of graphs, figures, tables, charts and photographs (2 mark)	2 marks
<i>Overall presentation: (Format)</i>	title page, table of contents, list of acronyms and abbreviations (at least 3 features - 1 mark)  Bibliography (1 mark)	2 marks
<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		
Aim (2)	Technical /technology related objective addressing production and post-production levels		1		
	Income related		1		
<b>METHODOLOGY (11)</b>	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		
Data Collection - Data (at least 2 sets) and how it was collected (3)		3			
<b>RESULTS (9)</b> - Production and Post-Production Value Addition (where applicable)	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		
	Labelled tables, charts (1)		1		
<b>DISCUSSION (8)</b>	How technical results relate to the issue (2)	Provided a full discussion of results"	1		
		Relating results to literature accurately with reference	1		
	Effect of the technology used during production/ after production / for	discussed the effect of technology used during production/post-production as it relates to value addition with supporting evidence and cited relevant literature	2		

	value addition (2)			
	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 AND 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 $\checkmark$ 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 - Income - Expenditure - 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

Item	Description	Total
<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: (2 marks)</u></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: (2 marks)</u></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: (2 marks)</u></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> <p><b><u>Activities (4 marks)</u></b></p> <p>How the crops/birds were:</p> <ul style="list-style-type: none"> <li>- maintained (1 mark)</li> </ul>	<b>11 marks</b>

	<ul style="list-style-type: none"> <li>- processed (1 mark)</li> </ul> <p><b>These activities 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> <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>Data collection (3 marks)</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> <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>9 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>(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 AND 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>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). <b>(3 marks each)</b></p>	<b>10 marks</b>
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	<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>After each budget is completed, an analysis/comparison of the projected and actual income, expenditure and profit/loss (surplus/shortfall) must be done. <b>(4 marks)</b></p> <p>For each of the <b>three</b> parameters listed above:</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 exp.</li> <li>• Projected profit/loss and actual profit/loss.</li> </ul>	
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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>

**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 = Total projected income – total projected expenditure</b>				<b>28,875 – 11,597 = 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.

<b>OR COST ANALYSIS 2 – (Production, Post-Production and Value-addition)</b>	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.  This analysis is to be done only if the investigative project includes the business plan.	<b>10 marks</b>
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#### 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
Expenses: Value-added products				
- 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

Income	Quantity	Unit	Price (\$)	Total (\$)
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>
Expenditure	Quantity		Unit Cost (\$)	Total (\$)
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
Expenses: Value-added products				
- 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 candidates name, registration numbers, 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>	40%
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>	40%

## ◆ RESOURCES

The following books, other printed material and websites can be used for the **CXC**<sup>®</sup> 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	

<u>WORD/TERM</u>	<u>DEFINITION/MEANING</u>	<u>NOTES</u>
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.**

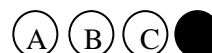
1. This test consists of 60 items. You will have 1 hour and 30 minutes to answer them.
2. Each item in this test has four suggested answers lettered (A), (B), (C), (D). Read each item you are about to answer and decide which choice is best.
3. Look at the sample item below.

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

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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

**CARIBBEAN EXAMINATIONS COUNCIL**  
**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**  
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**S P E C I M E N P A P E R**

**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.

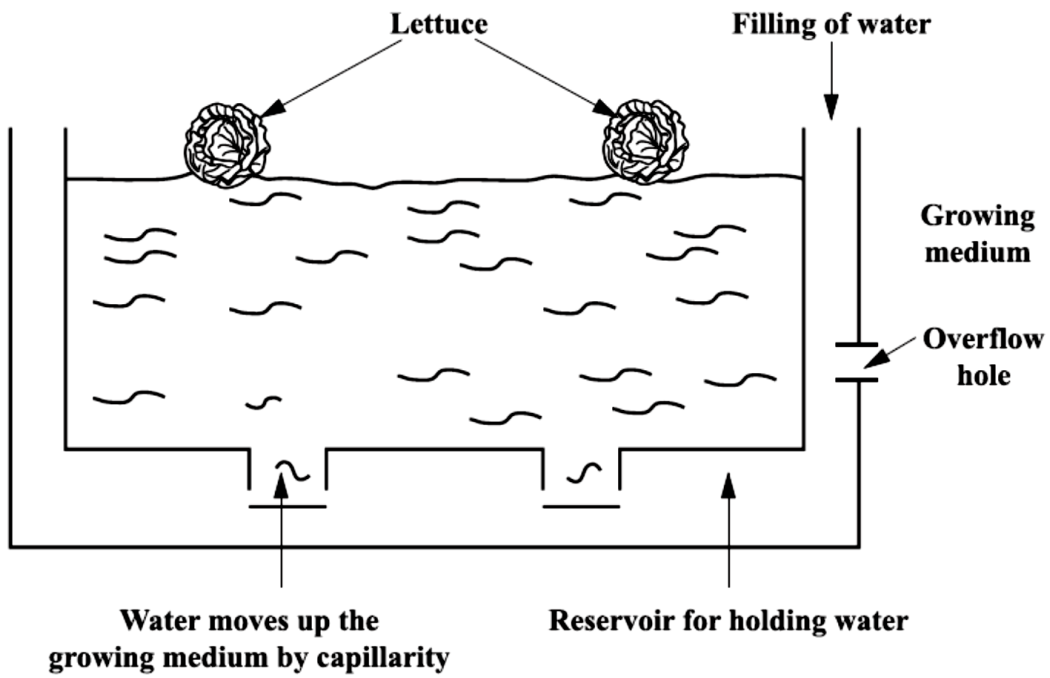


Figure 1. Cross section of a container used for growing vegetable crops

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.

.....

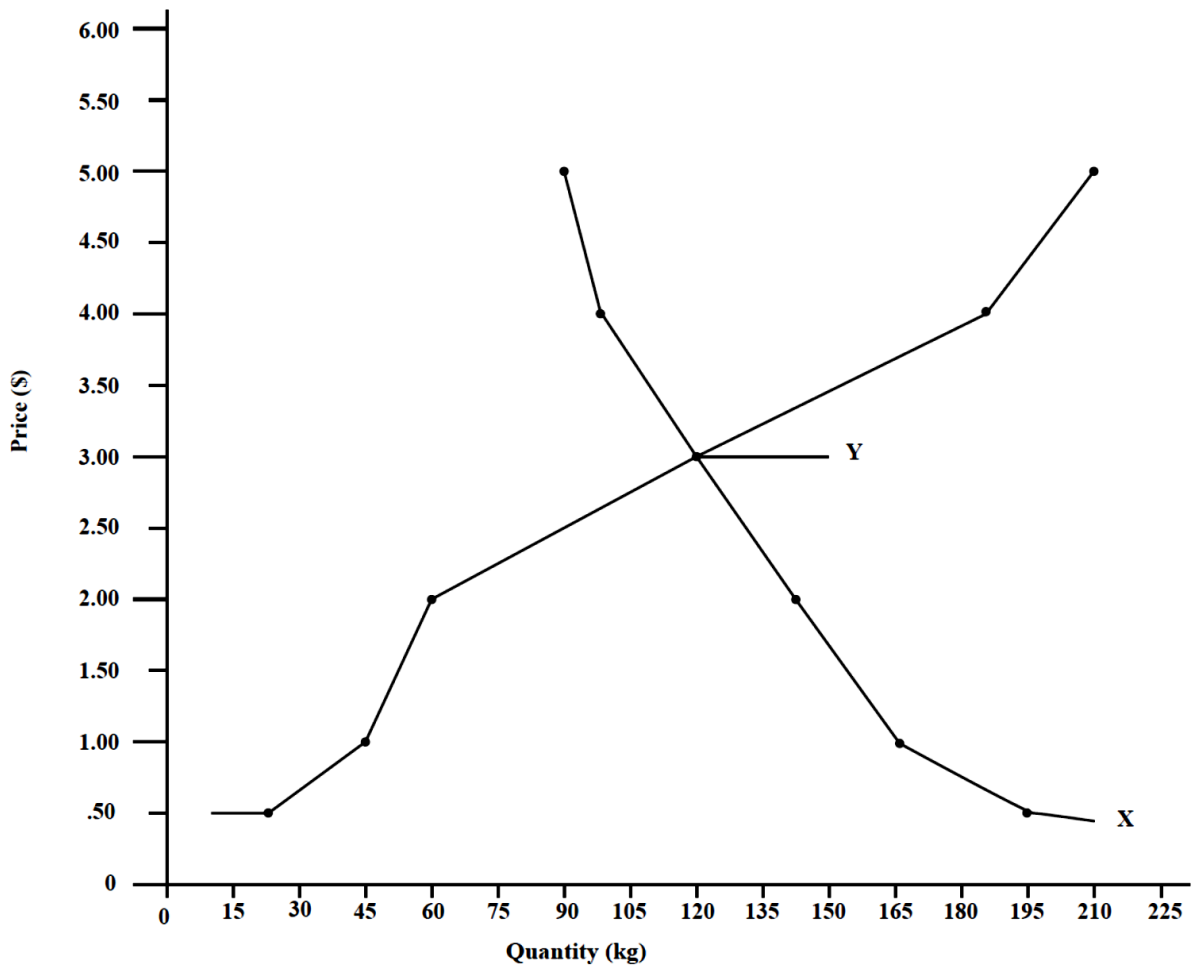
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**(2 marks)**

(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)**

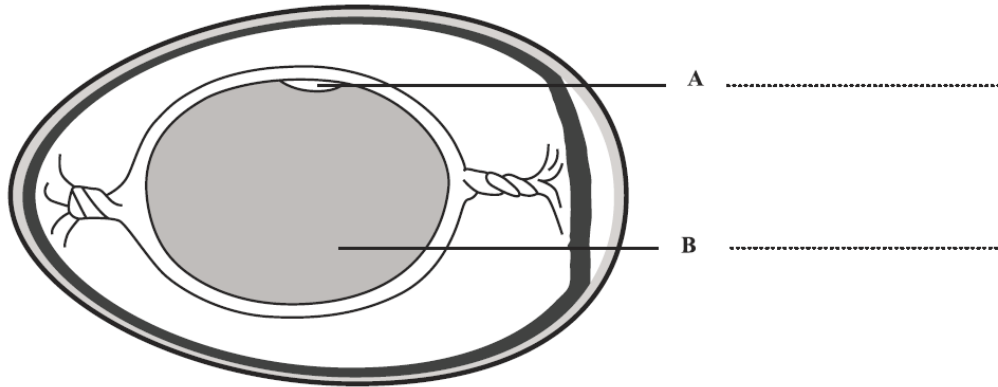
**Total 10 marks**

**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.

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

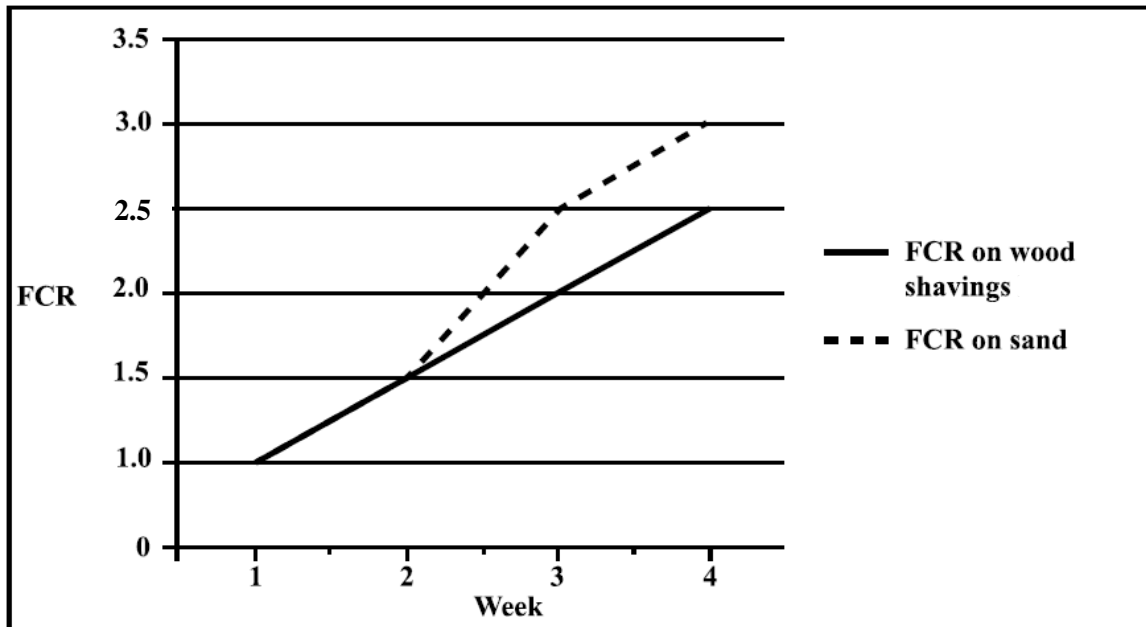
**(2 marks)**

(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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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

SINGLE AWARD

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)	<p>Two ways in which biotechnology can improve animal production</p> <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)	<p>Three ways of modifying the container (Figure 1) to improve efficiency</p> <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> <p><b>S.O. A1.3, A3.1</b></p>	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

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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 – \$42000) – \$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>		<b>2</b>
(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>	<b>2</b>	<b>1</b>
	<b>TOTAL</b>		<b>3</b>	<b>7</b>

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DOUBLE AWARD

Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
3. (a)	<p>Manual methods Physical or done by hand, e.g. hand cutting, hoeing, weeding, forking, cutlasses, traps.</p> <p>Mechanical Using machinery, e.g. shoots, brushcutting, sticky traps, ploughing, harrowing, rotavating, forking, cutlasses, traps, power washing pen.</p>	1 mark for each method up to a maximum of 2 marks	2	
(b)	<p>Use of technology to enhance crop production</p> <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)	<p>- 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.</p> <p>Any other reasonable conclusions</p>	1 mark for each up to a maximum of 2 marks	2	
(ii)	<p>Biological control</p> <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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Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
(d)	<p>Cultural methods</p> <ul style="list-style-type: none"> <li>- Resistant tolerant varieties</li> <li>- Mulching</li> <li>- Repellent plants/trap crops</li> <li>- Wider spacing</li> <li>- Crop rotation</li> <li>- Field sanitation (remove infected leaves/fruits)</li> <li>- Weed removal/field sanitation</li> </ul> <p>Reasons why the seeds had to be destroyed</p> <ul style="list-style-type: none"> <li>- Import procedures not followed/protocol not followed/illegal to the country</li> <li>- No import certificates/phyto-sanitary certification</li> <li>- Pests and diseases detected on the seeds</li> <li>- To control the spread of pests and diseases</li> <li>- To prevent the introduction of new pests and disease/ weeds</li> <li>- To control the spread to other economic crops</li> <li>- It is considered an evasive/species/ toxic to man/animals/other crops, weed seeds</li> </ul> <p><b>S.O. B3.3, B5.5, B5.8, B5.9</b></p>	<p>1 mark for each up to a maximum of 3 marks</p>		<b>2</b>
	<b>TOTAL</b>		<b>3</b>	<b>7</b>

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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)	- Moulding involves heaping/pulling/placing/applying gathering/adding/manure/animal dung/soil around the base of the plant	1 mark for each correct response	<b>1</b>	
(ii)	Two benefits of moulding  - Increases drainage/reduces waterlogged conditions at the base of the plant - Assists with recycling of plant nutrients - Stimulates root growth on the stem - Help to stabilize the plant/anchor the plant - Keeps the plant upright - Covers exposed roots - Aeration of the soil - Provides a more compact soil for - The growing of certain root crops - Helps to retain soil moisture.	1 mark for each up to a maximum of 2 marks	<b>2</b>	
(iii)	Reasons for restricted use of chemicals <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)	Identify the pests responsible for damage to Leaf A and Leaf B  - A = Leaf miner - B = Cut worm/worm/caterpillars/flee beetle/beetle/slug/snail/grasshopper/hairy worms/acoushi ants/drugger/locust	1 mark for each up to a maximum of 2 marks		<b>2</b>

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Paper 02 MARK SCHEME

Question Number	Possible Answer	Instructions	Marks	
			KC	APP
(ii)	<p>Two ways in which damage caused by Pest A and Pest B above can affect farm profitability</p> <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>	<p>1 mark for each up to a maximum of 2 marks</p>		2
(iii)	<p>Suggest two ways of controlling these pests</p> <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>	<p>1 mark for each up to a maximum of 2 marks</p>		2
	<b>TOTAL</b>		<b>3</b>	<b>7</b>

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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





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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

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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> <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><b>S.O. C3.4, C3.5, C3.11</b></p>	1 mark for any 2 management practices		<b>1</b>
	<b>TOTAL</b>		<b>3</b>	<b>7</b>



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**EXAMINATION**

**AGRICULTURAL SCIENCE**

**DOUBLE-AWARD**

**SPECIMEN PAPER**

**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.

.....

.....

.....

.....

.....

.....

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.....

.....

**(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

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GENERAL PROFICIENCY

MARK SCHEME FOR SPECIMEN PAPER 03

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

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Paper 03 MARK SCHEME

Question	Possible Answer	Instructions	Profiles	
			KC	APP
	<p>- Employees can purchase shares in the company, which makes them feel part and parcel of the business.</p> <p><u>Disadvantages</u></p> <p>- Reporting requirements may be onerous.</p> <p>- It may be costly and time consuming to set up.</p> <p>- Dilution of power among shareholders may negatively impact on management's ability to make speedy decisions.</p>			
(c)	<p><b>Steps in establishing poultry farm:</b></p> <p>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.</p> <p>2. Conduct feasibility analysis: management, operational, financial and marketing.</p> <p>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,</p>	1 mark each for any five steps identified correctly		5

AGRICULTURAL SCIENCE

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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 Number	Possible Answers	Instructions	Marks	
			KC	APP
3. (a) (i)	<p><b>S.O. E1.1, E1.4</b></p> <p><b>Features of precision agriculture:</b></p> <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)	<p><b>Instrument to measure temperature in greenhouse</b></p> <ul style="list-style-type: none"> <li>- A temperature data logger.</li> </ul>	1 mark for naming correct instrument	1	
(b) (i)	<p><b>Suitable technology:</b></p> <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		2
b(ii)	<p><b>Management of water supply:</b></p> <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

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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)	<p><b>S.O. F1.1, F1.4, F2.3</b>  <b>Obtaining information on the nutrient content of a soil:</b></p> <ul style="list-style-type: none"> <li>- Conduct a soil test</li> </ul>	1 mark for naming test	1	
(ii)	<p><b>Ways in which the information on the nutrient content of a soil is useful to farmers:</b></p> <ul style="list-style-type: none"> <li>- They will be able to know exactly which nutrients are needed;</li> <li>- They will know how much is needed of each important nutrient</li> <li>- They will be able to save money by not applying nutrients that are in sufficient quantities</li> </ul>	1 mark for each up to a maximum of 2 marks.	2	
b(i)	<p><b>Low-cost techniques and technologies used to achieve:</b></p> <p><b>Improved soil fertility</b></p> <ul style="list-style-type: none"> <li>- Reducing erosion e.g. by using contour drains,</li> <li>- Placing the banana trash along the contours to reduce erosion, and to add organic matter and nutrients to the soil when it rots,</li> <li>- Grow a leguminous cover crop for mulch to reduce erosion, and for nitrogen to nourish the plant.</li> </ul>	1 mark each for any 3 relevant points with an explanation		3

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b(ii)	<p><b>Reducing fruit damage</b></p> <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)	<p><b>Adding value to the fruit</b></p> <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>

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Questions	Possible Answer	Instructions	Marks	
			KC	APP
5 (a) (i)	<p><b>S.O. E4.2, E4.3</b></p> <p>Reasons:</p> <ul style="list-style-type: none"> <li>- to keep them cool enough to encourage their growth</li> <li>- to keep them healthy through lower levels of pathogens</li> </ul>	1 mark for each up to a maximum of 2 marks	2	
(ii)	<p><b>Space requirement for mature layer bird:</b></p> <ul style="list-style-type: none"> <li>- 1 to 2 cm</li> </ul>	1 mark for correct space requirement	1	
(b) (i)	<p><b>Guidelines with explanations:</b></p> <ul style="list-style-type: none"> <li>- 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</li> <li>- When the birds start growing natural light is best/because the birds should not be allowed to start laying before they are mature</li> <li>- 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</li> <li>- 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</li> </ul>	1 mark for each correct response up to a maximum of 5 marks		5

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Questions	Possible Answer	Instructions	Marks	
			KC	APP
(ii)	<p><b>Provision for proper lighting:</b></p> <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>	<p>1 mark for spacing and wattage</p> <p>1 mark for explanation</p>		2
	<b>TOTAL</b>		<b>3</b>	<b>7</b>

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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>	<b>2</b>	
(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>	<b>1</b>	
(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>		<b>7</b>

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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>



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