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Stage 6

Support Document

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1 Introduction

This support document is designed to assist teachers as they plan for the implementation of the *Agriculture Stage 6 Syllabus*.

It provides advice on the implementation of the optional research project and the programming of selected electives in the HSC course. These areas of the syllabus content have been identified as focus areas of the document as they represent the most significant changes to the former syllabus. Advice is also provided on the use of animals in teaching agriculture and on developing an internal assessment schedule.

Resources relevant to each unit of work are included. However, it should be noted that a more extensive list of subject-specific resources is also provided on this website.

The *Agriculture Stage 6 Support Document* produced by the Board of Studies in 1997 provides useful information and resources that are relevant to aspects of the new *Agriculture Stage 6 Syllabus*.

2 Information Specific to Units of Work

- **Resources**

Each unit of work has a variety of resources listed; however, it would be possible to use other relevant references. The intention is that teachers may elect to use these resources to assist in the delivery of the unit.

- **Unit Length**

A suggested unit length has been provided; however, teachers may elect to alter this. Teachers may also find it appropriate to delete or expand suggested activities.

3 Implementation of the Optional Research Project

For the HSC, students have the option to undertake either a research project or to complete two electives. Those who elect to complete the Optional Research Project must document their research and present a report for the HSC examination. 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 of data and writing of results) is substantially completed in the HSC year.

The optional research project has two components:

- 1 a report that communicates the research methodology, data analysis and evaluation. This should include:
 - a research question
 - acknowledgements
 - synopsis or abstract
 - literature review
 - research methodology
 - results
 - data analysis
 - conclusion
 - recommendations
 - references.

The optional research project enables students to research issues or perspectives that arise from production, the economic environment, marketing and/or the social environment. The project must be the student's own work and should reflect their interests, skills and knowledge. It is important that students acknowledge the source of all material used in the preparation of the major research project by providing complete and accurate references.

- 2 a process diary that records the student's progress throughout the research project.

The process diary should describe the procedures undertaken in researching the topic, as well as providing a dated sequence of events that occurred during the research.

As a working document, the process diary should be an ongoing account of the processes of research and should include original documentation such as handwritten notes and annotated sketches. Extensive rewriting and word processing is unnecessary. The process diary should be presented in its original form.

The format of the diary is not prescribed. There are many acceptable approaches to the organisation of the process diary. The following points outline the minimum requirements.

- **Date.** Entries should be dated so that the research processes and sequence of events can be traced by the examiners.
- **Students' comments.** Students should record their ideas, observations and reflections. Discussions with researchers, statisticians, farm managers, scientists, technologists, etc consulted during any stage of the major research should be documented.

- **Teacher comments.** Suggestions, critical comments and advice on future directions or further consultation with appropriate advisers should be included in the process diary. Teacher comments, at regular intervals, assist students to stay 'on task' and provide valuable feedback for them. Teacher entries should be initialled and dated.

Entries should be more than superficial one-line comments, and should provide the examiner with an understanding of the most significant decisions made and the problems encountered in the research, eg problems associated with topic choice, research methodology or experimental design, significant conversations with others, and ideas and possibilities that come to mind. It should be not only descriptive but, to assist the quality of the final product, should also include critical reflections on decisions, events and procedures.

To be of significant use to the students, the process diary should have a minimum length of five pages.

Monitoring the process

Students should be introduced to the nature of the methodologies of quantitative and qualitative research techniques during Preliminary and HSC course work. In this way, students are exposed to the two ways in which research data can be collected and will gain confidence in selecting appropriate methodologies for their major research project.

To ensure originality of students' work, and to monitor their progress, teachers could:

- discuss the progress of the project with students on a regular basis
- check students' process diaries and make comments in the diary regularly
- encourage students to present one seminar to the class, parents or any appropriate audience.

What is the role of the teacher?

The research project must be the work of the student and should reflect their interests, skills and knowledge. The major role of the teacher is to facilitate and guide students in the management of the project.

However, the teacher may:

- assist students to develop ideas and proposals for topic areas
- encourage a diversity of choice of research topics within the class (if students happen to choose the same or similar topics, they should be encouraged to focus on different issues within that topic)
- assist students to evaluate the feasibility of proposed topics (the choice of topic must be made by the student)
- facilitate access to resources and references
- assist students to identify and use appropriate reference material
- assist students with appropriate research methodology including data analysis
- assist students to draw valid conclusions and recommendations
- assist in the development of referencing skills
- motivate students to maintain consistency of work patterns
- validate students' work
- provide written comments, suggestions and advice in the process diary on a regular and consistent basis

- assist students to evaluate the outcomes of their research
- counsel students in dealing with problems encountered
- organise submission of research projects for marking
- verify the independence and originality of students' work.

With regard to the assessment of students' work, teachers are required to develop an internal assessment task to assess achievement in terms of the specified outcomes.

Teachers should note that the research project and electives have the same syllabus outcomes. Formal assessment tasks should reflect this syllabus requirement.

Choosing a topic

Identifying a research topic is not an easy task and students will require time and guidance when selecting an appropriate topic. It is important from the outset that topics should be viable. Although the ultimate responsibility for development and submission of the project lies with the student, it is important that the teacher should monitor this process and assist the student early in the planning process to identify the strengths and weaknesses of the topic selected. In particular, where students outline projects with multivariate experiments, or experiments that are likely to take excessive time or where resources may be difficult to obtain, early advice from the teacher about redefining the project is appropriate.

Brainstorming sessions to explore the opportunity for research in the local community may generate student ideas. These sessions may identify a wide variety of areas for study and a variety of perspectives within each area.

The following ideas indicate a broad range of possible areas for investigation. A wide variety of topics may be developed from each of these areas. This list is by no means prescriptive and is certainly not exhaustive. Possible areas for investigation include:

- the effect of a range of variables on a plant or animal product yield
- the effect of different management systems on production
- the effect of a range of variables on product quality
- comparative effects of techniques on production
- marketing trends
- consumer preferences
- factors that affect farmers' decision-making
- marketing technologies — effectiveness in promotion
- variables affecting sustainability
- social values and perspectives of farmers on production techniques and farming
- comparative case studies of farms and farmer decision-making
- economic assessments of farms, enterprises or techniques
- historical comparative research
- land-holding or land-use patterns as they affect production or production decisions.

Projects involving animals

Any project based on using animals must be carried out in accordance with the activities and categories listed in *Animals in Schools: Animal Welfare Guidelines for Teachers*. A project that intends to use animals in any way other than those described in this document must be submitted to the Schools Animal Ethics Committee (SACEC) for written approval

prior to commencement. If approval is required for a project, then time must be allowed for the project plan to be assessed by the SACEC prior to its commencement. A time period of two months may be required for approval, depending on when the application is lodged in relation to the scheduled meetings of the SACEC.

Teachers are reminded of their responsibilities in supervising any project that involves the use of animals. These responsibilities are clearly described in *Animals in Schools: Animal Welfare Guidelines for Teachers*, which presents a set of questions that should be answered by both the supervising teacher and the students(s) before any project involving the use of animals is commenced.

The report

The report of the project, which is submitted to the Board of Studies for external examination, must consist of at least 3000 and not more than 5000 words. The text may be supplemented by additional material in the form of graphs, figures, tables, photographs or video tapes.

The report should avoid being solely descriptive. It should reflect critical thought, with evidence of analysis and synthesis of findings that relate back to the research question and literature review.

Useful information on successful approaches to the research project from past years can be obtained from the *HSC Agriculture Examination Reports* published by the Board of Studies.

It should be noted that the completed research project should not be used for internal assessment purposes as it is presented for assessment at the HSC.

Some features of a good report

A research question

The research question should introduce the report by providing a clear focus and purpose. For example, if the student is looking at the effect of the rate of fertiliser on plant growth, an appropriate research question could be: 'How does the level of nitrogen fertiliser affect the quantity of vegetative matter produced in a fodder crop?'. If the project deals with consumer preferences, a question could be: 'How does consumer perception of dietary fat affect the selection and intake of red meat?'. If the project is a case study of a farm, a question could be: 'What is the effect of a farmer's attitudes to change on the kinds of production systems employed?'.

Acknowledgements

Students may seek assistance in carrying out the investigation (eg from Officers of the NSW Department of Agriculture for statistical analysis or experimental design). They may collaborate (eg 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.

Acknowledgements must not reveal teachers, schools, Department of Agriculture officers, scientists, 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 student number.

Synopsis or abstract

This should be a summary of the research project, consisting of about 200–250 words. An effective synopsis will draw together the research purpose, what is known, what is found (results) and the conclusions drawn. It demonstrates how well a student is able to synthesise the project as a whole.

Literature review

A literature review should describe the results, techniques, research methods and possibilities suggested in the available literature pertaining to the research question being investigated. Literature reviews may vary considerably in length, depending on the available literature. A literature review should include discussion of techniques and possible research approaches, as well as discussion of existing results and findings of similar research done by others.

It should be noted that a literature review:

- goes beyond the general information provided in two or three school textbooks
- assesses current knowledge of the topic and research methods related to the research question and acknowledges the source of information or data
- cites all ideas, data and conclusions from others, for example:
Jones (1989) showed that ...
'Lambs weaned early have low body fat.' (Smith, L, 1992).

At the end of the literature review or the end of the project, all citations should be listed in full reference form. The review:

- must be the students' interpretation and understanding of their reading
- avoids being a presentation of general information about the topic
- is concise and relevant to the research question being investigated.

Research methodology

The selection of the method or methods of research used by students often poses a problem. For most teachers of Agriculture, the use of the scientific method of controlled experimentation is familiar and easily used in agricultural research. Most research questions related to production quantity and quality use this research methodology. This kind of research is now generally called quantitative research. Quantitative research may also include collection of costs and prices data, use of government statistics and similar numerical data.

If research is to be undertaken in the area of social contexts of agriculture, case studies, consumer attitudes/preferences, management styles and similar areas, qualitative research methodologies are appropriate. Methods used in this kind of research include:

- observation
- questionnaires
- interviews
- case studies
- document analysis (newspapers, books, maps, Hansard, government policy).

The following list provides easy-to-read references on research for teachers and students.

Australian Bureau of Statistics, *Striking a Balance: Australia's Development and Conservation*, Australian Bureau of Statistics, Canberra, ACT, 1992.

Bentley, I, *Topics In Biology: Research Investigation*, Nelson, Melbourne, 1984.

Lindsay, D R, *A Guide to Scientific Writing*, 2nd edn, Longman, Melbourne, 1995.

Orange Agricultural College, The University of Sydney, *Research in Agricultural Education*, Orange Agriculture College, Orange, NSW, 1995.

Smith, D L, *People, Culture and Change: Becoming Your Own Researcher*, Social Science Press, Wentworth Falls, 1988.

Wadsworth, Y, *Do it Yourself Social Research*, Victorian Council of Social Science, Collingwood, Vic, 1984.

White, P, Davies, J and Donald, G, *Society and Culture Personal Interest Projects*, NSW Department of Education and Training, Learning Materials Production Centre, Sydney, 1993.

Results

The following points on the results component of the research project are derived from the HSC *Agriculture Examination Reports* from past years.

- Summary tables and graphs should be included in the body of the report. Raw data detract from the report but can be included in an appendix.
- Appropriate graphs should be used to describe continuous and non-continuous data.
- Axes on graphs must be labelled and drawn using appropriate scales.
- Computers should be used to generate graphs that give a meaningful description of the data, ie graphs with appropriate scales that compare all the treatments on the one set of axes. A common fault is to present each treatment on separate graphs (often with different scales), which makes comparisons difficult and detracts from the quality of the presentation of the data.

Data analysis

Data analysis and the interpretation of the analysis are crucial to the research project. The following points should be noted:

- statistical analysis that finds no difference between treatments is as valid as analysis that finds difference.
- failure to relate statistical analysis to the conclusion is a common problem for students. They often present calculations or computer output sheets then move to the conclusion and state that the results show a statistical difference. The reader is left to confirm this or otherwise. Students should indicate why and how their results are statistically significant before concluding that they are so.

Conclusion

The role of the conclusion is to draw together all aspects of the research project. Good conclusions refer to the research question and compare the findings with others cited in the literature review. Some students take the view that, because their results differ from those previously found, all previous work must be wrong and their method or results should be adopted by whole industries. This kind of argument clearly shows a lack of understanding about replication as a means of confirming results. Differences should be noted and the suggestion made that, if this result is valid, it could be further confirmed or it could have some telling implications. A discussion should include reflection on the research methodology and experimental design used.

Recommendations

Recommendations should include realistic suggestions for further investigations based on the findings presented in the research project. These suggestions would take into account some of the limitations of the project described in the conclusion.

References

Students should be encouraged to use a recognised referencing method for the identification of the resources used in the development of the research project. Resources such as textbooks, videos and Internet websites should be included in the reference list. Possible examples of referencing materials are indicated below.

Books:

Brown, A and Lawler, B, *Rural Safety: machinery, stock and general hazards*, Inkata Press, Sydney, NSW, 1994.

Videos:

Environmental Media Resources, *The Complete Guide to Compost*, Sydney, NSW, 1995.

Websites:

Australian Agriculture on Line – <http://www.agriculture.net.au>

4 Use of Animals in Teaching Agriculture

Teachers of Agriculture need to use animals in their teaching and learning strategies in order to meet the syllabus outcomes. The use of animals provides opportunities for students to gain knowledge, acquire skills and develop appropriate positive values towards the welfare of animals while meeting the requirements of the *Agriculture Stage 6 Syllabus*. Consequently, teachers of Agriculture have the responsibility of ensuring that the use of animals is at a 'best practice' standard. This means that teachers must understand the legal, ethical and welfare aspects of the use of animals.

The use of animals in research and teaching in NSW is regulated by the *Animal Research Act 1985*, which places the responsibility for the care and welfare of animals in schools upon the teacher involved with their use. Under the Act, an animal means: 'a vertebrate animal, and includes a mammal, bird, reptile, amphibian and fish, but does not include a human being'.

This legislation requires researchers and teachers to consider and apply three general principles (the 3Rs). They are:

- the **replacement** of animals with other methods
- the **reduction** of the number of animals used
- the **refinement** of techniques used, to reduce the impact on animals.

Teaching activities involving animals may be performed only when a decision has been made that, after weighing the educational value against the potential negative effects on the welfare of the animal and deciding that no other non-animal or less sentient animal alternative is suitable, they are justified.

If it has been decided that animal use is justified, approval to do so must be obtained from an appropriate Animal Ethics Committee (AEC) prior to commencing the activity as indicated below.

The appropriate committee for the Department of Education and Training (DET) and Catholic Education Commission (CEC) schools is the Schools Animal Care and Ethics Committee (SACEC). Schools that are part of the Association of Independent Schools (AIS) and other independent schools must apply to the SACEC for approval or set up their own AEC. The SACEC was established in 1990 by joint agreement between the AIS, the CEC and the DET. Its role is to ensure that the use of animals by schools complies with the Act. All CEC schools, DET, AIS and independent schools that have nominated the SACEC, are accredited to use animals for teaching purposes, on the condition that:

- the school has appointed an appropriately trained Animal Welfare Liaison Officer
- activities using those animals are conducted in accordance with the *Australian Code of Practice for the Care and Use of Animals for Scientific Purposes* (publications details on p 14).

That code has been interpreted for teachers in the book called *Animals in Schools: Animal Welfare Guidelines for Teachers* produced on behalf of the SACEC by the NSW Department of Education and Training (publication details on p 14).

This book is a mandatory document in all schools covered by the SACEC and includes:

- a discussion of community concerns and expectations, how these are reflected in the legislation and the framework for using animals in schools

- advice on how the 3Rs work in the school context
- a role statement for the school's Animal Welfare Liaison Officer
- a list of approved and categorised activities and procedures involving animals
- advice on the care standards for animals and responsibilities
- a list of procedures that must not be done to animals
- a proforma to use when seeking SACEC approval to conduct an activity involving animals that is not listed in the guidelines.

The SACEC sends annually, to all the schools it serves, a research authority. The school principal is responsible for identifying, and listing on the authority, all appropriately qualified teachers who have the principal's approval to use animals for teaching or research. The authority must be kept in the principal's office and be available for inspection by appropriate officers from the Animal Welfare Unit or members of the SACEC.

Progressively, schools will be required to provide more information to the SACEC about the animals they use. The SACEC will communicate with schools directly regarding this information.

Gaining approval to use animals for teaching purposes

Approval may be gained in one of two ways as indicated below. Regardless of which method of approval used, the 3Rs must be continuously applied to evaluate the plan to be followed.

1. Check the publication *Animals in Schools: Animal Welfare Guidelines for Teachers*. If the activity chosen is an approved activity, proceed to use the animals in accord with the advice provided in the book.
2. Where the planned activity is not on the approved list, the school's Animal Welfare Liaison Officer is responsible for making an application to the SACEC (an application form is included in *Animals in Schools*). Approval must be obtained from the SACEC before the activity commences.

The code requires that students be given the opportunity to discuss the ethical, social and scientific issues involved in the use of animals for teaching purposes.

Resources

Australian Code of Practice for the Care and Use of Animals Scientific Purposes, 6th edn, AGPS, Canberra, 1997.

Animals in Schools: Animal Welfare Guidelines For Teachers NSW Department of Education and Training, 1999. This book may be obtained from Education Sales, Phone: (02) 9822 7500, Fax: (02) 9822 7511, PO Box 564, Moorebank, NSW, 1875.

Board of Studies, *Agriculture Stages 4 and 5 Support Document*, Sydney, 1998.

Enquiries relating to the use of animals in teaching and research may be made to the Executive Officer, SACEC on (02) 9886 7626 or by fax on (02) 9886 7654.

Programmed Units of Work for the HSC Course Electives

5 Programmed Units of Work for the HSC Course Electives

5.1 Innovation and diversification

Suggested Time Allowed: 18 hours

Rationale

The HSC course structure provides opportunities for students either to undertake a research project or complete two electives. Electives provide opportunities for teachers to utilise student-centered learning activities such as contract systems.

Students studying the electives need specific programmed strategies and activities in order to both learn about the related syllabus content and develop skills in research methodology and the presentation of research results.

Resources

Books:

Alternative Farm Directory, 3rd edn, Alternative Directions, Ballarat, 1996 ISSN 13237993
Australian Quarantine and Inspection Service, *National Standards for Organic and Bio-Dynamic Produce*, Organic Produce Advisory Committee, Canberra, ACT, 1992.
Larkin, P J (ed), *Genes at Work: Biotechnology*, CSIRO Publications, 1994.
Madge, D, *Organic Agriculture*, Agriculture Media Publications, Agriculture Victoria, 1995.

Journals:

Australian Farm Journal, Worms and Organic Farming, August 1997, Volume 6 No 12, Rural Press Publications.
Australian Farm Journal, Organic Farming, August 1997, Volume 7 No 7, Rural Press Publications.
Australian Farm Journal, Special Organic Issue, August 1998, Volume 8 No 6, Rural Press Publications.

Videos:

Cundall, P, *Peter Cundall's practical guide to organic gardening* (60 minutes), Gardening Australia, ABC Publishing, 1992.
LMPC Media Production Unit OTEN, *On the Case* (25 min) 1995.

Websites:

Australian Agriculture on Line <http://www.agriculture.net.au>
Australian Agriculture Index <http://agnet.com.au>

Assessment

Teachers should note that the electives and research project have the same syllabus outcomes. Formal assessment tasks should reflect this syllabus requirement.

In addition, a research assignment based on a student case study is included in the program.

Elective Outcomes

- H3.4 evaluates the management of the processes in agricultural systems
- H4.1 applies appropriate experimental techniques, technologies, research 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.

Students learn about:	Strategies and activities
<ul style="list-style-type: none"> • processes in agricultural systems by: <ul style="list-style-type: none"> – appraising the production systems or technological innovations available for some existing agricultural enterprises • innovation, ethics and current issues by: • outlining the diversity of new agricultural enterprises or technologies <ul style="list-style-type: none"> – explaining the need for research in the development of alternative enterprises • processes in agricultural systems by: <ul style="list-style-type: none"> – 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 	<p>Students are divided into groups of 3–4 students. Each group is required to identify one agricultural enterprise to research in respect of related production systems or technological innovations. Examples of enterprises may include organic agriculture, olives, alpacas and genetically modified cotton. At the conclusion of the research, each group presents an appraisal of their enterprise, in the form of a one page summary, based on:</p> <ul style="list-style-type: none"> – economic viability and trends – environmental impact/consequences – managerial/lifestyle aspects. <p>Each group also makes an oral presentation, which is a basis for class discussion on the viability or profitability of existing enterprises and the need for alternatives. Each group’s summary is copied and distributed to all class members.</p> <p>Identify new agriculture enterprises or technologies in order to compile a relevant list for both plant and animal production systems. This provides background information for the choice of the alternative agricultural production system to be studied.</p> <p>Class discussion to analyse each case study that has been identified in terms of the type of research needed prior to the commencement of a new enterprise. Students draw up a checklist of areas requiring research. These should include: existence of markets, profitability, specialised equipment and expertise required, availability of inputs, expected time-frame for returns, difficulties with rules and regulations.</p> <p>Select one alternative production system for class study, eg organic vegetable growing.</p> <p>Visits to a local organic vegetable farm and market.</p> <p>Teacher-prepared worksheets and practical experiences on the following are to be covered :</p> <ul style="list-style-type: none"> • general management of different varieties of vegetables • use of crop rotation, free range poultry, composting, worm-farming, seedling production, tillage, water management, non-chemical pest control • understanding legal and institutional requirements of organic production.

Students learn about:	Strategies and activities
<ul style="list-style-type: none"> • innovation, ethics and current issues by: <ul style="list-style-type: none"> – 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 • research methodology and presentation research by: <ul style="list-style-type: none"> – analysing a study of the development and implementation of one alternative agricultural production system or technology 	<p>Class discussion on relevant local government requirements and appropriate State and Commonwealth regulations.</p> <p>Testing, certification, product specification:</p> <ul style="list-style-type: none"> • social issues relating to marketing of organic products • marketing techniques, both on-farm sales through shops and wholesale markets via dedicated merchants • construction of marketing chain for salad-lettuce • trends in supply and demand of various vegetables. <p>Revise and outline possible research methods and presentation styles:</p> <ul style="list-style-type: none"> • use of existing data • graph value of organic vegetables over a period of time using ABARE figures • conducting trials or experiments to gather new data • quantitative trial on a production aspect, eg comparison of seedling-raising techniques • qualitative trial on marketing aspect, eg survey of consumer preferences. <p>Research assignment. Students conduct a study of the development and implementation of one other alternative production system. This should include all the points covered in class study and must include an analysis of data from research previously done in some area of production marketing for their chosen system. Written report (length approximately 1000 words).</p>

5.2 Plant management

Suggested Time Allowed: 18 hours

Rationale

The HSC course structure provides opportunities for students either to undertake a research project or complete two electives. Electives provide opportunities for teachers to utilise student-centered learning activities such as contract systems.

Students studying the electives need specific programmed strategies and activities in order to both learn about the related syllabus content and develop skills in research methodology and the presentation of research results.

Resources

Books:

Campbell, K, and Bowyer, J, (eds), *The Scientific Basis of Modern Agriculture*, Sydney University Press, Sydney, 1988.

King, R J and Sullivan, F M, *Senior Biology*, Longman Cheshire, 1991.

Lovett, J V, Parbery, I H and Guest, R J, *Australian Agriculture: Plant Production Systems*, University of New England, Armidale, 1982.

Mundi, K and Brotherton, J, *Core Biology*, Heinemann, 1985.

Resource Kit:

Independent Commission Against Corruption, *Design and Technology – Valuing Our Work*, resource kit available from GPO Box 500, Sydney, NSW, 2001.

Phone (02) 9318 5999, Fax (02) 9699 8067.

Websites:

Australian Agriculture on Line <http://www.agriculture.net.au>

Australian Agriculture Index <http://agnet.com.au/>

NSW Agriculture <http://www.agriculture.nsw.gov.au/>

Assessment:

Teachers should note that the electives and the research project have the same syllabus outcomes. Formal assessment tasks should reflect this syllabus requirement.

In addition, a research assignment based on a commercially important agricultural plant is included in the program.

Elective Outcomes

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

H4.1 applies appropriate experimental techniques, technologies, research 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.

Students learn about:	Strategies and activities
<ul style="list-style-type: none"> • processes in agricultural systems by: <ul style="list-style-type: none"> – 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 – describing the vegetative and reproductive anatomy of commercially grown plants in relation to their function – outlining the role of plant hormones in plant growth and development • innovation, ethics and current issues by: <ul style="list-style-type: none"> – 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 	<p>Draw and label major parts of an agriculturally significant monocot, eg sorghum and dicot, sunflower Construct a table to outline major functions of roots, stems, leaves, flowers, fruits and seeds</p> <p>View prepared slides of monocot and dicot plant tissue and draw and label cell structures in roots, stems and leaves</p> <p>Construct a table linking cell structures to plant function Review photosynthesis (include equation, constraints and consequences for growth and development)</p> <p>Through an osmosis experiment, explain water and nutrient uptake in a plant</p> <p>Conduct fertiliser tests on potted sample plants, eg oats Review nutrient cycling in relation to soil fertility and nutrient uptake in a plant</p> <p>Draw the following flower samples labelling the male and female structures:</p> <ul style="list-style-type: none"> • monoecious - pumpkin and corn • dioecious - pecan and pawpaw • bisexual - tomatoes, beans and peas <p>Outline the process of pollination, fertilisation and seed formation</p> <p>Prepare a table outlining major plant hormones (auxins, gibberellins, cytokinins, ethylene, abscissic acid) their effect on the plant and the existence of commercial formations</p> <p>Undertake a series of trials to demonstrate the effect of plant hormones (written up in practical books):</p> <ul style="list-style-type: none"> • use of bananas to ripen tomatoes (ethylene) • hormone powders to stimulate root growth • gibberellic acid to stimulate stem elongation • 'bonzai' to retard vegetative growth and speed up flowering • commercial hormone preparations to increase fruiting/fruit set • weed killers containing hormones • pre-prepared vials for tissue culture

Students learn about:	Strategies and activities
<ul style="list-style-type: none"> • processes in agricultural systems by: <ul style="list-style-type: none"> – explaining how plant density may affect the vegetative and reproductive yields • innovation, ethics and current issues by: • outlining technologies that produce and distribute new plant genetic material, including genetic engineering, tissues, grafting, budding and hybridising • 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 	<p>Plant density trial – divide class into two groups. Group 1 – sets up a trial using radishes planted at three different densities to determine vegetative yield in response to density. Group 2 – sets up a trial using oats planted at three different densities to determine reproductive yield in response to density. Both trials must be designed in accordance with biometrical principles introduced in the Preliminary course. Methods, results (including graphs) must be written up in practical books.</p> <p>Library/Internet research task (class divided into groups of 3–4 Students); each group researches one reproductive technique from genetic engineering, tissue culture, grafting and budding, hybridising, giving specific examples of plants reproduced using these techniques. Following a brief oral presentation by each group, their one page summary is copied and distributed to all class members. This prepares students for a guest speaker.</p> <p>Class discussion on the current issues involved in the production of genetically modified foods.</p> <p>Organise a guest speaker from a plant nursery or research station or an agronomist to outline their work in the production of hybrid lines including research methods and production techniques. Following questions and answers, students write a report which evaluates the research and experimental techniques of the specific plant breeder in meeting his production goals.</p>

Students learn about:	Strategies and activities
<ul style="list-style-type: none"> • innovation, ethics and current issues by: • 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 	<p>Research assignment. With the assistance of the teacher, each student selects a commercially important agricultural plant and presents a detailed study (written report) which covers the following factors that maximise sustainable production:</p> <ul style="list-style-type: none"> • diagram of plant and parts • soil fertility requirements • moisture requirements • seasonal requirements of light and temperature • pest and disease problems • management in manipulating the above production. <p>Length: 1000 words approximately.</p>

6 Developing an Internal Assessment Program

The development of assessment schedules for both the Preliminary and HSC courses can be achieved through the mapping of tasks to the syllabus components and related course outcomes as is indicated in the sample HSC internal assessment schedule below.

When developing an internal assessment schedule for Agriculture, the pattern of study in relation to the optional research project and/or the electives will influence the way in which the schedules may be developed.

Internal HSC Assessment Schedule

HSC Course Outcomes	Course Components	Syllabus Weightings	Task 1	Task 2	Task 3	Task 4	Task 5
			Due Date T4 W6	Due Date T3 W1	Due Date T2 W2	Due Date T1 W6	Due Date T3 W8
H1.1 H2.1 H2.2	Plant/animal production	45				25	20
H3.1 H3.2 H3.3 H3.4	Farm/product study	25		15			10
H3.4 H4.1 H5.1	Research Project OR Electives (2)	30	10		10		10*
	Marks	100	10	15	10	25	40

A mark for the completed major project must NOT be used for internal assessment purposes.

Teachers should note that the research project and electives have the same syllabus outcomes. Formal assessment tasks should reflect this syllabus requirement.

Task outline:

Task 1. Report on a trial that shows the use of experimental technique, technologies, data analysis and presentation.

Task 2. Practical test: Assessment of the quality of a plant or animal system.

Task 3. Open book examination on innovation, ethics and current issues in relation to either the relevant electives or the research project.

Task 4. Oral presentation on sustainable production techniques for either a plant or an animal.

Task 5. Trial HSC.

- * For students completing the Research Project, this component of Task 5 could be the submission of a report on how they considered various forms of presentation for their research findings.