



**ZIMBABWE SCHOOL
EXAMINATIONS COUNCIL
(ZIMSEC)**

ADVANCED LEVEL SYLLABUS

**AGRICULTURE
9159**

1.0 INTRODUCTION

The syllabus is designed for students who intend to follow more advanced courses in Agriculture at colleges and universities. It places much emphasis on the understanding and application of scientific concepts and principles of Agriculture. This focus has been adopted in recognition of the need for students to develop skills that will be relevant in the world of work.

'A' Level Agriculture will be offered to schools that have been assessed and approved by the Ministry of Education, Sport and Culture as being equipped to provide suitable courses of practical work both in the Laboratory and in the field.

To achieve the aims and objectives of the syllabus, the following approaches are recommended:

Theory and practice must go hand in hand in the teaching and learning of the subject. Emphasis must be placed on equipping students with skills and concepts.

Problem-based approach should be employed in the teaching and learning of the subject, in order to promote the development of concepts and the ability to solve problems.

Case studies, field trips, project method, audio-visual materials, demonstrations and experiments should be used wherever possible as these are the basis of consolidating abstract ideas and generalisations.

Agriculture is a subject which is related to the environment of most schools and is part of the life experience of most students, hence the teaching and learning of the subject should take full advantage of the resources of pupils' experience and environment around the schools.

Teachers may re-arrange the topics to suit their local conditions. They should plan theory and practical activities in such a way that there is a neat integration of these activities with the farming calendar.

2.0 AIMS

The syllabus aims to:

- (a) develop knowledge and understanding of advanced principles of scientific agriculture,
- (b) develop an appreciation of how knowledge of agriculture can be applied to identify and solve agricultural problems,
- (c) demonstrate sound agricultural practices and techniques,
- (d) promote awareness of the contribution of agriculture to the needs of society,
- (e) develop positive attitudes towards conserving natural resources and their use for sustainable development,
- (f) provide a suitable foundation for the study of agriculture or related courses at tertiary level and for professional courses which require students to have knowledge of agriculture on admission.

3.0 ASSESSMENT OBJECTIVES

Using the knowledge and understanding specified in the syllabus, candidates should be able to:

AO¹

- recall, recognise and demonstrate understanding of specific agricultural facts, principles, relationships, concepts, practical techniques and terminology,
- communicate information coherently in continuous prose,
- organise and present information by means of tables, graphs, diagrams, and drawings,
- analyse and interpret numerical and non-numerical agricultural information,

AO²

- explain and interpret specific phenomena in terms of agricultural principles,
- make predictions and propose hypotheses, using agricultural facts and principles,
- solve agricultural problems qualitatively and quantitatively,

AO³

- devise and plan experimental activities,
- make and record observations accurately,
- select and use appropriate equipment and materials to carry out experimental activities safely,
- interpret, evaluate and communicate the results of experimental activities,
- plan, implement and manage wildlife, crops, livestock and forestry enterprises,
- maintain accurate physical and financial records of an agricultural enterprise,
- apply terms, symbols, quantities and units of measurements.

3.1 Relationship between Assessment Objectives and Assessment Components.

	Assessment Objective	Weighting	Assessment Components
Knowledge with Understanding	AO ₁	50%	Papers 1, 2
Application of Knowledge with Understanding	AO ₂	20%	Paper 1, 2
Experimental Skills	AO ₃	30%	Papers 3 and 4

4.0 Scheme of Assessment

PAPER	DESCRIPTION	DURATION	MARKS	WEIGHTING
1	Short answer questions and free response based on the Core and Options	2½ hours	100	50%
2	Multiple choice from Core section	50 min	40	15%
3	Practical Examination work is set from the Core only	1½ hours	60	20%
4	Project work must be from the Option only .	Four terms	100	15%

Candidates are required to take papers 1 to 4.

Paper 1

The paper has two Sections namely A and B. Section A is set from the core and Section B from the options.

Section A

One question is set from each of the five core components. Each question carries twelve (12) marks. Candidates answer **all** questions in this section.

Section B: Free response questions based on options. Three questions are set from each option. Each question carries **20** marks. Candidates answer **two** questions from **one** Option only.

Paper 2: Consists of multiple choice questions from the core section only. Candidates will answer all the forty (**40**) questions.

Paper 3: A practical examination set from the core section only. The paper will be based on experiments, investigations, observations and calculations.

Where unfamiliar material/techniques are required, full instructions will be given.

Candidates will be expected to show evidence of the following skills:

- (a) timing,
- (b) ability to follow instructions,
- (c) observation,
- (d) handling of equipment,
- (e) recording of results,
- (e). data obtained,
- (f) making conclusions.

Paper 4: Candidates will be required to carry out experimental or survey projects. Candidates will design and carry out project work from the Option. The research project must emphasise both the theoretical and practical aspect of agriculture.

A project report of 2 500 to 3 000 words will be prepared and submitted by candidates. Refer to Guidelines on project work on page 27.

5.0 STRUCTURE OF THE SYLLABUS

The Syllabus is divided into two parts:

A. The Core Syllabus: 180 hrs

The core syllabus is compulsory and is expected to take up to 180 hours of teaching time. There are five core components:

Soil Science,

Crop Science,

Animal Science,

Agricultural Economics,

Agricultural Engineering,

B. The Options Syllabus: 50 hrs

There are four (4) options and each option would take 50 hours of teaching time. Candidates will study and be assessed on **one** of the following options:

Crop production,

Animal production,

Forestry and Wildlife management,

Horticulture.

C. Project: 70 hrs

Curriculum Content

The content for the Core and Options is presented as learning outcomes. The examination will assess the candidates' knowledge and understanding of these.

It is expected that practical activities will underpin the teaching of the whole syllabus.

6.0 CORE SYLLABUS: 180 Hrs

6.1 SOIL SCIENCE

Content

Physical properties

Chemical properties

Fertility

Soil and water conservation

6.1.2 Learning outcomes

Candidates should be able to:

- (a) define soil,
- (b) explain soil as a product of physical, chemical and biological weathering of rocks (include a study of soil horizon and catina effect).
- (c) discuss the significance of soil texture, structure, particle size including soil-water- plant relations, water movement.
- (d) determine soil composition (sieve or hydrometer method) bulk particle size, and porosity,
- (e) describe the formation of clay and humus colloids,
- (f) describe the basic structure of sectite, illite, kaolinite and hydrous oxide clays,
- (g) explain the source of negative charges on clay and humus colloids,
- (h) explain the origins and significance of cation exchange/cation exchange capacity (CEC), base saturation and anion exchange capacity (AEC),
- (i) determine CEC and base saturation percentage,
- (j) define pH in terms of H^+ ions and discuss the causes of soil acidity and alkalinity,
- (k) discuss the effects of soil acidity and alkalinity on crop growth,
- (l) list and explain methods of correcting soil acidity and alkalinity,
- (m) design and carry out experiments on soil analysis (soil sampling),

- (n) determine soil pH and calculate liming requirements,
- (o) explain the roles of macro-elements (NPK) and micro nutrient (Mo, B Zn) in plant growth and metabolism,
- (p) describe the role of nitrogen fixing bacteria in symbiosis with legumes and the importance of this biological nitrogen fixation (BNF) as an alternative to inorganic nitrogen fertilizers,
- (q) explain soil improvement through the application of organic fertilizers,
- (r) design and carry out experiments on efficiency of biological nitrogen fixation,
- (s) explain causes, types and prevention of erosion (study of erosivity and erodibility and the equation is expected) including the soil loss equation model of Southern African (SLEMSA),
- (t) evaluate the impact of Agriculture on the environment in Zimbabwe e.g. land degradation, use of fertilizers and pesticides,
- (u) describe biological, mechanical and cultural control measures of erosion.

candidates are expected to peg and construct contour ridges.

Use the knowledge gained in this section in new situations to solve related problems.

6.2.0 CROP SCIENCE

6.2.1 Content

Plant growth and development.
 Water and nutrient uptake.
 Photosynthesis and respiration.
 Principles of crop protection.

6.2.2 Learning outcomes

Candidates should be able to:

- (a) draw and describe the structure of a plant cell as seen under an electron microscope,
- (b) describe the structure of the cell membrane and chloroplast as seen under an electron microscope,

- (c) explain the functions of the following organelles: rough and smooth endoplasm, reticulum, golgi body, ribosomes, lysosome, chloroplast, cell surface membrane, nuclear envelope, centriole, nucleus and nucleolus,
- (d) describe mitosis and cell differentiation,
- (e) explain how cell division and enlargement leads to growth,
- (f) describe meiosis,
- (g) describe pollen structure, pollen formation and ovule development,
- (h) explain the concept of double fertilization in plants,
- (i) describe the structural changes that occur after fertilisation leading to the development of the seed and the fruit,
- (j) discuss the factors affecting germination (temperature including vernalisation, light, oxygen and water),
- (k) design and carry out experiments on germination,
- (l) test seed for viability and determine germination percentages,
- (m) discuss the different types of seed dormancy and methods of overcoming dormancy,
- (n) design and carry out experiments on seed dormancy,
- (o) discuss factors that effect water and nutrient uptake and explain the mechanism of water uptake (osmosis), and nutrient uptake (active transport),
- (p) explain the factors affecting photosynthesis, including carbon dioxide compensation point (C3 and C4 systems),
- (q) describe the structural differences between C3 and C4 plants,
- (r) compare C3 and C4 biochemical pathways,
- (s) measure the growth of a chosen plant in terms of increase in leaf area, leaf area index (LAI) and dry matter accumulation with time,
- (t) explain respiration as a consumer of products of photosynthesis,
- (u) describe the structure and synthesis of ATP,
- (v) explain the universal role of ATP as the energy 'currency' in all living organisms,

- (w) identify and classify common weeds,
- (x) discuss crop/weed competition,
- (y) discuss methods of weed control to include biological, cultural, mechanical, chemical, and integrated weed control,
- (z) identify and classify common pests, diseases and discuss methods of pest and disease control,

Use the knowledge gained in this section in new situations to solve related problems.

6.30 ANIMAL SCIENCE

6.3.1 Content

Nutrition.

Reproduction systems.

Breeding.

Health.

6.3.2 Learning outcomes:

Candidates should be able to:

- (a) classify livestock feeds in terms of energy and fat giving and protein providing,
- (b) enumerate the components in livestock feeds,
- (c) describe the structure of carbohydrates, protein, lipids, nucleic acids and include function of vitamins and minerals,
- (d) carry out tests for reducing and non-reducing sugars, fats and proteins in animal feeds,
- (e) calculate digestibility of feeds,
- (f) explain how feeds are evaluated,
- (g) determine the dry matter and ash (organic matter) content in animal feeds,
- (h) state and assess animal nutrient requirements,

- (i) describe the structure and mode of action of enzymes,
- (j) distinguish and explain the digestion and absorption in ruminants and non-ruminants,
- (k) identify and name parts of the male and female urinogenital systems of a mammal,
- (l) state how and where fertilisation occurs,
- (m) discuss infertility in male and female animals,
- (n) calculate conception, calving, farrowing, kidding and mortality rates,
- (o) explain the following terms as used in animal breeding and genetics:
 - gene, locus,
 - chromosome, genotype, phenotype,
 - dominance, recessive, epistasis,
 - heterozygous, homozygous, variation,
 - and heritability.
- (p) demonstrate at least two Mendelian laws of heredity,
- (q) explain the difference between inbreeding and cross-breeding and discuss the advantages and disadvantages for the animal breeder,
- (r) relate environmental factors to adaptability and reproduction,
- (s) carry out a simple test on the effects of heat stress (by measuring rectal temperature, heart beat in shade and in the sun),
- (t) carry out a survey on locally available breeds of livestock to ascertain adaptability to diseases and parasites,
- (u) identify and classify important parasites and diseases of farm animals,
- (v) discuss the economic importance of diseases and parasites of farm animals,
- (w) discuss the various methods of pest and disease transmission and control.

Use the knowledge gained in this section in new situations to solve related problems.

6.4 AGRICULTURAL ECONOMICS

6.4.1 Content

Principles of Agricultural Economics.

Farm Management.

Marketing.

6.4.2 Learning outcomes

Candidates should be able to:

- (a) define agricultural economics,
- (b) define and explain the principles of supply and demand of agricultural products,
- (c) derive simple demand and supply curves,
- (d) illustrate using diagrams the elasticity of supply and demand,
- (e) explain and illustrate the law of diminishing returns,
- (f) explain and illustrate the principles of economies of scale in agriculture,
- (g) explain price controls and discuss its implications in agriculture,
- (h) explain and discuss with examples opportunity costs,
- (i) define farm management,
- (j) identify and discuss land tenure systems and their implications to agriculture in Zimbabwe,
- (k) state and explain business objectives in farming,
- (l) identify and discuss risks and uncertainties in agriculture,
- (m) identify, explain and prepare gross margins, partial, complete and cash flow budgets,
- (n) calculate and illustrate price break even point,
- (o) discuss decision making processes to determine profitability and sustainability of a crop/animal enterprise,

- (p) define marketing,
- (q) explain perfect and imperfect competition in marketing,
- (r) explain and discuss the characteristics of perfect and imperfect competition and their implications in marketing,
- (s) state and explain the marketing functions of local banks, boards and unions,
- (t) identify Regional and International Trade Agreements and discuss their impact on marketing of agricultural products,
- (u) identify and explain problems of marketing agricultural products,
- (v) discuss government intervention in agricultural markets (include quotas, support prices, subsidies and deficiency payments),

Use the knowledge gained in this section in new situations or to solve related problems.

6.5 AGRICULTURAL ENGINEERING

6.5.1 Content

Farm Mechanization and Engineering.
Soil and water conservation.
Irrigation.
Animal drawn power and animal drawn implements.

6.5.2 Learning Outcomes

Candidates should be able to:

- (a) solve problems relating to work, force, energy, moments and friction,
- (b) describe the advantages and disadvantages of agriculture mechanization,
- (c) identify parts and explain operational principles of the two and four stroke cycle engines,
- (d) describe properties and uses of fuels and lubricants (oils),
- (e) explain the fuel systems of petrol and diesel engines and account for their differences,
- (f) describe the cooling and lubrication systems of petrol and diesel engines,

- (g) describe the power transmission system from the engine to the wheels,
- (h) compare and contrast the electrical systems of petrol and diesel engines,
- (i) carry out routine maintenance of a tractor (including the battery, oil level, water level, fuel, tyre pressure, greasing and filters),
- (j) describe the factors affecting selection of farm machinery,
- (k) identify and differentiate primary and secondary tillage implements e.g. ploughs, rippers and harrows,
- (l) compare and contrast conventional and conservation tillage practices,
- (m) identify parts, and describe the maintenance of a knapsack sprayer and a boom sprayer (include calibration),
- (n) identify parts and describe maintenance principles of a planter,
- (o) describe the operational principles of a combine harvester and a maize sheller,
- (p) select draught animals,
- (q) calculate draught force requirement of mouldboard ploughs, calculate angles of attack of mouldboard plough and the angle of inclination,
- (r) describe biological, mechanical and cultural control measures of erosion,
- (s) describe methods of water conservation e.g. dams, harvesting water from roofs, water weirs and conservation tillage practices,
- (t) calculate water requirements during crop growth and development using evaporation pan and E_t/E_o ratio concept (determine irrigation schedules),
- (u) layout different irrigation systems and calculate their efficiency,
- (v) discuss functional requirements of farm structures, animal housing structures and crop storage structures.

Use knowledge gained in this section in new situations or to solve related problems.

7.0 OPTION SYLLABUS - 50 HOURS

7.1 OPTION 1: CROP PRODUCTION

7.2 AIMS

This Option is intended to develop:

- (a) an understanding of the reasons for subdividing Zimbabwe into agro-ecological zones,
- (b) an appreciation of the need for crop breeding,
- (c) an understanding of principles in the growing of selected crops.

7.3 *Content*

Agro-ecological zones of Zimbabwe.

Crop breeding.

Crop Husbandry.

Two crops should be studied, one from each group.

CEREALS	LEGUMES
Maize	Groundnuts
Sorghum	Soya beans

7.4 Learning outcomes

Candidates should be able to:

- (a) identify the agro-ecological zones (natural farming regions) of Zimbabwe,
- (b) explain the basis for dividing Zimbabwe into agro-ecological zones,
- (c) design and recommend suitable cropping programmes for each Agro-ecological zone,
- (d) describe the methods used in the breeding of a named crop (including progeny testing),
- (e) demonstrate how the process of selective breeding may be carried out in the

named plant example,

- (f) discuss the importance of hybrid vigour (heterosis) in crop production,
- (g) compare hybrid versus home grown traditional seed for a crop studied,
- (h) discuss advantages and disadvantages of using genetically engineered crops,
- (i) grow and study two crops (*one legume, one cereal*) with reference to

soil and climatic requirements,

effects of timing of planting and population density, crop improvement and choice of cultivars,

nutritional requirements and soil water relationships,

crop protection,

harvesting and post harvesting technology,

marketing,

production and financial records.

Apply the skills gained in this section in new situations or to solve related problems,

7.2.0 OPTION 2: ANIMAL PRODUCTION

7.2.1 AIMS

This option aims to develop:

- (a) an understanding of the principles in relation to nutritional requirements, breeding and housing for named animals,
- (b) an appreciation of successful rearing of young stock,
- (c) an ability to promote animal health through good management,
- (d) an understanding of the techniques and principles of storage, processing and marketing of animal products.

7.2.2 Content

Management.
Nutrition.
Animal health.
Product processing.

A detailed study of **one** ruminant and **one** non-ruminant animal chosen from the following

GROUP 1	GROUP 2
Cow	Pig
Goat	Rabbit

7.2.3 Learning Outcomes:

Candidates should be able to:

- (a) state the breeds and relate their characteristics to environmental adaptation,
- (b) explain the suitability of each livestock housing system,
- (c) plan a breeding programme,
- (d) describe production systems,
- (e) rear young stock for the animals studied,
- (f) outline nutritional requirements,

- (g) formulate a ratio to meet maintenance and production requirements,
- (h) plan and implement a health calendar,
- (i) recognize and describe disease and parasite infested animals,
- (j) treat the parasite infested animals,
- (k) select appropriate methods of processing, storing and marketing the named animal products.

Apply the knowledge and skills gained in this section in new situations to solve related problems,

7.3.0 OPTION 3: FORESTRY AND WILDLIFE

7.3.1 AIMS

This Option aims to develop:

- (a) positive attitudes towards the conservation of wildlife and forestry,
- (b) an understanding of forestry and wild life establishment,
- (c) an appreciation of sustainable forest and wild life utilization,
- (d) an appreciation of wildlife and forestry as sources of income,

7.3.2 Content

Importance.

Principles.

Protection.

Utilization.

Marketing.

7.3.3 Learning outcomes

Candidates should be able to:

- (a) define forestry, agro-forestry and wildlife,
- (b) explain the economic, social and ecological importance of wildlife and forests,
- (c) classify plants,
- (d) establish and manage a nursery,
- (e) demonstrate skills of transplanting,
- (f) demonstrate skills of woodlot management techniques,
- (g) demonstrate timber harvesting and preservation techniques,
- (h) explain uses of different types of timber,
- (i) explain the principles of agro-forestry,
- (j) differentiate woodland types e.g. miombo and acacia,

- (k) describe the protection of wildlife and forest areas in Zimbabwe (legislation, traditional laws, international conventions, New Initiatives e.g Communal Area Management Programme for Indigenous Resources (CAMPFIRE)
- (l) describe the types of rangelands and relate tree grass density to biomass production,
- (m) explain factors determining carrying capacity,
- (n) explain the concept of adaptive management of wildlife,
- (o) explain aspects of wildlife that should be monitored,
- (p) describe methods of harvesting wildlife e.g. trapping, shooting, netting,
- (q) discuss reasons for culling wildlife,
- (r) examine factors and procedures considered when setting quotas, marketing and entering contracts,
- (s) describe interrelationships between tourism, wildlife, farming and forestry in Zimbabwe,

Apply the knowledge and skills gained in this section in new situations or to solve related problems.

7.4.0 OPTION 4: HORTICULTURE

AIMS

This option aims to develop an appreciation and understanding of

- (a) the importance of horticulture,
- (b) how fruit trees and flowers are established,
- (c) management of fruit trees and flowers,
- (d) harvesting and marketing techniques of fruit and cut flowers.

7.4.1 Content

Principles of horticulture production.

Fruit production.

Flower production.

7.4.2 Learning Outcomes

Candidates should be able to:

- (a) discuss the importance of horticulture in Zimbabwe,
- (b) classify horticultural plants according to: origin, use, response to day length and seasonality(to include botanical classification),
- (c) describe response to light and temperatures by horticultural plants,
- (d) select suitable nursery sites,
- (e) prepare rooting media,
- (f) discuss factors affecting rooting of cuttings,
- (g) discuss the advantages, the benefits and disadvantages of vegetative propagation,
- (h) perform a whip and tongue and, 'T' bud methods of propagating plants,
- (i) establish plants from softwood and hardwood cuttings,
- (j) manage seedling nurseries in relation to, thinning, hardening, root pruning, pricking out, pests and disease control,
- (k) describe tissue culture techniques including advantages and disadvantages,
- (l) grow and study either mangoes or oranges with reference to:

Origin,
Adaptation,
Planting,
Management,
Pests, diseases and physiological disorders,
Post harvest handling and marketing.

(m) calculate water requirements and schedule irrigation,

(n) grow and study one flower (*either rose or marigold*) with reference to:

Origin,
Land preparation,
Management practices,
Pests, diseases and physical disorders,
Factors affecting shelf life,
Post harvesting handling and marketing.

Apply the skills gained in this section in new situations to solve related problems.

8.0 RESEARCH PROJECT GUIDE

Preamble

A project report of 2500 to 3000 words should be prepared and submitted by candidates. The research project must emphasize both the theoretical and practical aspects of agriculture. Candidates should show problem solving skills.

Guidelines

8.1 STRUCTURE AND LAYOUT OF AN AGRICULTURE PROJECT

A project should be characterised by:

- preliminaries,
- text,
- reference,

There may be variations in organisation of divisions and sub-headings within the three parts but there must be clarity and sequential presentation of the reported work.

The preliminaries

- title page
- abstract
- dedication
- acknowledgements
- table of contents with page reference
- lists of tables with titles and page references
- list of figures if any with title and page references
- list of appendices if any, with title and page reference

The text

Introduction

- Define the problem under investigation and review related literature that attempts to solve the particular problem highlighting strengths and limitations of attempted solutions.

Research questions

- Experimental Procedure/Methods of Investigation/methodology. Should give a brief

outline of materials and methods used in carrying out the experiment.

- **Results**

Observations, measurements and analysis (descriptive statistics only i.e. measure of central tendency and dispersion).

- Conclusions and solutions reached/Discoveries.
- Recommendations
- The reference matter.
List of references, glossary (if any) and appendices (if any).

8.2 The preliminaries

8.2.1 Title page

Should show the research topic agreed upon, between the candidate and the teacher, followed by the candidate's name and number. Particulars of submission should appear on the title page and read as follows; 'A research project submitted for the requirements of Paper 4 'A' level Agriculture at
(name of school) and year

8.2.2 Abstract

Should be restricted to a maximum of 200 words and should give a brief summary of what the candidate investigated, how the investigation was carried out and the major findings (see example 2).

8.2.3 Acknowledgement

Candidates are expected to show gratitude to supervisors, relatives, individuals or any organisations that helped to make the project a success story (e.g. providers of laboratory/field assistance materials or financial support) see example III)

8.2.4 Table of contents

Should come after the title page, abstract, dedication and acknowledgement pages, and does not therefore show such pre-contents titles. Information to be indexed under content page includes list of tables, figures and appendices which form part of preliminaries and key sub-divisions of the main text, references and appendix sections (see example IV).

8.2.5 Lists of tables and figures and appendices

Detailed lists of tables, figures and appendices should appear on separate sheets of paper. Tables and figures are numbered sequentially and logically throughout the document except where the decimal system is used then numbering can be done

according to major sub-divisions within the text (see example V on page 31).

8.3 Text

8.3.1 Introduction

The purpose of the introduction is to orient the reader to the work under investigation. It should contain the background to the problem, research questions, link to the syllabus statement of the problem, aims and significance of the study. Review of literature that has a bearing on the problem under investigation should be done so as to show the strengths and limitations of the present knowledge.

8.3.2 Experimental Procedure/Research Method

A narrative description of the procedure followed in carrying out the research should be presented sequentially. The description should include materials used, experimental design and layout, methods used in collection of data against each set research question or objective, and methods used in presentation and analysis of collected data.

8.3.3 Results/Research Findings

Results should be presented in a factual and objective way, giving measurements and observations made from the investigation. Results are presented first then discussions follow immediately. Graphs, tables, pie-charts etc. can be used to represent findings and they should have appropriate titles.

8.3.4 Discoveries/Summary/Conclusion

Candidates should draw conclusions or discoveries from observations made. Some form of deductive reasoning should be demonstrated logically from the evidence provided. Candidates must desist from giving subjective opinions. If there are any aspects of the problem that may be left unresolved, candidates may give brief suggestions on possible future action concerning further investigation. That will help to show that research is a process and not an event.

8.3.5 The Reference Matter

Should be presented alphabetically according to the names of authors and not initials. All works cited in the main text should be acknowledged and should appear on the reference list. Similarly, listed references must have been cited in the main text.

8.3.7 Glossary/Abbreviations

These should be restricted to technical/scientific terms, construct terms and symbols frequently used in the text but may need further explanation. The terms should be presented alphabetically.

8.4 Editorial Considerations

Scientific writing(s) should show exactness, objectivity and clarity.

8.5 Example I - Title page

Effects of overgrazing on grass
Species composition at Kabako Small Scale Commercial Farming Area.

BY

TAFARA TANAKA
CANDIDATE NUMBER

Research Project Submitted for the requirements of Paper 4 'A' level
Agriculture at Rupiri School in 2001.

8.6.0 Example II - Abstract

Assessment of the veld condition at Kabako Farm was carried out using step point method and the line 'transect method'.

The grass species composition was established in terms of % decreases % increases % invaders and % weeds and forbs.

Results from the assessment showed that the veld condition of Kabako Farm is on a downward trend since there are no decreaser species, very few increaser species but more invaders and weeds.

8.7.0 Example III - Acknowledgements

The line that was used in this project was generously supplied by Mrs N. Peggy. Many thanks also go to Josphine and Chiedza who assisted me in the counting of various grass species. Great appreciation is also accorded to Dr Tafadzwa who guided and provided valuable advice that helped to make this research project a success.

8.8.0 Example IV - Table of contents

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8.9.0 Example V - Lists of Tables Figures, References and Appendices

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REFERENCES

- Ivy C 1979: Qualitative veld assessment
Harare: Mambo Press
- Jainton, K. 1990: Range Management
Pretoria: Kass
- Magadzire, J.D. 1977: Communal Pasture Management.
Agriculture Journal, 10, 50 - 80

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8.9.1 The extent of project supervision provided by the teacher

Candidates should be free to choose topics of their own, but linked to the course of

Agriculture, and decide on methods of investigation such as surveys or experiments. The teacher should only act as a facilitator of the research process and guide the student through provision of scientific advice and support. The supervisor should help to sustain the student's interest/enthusiasm so that the student never loses sight of the area of focus and be able to complete the investigation within scheduled time. Teachers should mark the project (final draft) and submit the mark sheet and the projects to ZIMSEC for moderation.

8.9.2 Assessment criteria

A. Preliminaries	Mark
<ul style="list-style-type: none"> • Title page • Abstract • Dedication • Acknowledgments • Table of contents with page references • List of tables if any with page references • List of figures if any with page references • List of appendices if any with page reference 	5
B. The text	
<ul style="list-style-type: none"> • Introduction/background/Research questions • Materials and Methods/Project Procedure • Results and Discussion • Conclusions, Discoveries/Summary 	10 10 10 10
C. Reference	
<ul style="list-style-type: none"> • List of references • Glossary (if any) • Appendices (if any) 	10
D. Editorial issued/Quality of Presentation	5
 TOTAL MARKS	
	60

9.0 GLOSSARY OF TERMS USED IN QUESTION PAPERS

It is hoped that the glossary will prove helpful to candidates as a guide, i.e. it is neither exhaustive nor definitive. The glossary has been deliberately kept brief not only with respect to the number of terms included but also to the descriptions of their meanings. Candidates should appreciate that the meaning of a term must depend in part in its context.

- 1 **define** (the term(s)...) is intended literally, only a formal statement or equivalent paraphrase being required.
- 2 **what do you understand by** (the term(s)..) normally implies that a definition

should be given, together with some relevant comment on the significance or context of the term(s) concerned especially where two or more terms are included in the question. The amount of supplementary comment intended should be interpreted in the light of the indicated mark value,

- 3 **state** implies a concise answer with little or no supporting argument, e.g. numerical answer that can readily be obtained 'by inspection',
- 4 **list** requires a number of points, generally each of one word, with no elaboration, where a given number of points is specified, this should not be exceeded.
- 5 **explain** may imply reasoning or some reference to theory, depending on the context,
- 6 **describe** requires the candidate to state in words (using diagrams, where appropriate) the main points of the topic. It is often used with reference either to a particular phenomena or to particular experiments. In the former instance, the term usually implies that the answer should include reference to (visual) observations associated with the phenomena,

In other context, **describe** and give an **account** of should be interpreted more generally, i.e. the candidate has greater discretion about the nature and the organisation of the material to be included in the answer. **Describe** and **explain** may be coupled in a similar way to **state** and explain.
- 7 **discuss** requires the candidate to give a critical account of the points involved in the topic,
- 8 **outline** implies brevity, i.e. restricting the answer to giving essentials,
- 9 **predict** or deduce implies that the candidate is not expected to produce the required answer by recall but by making a logical connection between other pieces of information. Such information may be wholly given in the question or may depend on answers extracted in an earlier part of the question,
- 10 **comment** is intended as an open-ended instruction, inviting candidates recall or infer points of interest relevant to the context of the question, taking account of the number of marks available,
- 11 **suggest** is used in two main contexts, i.e. either to imply that there is no unique answer or to imply that candidates are expected to apply their general knowledge to a 'novel' situation, one that may be formally 'not in the syllabus',
- 12 **find** is a general term that may variously be interpreted as calculate, measure, determine etc,
- 13 **calculate** is used when a numerical answer is required. In general, working should be shown, especially where two or more steps are involved,

- 14 **measure** implies that the quantity concerned can be directly obtained from a suitable measuring instrument, e.g length using a ruler, or mass, using a balance.
- 15 **determine** often implies that the quantity concerned cannot be measured directly but is obtained by calculation, substituting measured or known values of other quantities into a standard formula,
- 16 **estimate** implies a reasoned order of magnitude statement of calculation or the quantity concerned, making such simplifying assumptions as may be necessary about points of principle and about the values of quantities not otherwise included in the question,
- 17 **sketch**, when applied to graph work, implies that the shape and/or position of the curve need only be qualitatively correct, but candidates should be aware that, depending on the context, some quantitative aspects may be looked for, e.g. passing through the origin, having an intercept, asymptote or discontinuity at a particular value.
- in diagrams**, sketch implies that a simple, freehand drawing is acceptable, nevertheless, care should be taken over proportions and the clear exposition of important details,

RESOURCES LIST

Some of these can be used as textbooks for a course, while others are intended for reference and selected readings. The inclusion of books in this list does not imply a recommendation. It is simply a list from which teachers may like to select.

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|-------------------------------|--------------------------------------------------------------------------------|
| R.G.S Bidwell | Plant Physiology
<i>Macmillan 1978 0 - 02 - 309430 - 3</i> |
| Nyle C Brady | The Nature and Properties of Soils
<i>Macmillan Publishing Company 1984</i> |
| David Colman and Trevor Young | Principles of Agricultural Economics |

D.C. Dalton	An Introduction to Practical Animal Breeding <i>ELBS 1987</i>
P.M.C. Donald R.A Edwards, J F D Greenhalsh	Animal Nutrition <i>ELBS 1984</i>
D.S. Falcone	Introduction to Quantitative Genetics <i>1981 Longman</i>
Everett James Warwick and James Edward Legates	Breeding and Improvement of Farm Animals
A.R . Loveless	Principles of Plant Biology for the Tropics <i>ELBS 1986</i>
A.M.Michael	Irrigation Theory and Practice <i>Vikas Publishing House Pvt Ltd 1998</i>
Jean Pagot	Animal Production in the Tropics and Subtropics <i>Macmillian CTA 1992 0-333-53818-8</i>
R P Rice L.W. Rice, H.D. Tindall	Fruit and Vegetable Production in Warm Climates <i>Macmillian 1987 03-333-46850 - 3</i>
H.D. Tindall	Vegetables in the Tropics <i>Macmillian 1983 0-333-24268-8</i>
Anthony Youdeowei F.O.C Ezeinna ETEL	Introduction to Tropical Agriculture

