CARIBBEAN EXAMINATIONS COUNCIL

Caribbean Secondary Education Certificate
CSEC®

AGRICULTURAL SCIENCE SYLLABUS

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Content

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Please check the website, www.cxc.org for updates on CXC's syllabuses.

Agricultural Science Syllabus

♦ RATIONALE

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

There is a basic similarity in the agriculture of the several territories in the region. However, there are important differences and these must be recognized in the coverage of material in individual territories. Therefore, the syllabus offers the opportunity for special features and challenges of a territory to be closely studied by students in that territory. The syllabus is also designed to provide the basis for post-secondary education and training and the knowledge and skills required for the world of work. The syllabus provides for study leading to a Single Award or a Double Award in the subject.

This syllabus will contribute to the development of the Ideal Caribbean Person as articulated by the CARICOM Heads of Government in the following areas: has developed the capacity to create and take advantage of opportunities to control, improve, maintain and promote physical, mental, social and spiritual well-being and to contribute to the health and welfare of the community and country; and nourishes in him/herself and in others, the fullest development of each person's potential without gender stereotyping and embraces differences and similarities between females and males as a source of mutual strength. Based on the UNESCO Pillars of Learning, this course of study will also contribute to a person who will learn how to do, learn to live together and learn to transform themselves and society.

♦ AIMS

The syllabus aims to:

(i) develop knowledge and understanding of the importance of agriculture to the economies of territories of the Caribbean region;

(ii) provide knowledge of the dynamic nature of agricultural production, post-production and marketing in a complex national, regional and international market;

(iii) develop an appreciation of the importance of agriculture in alleviating poverty, providing multiple pathways to employment and further education, ensuring food security and preservation of the environment.

♦ 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
Agricultural Engineer
Agronomist
Animal Nutritionist
Animal Physiologist
Aquaculturist
Biochemist
Biometrician
Biosystems Engineer
Botanist (Plant Biologist)
Climatologist
Ecologist
Entomologist
Environmental Scientist
Farmer
Fisheries Scientist
Florist
Food Process Engineer
Food Scientist
Food Inspector
Food Safety Specialist
Forage Agronomist
Forester
Geneticist
Horticulturist
Hydrologist
Logging Engineer
Marine Scientist
Molecular Biologist
Naturalist
Nutritionist/Dietician
Plant Pathologist
Plant Physiologist
Postharvest Technologist
Range Manager
Remote Sensing Specialist
Science Writer
Soil Scientist
Toxicologist
Turf Scientist
Veterinarian
Viticulturist
Weed Scientist
Wildlife Biologist
Wood Scientist

♦ 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:

(i) summer attachment programmes under guidance and supervision;

(ii) sharing practical instructional facilities;

(iii) visits to Agricultural stations;

(iv) visits to private commercial farms;

(v) 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 thirty students**:

The Field

1.	Land Space	-	1 bed 9' x 3' (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		
2.	Livestock	-	(i) poultry:	(a)	layers - 25 once per year
				(b)	broilers -100 once per term
			(ii) rabbits		3 does; 1 buck
			OR guinea pigs		10 females; 1 male
			OR agouti		
			(iii) pigs		1 sow (access to a boar)
			(iv) EITHER sheep		2 ewes; 1 ram
			OR goats		2 ewes; 1 buck
3.	Security	-	fencing		
4.	Field Tools and Equipment	-	access to:		
		-	wheelbarrow		
		-	watering hose		
		-	watering cans		
		-	miscellaneous propagating tools, for example, pruning shears, secateurs, pruning saw, budding knife, tapes		
		-	other agricultural tools - spade, hoe, rake, fork, cutlass		

		-	scale
		-	soil auger or substitute, for example, flat spade and knife or cutlass
		-	rain gauge
		-	wet and dry bulb thermometers, weather vane, anemometer
5.	Safety	-	first aid kit

Other Facilities

1.	Maintenance	-	1 farm attendant
2.	Field Tools, Materials and Equipment	-	access to: spraying equipment, for example, mist blowers
		-	2 knapsack sprayers with shield
			(i) Insecticides and fungicides (ii) herbicides
		-	miscellaneous veterinary equipment, for example, syringes, ear markers, clinical thermometers.
3.	Laboratory Equipment	-	access to science laboratory:
		-	simple balances
		-	microscopes
		-	hand lenses (one per student)
		-	glassware including crucibles
		-	chemicals
		-	lamps
		-	1 potometer
		-	1 desiccator
		-	1 set of sieves
		-	measuring instruments - tapes, rulers, pH meter
4.	Visual Aids		access to:
		-	overhead projector
		-	slide and filmstrip projector
		-	charts and diagrams
		-	television and VCR
		-	multimedia projector
		-	computer

♦ 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 the Single Award examination and a minimum of eight (8) forty-minute periods per week for the Double Award examination.

♦ ORGANIZATION OF THE SYLLABUS

The Agricultural Science syllabus is arranged in five sections, namely, Sections A, B, C, D and E, 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 and C **only**. Candidates presented for the Double Award examination must complete Sections A to E (all five sections).

SECTION A - THE BUSINESS OF FARMING

SECTION B - CROP PRODUCTION

SECTION C - ANIMAL PRODUCTION

*SECTION D - HORTICULTURE

*SECTON E - ANIMAL MANAGEMENT

*** For Double Award only**

♦ CERTIFICATION AND DEFINITION OF PROFILE DIMENSIONS

The syllabus will be examined for General Proficiency certification only. The certificate will report:

(i) the overall grade achieved, with Grade I, the highest and Grade VI, the lowest;

(ii) three Profile dimensions, The Business of Farming, Crop Production and Animal Production for Single Award and Double Award.

♦ 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;

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; sixty items based on Specific Objectives in Sections A, B and C. Each item is worth 1 mark.

Paper 02

(2 hours)

This paper consists of two sections for a total of 60 marks.

Section I: six compulsory structured questions, two each from Sections A, B and C. Each question is worth 4 marks. These questions will require one word, one phrase or one sentence for an answer.

Section II: three compulsory extended response questions, one each from Sections A, B and C. Each question is worth 12 marks.

Paper 03
(SBA)

The SBA component comprises 10 skill performances in the field. Each performance will be rated on a 5-point scale (0-4) by the teacher using criteria set out by CXC (see pages 38-49 for details).

Candidates will be required to keep a Portfolio in which they will document all aspects of their projects on broilers, layers and on crops grown. Each production project will be marked out of 20 marks.
Total marks on the SBA will be 80.

For Double Award Only

Paper 01
(*1* hour 15 minutes)

Multiple Choice; sixty items based on Specific Objectives in Sections A, B and C. Each item is worth 1 mark.

Paper 02
(2 hours)

This paper consists of two sections for a total of 60 marks.

Section I: six compulsory structured questions, two each from Sections A, B and C. Each question is worth 4 marks. These questions will require one word, one phrase or one sentence for an answer.

Section II: three compulsory extended response questions, one each from Sections A, B and C. Each question is worth 12 marks.

Paper 03
(2 hours)

Two essay-type questions will be set on Section D and two essay-type questions on Section E. Candidates are required to answer ALL questions. Each question will be worth 15 marks, for a paper total of 60 marks.

Paper 04
(SBA)

The SBA component comprises 10 skill performances in the field. Each skill performance will be rated on a 5-point (0 - 4) scale by the teacher using criteria set out by CXC (see pages 38- 49 for details).

Candidates will be required to keep a Portfolio in which they will document all aspects of their projects on broilers, layers and on the crops grown. Each production project will be marked out of 20 marks.

Candidates will be required also to complete a Research Project on an agricultural problem. The Research Project will be marked out of 20 marks. The 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 (%)	
The Business of Farming (BF)	20	20	40	80	(40%)
Crop Production (CP)	20	20	20	60	(30%)
Animal Production (AP)	20	20	20	60	(30%)
TOTAL MARKS (%)	**60 (30%)**	**60 (30%)**	**80 (40%)**	**200**	**(100%)**

Table 2
Relationship between Papers and Skills

Skills	PAPER 01 Multiple Choice	PAPER 02 Structured/ Essay	PAPER 03 (SBA)	TOTAL MARKS
Knowledge and Comprehension (KC)	60	21	40	121
Application (A)		39	40	79
TOTAL	**60**	**60**	**80**	**200**

Table 3
Generalised Table of Specification

Profile	Number of Questions			
	Paper 01	Paper 02	Paper 03 (SBA)	Total Marks
BF	20 (1 mark each)	2 (2KC, 2A marks each) 1 (3KC, 9A marks each)	2 cost analyses (20 marks each)	80
CP	20 (1 mark each)	2 (2KC, 2A marks each) 1 (3KC, 9A marks each)	5 practical skills (4 marks each)	60
AP	20 (1 mark each)	2 (2KC, 2A marks each) 1 (3KC, 9A marks each)	5 practical skills (4 marks each)	60
TOTAL	**60**	**60**	**80**	**200**

DOUBLE AWARD

Table 4
Relationship between Papers and Profile Dimensions

PROFILE	PAPER 01 Multiple Choice	PAPER 02 Structured/ Essay	Paper 03 Essay	PAPER 04 SBA	TOTAL MARKS (%)
The Business of Farming (BF)	20	20		80	120 (40%)
Crop Production (CP)	20	20	30	20	90 (30%)
Animal Production (AP)	20	20	30	20	90 (30%)
TOTAL MARKS (%)	**60 (20%)**	**60 (20%)**	**60 (20%)**	**120 (40%)**	**300 (100%)**

Table 5
Relationship between Papers and Skills

Skills	PAPER 01 Multiple Choice	PAPER 02 Structured/ Essay	PAPER 03 Essay	PAPER 04 (SBA)	TOTAL MARKS
Knowledge and Comprehension (KC)	60	21	20	80	181
Application (A)		39	40	40	119
TOTAL	**60**	**60**	**60**	**120**	**300**

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)	2 (2KC, 2A marks each) 1 (3KC, 9A marks each)		3 cost analyses 1 Research Project (20 marks each)	120
CP	20 (1 mark each)	2 (2KC, 2A marks each) 1 (3KC, 9A marks each)	2(5KC, 10A marks each)	5 practical skills (4 marks each)	90
AP	20 (1 mark each)	2 (2KC, 2A marks each) 1 (3KC, 9A marks each)	2(5KC, 10A marks each)	5 practical skills (4 marks each)	90
	60	**60**	**60**	**120**	**300**

♦ RELATIONSHIP BETWEEN THE SINGLE AND DOUBLE AWARD OPTIONS

This syllabus is designed for Single Award and Double Award certification at General Proficiency. The Single Award differs from the Double Award in that students presented for the Single Award are required to study Sections A to C of the syllabus **only**, while those students presented for the Double Award are required to study Sections A to E of the syllabus.

♦ 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 RESIT CANDIDATES

(i) Resit candidates must complete Papers 01 and 02 for the Single Award examination or Papers 01, 02, and 03 for the Double Award examination for the year for which they re-register. Resit candidates who have earned 50% of CXC moderated marks for the SBA may elect not to repeat this component, provided they re-write the examination no later than the year following their first attempt. The marks for the SBA can be transferred once only, that is, to the examination immediately following that for which they were obtained.

(ii) Resit candidates who have obtained less than 50% of the CXC moderated marks for the SBA must repeat the component at any subsequent sitting.

(iii) All resit candidates may enter through schools, recognized educational institutions or Local Registrar's Office.

♦ REGULATIONS FOR PRIVATE CANDIDATES

(i) Private candidates must be entered through institutions recognized by the Council.

(ii) Private candidates will be required to complete all aspects of the examination, Papers 01, 02 and 03 for the Single Award or Papers 01, 02, 03 and 04 for the Double Award.

(iii) The SBA activities of private candidates must be monitored by tutors in the institution through which they register.

(iv) Private candidates must submit their own work, which must be validated by their tutors.

♦ SECTION A: THE BUSINESS OF FARMING

GENERAL OBJECTIVES

On completion of the section on The Business of Farming, students should:

1. understand the role of agriculture in the local, regional and international economies;
2. know the range of agricultural careers and related training opportunities and institutions;
3. develop the skills to make accurate observations and interpret data from simple experiments;
4. know the importance of alternative farming techniques;
5. understand that the farm is an economic unit engaged in profitable production of commodities;
6. understand the importance of marketing as an economic activity that links production to consumption;
7. develop knowledge and understanding of international trade agreements and note their impact on the agricultural sector;
8. know the role of support services in modern agricultural economies;
9. know that success in any business venture is dependent on proper planning, coordination, supervision and accurate record keeping.

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:		
1. ROLE AND IMPORTANCE OF AGRICULTURE		
1.1 discuss the role and importance of agriculture in national, regional and international economies;	Role and importance of: (a) foreign exchange earnings; (b) contribution to GNP; (c) food security; (d) employment ratio of imported food to local produce; (e) national and regional plans for agricultural development; (f) trade liberalisation.	Interpretation and analysis of national, regional and international statistical reports.

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:		
1.2 list the various career opportunities in the agricultural sector;	Careers in: (a) sales; (b) services; (c) marketing; (d) production; (e) education; (f) agroprocessing; (g) journalism; (h) engineering; (i) administration; (j) management; (k) quality control; (l) food inspection; (m) certification.	Access career profiles through the Internet and any other relevant sources.
1.3 state the functions of local, regional and international institutions concerned with agricultural development in the Caribbean.	Local: Ministry of Agriculture (MA) Regional: (a) Caribbean Community (CARICOM); (b) Caribbean Food and Nutrition Institute(CFNI); (c) Caribbean Development Bank (CDB); (d) Caribbean Agricultural Research and Development Institute (CARDI); (e) The University of the West Indies (UWI); (f) College of Agriculture, Science and Education (CASE) [formerly JSA]; (g) Eastern Caribbean Institute of Agriculture and Forestry (ECIAF); (h) Guyana School of Agriculture (GSA). International: (a) European Union (EU); (b) Inter-American Institute for Cooperation on Agriculture (IICA);	

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
		(c) Food and Agriculture Organization (FAO); (d) Organization of American States (OAS); (e) Inter-American Development Bank (IDB); (f) Canadian International Development Agency (CIDA).	
2.	**CHALLENGES CONFRONTING AGRICULTURE**		
2.1	discuss the major challenges affecting local and regional agriculture;	Climate and topography, appropriate technology, rural infrastructure, extension services, praedal larceny, land tenure systems, sustainable agriculture, environmental issues, food safety, natural disasters, gender issues.	Literature review using Internet. Resource persons.
2.2	discuss major current issues that could affect global agriculture;	Biodiversity, global warming, bio-terrorism, food security, environmental degradation.	Literature review using Internet. Resource persons.
2.3	explain the terminology used in food safety, importation and certification exercises.	GAPs – Good Agricultural Practices. HACCP – Hazard Analysis Critical Control Point. GMPs – Good Manufacturing Practices.	Literature review using Internet.
3.	**ALTERNATIVE TO CONVENTIONAL FARMING**		
3.1	explain the importance of non-conventional farming systems;	Organic farming, hydroponics. Grow box, trough culture, urban and peri-urban farming.	Field trip to non-conventional farms. Use non-conventional methods to grow crops, for example, grow box and trough culture.

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
3.2	explain the principles that govern organic farming.	Maintaining ecological balance and biodiversity; integrated health management of soils, crops and animals. Certification of organic farms.	Develop a herb (organic) garden. Collect beneficial insects.
4.	**ECONOMIC FACTORS OF PRODUCTION**		
4.1	define the economic functions of production, consumption and marketing;		
4.2	state the factors of production;		
4.3	relate the factors of production to agriculture;	Land: (a) tenure; (b) suitability. Labour: (a) farmer's labour; (b) hired labour. Capital: (a) Source - commercial banks; agricultural banks; cooperatives; credit unions; (b) Types– fixed capital, working capital. Management: Ability to combine the other factors to make a profit.	
4.4	explain the law of diminishing returns;	Graphical representation (no calculations required for total product, average product, marginal product, marginal cost).	

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
4.5	relate demand and supply to pricing.	Consumption: supply and demand and the price mechanism.	Class exercises in plotting demand and supply curves.
5.	**TRADE AGREEMENTS**		
5.1	evaluate the effects of international trade agreements on the agricultural sector and peoples of the Caribbean.	Specific international trade agreements: (a) Caribbean Single Market and Economy (CSME); (b) World Trade Organisation (WTO); (c) Free Trade Area of the Americas (FTAA); (d) Lome I -IV; (e) International Sugar Agreement (ISA).	Group presentations; posters; open day.
6.	**FARM FINANCING AND SUPPORT SERVICES**		
6.1	evaluate the process of obtaining capital from established sources;	Collateral, credit history, budget, employment status, project proposal.	Completion of sample loan application forms. Resource persons.
6.2	discuss the concept of cooperatives;	Types of agricultural cooperatives, their roles, function and management problems.	Visit established agricultural cooperatives. Resource persons.
6.3	evaluate the incentives that may be given to farming.	Subsidies, price support guaranteed prices, tax exemptions on inputs.	Group presentations.
7.	**FARM ORGANIZATION AND PLANNING**		
7.1	prepare different types of farm records;	Crop production record, chemical treatment record, rabbit production record, broiler production record, farm inventory.	Analysis of records for decision making.

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:		
7.2 distinguish among gross farm income and net farm income, gross margin and net profit;	Income and expenditure: value of outputs, fixed costs and variable costs.	Use of farm records on income and expenditure to determine profitability.
7.3 develop a partial and a complete budget;		Prepare a complete budget for broiler and crop production projects. Prepare a partial budget for an increase in number of broilers reared.
7.4 explain the relationship between budgeting and decision making.		

♦ SECTION B: CROP PRODUCTION

GENERAL OBJECTIVES

On completion of the section on Crop Production, students should:

1. demonstrate knowledge and understanding of the economic importance of agriculture to the people of the Caribbean;
2. develop an understanding of the inter-relationships between the physical environment and agriculture;
3. develop the skill to investigate the relationship of the physical and chemical properties of soil to plant growth;
4. understand the structure and functions of plants;
5. understand the phases of crop growth in relation to yield and nutritional value;
6. develop the skill to produce vegetable crops of local and regional importance, efficiently and profitably;
7. develop safe practices in handling chemicals in crop production;
8. understand how crops can be improved by breeding, selection and biotechnology;
9. understand the term postharvest technology and appreciate the significance of the various stages of maturity in relation to harvesting times;
10. be able to understand the various steps in the handling of crops after harvest until consumption;
11. understand the basic principles of processing agricultural crops and the various methods of utilizing these crops.

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:		
1. SOIL AND SOIL FERTILITY		
1.1 describe the process of soil formation;	The soil formation process: weathering – physical, chemical; the effects of volcanic action on soil formation; the effects of animal and plant matter on soil formation; the activities of man in soil formation; the effects of soil organisms.	Association of certain soil types with their parent material. Collection and examination of soils formed from different soil forming activities.

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
1.2	describe a soil profile with reference to major soil horizons;	Soil profile characteristics.	Examination of soil profiles. Use the soil auger to determine soil profile characteristics.
1.3	describe the major components of soil;	Inorganic – sand, silt and clay particles. Organic- humus, soil organisms; Water, air.	Collect soil sample and identify components by mechanical analysis.
1.4	describe the physical and chemical properties of major soil types;	Major soil types: sand, clay and loam. 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: soil nutrients; soil particle – soil nutrient relationship; soil pH.	Identify types of soil by touch and feel. Laboratory demonstration of particle density, bulk density and pore space. Laboratory practical exercises on water movement and determination of water status of soil.
1.5	explain how major elements are recycled in nature;	Role of bacteria, actinomycetes, fungi, algae, protozoa, viruses in carbon and nitrogen cycles.	
1.6	explain the factors affecting soil fertility;	Factors affecting soil fertility: climatic factors; biotic factors; topographic factors; the nature of the parent material; management; organic and inorganic fertilizers; physical and chemical conditions of the soil.	Test for soil acidity and alkalinity. Experimental trials to grow seedlings using a fertilized soil and an unfertilized soil.
1.8	state the importance of minor nutrients in crop production;	For healthy crop growth.	
1.9	interpret fertilizer ratio;		

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
1.10	explain how soil fertility can be maintained;	Factors enhancing the soil fertility: amendments; lime, gypsum; fertilizer (NPK), urea, muriate of potash, triple super phosphate, ammonium sulphate, organic manures, cropping systems; soil and land management – cover cropping; irrigation and drainage, tillage.	Identification of different types of fertilizers. Demonstration of fertilizer application. Practical field application.
1.11	describe the process of composting;	Materials and processes in composting.	Preparation of compost.
1.12	define soil erosion;		Erosion demonstration using classroom models.
1.13	distinguish among different types of soil erosion;		
1.14	explain the causes of soil erosion;	Causes of soil erosion: water, wind, indiscriminate land clearing and burning, poor land and crop management, animal activities.	
1.15	explain soil and water conservation methods.	Soil and water conservation including forestry, terracing, windbreaks, grass bunds or barriers, strip cropping, contour cropping, vegetative cover, gabion weirs, drains, ponds, tanks.	Field trip to water shed management area. Use an "A" frame (level) to establish contour lines.
2.	**LAND PREPARATION**		
2.1	explain the relationship between climate and agricultural production;	Seasonality of production; natural disasters; changing weather patterns.	Use of Internet to monitor changing weather patterns.
2.2	measure rainfall and temperature;		Set up and use of the rain gauge. Maximum and minimum thermometer.

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
2.3	interpret weather records;		Use of the Internet.
2.4	use weather records in farming decisions;		
2.5	evaluate land preparation methods;	Site selection, land clearing, primary and secondary tillage, ridges and furrows, cambered beds, drains.	Prepare land for planting a crop.
2.6	discuss the importance of machinery in crop husbandry;	Seeders, harvesters, tractors and attachments.	
2.7	describe the care and maintenance of simple tools and equipment;	Simple tools and knapsack sprayer.	Clean and maintain simple tools and knapsack sprayer.
2.8	describe the safety precautions in the operation of tools, machinery and equipment.	Use of protective clothing, timing of operations, correct procedures.	
3.	**PLANT MORPHOLOGY AND PHYSIOLOGY**		
3.1	describe the external and internal structure and functions of plants;	External structure of monocots and dicots. Internal structure of seeds, stem, roots and leaves of monocots and dicots. Function of structures identified.	Laboratory practical exercises, line drawings.
3.2	explain the processes of sexual and asexual reproduction in plants;	Sexual reproduction: pollination, fertilization, seed formation. Asexual reproduction (natural and artificial). Artificial - budding, grafting, tissue	

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
		culture, layering, root cuttings, stem cuttings. Natural - rhizome, suckers, corms, bulbs, tuber, runners, stolons.	
3.3	relate sexual and asexual reproduction to crop production;	Advantages and disadvantages of sexual and asexual reproduction including tissue culture.	
3.4	describe conditions necessary for germination of seeds and growing of seedlings;	Germination: hypogeal and epigeal growth, nursery production; stages of plant growth.	Growing seedlings under varying conditions. Germination tests. Produce seedlings for sale.
3.5	explain the role of photosynthesis, respiration, transpiration, absorption, translocation, photoperiodism and phototropism;		Experiments related to named processes.
3.6	discuss the effects of environmental factors on plant growth and development.	Decide on the appropriate area for planting in relation to weather, day length and market conditions.	
4.	**PLANT GENETICS, BREEDING AND BIOTECHNOLOGY**		
4.1	explain the basic principles of genetic inheritance in plant breeding;	The cell with emphasis on the nucleus and cell division (mitosis and meiosis), genes and chromosomes, variation.	
4.2	explain the nature and purpose of plant breeding;	Heredity and environment (genotype and phenotype). Simple monohybrid crosses: homozygous and heterozygous	Varietal trials: growing and making observations on the growth and production of different varieties of a given crop.

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
		conditions; dominance and recessiveness; hybridizaton. Purpose of selection and breeding: objectives of increased yields and resistant varieties; issues involved. The importance of germplasm to maintain biodiversity.	Field trips to botanical gardens, nature parks and protected areas to observe germplasm collections.
4.3	explain the nature and purpose of biotechnology in plant improvement.	The significance of biotechnology or genetic engineering (artificial alteration of the genetic composition of the organisms); benefits and concerns.	Internet search on genetically bioengineered crops.
5.	**CROP HUSBANDRY**		
5.1	describe the major cropping systems;	Include mixed cropping, mixed farming.	Plan a one year crop rotation programme using leaf, legumes, root and fruit vegetables.
5.2	discuss the benefits of the cultural practices associated with crop production;	Moulding, mulching, staking, pruning, irrigating, fertilizing.	Use cultural practices in producing a fruit, leaf, flower, and root vegetable crop. Develop a portfolio on production of vegetable crops.
5.3	describe the cultural practices associated with crop production;		
5.4	explain the effects of weeds on crop production;	Weed- definition, major local types. Effects of weeds on crops.	Collection and identification of common weeds. Conduct a weed control trial.
5.5	identify different methods of weed control;	Manual, mechanical, chemical, biological, cultural.	Practise weed control in vegetable production.

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
5.6	identify pests and the damages caused by pests;	Symptoms of damage caused by biting and chewing, piercing and sucking pests.	Collection of and categorizing insects into groups of biting and chewing, piercing and sucking.
5.7	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.
5.8	recommend the appropriate methods of pests and disease management;	Cultural, manual, mechanical, chemical, biological, Integrated Pest Management (IPM), categories of pesticides, genetic resistant varieties.	Use appropriate methods to control pests and diseases. Collect insect deterrent crops.
5.9	evaluate the effects of indiscriminate use of chemicals in the environment;	Pollution of groundwater, atmosphere, eutrophication, destruction of flora and fauna and marine life.	Interpretation of pesticide labels. Safe handling, storage and disposal of chemical containers.
5.10	Cultivate a fruit, root, leaf and flower vegetable crop;	Fruit crop - for example, bean, tomato, sweet pepper, hot pepper, cucumber, ochro. Root crop - for example, sweet potato, cassava, yam. Leaf crop – for example, lettuce, cabbage, chinese cabbage (patchoi), spinach, seasoning herbs. Flower crop – cauliflower, broccoli.	Develop a portfolio of crop production activities. Prepare a cost analysis for one of the crops cultivated.
5.11	explain the importance of plant quarantine.	Principles involved in plant quarantine.	Visit to quarantine stations.

6. HARVESTING AND POSTHARVEST PRACTICES.

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
6.1	define postharvest technology;		
6.2	identify the stages of maturity at the time of harvest;	Cucumber, tomato, bean, sweet pepper, cassava, sweet potato, yam, ochro, lettuce, cabbage, cauliflower.	
6.3	recommend the appropriate harvesting method for crops;	Manual and mechanical harvesting methods.	Harvest the crop planted. Conduct an Open day to market produce.
6.4	describe the harvest and postharvest practices for heliconia, orchid, ginger lily and anthurium;		Visit flower shows or ornamental farms.
6.5	explain postharvest operations from the farm to the table.		Conduct postharvest handling system.
7.	**PROCESSING AND UTILIZATION**		
7.1	outline the reasons for processing crops;		
7.2	identify the various types of processing techniques;	Application of processing techniques using heat, refrigeration, freezing, drying and fermentation techniques.	Visit a food processing plant. Develop a processed product from the crops cultivated. Conduct an Open day in collaboration with other departments.
7.3	state how the processed product	Food and non-food items.	

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:		
is utilized.		

♦ SECTION C: ANIMAL PRODUCTION

GENERAL OBJECTIVES

On completion of the section on Animal Production, students should:

1. demonstrate an understanding of livestock production in the Caribbean region;
2. understand how the inputs and processes interact in animal production systems;
3. understand the technologies used in producing and marketing animal and animal products;
4. know the biology of animals and its interactions with the environment.

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:		
1. MORPHOLOGY AND PHYSIOLOGY		
1.1 relate the structure of the digestive system of a bird to its functions;	Structure and functions of the digestive system of a bird.	Examine and identify the parts of the digestive system of a bird.
1.2 identify the parts of the digestive system of ruminant and non-ruminant animals;		Visits to abattoir. Video presentation.
1.3 explain the functions of the parts of the digestive system of ruminant and non-ruminant animals;		View preserved parts of the digestive system of ruminant and non-ruminant animals.
1.4 describe the process of digestion in ruminant		

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
	and non- ruminant animals;		
1.5	explain digestion in rabbits;	Ruminant versus pseudo-ruminant	Examine and identify the parts of the digestive system of a rabbit.
1.6	relate the structure of the parts of an egg to its function.		Observation of the internal and external parts of an egg.
2.	**NUTRITION**		
2.1	identify the sources of carbohydrates, proteins, fats, minerals and vitamins;	Feed and feed rations; constituents and their sources, and roles in animal nutrition. Use of bagasse, molasses, fish meal, rice bran, broken rice, wheat middling, citrus meal, coconut meal, brewers grain (hops), cocoa pod meal, urea.	Use simple food tests to identify carbohydrates, proteins and fats. Examine samples of different feedstuffs.
2.2	explain 'balanced ration';	Essential components of a balanced ration.	Examine labels from commercial ration and identify the components. Visit a feed mill.
2.3	select appropriate rations for each stage of growth of broilers and layers;	Include: (a) starter; (b) finisher; (c) layer feed.	Rear a batch of broilers and layers. Develop a portfolio on broiler and egg production.
2.4	calculate Feed Conversion Ratio (FCR);		Calculate FCR.
2.5	explain the importance of FCR;		

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
2.6	describe systems of grazing;	Include rotational grazing, zero grazing, continuous grazing.	Field trip: observe pasture management.
2.7	state the advantages and disadvantages of different grazing systems;		
2.8	explain the importance of forages(grasses and legumes) in livestock feeding;	Grasses: pangola, elephant, guatemala, antelope, african star, para, guinea, tanner, king grass. Legumes: gliricidia, kudzu, stylosanthes, desmodium, leucaena, centrosema. Other forages: mulberry, neem.	Maintenance of small grass and legume plots. Identify, collect and mount forage plants.
2.9	describe the measures used to feed ruminants when forage is unavailable.	Supplementary feeding, concentrate, silage, hay.	
3.	**HOUSING**		
3.1	explain the principles that govern housing requirements for farm animals;	Safety, security, cleaning, sanitation, ventilation, protection from elements.	
3.2	describe the housing and space requirements for broilers, layers and rabbits;	Appropriate materials used in construction of animal housing.	
3.3	explain the factors to be considered in the siting and establishment of an apiary and a fish farm.	Components of a bee production system. Components of a fish farming system.	Visit to an apiary and aquaculture projects.
4.	**ANIMAL GENETICS, BREEDING AND REPRODUCTION**		

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES

Students should be able to:

4.1 list the breeds of each class of animals commonly reared in the Caribbean;	Cattle: Dairy: Jersey, Jamaica Hope, Holstein Beef: Jamaica Red, Jamaica Black, Charolais, Zebu, Buffalypso. Pigs: Landrace, Large White, Duroc, Hampshire, Tamworth. Goats: British Alpine, Anglo Nubian, Saanen, Toggenburg. Sheep: Barbados Black Belly, Black Head Persian, West African, Virgin Island White; Rabbits: Flemish Giant, New Zealand White and Red, California, Chinchilla. Poultry: Layers-White Leghorn, Rhode Island Red, Bevan Brown, Hyline or Hybrid Crosses; Broilers-Vantress Cross or other hybrid crosses, for example, Peterson, Shaver.	
4.2 state the purpose for which the different breeds of animals are reared;		

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
4.3	explain simple Mendelian inheritance and common terms in genetics;	Animal genetics, breeding and biotechnology, inheritance, gene, genotype, phenotype, homozygous, heterozygous, recessive, dominant.	
4.4	explain different breeding systems in animal production;	Cross-breeding, upgrading, in-breeding, back crossing.	
4.5	explain the advantages of cross-breeding;	Advantages of cross-breeding: heterosis, disease resistance, improved production.	
4.6	explain the genetic improvement principles;	Principles; animal identification; record keeping; estimating genetic value.	
4.7	describe the process of artificial insemination (AI) in farm animals;	Artificial insemination; frozen semen; oestrus synchronization.	
4.8	evaluate the use of A.I. in farm animals;	Advantages and disadvantages of A.I.	Signs of heat in fa animals.
4.9	differentiate among the terms: a. ovulation; b. fertilization; c. gestation; d. oestrous cycle; e. kindling, parturition, farrowing.		
4.10	describe the process of egg formation and incubation in poultry;	Natural and artificial incubation. Candling	Experiment with small scale incubators. Visit to hatcheries. Video Presentation.

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
4.11	state the benefits of embryo transfer;	Embryo transfer – transfer of embryo from a donor to a surrogate mother. 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.	
4.12	explain genetic engineering in livestock production.	The significance of biotechnology or genetic engineering (artificial alteration of the genetic composition of the organisms); benefits and concerns including ethical and religious.	Class presentation using Internet research.
5.	**ANIMAL HUSBANDRY**		
5.1	describe the management practices associated with the care of baby chicks and baby rabbits (kittens);	Include brooding, feeding, immunization, debeaking in layers.	Conduct management practices in rearing broilers, layers and rabbits.
5.2	explain the management practices associated with rearing broilers, layers and rabbits;	Include feeding, cannibalism, sanitation.	Rear rabbits and a batch of broilers and layers.

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
5.3.	rear a batch of 100 broilers per term;		Prepare a cost analysis for a batch of broilers.
5.4	describe the general signs of illness in farm animals;	Include bird flu.	
5.5	identify pests and diseases of poultry and rabbits;		
5.6	describe the symptoms of pests and diseases infestation in poultry and rabbits;		
5.7	determine the prevention, control and cure of pests and diseases in poultry and rabbits;		
5.8	explain the economic importance of bees;		Visit an apiary.
5.9	differentiate among the types of bees in a hive;	Queen, drone, worker.	Visit an apiary.
5.10	describe the social activities of bees.	Functions.	Visit an apiary.
5.11	identify the causes, symptoms, prevention, control and cure of pests and diseases infestation in bees;		
5.12	describe the harvesting of honey and other bee products.		

6. ANIMAL PRODUCTS TECHNOLOGY

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
6.1	list principal farm animal products and by-products including those derived from offal;	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 fertilizer, 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.
6.2	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.
6.3	determine the most appropriate age to slaughter broilers;	Age: five to six weeks.	Slaughter and dress broilers. Conduct marketing strategies to sell broilers. Conduct an Open day in collaboration with other departments.
6.4	explain the process involved in the marketing of eggs and meat.	Processes from egg collection stage to when the egg reaches the consumer.	Collect, clean, sort, grade and pack eggs.

♦ SECTION D: HORTICULTURE

GENERAL OBJECTIVES

On completion of the section on Horticulture, students should:

1. develop knowledge and understanding of horticultural practices;
2. understand the factors that contribute to good soil management;
3. develop awareness of the methods of Integrated Pest Management (IPM);
4. appreciate the symbiotic relationship between soil properties and plant growth.

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:		
1. define horticulture;		Visit to horticultural station and botanical gardens or nature parks.
2. explain the importance of horticultural plants;	Including nutritional, aesthetic, medicinal, therapeutic, religious, shading, recreational, handicraft.	
3. discuss the management practices in the cultivation of horticultural plants;	All of the following: (a) citrus; (b) mango; (c) avocado; (d) banana; (e) miniature golden apple (june plum, pommecythere); (f) heliconia; (g) orchid; (h) ginger lily; (i) anthurium; (j) rose. With reference to: (a) varieties; (b) propagation;	Establish and maintain one of the following from (a) to (e). Cultivate two ornamental plants from (f) to (j). Written project on any of the horticultural plants listed.

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
		(c) environmental requirements- light, photoperiodism, temperature, growth medium, water and nutrients; (d) other cultural practices, including pests and disease control, thinning, pruning, pinching, anchoring, topiary (shaping); (e) harvesting, postharvesting (f) marketing; (g) utilization.	
4.	describe the harvesting techniques of horticultural plants;	For the horticultural plants; maturity indices.	Harvest ornamental plants.
5.	state the quality requirements for the flowers of the horticultural plants;	For the harvested plant parts.	
6.	describe the management practices in the establishment of lawn and turf grasses.	Lawn establishment from seeds, sod, sprigs, or plugs; maintenance or management requirements: fertilizing, pests and diseases control, watering, mowing of lawn or turf area in landscape. Include: Cynodon dactylon – Bermuda grass; Axonopus compressus – Savanna grass; Zoysia sp. – Turf grass.	Maintain a lawn or turf area in the landscape.

♦ SECTION E: ANIMAL MANAGEMENT

GENERAL OBJECTIVES

On completion of the section on Animal Management, students should:

1. develop knowledge and understanding of the principles of good management practices in the rearing of livestock;

2. appreciate the economic importance to be derived from rearing of livestock;

3. understand to the importance of good record keeping practices in the management of farms.

SPECIFIC OBJECTIVES	CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:		
1. describe the management practices in the rearing of livestock;	Any four from the following: (a) layers; (b) sheep or goats; (c) pigs; (d) cattle (beef and dairy); (e) buffalypso(beef and dairy); with reference to: (i) reproduction – male and female reproductive system, ovulation, fertilization, gestation, parturition, oestrus, oestrous cycle; (ii) care of the young; (iii) feeding requirements (water, grass, concentrates, colostrum, milk); (iv) housing requirements (spacing, ventilation, temperature, shade, ease of cleaning); (v) general notes on health, pests and diseases prevention and control; (vi) milk and egg production; (vii) removal, conservation and use of manure,	Rear layers and prepare a cost analysis of egg production. Practical work with cows, rabbits, sheep or goats and pigs. Identify the signs of heat in farm animals. Written project on any of the animals listed.

SPECIFIC OBJECTIVES		CONTENT	SUGGESTED PRACTICAL ACTIVITIES
Students should be able to:			
		(including source of feed and biogas); (viii) record keeping; (ix) cost of production.	
2.	describe the processes used to prevent food spoilage;	Include cooling, drying, pasteurisation, UHT (Ultra High Temperature), curing, smoking of animal products.	Visit a milk processing facility. Video presentation. Demonstration of preservation by smoking meat.
3.	identify principal cuts of meat;	Cuts of meat in animals sought by consumers.	Charts or video presentation meat cuts.
4.	explain the quality requirements of the various meat cuts;	Quality indices consumers look for in meat.	Visit markets to ascertain meat quality
5.	describe the food safety requirements for the processing of food;		
6.	describe utilization of animal products, animal by-products and animal wastes into value-added products;		
7.	evaluate the role of biotechnology in animal production.	Biotechnology concept; benefits and concerns of consumer.	Group presentations, debates.

♦ GUIDELINES FOR THE CONDUCT OF SCHOOL-BASED ASSESSMENT

RATIONALE

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

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

The guidelines provided in this syllabus for selecting appropriate tasks are intended to assist teachers and students in selecting assignments that are valid for the purpose of the SBA. These guidelines are also intended to assist teachers in awarding marks according to the degree of achievement in the SBA component of the course. In order to ensure that the scores awarded by teachers are not out of line with the CXC standards, the Council undertakes the moderation of a sample of SBA assignments marked by each teacher.

School-Based Assessment provides an opportunity to individualize a part of the curriculum to meet the needs of students. It facilitates feedback to the students at various stages of the experience. This helps to build the self-confidence of the students as they proceed with their studies. School-Based Assessment further facilitates the development of essential investigative and practical skills that allow the student to function more effectively in his or her chosen vocation. School-Based Assessment, therefore, makes a significant and unique contribution to the development of relevant skills of the students. It also provides an instrument for testing them and rewarding them for their achievements.

The assessments should be made in the context of normal practical coursework exercises. It is not intended that the exercises used for assessment should be artificial and meaningless. Assessments should only be made after candidates have been taught the skills and given enough opportunity to develop them. Skills that are not being assessed for CXC at a particular time should, therefore, not be neglected. Questions at the end of the practical exercises should assist in developing interpretation skills.

There is no upper limit to the number of assessments. Note, however, that not all practical exercises are used for assessment. Candidates should be given the opportunity to develop skills and to feel free to ask for guidance from the teacher without penalty.

THE PRINCIPLE OF ASSESSMENT

(i) **Assessment of Skills**

The student will be credited for performances 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**

Single Award

This component involves the study of farm production systems by producing selected crops and rearing a batch of broilers. The student would be required to perform the activities given below.

(a) Plant a crop and **record** all activities associated with the cultivation of the crop from the planning stage to marketing of the crop, including all cultural practices, harvesting and postharvesting techniques and marketing. The student with guidance from the teacher must develop a portfolio on this aspect of the production. A profit and loss analysis must be completed. This cost analysis is to be marked out of 20 using the guidelines provided in Table 7.

(b) Rear a batch of broiler chicks from day old to slaughter, carrying out all the necessary practices associated with broiler production. All activities are to be documented in a portfolio and presented with a profit and loss analysis. This cost analysis is to be marked out of 20, using the guidelines provided in Table 7.

Students can work in groups or by themselves, but this must be decided and agreed upon before the project begins.

Note that students are required to cultivate at least four (4) crops (a fruit, root, leaf and flower vegetable crop) and rear a batch of 100 broilers per term. However, a cost analysis of ONLY one crop and a cost analysis of ONLY one batch of broilers are to be presented for the SBA requirement.

TABLE 7
Guidelines for Cost Analysis of Farm Production Project

Item		Description	KC Marks	Total
(i)	Introduction	Name of project Location Duration Description of activities, sketch of layout of plot, materials and equipment Schedule of operations	 3 1	4
(ii)	Complete budget	Projected income (output x price) Projected expenditure (itemised) Surplus	1 1 1	3
(iii)	Actual income and expenditure	Income (from sale of produce) Expenditure Surplus/shortfall	2 2 1	5
(iv)	Analysis	Comparison of projected and actual income, expenditure and surplus/shortfall General comments Conclusion Recommendations	 2 2 1 1	6
(v)	Language	Communication of information in a logical manner using correct grammar	2	2
TOTAL				20

Double Award

This component involves the study of farm production systems by producing selected crops and rearing a batch of broilers and a batch of layers. The student would be required to perform the activities given below.

(a) Plant a crop and **record** all activities associated with the cultivation of the crop from the planning stage to marketing, including all cultural practices, harvesting and postharvesting techniques and marketing. The student with guidance from the teacher must develop a portfolio on this aspect of the production. A profit and loss analysis must be completed. This cost analysis is to be marked out of 20 using the guidelines provided in Table 7 above.

(b) Rear a batch of broiler chicks from day old to slaughter, carrying out all the necessary practices associated with broiler production. All activities are to be documented in a portfolio and presented with a profit and loss analysis. This cost analysis is to be marked out of 20, using the guidelines in Table 7 above.

(c) Rear a batch of 25 layers from day old to egg production, carrying out all the necessary practices associated with layer production. All activities are to be documented in a portfolio and presented with a profit and loss analysis. This cost analysis is to be marked out of 20, using the guidelines in Table 7 above.

Students can work in groups or by themselves, but this must be decided and agreed upon before the project begins.

Note that students are required to cultivate at least four (4) crops (a fruit, root, leaf and flower vegetable crop), rear a batch of 100 broilers per term and a batch of 25 layers per year. However, a cost analysis of ONLY one crop and a cost analysis of ONLY one batch of broilers and ONLY one batch of layers are to be presented for the SBA requirement.

PRESENTATION

1. The cost analyses for the crop and animal production projects should be kept in a soft-backed folder of "Quarto' or A4 size.

2. The candidate's name, registration number, name of school and Award (Single or Double) should be clearly written on the outside of the folder and on the first page of the report.

3. The mark scheme for **EACH** cost analysis report should be at the end of the report, indicating clearly the teacher's assessment of each report.

(iii) **Research Component (Double Award only)**

In addition to (i) and (ii) above, students who are completing the Double Award syllabus would also be required to do a Research Project. The student should be able to apply appropriate experimental techniques, technologies, research methods and data presentation and analysis techniques in relation to agricultural problems and situations.

The research project enables students to study a particular agricultural issue or problem. The material submitted by students for the research project must consist of a report. The report communicates the research methodology, data analysis and evaluation. It must consist of approximately 1000-1500 words. The text can be supplemented by additional appropriate material such as graphs, figures, tables, slides and photographs. Wherever a candidate exceeds the maximum length for the project by more than 10 per cent, the teacher must impose a penalty of 10 per cent of the score that the candidate achieves on the project. On the candidate's script, the teacher should clearly indicate the candidate's original score – that is, the score before the deduction is made – the marks which are to be deducted, and the final score that the candidate receives after the deduction has been made. Only the final score is to be indicated on the record sheets which are submitted to CXC. The research project contributes 20 percent of the SBA marks. It must be submitted to the teacher and marked by the 31st January of the year of the examination and kept to be examined by the CXC moderator.

The work presented must have been undertaken by the student and the results must be based on the student's own investigation. **Information may be used from the Internet, pamphlets and**

textbooks but should not be copied directly. Any information used from such sources must be appropriately acknowledged by having the relevant reference included in the bibliography.

The Research Project must include:

1. the title;
2. the table of contents;
3. abstract;
4. literature review;
5. methodology;
6. results;
7. data analysis;
8. discussion;
9. conclusion and recommendations;
10. bibliography.

Criteria for Marking the Report

Wherever the length of the research report exceeds 1650 words, the teacher is required to impose a penalty of 10 percent of the score that the candidate achieves on the report.

Criteria for Marking Research Project

Item	Description	KC Marks	Total
i. Research Question	A short description of the project with the objectives.	1	1
ii. An abstract	Précis of what was done Results	1 1	2
iii. Literature Review	Relevance to Topic Depth	1 1	2
iv. Research Methodology	Relevance to topic Choice of method	1 1	2
v. Results	Accuracy Totality	1 1	2
vi. Data Analysis	Statistical Method Relevance to Project Accuracy Depth	1 1 1 1	4

Item	Description	KC Marks	Total
vii. Discussion	Relevance to results Depth	1 1	2
viii. Conclusion and recommendations	Relevance to discussion Relevance to objectives	1 1	2
ix. Communication of information in a logical manner using correct grammar.	Relevance to objectives Topical		3
Total			20

PRESENTATION

1. The research project should be submitted to the teacher in a soft-backed folder.

2. The candidate's name, registration number, name of school, and the title of the project should be clearly written on the outside of the folder and on the first page of the report.

3. The report should be clearly and legibly hand written or typed.

4. A mark scheme should be included at the end of the report, indicating clearly the teacher's assessment of the project.

5. A table of contents should be included at the beginning of the report.

6. Tables, graphs, diagrams, or any form of illustration should be suitably chosen, structured and integrated into the report.

7. References should be in alphabetical order in a bibliography at the end of the report.

8. Appendices should appear at the end of the report.

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. For the **Single**

Award, the ten practical exercises must consist of five skills from Section B: Crop Production and five skills from Section C: Animal Production. For the **Double Award**, the ten practical exercises must consist of five skills from Section B: Crop Production and Section D: Horticulture and five skills from Section C: Animal Production and Section E: Animal Management. These skills are listed on pages 46 – 49 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

2 marks = 0
3 marks = 1
4 marks = 2
5 marks = 3
6 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 for Single and Double Award, and the Research Projects for 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 do 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
   - highest Total mark;
   - middle Total mark;
   - lowest Total mark;
   - mark midway between the highest and middle Total mark;
   - 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 Research Projects 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 (for Single Award and Double Award)

1. Identify the textural classes of soil.

2. Determine the pH of soil.

3. Use techniques of fertilizer 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. Use a rain gauge to produce rainfall records.

7. Demonstrate land preparation techniques:

   (a) land clearing;

(b) primary and secondary tillage;

(c) drain formation;

(d) ridges and furrows.

8. Clean and maintain simple tools and the knapsack sprayer.

9. Demonstrate plant propagation techniques;

(a) budding;

(b) grafting;

(c) layering;

(d) cuttings.

10. Prepare seed boxes and seed beds.

11. Thin out seedlings.

12. Demonstrate cultural practices associated with crop production:

(a) moulding;

(b) mulching;

(c) staking;

(d) pruning;

(e) irrigating;

(f) weed control;

(g) pests and diseases control.

13. Use appropriate harvest and postharvest techniques.

Section D: Horticulture (For Double Award ONLY)

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.

19. Prepare cut flowers for the market.

20. Establish a lawn or turf area.

21. Practise weed control in a lawn or turf area.

22. Mow a lawn or turf area.

SBA Skills – ANIMAL PRODUCTION

Section C (for Single Award and Double Award)

1. Identify parts of the digestive system of farm animals.

2. Use food tests to identify carbohydrates, fats and proteins in feeds.

3. Identify, collect and mount forage plants.

4. Determine the space requirements for different batches of broilers, layers.

5. Prepare a brooder for baby chicks.

6. Clean and disinfect pens.

7. Prepare eggs for incubation in a small-scale incubator.

8. Identify and treat pests and disease in poultry, rabbits and bees.

9. Collect, clean, sort, grade and pack table eggs.

10. Determine the dressing percentage of broilers and rabbits.

11. Slaughter and dress broilers.

12. Plan a marketing strategy for broilers.

Section E: Animal Management (For Double Award ONLY)

13. Identify major breeds of livestock.

14. Prepare accommodation for mother and young animals.

15. Attend to young animals:

    (a) inoculate;

(b) debeak;

(c) treat navel against flies;

(d) clip teeth in piglets;

(e) administer iron injection.

16. Apply first aid procedures in animals.

17. Maintain animals and surroundings in a hygienic condition.

18. Administer control measures against internal and external parasites.

19. Use different methods of harvesting forage.

OVERALL ASSESSMENT

1.	**Single Award**			
	Skills 10 x 4 Production Projects (2 cost analyses – one on broilers and one on crops)		40 Application marks 40 KC marks	
	Contribution to Total Marks		80	40%
2.	**Double Award** Skills 10 x 4 Production Projects (3 cost analyses – one on broilers, one on layers and one on crops)		40 Application marks 60 KC marks	
	Research Project		20 KC marks	
	Contribution to Total Marks		120	40%

♦ RESOURCES

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

Ahn, M. P. — *Tropical Soils and Fertilizer Use, Intermediate Tropical Agriculture Series*, United Kingdom: Longman, 1993.

Elliott, I. and Wolsey. O. — *Agricultural Science 1 and 2: A Junior Secondary Course for the Caribbean*, Longman Caribbean, 1996.

Elliott, I. and Wolsey O. — *Agricultural Science 3: A Lower Secondary Course for the Caribbean*, Longman Caribbean, 1996.

Orse, B. — *Where There Is No Vet,* London and Oxford: MacMillan, 1999.

Hall, B. — *Diseases and Parasites of Livestock in the Tropics, Intermediate Tropical Agriculture Series*, London: Longman, 1997.

Publications by:

(i) Ministries responsible for Agriculture in Barbados, Guyana, Jamaica, Trinidad and Tobago.

(ii) University of the West Indies, Department of Agricultural Extension.

(iii) Jamaica Agricultural Society.

(iv) Technical Centre for Agriculture and Rural Cooperation (CTA)
(a) Agrodok Series
(b) The Tropical Agricultural Series

HORTICULTURE

Hartman, H. et al — *Plant Propagation: Principles and Practices,* New Jersey: Prentice Hall, 1997.

Walt, D. — *Ornamental Plants: their Care, Use, Propagation and Identification*. E.H.C., California: Modesto, 1994.

Powell, C. et al — *Ball Pest and Disease Manual,* Illinois: Ball, 1996.

Jannick, J. — *Horticultural Science,* New York: CRC Press, 1996.

ORGANIC AGRICULTURE

Helburg, U. — *Jamaica Organic Agriculture Movement (JOAM) – Organic Farming Handbook,* Kingston, Jamaica: JOAM, Ministry of Agriculture, 2005.

Munroe, L. and Francis, P. — *Development of Sustainable Regional Organic Agriculture in the Caribbean*, Guyana: University of Guyana, 2005.

WEBSITES

www.cardi.org
www.cta.int
www.ift.org
http:/ific.org
www.fao.org
www.dexiaexport.com

Western Zone Office
2006/05/09