

B O A R D O F S T U D I E S
NEW SOUTH WALES

Agriculture

Stage 6

Syllabus

PLEASE NOTE

The assessment and HSC examination requirements detailed in this syllabus refer to the 2009 HSC. New *Assessment and Reporting* information will apply to this syllabus for the 2010 HSC and beyond.

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Contents

1	The Higher School Certificate Program of Study.....	5
2	Rationale for Agriculture in the Stage 6 Curriculum.....	6
3	Continuum of Learning for Agriculture Stage 6 Students	8
4	Aim	9
5	Objectives	9
6	Course Structure	9
	6.1 Preliminary Course.....	10
	6.2 HSC Course.....	11
7	Objectives and Outcomes	12
	7.1 Table of Objectives and Outcomes.....	12
	7.2 Key Competencies	13
8	Content: Agriculture Stage 6 Preliminary Course	14
	8.1 Overview	14
	8.2 Farm Case Study	15
	8.3 Plant Production.....	16
	8.4 Animal Production	18
9	Content: Agriculture Stage 6 HSC Course	20
	9.1 Plant/Animal Production	20
	9.2 Farm/Product Study	22
	9.3 Optional Research Project.....	23
	9.4 Electives.....	24
10	Course Requirements	30
11	Post-school Opportunities	31
	11.1 Recognition of Student Achievement in Vocational Education and Training (VET)	31
12	Assessment and Reporting	32
	12.1 Requirements and Advice	32
	12.2 Internal Assessment.....	33
	12.3 External Examinations	33
	12.4 Board Requirements for the Internal Assessment Mark in Board Developed Courses.....	34
	12.5 Assessment Components, Weightings and Tasks.....	35
	12.6 HSC External Examination Specifications	37
	12.7 Summary of Internal and External Assessment.....	40
	12.8 Reporting Student Performance against Standards	41
13	Glossary	42

1 The Higher School Certificate Program of Study

The purpose of the Higher School Certificate program of study is to:

- provide a curriculum structure which encourages students to complete secondary education;
- foster the intellectual, social and moral development of students, in particular developing their:
 - knowledge, skills, understanding and attitudes in the fields of study they choose
 - capacity to manage their own learning
 - desire to continue learning in formal or informal settings after school
 - capacity to work together with others
 - respect for the cultural diversity of Australian society;
- provide a flexible structure within which students can prepare for:
 - further education and training
 - employment
 - full and active participation as citizens;
- provide formal assessment and certification of students' achievements;
- provide a context within which schools also have the opportunity to foster students' physical and spiritual development.

2 Rationale for Agriculture in the Stage 6 Curriculum

Agriculture provides people with food, fibre, shelter and the possibility of diverse lifestyles. Agriculture is a composite of rural and urban industries that are structured to produce both raw and value-added materials from plants and animals to meet identified consumer needs.

Agriculture has a unique place in the history of human society. It underpins social structures and provides for basic human needs. It is fundamental to human progress.

Agricultural industries make a significant contribution to Australia's economy through investment, employment of skilled workers, consumption of products from other sectors of the economy and export. Agricultural products contribute significantly to Australia's export income. The total chain, from the farm and the research laboratory to the processing plant, retail outlet and exporter, accounts for a major portion of the nation's Gross Domestic Product. Australia's agricultural industries must undergo significant and continuous change to maintain and possibly enhance this contribution to the Australian economy.

The *Agriculture Stage 6 Syllabus* provides students with opportunities to understand and appreciate these essential aspects of agriculture.

Agriculture's dynamic nature results from the increase in knowledge and the application of technology to the production, processing and marketing of products in complex national and international marketplaces. This complexity has political, social, ethical, economic and environmental implications for Australia. Furthermore, the majority of consumers are isolated from the production and processing of food and fibre. This course provides students with an understanding of the relationships between production, processing and consumption to enable them to participate in debate on the impact of each upon society and the environment.

Agriculture Stage 6 has been 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 diverse range of students and ability levels. It has the facility to challenge students academically as well as providing them with a wide range of practical skills and an awareness of technologies associated with agriculture.

Opportunities are also provided for students to develop awareness of the welfare, ethical and legal issues relating to animal research.

Agriculture Stage 6 provides opportunities for multiple pathways to employment and further education. Some students may well be stimulated to move into post-secondary agricultural courses or to seek employment in rural and related industries.

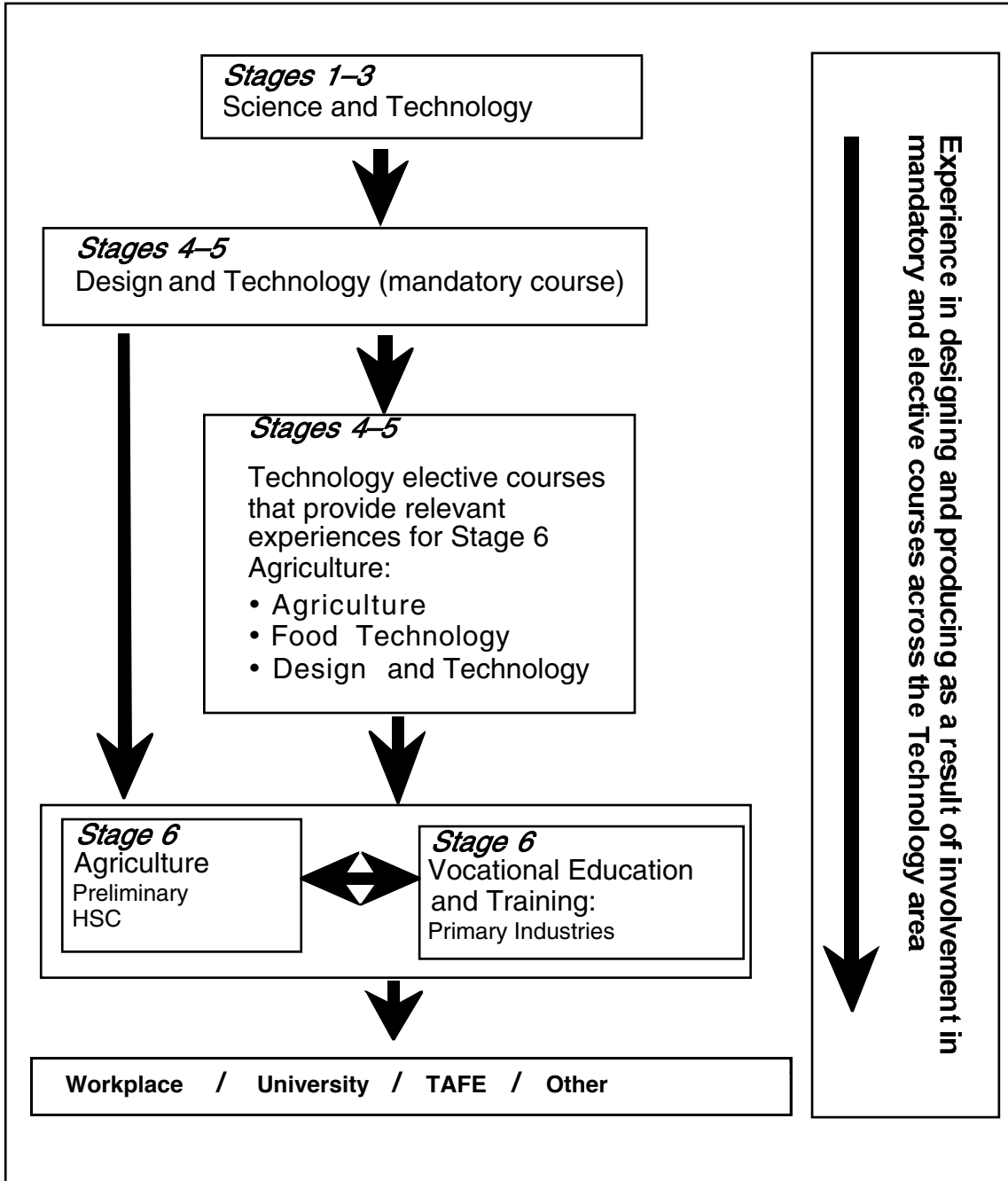
The *Agriculture Stage 6 Syllabus* is designed to increase student understanding and capabilities in a continuum from the farm level through to the international markets in which agricultural commodities are traded. Because it includes the study of a farm and agricultural product of particular interest to the student, the relevance of the course is enhanced.

Agriculture Stage 6 Syllabus

The assessment and HSC examination requirements detailed in this syllabus apply to the 2009 HSC.
New *Assessment and Reporting* information will apply to this syllabus for the 2010 HSC and beyond.

It is important that students realise that long-term benefits of agriculture can only accrue if systems can be sustained environmentally, economically and socially. Sustainability is critical if agriculture is to meet the food and fibre needs of society. An understanding of current land use must involve a historical perspective that extends back beyond the arrival of Europeans in 1788. Resolving issues of long-term profitability and sustainability is the challenge for agriculture and is the basis of this course.

3. Continuum of Learning for Agriculture Stage 6 Students



4 Aim

Agriculture Stage 6 is designed to develop students' knowledge and understanding about the production and marketing of both animal and plant products. Students should also develop the associated skills and responsible attitudes that are necessary to manage and market these products in a sustainable manner.

5 Objectives

Students will develop:

1. knowledge and understanding of the physical, chemical, biological, social, historical and economic factors that interact in agricultural production systems
2. knowledge, understanding and skills required to manage agricultural production systems in a socially and environmentally responsible manner
3. knowledge of, and skills in, decision-making and the evaluation of technology and management techniques used in sustainable agricultural production and marketing
4. skills in effective research, experimentation and communication
5. knowledge and understanding of the impact of innovation, ethics and current issues on Australian agricultural systems.

6 Course Structure

The *Agriculture Stage 6 Syllabus* has a Preliminary course and an HSC course.

It is intended that students engage in and reflect upon practical experience relevant to all aspects of the physical, chemical, biological, economic and social sciences embodied within Agriculture Stage 6. Some of this experience will be in the laboratory, some in small plot work and some on commercial farms or other components of the industry. In all cases, students should use these practical experiences to develop design, practical, management, observation, recording, interpretation and communication skills. Practical experiences may also be used to achieve coverage of the content statements not specifically related to skills. The practical experiences should occupy a minimum of 30 per cent of allocated course time.

6.1 Preliminary Course

120 indicative hours

The Preliminary course incorporates the study of the interactions between the components of agricultural production, marketing and management, while giving consideration to the issues of sustainability of the farming system. This is an 'on-farm', environment-orientated course.

Overview (15%)

- 0 The dynamic nature of agriculture and its role in Australian society
- 1 The components of agricultural production systems and factors that affect these systems

The Farm Case Study (25%)

- The farm as a unit of production
- Farm management
- Marketing
- Farm technology
- Agricultural workplaces

Plant Production (30%)

- Plants and their commercial production
- Animals, climate and resource interactions
- Microbes and pests
- Technology
- Research

Animal Production (30%)

- Animals and their commercial production
- Plants, climate and resource interaction
- Microbes and pests
- Technology
- Research

6.2 HSC Course

120 hours indicative time

The Higher School Certificate course builds upon the Preliminary course. It examines the complexity and scientific principles of the components of agricultural production, but places a greater emphasis on the place of the farm in the wider economic, environmental and social environment. The farm as a fundamental production unit provides a basis for analysing and addressing social, environmental and economic issues as they relate to sustainability, from a national and international perspective. This is achieved through the farm /product study.

Core 70% (approximately 84 indicative hours)

Plant/Animal Production (45%)

- Sustainable agricultural production
- Plant and animal systems
- Microbes and invertebrates
- Experimental analysis and research

Farm/Product Study (25%)

- The farm as a business
- Marketing product/s from the farm
- Decision-making processes and management strategies
- Agricultural technology

Optional Components 30% (approximately 36 indicative hours)

Research project (30%)	OR	2 electives (15% each)
Components include both a project report and process journal		18 hours per topic <ul style="list-style-type: none"> • Agribusiness • Horticulture • Innovation and diversification • Animal management • Plant management • Sustainable land and resource management

7 Objectives and Outcomes

7.1 Table of Objectives and Outcomes

Objectives	Preliminary Course Outcomes	HSC Course Outcomes
Students will develop: 1. knowledge and understanding of the physical, chemical, biological, social, historical and economic factors that interact in agricultural production systems	A student: P1.1 describes the complex, dynamic and interactive nature of agricultural production systems P1.2 describes the factors that influence agricultural systems	A student: H1.1 explains the influence of physical, biological, social, historical and economic factors on sustainable agricultural production
2. knowledge, understanding and skills required to manage agricultural production systems in a socially and environmentally responsible manner	P2.1 describes the biological and physical resources and applies the processes that cause changes in plant production systems P2.2 describes the biological and physical resources and applies the processes that cause changes in animal production systems P2.3 describes the farm as a basic unit of production	H2.1 describes the inputs, processes and interactions of plant production systems H2.2 describes the inputs, processes and interactions of animal production systems
3. knowledge of, and skills in, decision-making and the evaluation of technology and management techniques used in sustainable agricultural production and marketing	P3.1 describes the role of decision-making in the management and marketing of agricultural products in response to consumer and market requirements	H3.1 assesses the general business principles and decision-making processes involved in sustainable farm management and marketing of farm products H3.2 critically assesses the marketing of a plant OR animal product H3.3 critically examines the technologies and technological innovations employed in the production and marketing of agricultural products H3.4 evaluates the management of the processes in agricultural systems
4. skills in effective research, experimentation and communication	P4.1 applies the principles and procedures of experimental design and agricultural research	H4.1 applies appropriate experimental techniques, technologies, research methods and data presentation and analysis in relation to agricultural problems and situations
5. knowledge and understanding of the impact of innovation, ethics and current issues on Australian agricultural systems	P5.1 identifies the role of associated technologies and technological innovation in producing and marketing agricultural products	H5.1 evaluates the impact of innovation, ethics and current issues on Australian agricultural systems

7.2 Key Competencies

Agriculture provides a powerful context within which to develop general competencies considered essential for the acquisition of effective, higher-order thinking skills necessary for further education, work and everyday life.

Key competencies are embedded in the Agriculture syllabus to enhance student learning. The key competencies of ***collecting, analysing and organising information*** and ***communicating ideas and information***, reflect core processes of agricultural inquiry and are explicit in the objectives and outcomes of the syllabus. The other key competencies are developed through the methodologies of the syllabus and through classroom pedagogy. Students work as individuals and as members of groups to conduct agricultural activities and investigations, and through this, the key competencies ***planning and organising activities*** and ***working with others and in teams*** are developed.

When students plan trials and analyse experimental data, they are developing the key competency ***using mathematical ideas and techniques***. During research investigations, students will need to use appropriate information technologies and so develop the key competency of ***using technology***. Finally, the exploration of current issues and the evaluation of technology and management techniques contributes towards the students' development of the key competency ***solving problems***.

8 Content: Agriculture Stage 6 Preliminary Course

8.1 Overview

This component is focused on the interactive nature of agricultural production. The factors that influence agriculture and that are in turn influenced by agriculture are studied. The concepts raised in the overview are integrated throughout the course.

Outcomes

A student:

- P1.1 describes the complex, dynamic and interactive nature of agricultural production systems
- P1.2 describes the factors that influence agricultural systems
- P2.3 describes the farm as a basic unit of production.

Content

Students learn about:

- agricultural systems
 - the interaction between subsystems on a farm, resources, plants, animals, management and microbes
 - the patterns of climate and soil resources that influence the distribution of agricultural enterprises
 - the impact of physical, biological, social, historical and economic factors on systems
- agricultural history
 - the changes in the Australian environment that have occurred since the arrival of Europeans
 - Aboriginal land practices before the arrival of Europeans
- social aspects surrounding agriculture
 - the changing role of the family farm in Australian agriculture
 - the interaction between agriculture and Australian society.

Students learn to:

- construct an appropriate model showing interactions between subsystems on a farm
- access information relevant to Australian agriculture.

8.2 Farm Case Study

This component involves the study of farm production systems by investigating a selected farm or farms.

Outcomes

A student:

- P1.1 describes the complex, dynamic and interactive nature of agricultural production systems
- P1.2 describes the factors that influence agricultural systems
- P2.3 describes the farm as a basic unit of production
- P3.1 describes the role of decision-making in the management and marketing of agricultural products in response to consumer and market requirements
- P5.1 identifies the role of associated technologies and technological innovation in producing and marketing agricultural products.

Content

Students learn about:

- the farm as a production unit
 - the enterprises on a farm
 - the physical and biological environment of a farm
 - a calendar of operations for an enterprise production cycle
 - the physical resources of a farm
 - agricultural record-keeping
 - measures of performance on farms
 - problems associated with production on a farm
 - the role of the farm manager
 - the impact of consumers on marketing
- farm management
 - the key factors involved in the decisions made by the farm manager
 - current management practices, with reference to sustainability
- marketing
 - the various ways in which agricultural products are marketed on the farm
- farm technology
 - technology used in management and production on the farm
 - technology used in marketing the products of the farm
- the agricultural workplace
 - potential hazards in agricultural workplaces
 - safe work practices employed in agricultural workplaces
 - animal welfare requirements.

Students learn to:

- observe, collect, record information on the physical resources of the farm, such as soil, climate, vegetation, topography
- calculate measures of performance
- gather data using appropriate instruments to measure resources, such as weather and soils
- use safe work practices
- identify potential hazards in agricultural workplaces, eg unsafe machinery
- identify and report on land degradation problems on the farm.

8.3 Plant Production

This component focuses on production and management of plants for commercial purposes. Plants in agricultural systems cannot be studied without analysing their interactions with resources (soils, climate, farm structures etc) and microbes/pests that exist in most farm environments.

Outcomes

A student:

- P2.1 describes the biological and physical resources and applies the processes that cause changes in plant production systems
- P3.1 describes the role of decision-making in management and marketing of agricultural products in response to consumer and market requirements
- P4.1 applies the principles and procedures of experimental design and agricultural research
- P5.1 identifies the role of associated technologies and technological innovation in producing and marketing agricultural products.

Content

Students learn about:

- plants and their commercial production
 - basic morphology and function of leaves, stems, roots, flowers and fruits
 - regionally significant plants
 - consumer and market requirements for commercial plant products
 - propagation techniques
- animals, climate and resource interactions
 - effects of soil texture, structure, pH, fertility on plant production
 - cultivation and/or grazing practices
 - management for sustainable production
 - effective rainfall and the concept of the growing season
- microbes and pests
 - their nature and impact on plant production systems
- technology
 - use of technologies in producing and marketing plant products
- experimental design and research
 - the role of a control
 - the collection and simple analysis of data
 - recent findings that contribute to sustainable plant production systems.

Students are expected to conduct at least ONE plant OR animal trial.

Students develop the concept of the dynamic and interactive nature of plant enterprises by designing and developing models of plant enterprises where the interactions between their components are highlighted. Learning about the components and interaction of plant enterprises will be enhanced by developing practical skills in growing and monitoring plants or crops.

Students learn to:

- identify a range of regionally significant plants
- select fertiliser(s) appropriate to the soil and the requirements of crop/pasture
- select appropriate tillage implements and/or techniques to establish a crop or pasture
- collect and use meteorological data, eg temperature, rainfall, evaporation, effective rainfall
- grow and monitor a crop/pasture from planting through to harvest
- identify important diseases and pests of a selected crop/pasture
- use a variety of sources to gather information about a specific agricultural problem or situation
- design and/or conduct a simple trial using appropriate methodology
- measure and describe the features of soil, including colour, texture, structure, pH, parent material and water-holding capacity.

8.4 Animal Production

This component is focused on the production and management of animals for commercial purposes. Animals in agricultural systems cannot be studied without analysing their interactions with plants, climate, resources and microbes/pests that exist in most farm environments.

Outcomes

A student:

- P2.2 describes the biological and physical resources and applies the processes that cause changes in animal production systems
- P3.1 describes the role of decision-making in management and marketing of agricultural products in response to consumer and market requirements
- P4.1 applies the principles and procedures of experimental design and agricultural research
- P5.1 identifies the role of associated technologies and technological innovation in producing and marketing agricultural products.

Content

Students learn about:

- animals and their commercial production
 - basic anatomy and physiology of digestive and reproductive systems
 - basic nutritional requirements
 - growth and development
 - regionally significant animals
 - safe handling and management techniques for the care and welfare of animals
 - the legal requirements relating to the care and welfare of the animal
 - consumer and market requirements for commercial animal products
- plants, climate and resources interactions
 - management for sustainable production
- microbes and pests
 - their nature and impact on animal production systems
- technology
 - use of technologies in producing and marketing animal products within animal welfare guidelines
- experimental design and research
 - the role of a control
 - the collection and simple analysis of data
 - recent findings that contribute to sustainable animal production systems
 - the ethical, legal and animal welfare requirements.

Students are expected to conduct at least ONE plant OR animal trial.

Students develop the concept of the dynamic and interactive nature of animal enterprises by developing models of animal enterprises whereby the interactions between components are highlighted. Learning about the components and interactions of animal enterprises will be enhanced by developing practical skills in growing and monitoring animals.

Students learn to:

- identify a range of regionally significant farm animals
- manage and monitor the growth and development of a farm animal
- select and perform appropriate and safe handling and management techniques for the care and welfare of farm animals
- identify important pests and diseases of an animal enterprise
- monitor the physical aspects of the environment of a selected farm animal
- design and/or conduct a simple trial using appropriate methodology within animal welfare guidelines.

All practical activities involving animals must comply with the *Animal Research Act 1985* (NSW) as described in the current edition of *Animals in Schools: Animal Welfare Guidelines for Teachers*, produced on behalf of the Schools Animal Care and Ethics Committee by the NSW Department of Education and Training.

9 Content: Agriculture Stage 6 HSC Course

9.1 Plant/Animal Production

Outcomes

A student:

H1.1 explains the influence of the physical, biological, social, historical and economic factors on sustainable agricultural production

H2.1 describes the inputs, processes and interactions of plant production systems

H2.2 describes the inputs, processes and interactions of animal production systems.

Content

Students learn about:

- sustainable agricultural production
 - the historical development of Australian land use practices, including Aboriginal practices, up to the present day
 - the chemical and physical characteristics of soil
 - techniques to maintain and/or improve soil fertility, including alternative strategies to the application of inorganic fertilisers
 - the role of soil nutrient cycles in Australian agricultural systems
 - the farming practices that have led to soil degradation, such as salination, acidification, soil structure decline and erosion, and the effects of these on soil and water
 - sustainable farming practices, including minimum tillage and crop rotation
 - the role of individual farmers, the broader community and government in reducing the harmful environmental effects of agriculture and in conserving water and protecting waterways
 - the tension between sustainability and short-term profitability in farming systems
- plant production systems
 - the processes of respiration and photosynthesis and net assimilation rate
 - the constraints imposed by environmental factors, including light, temperature, available moisture, oxygen/carbon dioxide ratios, wind and biotic factors on plant growth, development and production
 - the interaction of genotype with environment and the consequent opportunities for plant productivity
 - breeding systems and their genetic basis to improve quality and production of plants
 - the major components of interference in plant communities, ie plant competition, allelopathy, environmental modification of plants and plants acting as alternative hosts
 - the role of native and introduced pasture species in pasture management systems

- animal production systems
 - the similarities and differences in the anatomy and physiology of ruminants and monogastrics
 - the nutritional requirements of a selected animal
 - the fate of energy in animal nutrition
 - the processes of growth and development in animals in terms of the proportion of muscle, fat and bone
 - breeding systems and their genetic basis to improve quality and production of animals
 - the role of hormones in the regulation of animal reproduction and behaviour
 - the factors that limit the fertility of farm animals
 - ethics, welfare and legal issues and requirements
- microbes and invertebrates
 - the role of microbes and invertebrates in the decomposition of organic matter and the fixing of atmospheric nitrogen via their association with legumes
 - the complex interaction involving problem organisms (pathogenic microbe or invertebrate), the host and the environment in plant and animal disease
 - the problems of pesticides and chemical resistance in target organisms
 - the importance of agricultural chemical labels as they relate to safe practice and correct usage
 - the use and potential for integrated pest management (IPM)
- experimental analysis and research in plant/animal systems
 - the role of a control, randomisation, replication and standardisation of conditions
 - the collection and analysis of data
 - impact of research on agricultural production systems.

Students learn to:

- use nutritional data to determine the suitability of animal feeds
- use a computer to simulate agricultural problem situations and test solutions
- interpret a chemical label and relate it to safe practice and correct usage
- research an integrated pest management program for a plant or animal production system
- measure and monitor plant and animal production systems within animal welfare guidelines
- analyse and interpret agricultural data, for example animal performance measures, climatic information and crop production data
- investigate examples of plant interference, including weeds and planting density
- calculate a measure of variability (standard deviation) using a calculator/computer
- make recommendations based on the interpretation of the results of agricultural experiments.

All practical activities involving animals must comply with the *Animal Research Act 1985* (NSW) as described in the current edition of *Animals in Schools: Animal Welfare Guidelines for Teachers*, produced on behalf of the Schools Animal Care and Ethics Committee by the NSW Department of Education and Training.

9.2 Farm/Product Study

Outcomes

A student:

- H3.1 assesses the general business principles and decision-making processes involved in sustainable farm management and marketing of farm products
- H3.2 critically assesses the marketing of a plant OR animal product
- H3.3 critically examines the technologies and technological innovations employed in the production and marketing of agricultural products
- H3.4 evaluates the management of the processes in agricultural systems.

Content

Students learn about:

- the farm as a business
 - the place of the farm in the wider agribusiness sector
 - the range of marketing strategies, for example vertical integration, contract selling, direct marketing, cooperatives, marketing boards, available to producers
 - the interaction between the farm and the market
 - ways in which governments can intervene in aspects of agricultural production and marketing
- the marketing of a specific farm product
 - the quality criteria for the product
 - the importance of product specification in the marketing of the product
 - the processes involved in turning the raw agricultural commodity into various forms to satisfy consumer demand
 - the role of advertising and promotion in the marketing of the product
 - the nature and potential for value adding on the product
- decision-making processes and management strategies
 - assessment of the performance of systems and decision-making based on measurements of quality and quantity
 - the financial pressures that have an impact on farmers, including the irregular nature of income, high expenditure on inputs, the dynamic nature of markets and interest rates, risk management
 - the problems that may occur in meeting market specifications
- agricultural technology
 - the impact that scientific research and associated technology has had on agricultural production and marketing.

Students learn to:

- assess the quality of the product of a plant or animal system
- calculate a gross margin for an enterprise
- schedule the timing of operations in a production cycle
- determine the marketing chain for a particular product
- evaluate marketing information, such as a sales report, for a product
- interpret supply and demand information for the product.

9.3 Optional Research Project

Outcomes

A student:

H3.4 evaluates the management of the processes in agricultural systems

H4.1 applies appropriate experimental techniques, technologies, research by methods and data presentation and analysis in relation to agricultural problems and situations

H5.1 evaluates the impact of innovation, ethics and current issues on Australian agricultural systems.

Content

Students learn about:

- processes in agricultural systems by:
 - conducting an independent investigation in an agricultural situation
 - using data/information from research to evaluate the management of agricultural processes
- research methodology and presentation of research by:
 - identifying a research question that could be investigated
 - accessing and evaluating sources of information pertinent to the question being investigated, eg a review of the literature
 - selecting appropriate research methods to find answers to the questions being investigated
 - collecting, presenting and interpreting data in a way appropriate to the research methods used
 - evaluating and communicating the processes and results of research in a formal report and through a process journal
- innovation, ethics and current issues by:
 - identifying issues relevant to the ethical behaviour and responsibilities of agricultural researchers
 - considering issues of ethics and welfare in the design of the research
 - making some recommendations from the research that could be of use to others and lead to further research.

9.4 Electives

Each elective has one or more content statements that suit individual research by students. While not intended to be as complex and self-directed as the optional research project, students should attempt to undertake an investigation involving research, data collection and use an appropriate form of presentation.

Elective 1 – Agribusiness

For the purpose of this study, *Agribusiness is the food and fibre business. It includes all the activities involved in the production, processing and distribution of food and fibre products; input supply, agricultural production, marketing and processing together with related activities in government and education (Agribusiness Association of Australia and New Zealand).*

This elective examines the farm as part of agribusiness. It describes the impact of international and domestic forces on farm business. The role of a large organisation (corporation or company) in the agricultural sector is examined.

Outcomes

A student:

H3.4 evaluates the management of the processes in agricultural systems

H4.1 applies appropriate experimental techniques, technologies, research methods and data presentation analysis in relation to agricultural problems and situations

H5.1 evaluates the impact of innovation, ethics and current issues on Australian agricultural systems.

Content

Students learn about:

- processes in agricultural systems by:
 - analysing the financial situation of a farm using a variety of techniques
 - describing the choices available for a farm business to obtain finance for its operations
 - explaining the strategies that could be used for a farm business to obtain finance for its operations
 - assessing the role of farm advisory services in farm management decision-making
 - investigating the impact of the organisation on the biological and physical components of the industry
- research methodology and presentation of research by:
 - analysing a study of the impact of a large rural business organisation on the agricultural industries in which it is involved
- innovation, ethics and current issues by:
 - outlining an example of a successful value adding, niche marketing, product diversification strategy that has been used to vary the marketing opportunities for a particular agricultural product
 - critically evaluating alternative selling systems and marketing options for a particular agricultural product
 - evaluating the impact of international markets on farm businesses
 - investigating methods that are employed to develop new domestic and international markets.

Elective 2 – Animal Management

This elective examines the principles of animal production. This study is based on an understanding of the biology of animals and their interactions with the environment.

Outcomes

A student:

H3.4 evaluates the management of the processes in agricultural systems

H4.1 applies appropriate experimental techniques, technologies, research methods and data presentation analysis in relation to agricultural problems and situations

H5.1 evaluates the impact of innovation, ethics and current issues on Australian agricultural systems.

Content

Students learn about:

- processes in agricultural systems by:
 - relating knowledge of animal hormonal systems and reproductive anatomy to breeding techniques and reproductive management
 - evaluating management techniques available to farmers to manipulate the rates of growth, development and reproduction in farm animals, including the use of chemicals and hormones
 - outlining the role of objective measurement and heritability on the breeding programs of farms, using at least one specific program used in one animal industry
 - describing the nature of the immune system in terms of antibody, antigen, vaccine, immunity, antitoxin and linking it to the prevention of diseases by vaccination
- research methodology and presentation of research by:
 - analysing a study of a current technique/technology which is advancing productivity in animal production systems
- innovation, ethics and current issues by:
 - discussing the impact or potential impact of genetic engineering and associated genetic technologies on animal production systems
 - evaluating changes being made to breeding systems and techniques in terms of their impact on reproductive efficiency, product quality, individual farm breeding programs and animal adaptability in a wide range of commercial industries
 - discussing the advantages and disadvantages of various management practices associated with disease control, with emphasis on animal welfare issues, environmental protection, chemical resistance in target organisms and human safety
 - outlining some of the issues (for example economic, management, social, legal and ethical) that may have an impact on the successful implementation of new technologies in animal production systems.

Elective 3 – Horticulture

This elective involves the study of horticulture, including the amenity, floriculture and production industries. It investigates the role of technology and innovation in one horticultural industry and shows the potential of improving market share by innovative marketing of horticultural products.

Outcomes

A student:

H3.4 evaluates the management of the processes in agricultural systems

H4.1 applies appropriate experimental techniques, technologies, research methods and data presentation analysis in relation to agricultural problems and situations

H5.1 evaluates the impact of innovation, ethics and current issues on Australian agricultural systems.

Content

Students learn about:

- processes in agricultural systems by:
 - explaining the relationship between the level of output in intensive horticulture and the nature and level of input
 - critically analysing the role of the manager in manipulating parts of the horticultural system to balance economic viability, environmental sustainability and new or developing markets
 - describing how the characteristics of plants affect their use in horticulture
 - discussing how plant physiology and plant response to environment (including pests and disease) affect the production cycle of a horticultural system
- research methodology and presentation of research by:
 - analysing a study of one technological innovation aimed at improving productivity in a particular horticultural industry
- innovation, ethics and current issues by:
 - describing the existing and potential economic importance of horticulture at the domestic and international levels
 - relating plant physiology to techniques of plant propagation and reproduction
 - describing how factors such as quarantine and market proximity affect production and post-production strategies for horticultural products
 - assessing the influence of changing markets, both domestic and international, on the types of products, production techniques and post-harvest handling in horticulture.

Elective 4 – Innovation and Diversification

While Australian agriculture is still composed of many traditional agricultural industries, new or alternative industries or production methods are emerging, either on existing farms or on new farming enterprises. Both plant and animal systems are involved and a knowledge of the biology and associated management of the new enterprise or technologies is essential for the economic viability of that enterprise.

Research, development and trialling of potential industries prior to full implementation is an ongoing process in Australian agriculture.

Outcomes

A student:

H3.4 evaluates the management of the processes in agricultural systems

H4.1 applies appropriate experimental techniques, technologies, research methods and data presentation analysis in relation to agricultural problems and situations

H5.1 evaluates the impact of innovation, ethics and current issues on Australian agricultural systems.

Content

Students learn about:

- processes in agricultural systems by:
 - appraising the production systems or technological innovations available for some existing agricultural enterprises
 - appraising economic, environmental and managerial factors of one alternative agricultural production system or technology
 - applying knowledge of the biology of a plant or animal to the management of alternative production systems or technology
 - discussing the techniques that may be used to market the innovation, for example niche markets in alternative agricultural production
- research methodology and presentation of research by:
 - analysing a study of the development and implementation of one alternative agricultural production system or technology
- innovation, ethics and current issues by:
 - outlining the diversity of new agricultural enterprises or technologies
 - explaining the need for research in the development of alternative enterprises
 - outlining legal or other institutional requirements that must be met in order to establish alternative agricultural systems and enterprises or technologies
 - evaluating trends in marketing, production or technologies and development of alternative agricultural systems and enterprises and any social barriers that may need to be overcome.

Elective 5 – Plant Management

This elective examines the principles of plant production. This study is based on an understanding of the biology of plants and their interactions with the environment.

Outcomes

A student:

H3.4 evaluates the management of the processes in agricultural systems

H4.1 applies appropriate experimental techniques, technologies, research methods and data presentation analysis in relation to agricultural problems and situations

H5.1 evaluates the impact of innovation, ethics and current issues on Australian agricultural systems.

Content

Students learn about:

- processes in agricultural systems by:
 - relating the cellular anatomy of plants to the functions of the main organs (roots, stems and leaves)
 - explaining the plant physiological processes: photosynthesis, water and nutrient uptake and reproduction
 - outlining the role of plant hormones in plant growth and development
 - describing the vegetative and reproductive anatomy of commercially grown plants in relation to their function
 - explaining how plant density may affect the vegetative and reproductive yields
- research, methodology and presentation of research by:
 - analysing a study of the role of plant breeding or related research in advancing productivity in plant production systems
- innovation, ethics and current issues by:
 - outlining technologies that produce and distribute new plant genetic material, including genetic engineering, tissues, grafting, budding and hybridising
 - explaining how environmental factors, such as mineral nutrients, soil moisture, temperature, pests and disease, light and photoperiod, can be managed to manipulate plant production
 - analysing the management of plant/cropping systems, in relation to nutrient cycles and soil fertility
 - describing how plant hormones may be used to manipulate plant production. Consider their use in herbicides, inducing or inhibiting fruit set, cuttings, tissue culture, inhibiting stem elongation, ripening.

Elective 6 – Sustainable Land and Resource Management

This elective examines the principles involved in the long-term sustainability of resources, such as land and water, in farming systems. It deals with both the historical factors and current management techniques related to sustainable farming systems. Whole-farm planning should ensure the sustainability of a farm is covered in terms of the environment, its financial status and its social context.

Outcomes

A student:

H3.4 evaluates the management of the processes in agricultural systems

H4.1 uses appropriate experimental techniques, technologies, research methods and data presentation analysis in relation to agricultural problems and situations

H5.1 evaluates the impact of innovation, ethics and current issues on Australian agricultural systems.

Content

Students learn about:

- processes in agricultural systems by:
 - applying the Australian land capabilities system to the local area in order to compare existing land use to that suggested by a land capability assessment, to ensure sustainable land use
 - discussing the effects of soil degradation on agricultural productivity and sustainability
 - discussing the issues related to water quality, supply and regulation
 - examining the causes of the following types of soil degradation: soil erosion, dryland salinity, irrigation salinity, soil acidification and soil structure decline (with special reference to those arising from farming practices)
 - explaining in detail the processes that have led to **one** of the above types of soil degradation and outlining the extent of this soil degradation problem in Australia, with specific reference to effects on plant and animal production
- research methodology and presentation of research by:
 - analysing a study of innovative technologies or practices that are assisting with the conservation and efficient use of water in agricultural production systems
- innovation, ethics and current issues by:
 - examining and evaluating the current recommended procedure to alleviate the problem studied above with special reference to the physical and biological processes occurring in the soil
 - analysing the strategies and innovative activities occurring in programs related to total catchment management landcare and whole-farm planning as a means of dealing with sustainability in agriculture
 - discussing the importance of the attitudes of farmers and the wider community to effectively achieve environmental, economic and social sustainability in agricultural systems
 - appreciating the role of the government in land and resource management.

10 Course Requirements

For the Preliminary course:

- 120 indicative hours are required to complete the course
- practical experiences should occupy a minimum of 30% of course time.

For the HSC course:

- the Preliminary course is a prerequisite
- 120 indicative hours are required to complete the course
- practical experiences should occupy a minimum of 30% of course time
- if the research project option is undertaken, a project report and process diary must be submitted to the Board of Studies.

11 Post-school Opportunities

The study of Agriculture Stage 6 provides students with knowledge, understanding and skills that form a valuable foundation for a range of courses at university and other tertiary institutions.

In addition, the study of Agriculture Stage 6 assists students to prepare for employment and full and active participation as citizens. In particular, there are opportunities for students to gain recognition in vocational education and training. Teachers and students should be aware of these opportunities.

11.1 Recognition of Student Achievement in Vocational Education and Training (VET)

Wherever appropriate, the skills and knowledge acquired by students in their study of HSC courses should be recognised by industry and training organisations. Recognition of student achievement means that students who have satisfactorily completed HSC courses will not be required to repeat their learning in courses in TAFE NSW or other Registered Training Organisations (RTOs).

Registered Training Organisations, such as TAFE NSW, provide industry training and issue qualifications within the Australian Qualifications Framework.

The degree of recognition available to students in each subject is based on the similarity of outcomes between HSC courses and industry training packages endorsed within the Australian Qualifications Framework (AQF). Training packages are documents that link an industry's competency standards to AQF qualifications. More information about industry training packages can be found on the National Training Information Service (NTIS) website (www.ntis.gov.au).

Recognition by TAFE NSW

TAFE NSW conducts courses in a wide range of industry areas, as outlined each year in the *TAFE NSW Handbook*. Under current arrangements, the recognition available to students of Agriculture in relevant courses conducted by TAFE is described in the *HSC/TAFE Credit Transfer Guide*. This guide is produced by the Board of Studies and TAFE NSW and is distributed annually to all schools and colleges. Teachers should refer to this guide and be aware of the recognition available to their students through the study of Agriculture Stage 6. This information can be found on the TAFE NSW website (www.tafensw.edu.au/mchoice).

Recognition by other Registered Training Organisations

Students may also negotiate recognition into a training package qualification with another Registered Training Organisation. Each student will need to provide the RTO with evidence of satisfactory achievement in Agriculture Stage 6 so that the degree of recognition available can be determined.

12 Assessment and Reporting

PLEASE NOTE

The assessment and HSC examination requirements detailed in this syllabus refer to the 2009 HSC. New *Assessment and Reporting* information will apply to this syllabus for the 2010 HSC and beyond.

12.1 Requirements and Advice

The information in this section of the syllabus relates to the Board of Studies' requirements for assessing and reporting achievement in the Preliminary and HSC courses for the Higher School Certificate.

Assessment is the process of gathering information and making judgements about student achievement for a variety of purposes.

In the Preliminary and HSC courses those purposes include:

- assisting student learning
- evaluating and improving teaching and learning programs
- providing evidence of satisfactory achievement and completion in the Preliminary course
- providing the Higher School Certificate results.

Reporting refers to the Higher School Certificate documents received by students that are used by the Board to report both the internal and external measures of achievement.

NSW Higher School Certificate results will be based on:

- **an assessment mark** submitted by the school and produced in accordance with the Board's requirements for the internal assessment program.
- **an examination mark** derived from the HSC external examinations

Results will be reported using a course report containing a performance scale with bands describing standards of achievement in the course.

The use of both internal assessment and external examinations of student achievement allows measures and observations to be made at several points and in different ways throughout the HSC course. Taken together, the external examinations and internal assessment marks provide a valid and reliable assessment of the achievement of the knowledge, understanding and skills described for each course.

Standards Referencing and the HSC Examination

The Board of Studies will adopt a standards-referenced approach to assessing and reporting student achievement in the Higher School Certificate examination.

The standards in the HSC are:

- the knowledge, skills and understanding expected to be learned by students – the *syllabus standards*
- the levels of achievement of the knowledge, skills and understanding – the *performance standards*.

Both *syllabus standards* and *performance standards* are based on the aims, objectives, outcomes and content of a course. Together they specify what is to be learnt and how well it is to be achieved.

Teacher understanding of standards comes from the set of aims, objectives, outcomes and content in each syllabus together with:

- the performance descriptions that summarise the different levels of performance of the course outcomes
- HSC examination papers and marking guidelines
- samples of students' achievement on assessment and examination tasks.

12.2 Internal Assessment

The internal assessment mark submitted by the school will provide a summation of each student's achievements measured at points throughout the course. It should reflect the rank order of students and relative differences between students' achievements.

Internal assessment provides a measure of a student's achievement based on a wider range of syllabus content and outcomes than may be covered by the external examination alone.

The assessment components, weightings and task requirements to be applied to internal assessment are identified on page 35. They ensure a common focus for internal assessment in the course across schools, while allowing for flexibility in the design of tasks. A variety of tasks should be used to give students the opportunity to demonstrate outcomes in different ways and to improve the validity and reliability of the assessment.

12.3 External Examinations

In Agriculture Stage 6 the external examinations include a written paper and a project or two written papers for external marking. The specifications for the examination in Agriculture Stage 6 are on page 37.

The external examination provides a measure of student achievement in a range of syllabus outcomes that can be reliably measured in an examination setting.

The external examination and its marking and reporting will relate to syllabus standards by:

- providing clear links to syllabus outcomes
- enabling students to demonstrate the levels of achievement outlined in the course performance scale
- applying marking guidelines based on established criteria.

12.4 Board Requirements for the Internal Assessment Mark in Board Developed Courses

For each course, the Board requires schools to submit an assessment mark for each candidate.

The collection of information for the HSC internal assessment mark must not begin prior to the completion of the Preliminary course.

The Board requires that the assessment tasks used to determine the internal assessment mark must comply with the components, weightings and types of tasks specified in the table on page 35.

Schools are required to develop an internal assessment program that:

- specifies the various assessment tasks and the weightings allocated to each task
- provides a schedule of the tasks designed for the whole course.

The school must also develop and implement procedures to:

- inform students in writing of the assessment requirements for each course before the commencement of the HSC course
- ensure that students are given adequate written notice of the nature and timing of assessment tasks
- provide meaningful feedback on students' performance in all assessment tasks
- maintain records of marks awarded to each student for all assessment tasks
- address issues relating to illness, misadventure and malpractice in assessment tasks
- address issues relating to late submission and non-completion of assessment tasks
- advise students in writing if they are not meeting the assessment requirements in a course and indicate what is necessary to enable the students to satisfy the requirements
- inform students about their entitlements to school reviews and appeals to the Board
- conduct school reviews of assessments when requested by students
- ensure that students are aware that they can collect their Rank Order Advice at the end of the external examinations at their school.

12.5 Assessment Components, Weightings and Tasks

Assessment should include a range of tasks.

Preliminary Course

The suggested components, weightings and tasks for the Preliminary course are detailed below

Component	Weighting	Tasks
Overview	15	Tasks might include: <ul style="list-style-type: none"> – tests, including practical and open book – practical activities – farm case study report – oral presentation – extended responses – experimental report – research assignment
Plant production	30	
Animal production	30	
Farm case study	25	
Total Marks	100	

The assessment of course components should relate to the outcomes and course content.

HSC Course

The internal assessment mark for Agriculture Stage 6 is to be based on the HSC course only. Final assessment should be based on a range and balance of assessment instruments.

Component	Weighting	Tasks
Plant/animal production	45	Tasks might include: <ul style="list-style-type: none"> – tests, including practical and open book – practical activities – oral presentation – farm/product study report – extended responses – experimental report – research assignment – process journal
Farm/product study	25	
Research project OR Electives (2)	30	
Total Marks	100	

The assessment of course components should relate to the outcomes and course content.

One task may be used to assess several components. It is suggested that 3–5 tasks are sufficient to assess the HSC course outcomes.

Note: The completed research project should not be used for school-based assessment purposes because it is presented for examination at the HSC.

If within the same class some students are undertaking the research project while others are studying two electives, then internal assessment tasks must be comparable.

All students are required to undertake a minimum of 30% of allocated course time as practical work. **The school is required to maintain a record of the practical experiences satisfactorily completed by each student.**

12.6 HSC External Examination Specifications

Paper 1 **2 hours** (plus 5 minutes reading time). All students are required to complete this part of the paper.

Paper 1 will consist of THREE sections.

Section I (25 marks)

- This section will consist of short-answer questions.
- All questions will be compulsory.
- Questions focus on farm/product study, practical work, experimental design and analysis and ecological and sustainability issues.
- All questions must be answered on the examination paper in the space provided.

Section II (30 marks)

- There will be TWO questions on the plant/animal production component of the syllabus.
- Both questions will be compulsory.
- All questions will be of equal value.
- All questions will consist of a number of short-answer parts.
- All questions must be answered on the examination paper in the space provided.

Section III (15 marks)

- There will be FOUR questions based on all aspects of the syllabus except the electives and the research project.
- Candidates must attempt ONE question only.
- All questions will be of equal value.
- Each question will require an extended structured response.
- The question must be answered in a separate answer booklet.

Paper 2 **1 hour.** Only students who have completed electives will complete this part of the paper.

Paper 2 (30 marks)

- There will be SIX questions, ONE from each of the electives.
- Candidates are to attempt TWO questions only.
- All questions will be of equal value.
- Each question will require an extended structured response.
- All questions will be answered in separate answer booklets.

Research Project (30 marks)

Students who have chosen to complete the research project must submit their projects to the Board for marking.

Rules for the Research Project

The research project enables students to study a particular agricultural issue or problem.

The scope of issue or problem open to students includes those that arise from production, the economic environment, marketing and the social environment. There is a wide range of research methodologies that can be used and the most appropriate one must be applied to investigating and exploring the particular issue or perspective chosen.

The material submitted by students for the research project consists of a report and process journal. The report communicates the research methodology, data analysis and evaluation of the research project. It must consist of at least 3000, and no more than 5000, words. The text must be supplemented by additional appropriate material such as graphs, figures, tables, slides and photographs. The process journal details the student's progress throughout the research project, and is verified by the student's teacher. The process journal **will not** be marked or contribute to the report mark. It may be used for verification that the candidate has carried out the research identified in the formal report.

It is essential that students are aware of the legal requirements and ethical considerations involved in the aim, design and methodology of their research projects. Ethical considerations and legal requirements relate to animal welfare, the use of chemicals and occupational health and safety. It is expected that students be aware of specific laws, regulations and codes of practice that may affect the conduct of their projects.

The research project, certified both by the principal and the student to be the original work of the student, must be submitted to the Board of Studies. The Board will notify schools of the date for submission. Forms for certification will be provided by the Examinations and Certification Branch of the Board of Studies.

The research project must be identifiable only by the candidate number and centre number. Photographs must not reveal the identity of the student or school. Acknowledgments must not reveal teachers, NSW Agriculture officers, cooperating farmers or other students by name or specific locality. Where students have worked cooperatively with other students on a collaborative experiment, the **nature** and **extent** of such collaboration is to be identified by the student number.

To satisfy certification requirements, each student must submit an individual research project based on the student's original, individual investigation. Students may seek assistance in the investigation (for example sources such as NSW Agriculture for statistical analysis or experimental design). They may collaborate (for example where the student has been responsible for a number of plots in a large scale trial, but uses material from the whole trial) but they must acknowledge such assistance and all sources of information. The work presented in the project must have been undertaken by the student and the results must be based on the student's own

investigation. The investigation may be based on previously published work. Teacher comments on a project are NOT to be submitted but may be requested in exceptional circumstances, for example loss or damage.

Assessment of the project will be based on the extent to which the research project fulfils the outcomes and content specified in the syllabus.

The balance between various segments of the report may alter, depending on the specific nature of the research project undertaken and the resources available to the student.

The report must include:

- a research question
- synopsis or abstract
- literature review
- research methodology
- results
- data analysis
- conclusions
- ethical and welfare issues
- recommendations
- referencing and acknowledgements.

Students may commence the practical component of their research project at any time after the beginning of term 2 of the school year preceding their HSC year, provided that the student's report (analysis and writing up of material) is substantially completed in the HSC course.

Assessment Criteria

- Presentation of a cohesive, well-reasoned and detailed report on an appropriate independent investigation
- Inclusion of appropriate supporting material, such as graphs, figures, tables, slides and photographs
- Identification of an appropriate research question in an agricultural situation
- Provision of an accurate synopsis or abstract of the investigation
- Evidence of a comprehensive literature review
- Application of appropriate research methodology and technologies
- Presentation of results, appropriate data analysis and drawing of accurate and relevant conclusions from this investigation
- Identification and evaluation of ethical and welfare issues relevant to this research and the wider field of agricultural research
- Presentation of detailed and appropriate recommendations drawn from this research and supported by the data and/or research
- Inclusion of accurate referencing and acknowledgements.

12.7 Summary of Internal and External Assessment

External Assessment	Weighting	Internal Assessment	Weighting
Paper 1			
Section I Farm/product study, practical work, experimental design and analysis and ecological and sustainability issues (compulsory short answer questions)	25	Farm/product study	25
		Plant/animal production	45
Section II Plant/animal production (internal choice, short answer questions)	30		
Section III All aspects of the course (one extended structured response from a choice of four)	15		
Paper 2			
Questions on electives (one extended structured response)	30	2 electives	30
OR		OR	
Submission of research project		Research project	
	100		100

12.8 Reporting Student Performance against Standards

Student performance in an HSC course will be reported against standards on a course report. The course report contains a performance scale for the course describing levels (bands) of achievement, an HSC examination mark and the internal assessment mark. It will also show, graphically, the statewide distribution of examination marks of all students in the course.

Each band on the performance scale (except for band 1) includes descriptions that summarise the attainments typically demonstrated in that band.

The distribution of marks will be determined by students' performances against the standards and not scaled to a predetermined pattern of marks.

13. Glossary

agriculture	The range of activities aimed at producing food, fibre and other plant and animal derivatives to meet the demands of society
animal production	The raising of animals in order to acquire products used by society, eg the raising of sheep to produce meat and wool
electives	A series of six options, two of which can be selected for study as an alternative to the research project, in the HSC course
enterprise	An agricultural activity aimed at producing a particular commodity, eg the growing of carnations to produce cut flowers
farm case study	The study of a particular farm production system incorporating at least one visit to the selected farm. This is carried out in the Preliminary course
farm/product study	An extension of the farm case study. It is designed to develop the understanding of the sustainability of the farm, economically, culturally and environmentally. Emphasis should be put on both the marketing of the product and how management of the system improves the efficiency of production. This is carried out in the HSC course
plant production	The growing of plants in order to acquire products used by society, eg the growing of cotton to be used as a fibre for clothing
research project	An individual piece of work undertaken by HSC students as an alternative to the study of two electives. The research project requires students to explore a particular agricultural issue or perspective of their choice