

AGRICULTURE

Table of Contents

Section		Page
Foreword		
Acknowledgements		ii
1. Introduction		1
2. Aims		2
3. Assessment Objectives		3
4. Scheme of Assessment		5
5. Content		7
6. Coursework		26
7. Grade Descriptions		28
8. Appendices	A.	Examples of Tasks for Practical Work 30
	B.	Guide to Marking the Practical 32
	C.	Examples of Project work 34
	D.	Components of the Project Report 35
	E.	Glossary of Terms 36

BOTSWANA GENERAL CERTIFICATE OF SECONDARY EDUCATION
ASSESSMENT SYLLABUS FOR
AGRICULTURE
BECOMES EFFECTIVE FOR EXAMINATION IN 2001

FOREWORD

The Ministry of Education is pleased to authorise the publication of this senior secondary syllabus which marks a watershed in the development of the public education system in Botswana and signals another milestone of progress in fulfilment of the goals set by the Revised National Policy on Education, Government Paper No. 2 of 1994.

In this era of widespread and rapid technological change and an increasingly inter-dependent global economy, it is essential that all countries foster human resources by preparing children adequately for their future. Survival in the coming millennium will depend on the ability to accommodate change and to adapt to environmental needs and emerging socio-economic trends. It is the wish of government to prepare Botswana for future growth and adaptation to ongoing change in the socio-economic context; specifically the transition from an agro-based economy to the more broadly based industrial economy which we are aiming at.

The senior secondary programme builds on the Ten Year Basic Education programme and seeks to provide quality learning experiences. It aims to prepare our students for the world of work, further education and lifelong learning. However, secondary education must also pay attention to the all round development of the individual. It should provide not only for the acquisition of those skills needed for economic, scientific and technological advancement. It should also provide for the development of cultural and national identity and the inculcation of attitudes and values which nurture respect for one's self and for others.

Critical to the success of our secondary education programme is the recognition of individual talents, needs and learning styles. Hence, the role of the teacher in the classroom has changed. S/he must be a proficient manager and facilitator; a director of learning activities. S/he should be conscious of students' needs to take on board a measure of accountability and responsibility for their own learning. S/he must also take into account the widening range of ability of the student body and the different levels of achievement which they aspire to. This means active participation for all and the creation of rich and diverse learning environments.

It is important then that we value the students' own experiences, build upon what they know and reward them for positive achievement. At the same time, we must be prepared to offer them guidance and counselling at all levels; assisting them to make the best decisions in keeping with their own interests, career prospects and preferences. In that way we shall prevail in nurturing at the roots of our system, the national ideals of democracy, development, self-reliance, unity and social harmony.

This syllabus document is the outcome of a great deal of professional consultation and collaboration. On behalf of the Ministry, I wish to record my appreciation and thank sincerely those who contributed to and were involved in the production of this syllabus.

P. T. Ramatsui
Permanent Secretary
Ministry of Education

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1. INTRODUCTION

As part of the Botswana General Certificate of Secondary Education Programme, this Agriculture Assessment Syllabus is designed to assess candidates who have completed a two-year course based on the Senior Secondary School Agriculture Teaching Syllabus.

The syllabus aims to assess positive achievement at all levels of ability. Candidates will be assessed in ways that encourage them to show what they know, understand and can do.

The syllabus will be assessed by two papers, details of which are given in the Scheme of Assessment.

Candidates will be graded on a scale A — G. As a guide to what might be expected of a candidate's performance, grade descriptions are given later in section 7.

This syllabus should be read in conjunction with:

- (a) the Senior Secondary School Agriculture Teaching Syllabus;
- (b) the specimen question papers and marking schemes.

Syllabus-specific requirements and any further information are given in the Appendices.

Candidates following this syllabus should acquire and develop:

- 1 an appreciation of Agriculture as an applied science;
- 2 interest and awareness of existing problems and opportunities in Agriculture in the context of rural development;
- 3 exposure to out of school farming activities such as Agricultural fairs, field trips and the job shadowing exercise in preparation for the world of work;
- 4 skills to demonstrate the value of Agriculture to the family, community and the national and world economies;
- 5 initiative, problem solving abilities and scientific methods so as to encourage a spirit of resourcefulness and self-reliance;
- 6 a desirable behavioural pattern and frame of mind in interacting with the environment in a manner that is protective, preserving and nurturing;
- 7 business and entrepreneurial skills necessary to develop and manage an Agricultural project;
- 8 skills that are relevant to Agriculture that include objectivity, precision, initiative, experimentation and research;
- 9 knowledge and understanding about the efficient use of available government assistance programmes aimed at Agricultural development in Botswana;
- 10 knowledge and understanding of the recent technological developments in Agriculture.

As far as possible, the Aims will be reflected in the Assessment Objectives; however, some aims cannot be readily assessed.

3 ASSESSMENT OBJECTIVES

There are three main Assessment Objectives.

- 1. Knowledge with Understanding**
- 2. Handling Information, Application and Problem Solving**
- 3. Practical and Investigative Skills**

A description of each Assessment Objective follows:

1. Knowledge with Understanding

Candidates should be able to demonstrate Agricultural Knowledge and Understanding in relation to:

- 1.1 correct use of terms, symbols, quantities and units of measurement;
- 1.2 correct reference to facts, concepts, laws and principles;
- 1.3 safe Agricultural practices that prepare students for a productive life;

Questions assessing these objectives will often begin with one of the following words: *define, describe, outline, state* etc

2. Handling Information, Application and Problem Solving

Candidates should be able to use oral, written, symbolic, graphical, tabular, diagrammatic and numerical presentations to:

- 2.1 locate, select, organise and present information from a variety of sources;
- 2.2 translate information from one form to another;
- 2.3 use information to identify patterns, report trends, draw inferences, make predictions and propose hypothesis.
- 2.4 present reasoned explanations for phenomena, patterns and relationships;
- 2.5 solve problems of a quantitative and qualitative nature.

3 Practical and Investigative Skills

3.1 Practical Skills and Techniques

Candidates should be able to:

- 3.1.1 understand and follow instructions;
- 3.1.2 choose and use suitable techniques, equipment and materials safely and correctly;
- 3.1.3 record observations, measurements and estimates.

3.2 Practical Investigations Carried Out by Students

Candidates should be able to:

- 3.2.1 identify problems and plan an investigation;
- 3.2.2 organise and carry out an investigation;
- 3.2.3 interpret and evaluate observations and experimental data;
- 3.2.4 draw conclusions and make recommendations;

Weighting of Assessment Objectives

For the overall assessment, the approximate weightings of the Assessment Objectives will be as follows:

1.	Knowledge with Understanding	30%
2.	Handling Information, Application and Problem Solving	40%
3.	Practical and Investigative Skills	30%

4. SCHEME OF ASSESSMENT

The assessment will consist of school-based assessment and a terminal examination. All candidates should be entered for Papers 1, 2 and 3.

The Papers

Paper 1 Written	45 Minutes	40 marks
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This paper will consist of 40 multiple choice items, each with four possible responses. The paper will test Assessment Objectives 1 and 2.

Paper 2 Written	2 hours 15 minutes	100 marks
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Section A

This section will have compulsory short-answer questions and will be marked out of a total of 60. The paper will test Assessment Objectives 1 and 2.

Section B

This section will have seven essays. Candidates will be allowed to select four essays. Each essay will be marked out of 10 and will test Assessment Objectives 1 and 2.

Paper 3 Coursework	Five Terms	155 marks
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This paper is a continuous assessment of candidates' practical work. It will consist of practical tests and project work. Four practical tests will each be marked out of 20; the Project will be marked out of 75. This paper will test Assessment Objectives 2 and 3.

For details see:

Appendix B: Guide to Marking the Practical;
Appendix D: Components of the Project Report.

Weighting of the Papers

<u>P a p e r s</u>	<u>Weight (%)</u>
<u>1</u>	40
<u>2</u>	40
3	20

Assessment Grid

The following grid summarizes the connection between the Assessment Objectives and the papers.

<u>Assessment Objectives</u>	Paper 1	Paper 2	Paper 3
1			
2	V	V	V
3			V

The Syllabus content is arranged in three columns:

- (a) **T o p i c s**
- (b) **General Objectives**
- (c) **Specific Objectives**

- (a) A **Topic** refers to those components of the subject which candidates should have studied.
- (b) Each topic is then defined in the second column in terms of **General Objectives**. It is derived from the topics and is the general knowledge, understanding and demonstration of skills on which candidates may be assessed.
- (c) The **Specific Objectives** in the third column list the content to be covered by candidates. Thus once a topic has been identified in the first column, the second and third columns show in increasing detail which aspects of the topic are likely to be assessed.

The content material is divided into the following sections:

1. General Agriculture
2. Crop Husbandry
3. Ornamentals, Lawn Management and Landscaping
4. Livestock Husbandry
5. Crop and Livestock Improvement
6. Agricultural Economics
7. Agricultural Engineering

MODULE 1 GENERAL AGRICULTURE

Topic	General Objective	Specific Objective
	Candidates should be able to:	Candidates should be able to:
1.1 Trends of Agriculture	acquire knowledge and understanding of the transition from hunting and gathering to commercial farming	<ul style="list-style-type: none"> • identify the developmental stages from hunting and gathering through domestication, shifting cultivation, settled agriculture to commercial farming; • discuss the above developmental stages and their impact on the environment
1.2 Environmental influences	Understand how crops and animals are affected by the environmental	<ul style="list-style-type: none"> • describe how temperature, wind, humidity, rainfall, frost and photoperiodism affect the growth of plants and animals; • state the effects of day length on plant growth; • suggest ways of modifying the effects of environmental factors; • describe the water cycle.
1.3 Principles of land use	Know the different classes of land capability classification and the land tenure system of Botswana	<ul style="list-style-type: none"> • define <i>land tenure</i>; • describe the land tenure systems of Freehold, State land and Communal land in Botswana; • describe leasehold and inheritance with respect to Freehold, Stateland and Communal land; • describe the advantages and disadvantages of the land tenure systems; • list the eight classes of the United States Department of Agriculture (USDA) land capability classification; • describe the characteristics of the above 8 classes; • deduce the use of each class.
1.4 Agricultural technology	Acquire knowledge on Agricultural technology	<ul style="list-style-type: none"> • define Agricultural technology and give examples; • discuss the use of a farming system as a technology transfer approach.

MODULE 2 CROP HUSBANDRY

Topic	General Objective	Specific Objective
	Candidates should be able to:	Candidates should be able to:
2.1 Principles of Plant Growth	Acquire knowledge on the principles of plant growth in relation to plant structure and physiological processes	<ul style="list-style-type: none"> • state the conditions necessary for plant growth; • describe the internal structure of a leaf, stem and root for a monocotyledonous and a dicotyledonous plant; • state the functions of the parts identified above; • describe with the longitudinal section of a root; • describe the manufacture and utilization of food in plants • describe movement of water and dissolved substances into and in the plant; • discuss food storage in plants; • describe the types of reproduction in plants; • list the parts used for asexual propagation in plants; • demonstrate any two of the following methods of plant propagation- grafting, cutting, budding or layering; • identify from specimens, the structure of the flower of a maize and bean plant; • describe the functions of various parts of the flower described above; • describe the mechanism of pollination in maize (wind pollination) and bean (insect pollination); • define <i>fertilization</i>; • describe the process of fertilization in a named plant, including seed and fruit formation; • define <i>tropism</i>;

		<ul style="list-style-type: none"> • Legumes- green beans or green peas or ground nuts or field beans or cowpeas a) Leafy vegetables- spinach or kale or cauliflower, cabbage or lettuce or rape • Fruits- tomato or eggplant or green pepper <p><i>Only one vegetable from the above list should be selected, grown and studied in relation to the objectives stated below.</i></p> <p><i>The field crops to choose from are maize or sorghum or millet and only one is to be selected and studied according to the above objectives.</i></p> <p><i>The selected vegetable and field crop should be grown in the school.</i></p>
<p>2.4 Crop Protection</p> <p>2.4.1 Weeds</p>	<p>Show understanding of the principles underlying crop protection.</p>	<ul style="list-style-type: none"> • explain the negative and positive effects of weeds on crops; • identify four weeds found in Botswana; • collect and preserve for display some local weeds found in Botswana (English common names and Scientific names to be used for identification); • state the different ways of classifying weeds as in length of growing period, morphology and method of dispersal; • describe biological, cultural, mechanical and chemical weed control; • state advantages and disadvantages of each of the weed control methods.

2.4.2 Pests	Acquire knowledge on the common pests affecting crops and their control methods	<ul style="list-style-type: none"> • describe classification of pests according to mode of feeding; • identify at least one pest from each of the groups of pests of biting and chewing, piercing and sucking as well as boring pests; • identify and preserve for display local insects and other pests; • describe one pest from each of the biting and chewing pests, piercing and sucking pests and boring pests, in relation to the following: <ul style="list-style-type: none"> a)life cycle, b)method of control, c)host crop, d)damage caused to crops; <p><i>The list of pests to choose from is as follows:</i></p> <p>biting and chewing: grasshoppers or leaf miners or termites, beetles or locusts</p> <p>piercing and sucking: aphids or mealy bug or scale insects</p> <p>koring pests: stalk borer or weevil or American bollworm</p> <ul style="list-style-type: none"> • discuss damage caused by and control of nematodes and rodents.
2.4.3 Diseases	Acquire knowledge on crop diseases, their modes of infection and control	<ul style="list-style-type: none"> • define disease • describe the mode of infection, harmful effects, prevention and control of one plant disease from each of the following groups: <p>Bacterial Diseases: <i>Bacterial Blight of Cowpeas or Black rot of Cabbage or Bacterial Wilt of Tomatoes or Soft rot of Vegetables.</i></p>

		<p>Fungal Diseases: <i>Sorghum downy mildew or Sorghum Smuts or Maize Smut or Leaf Blight of Sorghum/Maize or Early and Late Leaf spots of Groundnuts or Charcoal rot on Sorghum/Maize.</i></p> <p>Virus Diseases: <i>Maize Dwarf Mosaic Virus on Sorghum or Maize Streak Virus on Maize or Groundnut rosette Virus or Cowpea Aphid-borne Mosaic Virus or Tobacco Mosaic Virus on Tomatoes.</i></p>
2.4.4 Pesticides	Acquire knowledge on the use of pesticides	<ul style="list-style-type: none"> • classify pesticides according to what they control • define contact, systemic, and stomach insecticides
2.4.5 Herbicides	Acquire knowledge on the various herbicides	<ul style="list-style-type: none"> • define herbicides • describe with examples selective herbicides and non selective herbicides
2.4.6 Use of farm chemicals	Acquire skills on the care and safe use of handling farm chemicals	<ul style="list-style-type: none"> • define the terms <i>active ingredient</i> and <i>inert material</i> • describe the following forms of pesticides: Dusts, Granules, Fumigants, Sprays and Aerosols; • demonstrate the proper use of a knapsack sprayer including its calibration; • describe the necessary precautions taken when handling and storing farm chemicals to minimise pollution and poisoning; • describe possible environmental hazards of farm chemicals.

MODULE 3 ORNAMENTALS, LAWN MANAGEMENT AND LANDSCAPING

Topic	General Objective	Specific Objective
	Candidates should be able to:	Candidates should be able to:
3.1 Ornamentals	Acquire the required skills necessary to manage and grow ornamental crops	<ul style="list-style-type: none"> • identify two plants for each of the following: Potting, Bedding and Flower cutting; • demonstrate the proper use of pots, seed beds and seed boxes including the importance of cleanliness of equipment as a precaution against disease; • choose only one plant from above and study practically under the following objectives; • demonstrate preparation of standard soil mixes; • demonstrate the hardening off of seedlings; • practice the following activities: pricking out of seedlings, timing of planting, transplanting, suitable spacing, apply suitable fertilisers; • demonstration of one suitable method of irrigation; • state timing and the required frequency of irrigation; • discuss the control of one common pest and one common disease of the chosen crop; • discuss pruning and topiary of ornamentals; • discuss the preparation and marketing of the ornamental crop chosen.
3.2 Lawn management	Acquire skills necessary to grow and manage lawns.	<ul style="list-style-type: none"> • define lawn • state the importance of lawns; • explain the preparation of land into a tilth suitable for lawn; • demonstrate proper use of fertilisers and manures;

		<ul style="list-style-type: none"> • identify three plant species used for lawn; • demonstrate the use of planting materials for lawns • practice appropriate management of lawns in relation to timing of planting, weed control, mowing, edging, spiking, scarification, irrigation, pest and disease control; • identify appropriate equipment for use in management of lawn.
3.3 Landscape Design	Show understanding and acquire skills on principles of landscape designing	<ul style="list-style-type: none"> • define landscaping • describe any two kinds of landscapes
		<p>from the following list: Formal landscape, Garden, Rockery, Civic space, Cemetery, Park, Playground or Waterfront;</p> <ul style="list-style-type: none"> • explain the use of five different
		<ul style="list-style-type: none"> • materials in landscaping; • explain the use of plant life in landscape design • describe the environmental impacts of landscape design; • observe existing examples of built landscapes through the use of field trips;

MODULE 4 LIVESTOCK HUSBANDRY

Topic	General Objective	Specific Objective
	Candidates should be able to:	Candidates should be able to:
4.1 Livestock Management	Understand essential aspects of livestock housing and general well being	<ul style="list-style-type: none"> • outline reasons for housing livestock; • describe type of housing needed for one type of livestock (broilers, layers, rabbits, dairy animals or pigs); • describe qualities of a good livestock house.
		<ul style="list-style-type: none"> • define stockmanship; • explain stockmanship in the following
	Understand the proper handling and stockmanship of	

	livestock	<p>areas for one of the following</p> <p>livestock (broilers or layers or rabbits or dairy animals or pigs):</p> <p>a) animal handling,</p> <p>b) record keeping,</p> <p>c) rearing of young stock,</p> <p>d) nutrition and feeding practices.</p>
4.2 Anatomy and physiology	Acquire understanding of farm animal anatomy and the physiology of digestion and reproduction	<ul style="list-style-type: none"> describe structure and function of the male and female reproductive systems of cattle and chickens describe digestion in ruminant and non-ruminant animals including enzymatic action. state at least four signs of heat in cow state the relevance of signs of heat for breeding describe oestrous cycle of a cow state the relationship between oestrous cycle and pregnancy; state the roles of oestrogen, progesterone, follicle stimulating hormone, corpus luteum, leutinising hormone and testosterone in the reproductive system of a ruminant.
4.3 Livestock health and disease	Know and understand livestock health and diseases	<ul style="list-style-type: none"> describe characteristics of healthy animals; outline general methods of prevention of livestock diseases; classify Coccidiosis, Trypanosomiasis, Fowl Typhoid, Tuberculosis, Mastitis, Botulism, Anthrax, Contagious Abortion, Foot and Mouth, Swine Fever, Newcastle, Heartwater, Rabies, Rickets, Piglet Anaemia, Aphosphorisis and Contagious Bovine Pleuro Pneumonia (CBPP) on the basis of causative agent and host animal(s) affected; choose one disease from above and describe the etiology, symptoms, prevention and control of the disease; classify round worms, tape worms,

		<p>liver fluke, ticks, flies, mites, lice and tsetse fly into internal or external parasites;</p> <ul style="list-style-type: none"> describe the host, life cycle and control of one internal and one external parasite from the objective above.
<p>4.4 Game farming and Game Ranching</p>	<p>Acquire skills on the principles of game farming and game ranching</p>	<ul style="list-style-type: none"> differentiate game farming, game ranching and game and livestock ranching; <u>name at least five game animals;</u> explain four importance of game farming; explain the following ecological principles used in selecting a suitable game farm: size of area, flow of energy, carrying capacity, numbers of game and ecosystem concept; <u>outline the habitat preference of three species found in different habitats of Botswana. Only one species from each of the three geographical areas should be selected. The species list to choose from is as follows;</u> Chobe area: Roam Antelope or Elephant or Buffalo; Tuli Block: Impala or Kudu; Kalahari: Gemsbok or Eland or Springbok; describe either Capture of game by means of movable capture corrals or Capture of game by use of crossbows, dart guns and game capture drugs; outline Ostrich farming in relation to the following: <ul style="list-style-type: none"> a) extensive, semi- intensive and intensive farming b) incubation of Ostrich eggs, c) the need to mark birds in captivity by the use of microchips

	day	
year		
Amount of substance	mole	mol

(b) Derived SI units are listed below

Energy	joule	
	kilojoule	kJ
	calorie is obsolete)	

(c) Recommended units for area, volume and density are listed below

Area	square metre		m^2
	square decimetre		dm^2
	square centimetre		cm^2
	square millimetre		mm^2
	hectare = 104 m ²		ha
	volume cubic millimetre		mm^3
	cubic centimetre		cm^3 (not ml)
	cubic decimetre (preferred to litre		dm^3
	cubic kilometre		km^3
	litre		litre (not l)
	density kilogram per cubic metre	or	$kg\ m^{-3}$
	gram per cubic centimetre	or	$g\ cm^{-3}$

(c) Use of Solidus

Negative indices — symbols combined in a quotient — will be written as, for example, either ms^{-1} or metre per second.

The solidus (/) will not be used for a quotient, e.g. m/s for metre per second.

The solidus (/) is used in tables and graphs to separate a physical quantity from its appropriate unit, e.g. time/s, rot time measured in seconds (see section 3).

3. Presentation of data

(a) Tables

- () Each column of a table will be headed with the physical quantity and the appropriate SI units, e.g. time/s, rather than time(s).
There are three acceptable methods of stating units, e.g. metre per sec *or* in per s or m s.

(ii) The column headings of the table can then be directly transferred to the axes of a constructed graph.

(b) Graphs

) The independent variable will be plotted on the x (horizontal axis) and the dependent variable plotted on the y (vertical axis).

(n) The graph is the whole diagrammatic presentation. It may have one or several curves plotted on it.

(iii) Curves and lines joining points on the graph should be referred to as 'curves'

(iv) Points on the curve should be clearly marked as crosses (x) encircled dots (o). If a further curve is included, vertical crosses (+) may be used to mark the points.

(c) Pie Charts

These should be drawn with the sectors in rank order, largest first, beginning at 'noon' and proceeding clockwise. Pie Charts should preferably contain no more than six sectors.

(d) Bar Charts

These are drawn when one of the variables is not numerical, e.g. number of eggs of different colours. They should be made up of narrow blocks of equal width which do not touch.

(e) Column Graphs These are drawn when plotting frequency graphs from discrete data, e.g.

frequency of occurrence

of nests with different numbers of eggs. They should be made up of narrow blocks of equal width which do not touch.

(f) Histograms

These are drawn when plotting frequency graphs with continuous data, e.g. frequency of occurrence of stems of different lengths or chicks of different masses. The blocks should be drawn in order of increasing magnitude and should be touching.