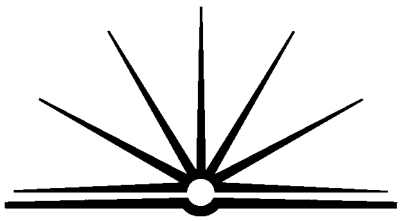

BOARD OF STUDIES
NEW SOUTH WALES

1999 HSC

Agriculture

Notes from the Examination Centre

Acknowledgements

Question 2, Table,	Australian Pork Corp., *Australian Pork Corporation Annual Report 1997/98*, St Leonards, 1998, p 14
Question 7, Graph,	Lovett JV & Scott JM, *Pasture Production and Management*, Inkato Press, Port Melbourne, 1997
Question 8b, Figure,	Wilson D & Bauer M, *Dynamic Science*, McGraw Hill, Roseville, 1991, p 91

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Contents

1999 Higher School Certificate
Agriculture
Notes from the Examination Centre

The total number of candidates presenting for Agriculture in 1999 was 2028, of whom 1793 presented for 2/3 Unit (Common) and 235 for 3 Unit.

2/3 Unit (Common)

Section I

Question 1

Name ONE farm product you have studied.

(a) State ONE feature of quality of the product.

(b) Describe how this feature affects the price received for the product by the farmer.

(c) Describe TWO actions a farmer may take to maximise the quality of the product before it leaves the farm.

(d) Give ONE example of feedback the farmer may receive on the quality of the product.

(e) Farmers do not always make changes to management in response to feedback. State TWO reasons for this.

(f) Explain how a factor, other than quality, may affect the price received for the product by the farmer.

(g) Explain how off–farm agencies or organisations may contribute to marketing of the product.

(h) Outline a possible strategy for value adding to increase returns from the product.

No marks were awarded for naming the farm product studied.

(a) The majority of candidates stated one feature clearly eg. % marbling, high protein in wheat, % butterfat in milk, stem length in roses.

(b) To gain full marks the candidates had to link part (b) to (a). Most students showed a good knowledge of how the feature in (a) affected the price received.

(c) Most candidates were able to list two actions carried out by a farmer to improve quality. The better candidates were able to describe how the farmer's action maximised quality. eg. A farmer may (if he/she feels the protein level may be low) decide to apply a late application of high nitrogen based fertiliser (such as drilled urea) at a fairly late stage in the growth, to raise grain protein levels.

(d) Most candidates had a clear idea of an example of feedback and gained the mark for the question, eg kill sheets from the abattoir, sample from wool clip

(e) This question was well answered by most candidates. They were able to identify reasons, eg it is the traditional way of doing the task, impractical to change due to economic circumstances.

(f) The majority of candidates identified one factor other than quality, eg over-supply of product, reduced demand from consumers. To get full marks there needed to be some explanation of how the factor affected the price.

(g) This question was answered poorly by most candidates. Lower scoring candidates were those who identified methods of marketing but did not comment on how they contributed, eg 'these organisations can help by promoting and advertising'. The better candidates linked promoting and advertising to the product by using a specific example, eg 'The Australian Wheat Board controls most international trade and sets the international price via promotion and seeking overseas markets'.

(h) The majority of candidates failed to distinguish between value adding and normal production techniques. Maximum marks were awarded to candidates who were able to state clearly a value adding technique and describe how it adds value to the product, eg flavouring milk increases its appeal to children so parents will pay a higher price than for standard milk; prime hard wheat changed into bread flour and the bread is higher in value. Lower protein wheats (soft wheats) go into biscuits.

Question 2

TABLE 1. NUMBER OF PIGGERIES AND BREEDING FEMALES IN AUSTRALIA, 1960–1995

Year	*Number of Piggeries (thousands)*	*Number of breeding females (thousands)*
1960	*50*	*305*
1965	*40*	*310*
1970	*30*	*320*
1975	*24*	*305*
1980	*20*	*305*
1985	*8*	*315*
1990	*5*	*305*
1995	*3*	*310*

(a) (i) Graph the data from Table 1 on the grid below.

(ii) From the graph, estimate the number of piggeries in 1982.

(iii) Describe the trends shown in the data you have plotted.

(iv) Give a possible explanation for the above trends.

(b) (i) Describe TWO factors a farmer may consider before borrowing money.

(ii) Outline a strategy, other than borrowing money, that a farmer may implement to manage economic sustainability.

(a) (i) The graph was generally well done. Common mistakes included:

- failing to label each axis correctly
- failing to provide a correct scale on each axis
- placing two different scales on the x-axis
- poor plotting where graphs could not be read easily.

(ii) The responses were often incorrect. Many candidates were careless. They used the incorrect unit eg.15 piggeries instead of 15000 piggeries. This question required the candidate to take the data from their own graph. If they had lost marks by not labelling their graph correctly, they were not penalised by getting the wrong figure from the graph for this part.

(iii) Most candidates recognised that the two trends were that piggery numbers had steadily decreased and the number of breeding sows had fluctuated over time.

(iv) Candidates had to provide accurate explanations for the cause of the trends. The better responses described the effect of economies of scale and the cost/price squeeze on the pig industry leading to both trends. Both trends had to be described to gain full marks.

(b) (i) Candidates had to clearly describe two different factors that farmers consider when borrowing money. Better responses included considering interest repayments, existing assets and liability and equity in the property. Full marks were only awarded to candidates who went on to describe the factors.

(ii) Candidates who only named a strategy were awarded half marks. Full marks were awarded to candidates who outlined how the strategy allowed the farmer to manage economic sustainability eg. diversification, breeding for niche/specific markets, using detailed budgeting techniques and farm planning. Many candidates continued to use examples from the pig industry for (b)(ii). This was not a requirement of the question.

Question 3

A farmer noticed that grazing animals were eating soil from one area (Area A) of a paddock, but not from the remainder of the paddock (Area B).

Soil samples were taken from each area and sent to a laboratory for analysis.

(a) Describe the actions the farmer would have taken to ensure that the soil sent to the laboratory provided reliable results.

The laboratory analysis revealed the following results for each area.

TABLE 2. RESULTS OF SOIL ELEMENT ANALYSIS

Soil Element Tested	*Amount of Element (mg/kg soil)*	
	Area A	*Area B*
Zinc	*53*	*52*
Iron	*20 655*	*15 536*
Copper	*6*	*8*
Phosphorus	*125*	*124*

(b) From the laboratory results, state which element is most likely to cause the animals to eat the soil.

(c) On the basis of these results, suggest further investigations that could be undertaken.

(d) Identify the statistical limitations of the data presented in Table 2.

(a) Most candidates were able to give a good description of how farmers should take and send soil samples. The best candidates included two well described actions, eg taking several samples from both areas, ie replication; taking samples in an unbiased way ie. randomisation; keeping collected samples separate and clearly labelled. Candidates who only listed scored lower marks.

(b) The majority of candidates identified iron as the element most likely to cause animals to eat soil.

(c) Most candidates understood the question and suggested further investigations that could be undertaken. The best candidates outlined at least two investigations, eg fertiliser trials, nutritional supplement trials, plant/animal tissue tests, further soil tests, eg pH, salt. No marks were awarded to students who suggested repeating the same investigation.

(d) Many candidates failed to identify a statistical limitation of the data presented. Better candidates were able to identify two limitations, eg only a limited number of elements tested, no stated limits of the normal range for elements tested given, no mean or standard deviation for data given.

Section II – Short-response Answers (45 marks)

Question 4

(a) For an animal production system you have studied, answer the following questions.

(i) List THREE characteristics a farmer may select for, as part of a genetic improvement program for this animal production system.

(ii) For a named characteristic listed in part (a)(i) above, explain why this characteristic is considered desirable.

(iii) Suggest reasons why the farmer is not always successful in breeding animals with the desired characteristics.

(b) Explain how farmers can use objective measurement and associated data in animal production systems.

(c)

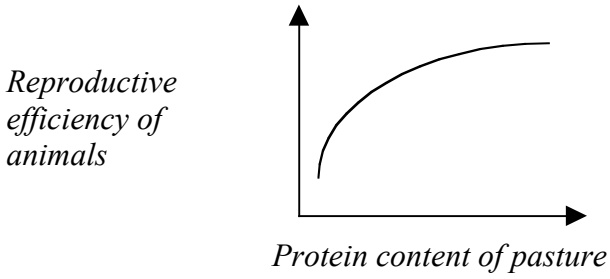

FIG. I EFFECT OF PROTEIN CONTENT OF PASTURES ON REPRODUCTIVE EFFICIENCY OF ANIMALS

(i) From the information presented in Figure 1, describe the relationship between protein content of pastures and reproductive efficiency.

(ii) Outline TWO management practices a farmer may use to optimise the protein content of pastures.

(iii) Describe TWO management techniques a farmer may use to optimise intake of available pasture protein.

(iv) Describe how the reproductive efficiency of animal production systems may be determined.

(v) List THREE factors, other than nutrition, that may affect the reproductive efficiency of animal production systems.

72% of candidates attempted this question.

(a) (i) The majority of candidates were able to list, using correct terminology, at least two specific characteristics a farmer may select for as part of a genetic improvement program for an animal production system, including for example, conformation, fecundity and wool fibre diameter. Lower scoring candidates

merely listed general characteristics eg wool or meat, or used non-specific terminology eg good wool or good genetic history.

(ii) The majority of candidates were able to relate the chosen characteristic to an increase in production. Better scoring responses linked the characteristic to profitability, demand and/or markets.

(iii) Higher scoring candidates were able to identify and describe at least two reasons why farmers are not always successful in breeding animals with the desired characteristics (for example, low heritability, poor management and pests and diseases). Low scoring candidates commonly stated that some desired characteristics occur as a result of a recessive gene.

(b) Low scoring candidates often described how measurements are made or simply listed a number of measurements including EBVs, liveweight gain and FCR without stating how they are used.

High scoring candidates gave examples of objective measurements or associated data and explained how they are used to improve production, by stating, for example: 'By ultrasounding for fat depth or marbling the farmer can determine when to alter rations to finish animals at an optimal time and EBVs are used to select bulls with high weight gains to improve overall herd production.'

(c) (i) The vast majority of candidates stated that reproductive efficiency improves as pasture protein content increases. Higher scoring candidates included a statement about the upper limit to reproductive efficiency at high levels of pasture protein content.

(ii) High scoring candidates correctly described two valid ways to optimise protein content of pastures, stating, for example 'Sowing legumes such as field peas as a rotation increases available soil nitrogen for subsequent grass pastures to convert into pasture protein. Sowing legumes such as clover as part of a mixed grass/legume pasture also increases available soil nitrogen for the grasses and produces an overall increase in total pasture protein.'

Poor scoring candidates simply listed practices such as irrigating and applying fertiliser without qualifying how these practices lead to optimal pasture protein. Many candidates incorrectly referred to soil protein rather than soil nitrogen.

(iii) High scoring candidates correctly described two strategies that optimise intake of available pasture protein, stating, for example 'Strip grazing optimises intake as it minimises pasture wastage through trampling. Grazing at appropriate stocking rate optimises intake of palatable pasture.'

Low scoring candidates often did not understand the question and simply stated techniques that increase soil nitrogen, such as applying fertiliser, but do not directly optimise pasture intake.

(iv) Most candidates were able to describe at least one method of determining reproductive efficiency, for example, lambing rates describes the number of lambs born in mob as a percentage, and weaning rate describes the number of lambs weaned in a mob as a percentage.

(v) Most candidates were able to list 3 different factors that affect reproductive efficiency, such as breed of the animal, management and environment. Low scoring candidates often stated the animal's environment as a factor and then simply restated specific environmental factors such as high temperatures and low temperatures.

Question 5

(a) Figure 2 illustrates the effect of the numbers of harmful soil organisms in a paddock on the yield of a crop over five years. Note that no crop was grown in Year 3 (fallowing).

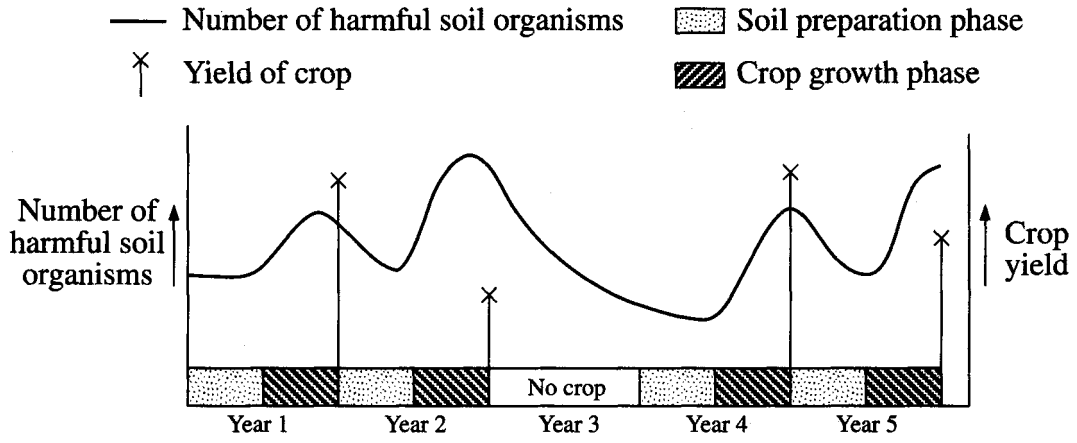

FIG. 2. RELATIONSHIP BETWEEN HARMFUL SOIL ORGANISMS AND CROP YIELD

(i) From the data presented in Figure 2, give a reason why crop yield has decreased in Year 2 and Year 5.

(ii) Give reasons for the trend in the number of harmful organisms in Figure 2.

(iii) Name a management strategy, other than fallowing or using chemicals, and describe how this strategy may reduce the number of harmful soil organisms.

(iv) Name a soil organism that may benefit plant production.

(v) Explain how this named organism can improve plant production.

(b) For a plant production system you have studied, answer the following questions.

(i) Describe TWO reasons why the farmer has chosen this plant production system.

(ii) Name a pest or disease of the named plant production system.

(iii) Describe how this pest or disease affects the productivity of the plant production system.

(iv) State THREE factors a farmer may consider before deciding to use a chemical agent to control pests or diseases.

(v) For one of the factors mentioned in part (iv) above, explain why this factor must be considered.

(vi) Describe how a factor outside the farmer's control may affect the impact of pests or diseases.

70% of candidates attempted this question.

(a) (i) The majority of candidates were able to state that the crop yield decreased in Year 2 and Year 5 because of an increase in harmful soil organisms from the previous year.

(ii) Higher scoring candidates gave explanations for the trends by stating that the number of harmful soil organisms were reduced during the soil preparation phase due to cultivation breaking the life cycle of the organism and/or reducing soil organic matter which acts as a food source for the organism. A second explanation included a reference to the fact that when the crop was grown over two successive years the soil organic matter increased causing an increase in organism numbers and lower yield in the second year. Lower scoring candidates simply listed trends such as, build up of pests with cropping, and pests decrease with fallow year and during soil preparation phase.

(iii) Most candidates were able to name a relevant strategy such as crop rotation. The better answers provided information describing how it decreased the number of harmful organisms by providing an inappropriate food source for the organism thus breaking its life cycle.

The poorer candidates simply stated a suitable strategy.

(iv) Most candidates named a soil organism that may benefit plant production, such as Rhizobium.

(v) The better candidates managed to provide three points about the ways the organism was beneficial or described stages in a process. These candidates then related that process to a specific production improvement such as an increase in leaf area or yield. For example, nitrogen-fixing bacteria, both free-living and symbiotic such as Rhizobia, can transform atmospheric nitrogen into nitrates to be used by the plant. Nitrogen-fixing bacteria improve levels of soil nitrogen therefore improving plant growth and yield.

The weaker candidates made one or two points about processes related to the organism only. Many candidates failed to relate the processes of the organism to the improvement in plant production.

(b) (i) The better candidates provided two well described reasons why the farmer had chosen the named plant production system, stating, for example:

1. Potatoes are high yielding crops in the cooler coastal and tableland zones.

2. There is constant demand for potatoes in the manufacturing sector for making crisps meaning less risk for price drops.

Poorer responses merely stated, for example

1. The soil is suitable.

2. The climate is suited to potatoes.

(ii) Most candidates managed to name a pest or disease such as the potato moth.

(iii) High scoring candidates provided responses, such as: Potato moth larvae burrow into developing tubers leaving faeces and destroying tubers, thus lowering the quality of the product and decreasing the quantity of saleable product.

Poorer quality responses did not provide sufficient description of the effect and failed to indicate the way the pest or disease affected production, eg Aphids are sap suckers and without food plants are not productive.

(iv) Most candidates were able to state three factors the farmer would need to consider before deciding to use a chemical agent, including cost of the chemical, long-term environmental effects of the chemical, availability/cost of equipment needed for its application.

(v) The candidates scoring full marks gave a well-developed description of the way the factor needed to be considered and then related this to a consequence. For example, residues from the chemical may remain in the tuber that can be potentially harmful to humans who eat the potato. Similarly any animals that eat the potato may be harmed or contaminated.

Poorer candidates made statements such as ‘IPM may be cheaper and safer’.

(vi) Most candidates identified a factor outside the farmer’s control and were able to state its relationship to the pest or disease. For example, dry climate causes the soil to crack so it is easier for the moth to lay eggs near the potatoes leading to a greater likelihood of damage from the larvae.

Question 6

(a) TABLE 3. PRODUCTION DATA FOR TWO FIELD CROPS ON A NSW FARM IN 1997

Factor	*Crop A*	*Crop B*
Yield (t/ha)	*2.5*	*3.0*
Fertiliser costs ($/ha)	*50*	*20*
Chemical and fuel costs ($/ha)	*75*	*85*
Seed costs ($/ha)	*45*	*35*
Price received ($/tonne)	*200*	*180*
Bank interest charges ($)	*10 000*	
Shire rates ($)	*7 000*	

(i) From the data in Table 3, calculate the gross margin for each crop. Show all working.

(ii) State which crop was the most profitable.

(iii) It is not always desirable for a farmer to grow the crop that would provide the most profit in the short term. Describe why a farmer may decide to plant the less profitable crop.

(iv) State TWO factors that can affect the price received ($/tonne) for a crop.

(v) List THREE factors other than price that a farmer may consider before deciding to introduce a new crop.

(b) Some farming activities have harmful effects on the farm and beyond the farm boundary.

(i) State ONE such activity and describe its harmful effects.

(ii) Describe actions a farmer may take to minimise the possible harmful effects.

(iii) Describe how a farmer may evaluate the effectiveness of one of the actions you have listed in part (ii).

(c) Table 4 illustrates the effect of a summer rain storm on five experimental plots of cropping land.

TABLE 4. EFFECT OF RAINFALL RUN–OFF ON SOIL LOSS

Treatment plot	*Run–off (% of storm rain)*	*Soil loss (tonnes/hectare)*
Stubble burnt	*83*	*100*
Stubble incorporated	*41*	*5*
Stubble mulched	*45*	*2*
Summer crop	*16*	*2*
Zero tillage	*2.0*	*negligible*

(i) Suggest a reason for the high soil loss in the 'stubble burnt' treatment.

(ii) Explain why farmers may choose to burn stubble.

(iii) State THREE factors, other than those listed in Table 4, that can affect the level of soil erosion.

72% of candidates attempted this question.

(a) (i) A small number of candidates achieved full marks for this question. Most candidates had difficulty in identifying variable costs and expressing the gross margin in $/ha. Many candidates demonstrated that they had a poor understanding of how to manipulate the given numbers in order to calculate a gross margin. High scoring candidates identified income and variable costs for both crops, and set out their working clearly, showing that the GM for crop A was $330/ha and crop B was $400/ha.

(ii) The majority of candidates were able to identify that the crop from (i) with the highest gross margin was the most profitable, that is Crop B, even if they showed little understanding of how to calculate it.

(iii) Higher scoring candidates were able to give a well-described reason for selecting the less profitable crop. For example, the less profitable crop may be more resistant to pests/diseases thus requiring less pesticide and therefore is more environmentally sustainable. Lower scoring candidates simply named one or more reasons with no description.

(iv) Most candidates were able to state two factors, such as quality and demand for the crop, that affect the price received. Poorer responses demonstrated that the candidate did not interpret the question correctly giving answers such as weight produced.

(v) The majority of candidates were able to list 3 factors such as

1. Suitability to climate
2. Nutrient requirements
3. Specialist machinery needed for sowing/harvesting.

(b) (i) The majority of candidates stated one harmful activity. A small proportion stated nouns such as pesticides (instead of a verb, such as spraying pesticides). This response scored no marks. A number of candidates incorrectly stated the effect, for example, degradation, as the activity.

A significant proportion of students did not clearly state both on-farm and beyond-farm effects of the activity. The better candidates named and described at least one on-farm and one beyond-farm effect.

(ii) Many candidates only listed the actions without any description. The better candidates clearly described two or more actions that would minimise the harmful effects.

(iii) Maximum marks were awarded to candidates who were able to name a specific technique used to measure one of the harmful effects for (ii) and determined the effectiveness by comparing results over time, or before and after the change. Poorer scoring candidates made general statements such as "collect data".

(c) (i) The majority of candidates realised that the stubble burnt treatment would result in removal of plant/vegetation cover, and thus leaves the soil bare for erosion by water.
Better responses noted the effects of stubble burning on binding soil, slowing the run-off of storm rain, and possible damage to surface soil structure.

(ii) The majority of candidates were able to name one or more reasons why farmers burn stubble. Full marks were awarded to responses which gave one or more well explained reasons, for example, stubble is burnt to kill any disease-causing organisms which may be present such as Take all. This reduces the risk of infection of the following crop. Poorer responses demonstrated a limited understanding of soil science and included responses such as 'burning the soil'.

(iii) Most candidates scored well in this question by stating three factors affecting soil erosion, eg overgrazing of pasture, slope of the land, overclearing of trees. The poorer candidate gave very general factors such as animals or rocks, which were awarded zero marks. Poorer candidates also mentioned secondary causes of erosion such as high water tables.

Question 7

(a) Figure 3 represents data from a dairy farm in the coastal district of NSW and shows:

- *the typical production patterns for a permanent grass/legume pasture and an annual grazing crop; and*
- *the feed requirement for the milking herd with a stocking rate of TWO cows per hectare.*

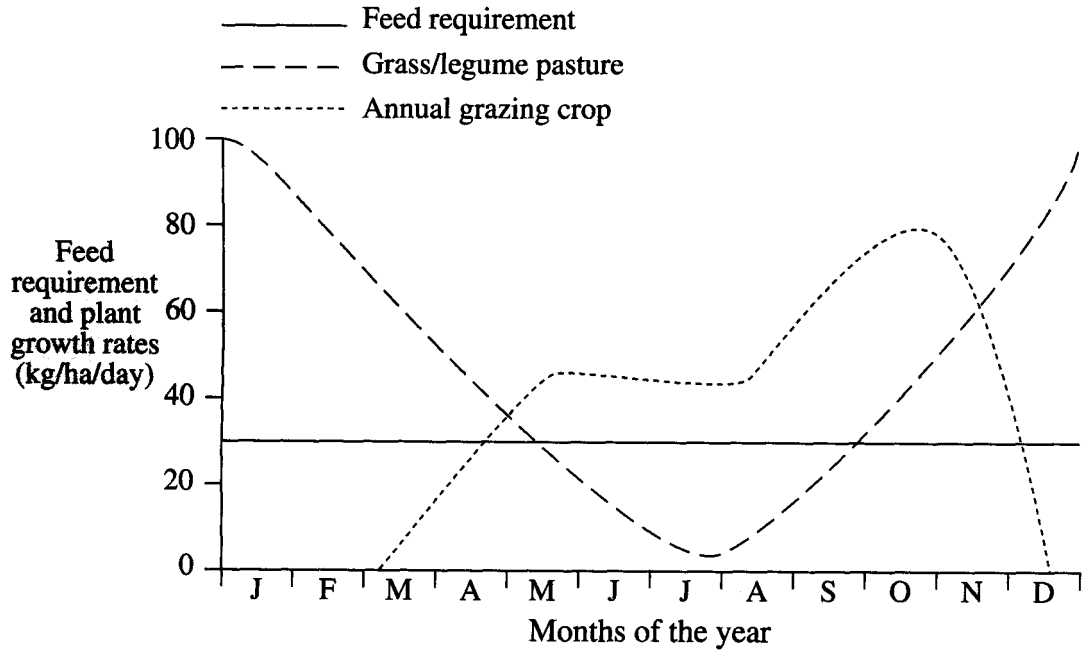

FIG. 3. PLANT GROWTH RATE AND ANIMAL FEED REQUIREMENT

(i) From Figure 3, calculate the feed requirement of one cow per day.

(ii) State the main reason for including the annual grazing crop in the farm's feed production program.

(iii) Outline a reason for the reduced plant growth rate between May and July.

(iv) Grass/legume combinations are important in productive sustainable pastures. Suggest TWO roles played by each type of plant.

(b) Figure 4 shows the life cycle of the cattle tick. This tick is an external parasite of cattle.

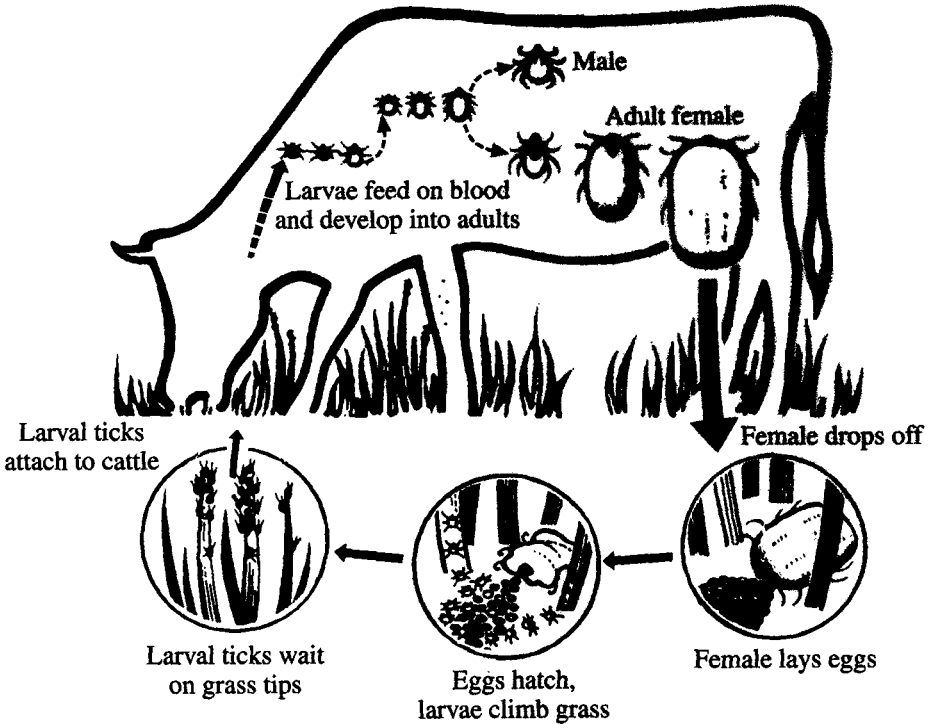

FIG. 4. THE LIFE CYCLE OF THE CATTLE TICK

(i) Describe the role of the host animal in the life cycle of the cattle tick.

(ii) Describe the role of the pasture in the life cycle of the cattle tick.

(iii) State TWO factors that could increase the number of laval ticks. Give reasons for your answer.

(iv) The farmer could use integrated pest management (IPM) techniques to reduce the number of parasites on this host animal. For a named pest or disease organism of an animal you have studied, describe a suitable IPM strategy.

(c) Read the following extract from a newspaper article and answer the questions that follow.

'An abattoir has warned a local piggery operator that pork recently processed has tested positive for the presence of antibiotics.

The evidence suggests that the producer has failed to observe the full withholding period required for the medication.'

(i) State reasons for the use of antibiotics in intensive animal production systems such as piggeries.

(ii) Describe what is meant by 'withholding period'.

(iii) State TWO animal welfare issues that must be considered by the farmer in intensive animal production systems.

75% of candidates attempted this question.

(a) (i) The majority of candidates were able to calculate the feed requirements as 15 kg/ha/day.

(ii) Most candidates were able to recognise that the annual grazing crop filled the feed gap left by the grass/legume pasture during the winter months and this provided the herd with a sufficient feed requirement all year round.

(iii) Higher scoring candidates outlined a reason for reduced plant growth and an explanation, for example, 'the crop cannot grow well in the winter season as there is reduced sunlight and low temperatures which adversely affect, both photosynthesis and respiration and therefore plant growth rate is low. Lower scoring candidates simply stated that winter reduced plant growth.

(iv) Candidates were generally able to suggest two roles played by both grasses and legumes. Higher scoring answers suggested not only roles within a plant production system but also within a grazing system, for example, legumes provide high quality pasture protein and grasses provide roughage needed by grazing ruminants. Lower scoring answers tended to repeat the same suggestion for both plants or merely indicated that they provided nutrition for animals.

(b) (i) Many candidates simply stated that 'larvae feed on blood and develop into adults, a response copied directly from the stimulus diagram. Higher scoring candidates were able to expand on the role of the host, including providing a suitable environment for breeding, protection from predators, by stating for example, 'the host provides a suitable environment and food source (blood) to enable the larvae to develop to adult stage capable of reproduction'.

(ii) Most candidates were able to describe the role of the pasture as being a medium into which the female tick lays eggs and as a means of reaching the host (cattle). High scores were recorded by candidates who described, for example how the pasture acts as protection for the egg-laying females and is used as a 'bridge' by the larvae to reach the host.

(iii) Higher scoring answers linked two factors to reasons for increased numbers of larval ticks, for example, 'increasing stocking rates increases the number of hosts and hence increases the number of eggs laid and larval ticks hatched'. Factors regarding suitable climate and environment for increasing numbers were common answers. Lower scoring candidates tended to list factors without stating reasons.

(iv) No mark was awarded for naming an animal.

The majority of candidates were successful in obtaining full marks in this question. Most could name a pest or disease related to the named animal.

Maximum marks were gained if a candidate could describe at least two strategies to control the named pest/disease therefore indicating their knowledge of Integrated Pest Management –biological, chemical, management etc. Poorer candidates simply described one strategy and did not describe a variety of control methods.

(c) (i) This question was generally poorly answered with candidates unable to state reasons for the use of antibiotics in intensive animal production systems. Higher scoring responses discussed the control of disease and linked this to an increase in feed conversion ratio and hence growth rates and overall production. For example, 'Antibiotics increase growth rates and feed conversion ratios which decrease the cost of feed. They help prevent bacterial infections also leading to increased production and profit'. Most students simply linked antibiotics to controlling disease.

(ii) For maximum marks the candidate needed to link a time period from application of a chemical/antibiotic to a specific event such as slaughter. For example, 'the withholding period is the minimum time elapsed between the application of an antibiotic and when the animal is slaughtered.'

(iii) This question was generally well answered with most students able to state an issue of importance to animal welfare, for example, 'avoiding over-crowding', 'providing sufficient nutrition to animals', and 'reducing stress on animals'.

Section III

Question 8

(a) *Using examples, describe techniques or strategies that lead to improved plant production through the manipulation of:*

(i) *soil moisture;*

(ii) *mineral nutrients.*

(b) [See examination paper for figure].

Using the above figure, complete the table below.

Part	*Plant part*	*Function*
a		
b		
c		

(c) *Using examples, outline the benefits to plant production systems of:*

(i) *hybridisation;*

(ii) *tissue culture.*

(d) *The following headline appeared in a recent rural newspaper.*

'The gene technology revolution: What's in it for farmers?'

– *Briefly describe the processes involved in genetic engineering (gene technology).*

– *Using examples from plan production systems you have studied, outline the benefits of genetic engineering.*

10% of candidates attempted this question.

(a) (i) The majority of candidates successfully identified examples that lead to improved plant production eg irrigation, mulching, windbreaks. Maximum marks were awarded to those candidates who were able to link the management technique to improving plant production eg irrigation can be used to supplement natural rainfall. It ensures that a lack of water does not limit photosynthesis and thus production.

(ii) This question was answered similarly to above with candidates identifying examples. However, to receive full marks students needed to link their example to the technique or strategy, eg the application of fertilisers, eg NPK increases the amount of mineral nutrients in the soil. An increase in nutrients will result in increased photosynthesis and hence production.

(b) Most candidates correctly named some of the plant parts and their function but less than 40% of candidates gained full marks for the question.

(c) (i) Very few candidates were able to outline the benefits of hybridisation. Higher scoring responses contained an example and a good explanation of hybridisation, eg hybridisation by crossing two varieties of a plant produces new plants with superior characteristics to either parent(hybrid vigour/heterosis) eg triticale-greater tolerance to low pH, higher yields, standardisation of maturity.

(ii) Many candidates had only a superficial understanding of tissue culture. The majority had some knowledge of the basic process but failed to describe adequately the role of tissue culture in giving benefits to plant production systems. To get full marks candidates needed to give examples which demonstrated their knowledge of the process of tissue culture. A number of candidates talked about grafting in this question.

(d) First Part

Many candidates had very limited knowledge of the processes involved in genetic engineering. A significant number confused GE with other forms of plant breeding. The better responses were able to clearly identify at least four steps in the process of genetic engineering.

Second Part

Candidates had difficulty in providing an adequate number of specific examples of genetic engineering and the associated benefits to plant enterprises. Higher scoring candidates were able to give at least two specific examples and their associated benefits to plant enterprises, eg BT or Ingard Cotton with subsequent reduced use of herbicide and less chance of herbicide resistance.

Question 9

(a) The growth curves for two genetically identical animals are shown in Figure 6 below.

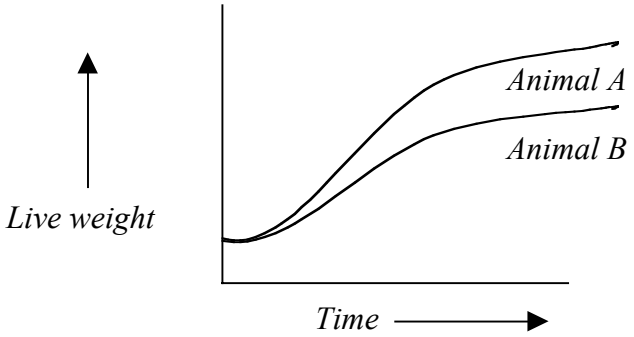

FIG. 6. GROWTH CURVES

(i) Explain how the use of manufactured chemicals or hormones may affect growth and development.

(ii) State TWO possible reasons, other than the use of manufactured chemicals and hormones, why Animal A has outperformed Animal B in terms of live–weight gain.

(iii) Describe ONE situation in which Animal B may be preferred to Animal A.

(b) (i) Define the terms 'antigen' and 'antibody'.

(ii) Explain how a vaccine can be used to develop long–term immunity to disease.

(c) For a named disease of an animal production system you have studied, answer the following questions.

Explain possible disadvantages of ONE management practice used to control this disease.

(d) Using appropriate terms, explain why energy ingested by an animal is not fully available for maintenance and production.

Explain the advantages of the ruminant digestive system.

26% of candidates attempted this question.

(a) (i) This question was poorly answered. Many candidates failed to detail any specific manufactured chemicals or hormones. The better answers used specific examples, eg Ralgro, food additives and chemicals in chicken starter pellets,

and linked their use to growth and development traits, eg Ralgro contains testosterone which increases muscle growth.

(ii) This question was well answered. Some candidates used manufactured chemicals or hormones and did not get the marks. Good examples included stress, climate, nutrition.

(iii) The most popular response for this question was providing examples suiting specific markets. Candidates who provided a reasonable description of an Agricultural situation scored the highest marks. Candidates needed to consider the information in the graph before making a response.

(b) (i) Specific definitions for antigens and antibodies were required. Definitions for antigens required information on the promotion of antibody production and causing an immune response, while the definition of antibody required information on its action and specificity.

(ii) A number of factors had to be mentioned to gain full marks for this question. This included stating the structure/effect of the vaccine, the specific antibody response, the memory response created in the body and the boosters required.

(c) There was a mixed response to this question. Candidates had to state more than one disadvantage caused by a management practice. The best responses used several disadvantages and explained them, eg resistance to chemicals by overuse or incorrect use which allows resistant pathogens to develop and the chemical becomes ineffective.

(d) Overall, this question was poorly done with many students showing a lack of knowledge of text book material.

First Part

This question required specific knowledge of the terms given to the various levels of energy as it is utilised by the animal, eg net energy, digestible energy. To obtain full marks candidates needed to state the four levels of energy and explain how (in terms of energy utilisation) energy is lost or changed and demonstrate an overall understanding of energy digestion and utilisation.

Second Part

Candidates awarded full marks were able to explain five advantages of ruminants. Good candidates explained how this was important for the utilisation of Australia's vast grassland pastures as well as how ruminants could utilise poor quality feed in times of drought.

Question 10

(a) (i) Describe TWO ways trees are beneficial on farms.

(ii) Suggest why tree–planting programs are not always implemented on farms.

(b) Explain how agricultural activities may increase the rate of soil acidification.

(c) Describe ways in which a farmer may become aware of a specific soil degradation problem on the farm.

(d) Describe the causes of:

(i) dry–land salinity;

(ii) irrigation salinity.

(e) Outline the activities used by Total Catchment Management and Landcare programs to improve the sustainable use of land and water.

Describe the effectiveness of these activities.

64% of candidates attempted this question.

(a) (i) This question was well answered by the majority of candidates. The higher scoring candidates gave a detailed description of the benefits and did not just name the benefit, eg trees prevent soil erosion by binding soil particles together. Lower scoring candidates simply stated trees prevent soil erosion.

(ii) The majority of candidates scored well on this question. Better scoring candidates gave one well justified suggestion or two suggestions.

(b) This question was poorly answered with few candidates able to give a clear explanation. Many candidates confused acidification with irrigation salinity or the addition of farm chemicals, eg pesticides or fertilisers. Higher scoring candidates linked activities, eg the addition of larger quantities of organic matter, use of specific acidifying fertilisers or use of superphosphate in combination with legumes, to an increase in soil nutrients which when *leached* resulted in an increase in concentration of hydrogen ions (ie increased acidity).

(c) Very few candidates scored full marks on this question because the majority of candidates did not describe a *specific* (named) soil degradation problem eg soil erosion, structure decline, acidification, salinity. Higher scoring candidates stated a degradation problem and described three ways a farmer might identify the problem. Many candidates simply listed signs of land degradation in a vague/general manner.

(d) (i) Most candidates gave a good description of the causes of dryland salinity. Higher scoring candidates linked the removal of trees in recharge areas to an increase in the level of the water table in discharge areas which brought underground salts to the surface. Lower scoring candidates did not link or describe all processes involved.

(ii) Many candidates gave a good description of irrigation salinity. The better candidates were able to give answers such as ‘excessive irrigation over and above crop needs results in an increase in the level of the water table, which brings salts closer to the soil surface’.

(e) This question was poorly answered. The majority of candidates showed some understanding of the activities. The better candidates were able to address the issues of TCM and Landcare separately and fully explain the activities. Poorer responses merely listed the activities. Many candidates failed to describe the effectiveness of the activities outlined. The better candidates were able to link the activities and describe the effectiveness eg tree planting in recharge areas(activity) lowered the water table thus reducing salinity. This maintained sustainability by keeping water ways free from extra salt loads (effectiveness).

(f) Section IV Essays (15 marks)

Question 11

For an agricultural product you have studied:

		Marks
(a)	*describe the effect of the shift from supply–oriented production to demand–driven production;*	***6***
(b)	*assess the role of each of the major components in the marketing chain.*	***9***

19% of candidates attempted this question.

(a) Higher scoring candidates displayed current knowledge of the shift from supply-oriented to demand-driven production for a named production system. These responses outlined factors such as the increasing importance of product specification, consistent quality, product differentiation and the need to target specific markets.

Higher scoring candidates were able then to describe the consequent effect of the shift, including management decisions or the utilisation of feedback to ensure the meeting of product specifications.

They outlined the changes in farm management which were taking place to accommodate these changes, such as selection of specific breeds with high marbling for the Japanese market. Some candidates explained that some farmers respond to market signals by changing the level of output or changing to another production system.

Poorer scoring candidates were not able to show a relationship between the shift that occurred and the resulting effect. Many of these candidates simply discussed the price mechanism of supply and demand. These candidates failed to describe the differences between demand-driven and supply-orientated production and the need to shift the focus of production and management.

(b) Most of the candidates attempting this question were able to construct a marketing chain of the chosen product.

The better candidates were able to assess the role of each of the stages of the marketing chain and discuss the importance of each stage in order to meet a demand driven market, for example, the importance of transporting milk at the correct temperature to maintain quality and minimise contamination.

The high scoring candidates were able to show at least 5 stages in the marketing chain and discuss the importance of at least 3 of these stages.

Poorer scoring candidates simply listed a marketing chain without assessing the value of each component of the chain. These candidates merely listed the stages in the chain, eg producer, processor, retailer and consumer. This was done without describing what happens at each stage and without outlining its importance in the supply of a quality product.

Question 12

A successful farmer must plan management practices to overcome limiting factors in plant production systems.

		Marks
(a)	*Outline some of the limiting factors involved in the growth and development of plants.*	***5***
(b)	*For a plant production system you have studied, describe management practices used to overcome limited factors.*	***7***
(c)	*In what ways is the farmer able to assess the effectiveness of these management practices?*	***3***

32% of candidates attempted this question.

(a) The majority of candidates were able to provide at least five limiting factors involved in plant production, with respect to growth and development.

Better candidates provided examples of limiting factors including interference, shading, insufficient water, mineral deficiencies and disease, and explained their individual impact on the plant.

Poorer candidates only listed limiting factors and did not outline their role on growth and development.

(b) In this section, higher scoring candidates provided a number of management practices as applied to each of the limiting factors. Poorer candidates, in describing the effects of these management practices, generalised with such statements as ‘improved / better growth’ of plants.

The more capable candidates described the effects of these management practices, for example ‘correct spacing of seeds at planting time reduces competition between individual plants for water, light, nutrients and space.’

(c) The majority of candidates were able to identify two methods of assessment of the effectiveness of management practices. Better candidates mentioned the comparison of yield using appropriate units, from one year to the next, or over a series of seasons. Other acceptable methods of assessment included comparison of soil nutrient levels, pH, incidence of diseases/pest populations, from one year to the next, gross margins, etc.

Question 13

Modern animal production systems require the management of both genetic and environmental factors.

Using examples from animal production systems:

		Marks
(a)	*describe how genetic factors are managed to optimise production;*	***5***
(b)	*describe how environmental factors are managed to optimise production;*	***5***
(c)	*outline how an area of scientific research, other than in the field of genetics, has improved the productivity of animals.*	***5***

38% of candidates attempted this question.

(a) The majority of candidates could list a range of management techniques using genetic factors and describe at least two in terms of optimising production.

The less successful candidates listed and described management of genetic factors, eg crossbreeding, AI, ABV's, progeny testing and selective breeding, but did not link these management procedures to an increase in quality or quantity of the product produced.

Few students mentioned the heritability of the various productive characters and the expected rate of improvement per generation.

This part of the question was well answered. Once again good responses were able to link the management of at least two environmental factors, eg windbreaks, shelter belts, nutrition, pest and disease control, to increases in productivity, eg decreased stress leads to an increase in milk production, weight gains, marbling, wool production, etc.

Poorer responses were able to give examples of management techniques but failed to describe them and link them to production increases.

Average responses were able to describe briefly management techniques but did not link them to production levels.

(c) This section was not handled well, with many students showing minimal understanding of scientific research methods that have led to improved productivity in animal production systems. Many responses referred to genetic examples, eg AI and ET and were awarded lower marks.

Good responses included examples such as, nutrition, disease control, chemicals, vaccines/drenches, by-pass protein etc and were able to outline how this research was implemented and applied in animal systems to increase productivity. For example, research into diet formulations has proven that balanced diets will lead to increased production.

Poorer responses merely gave a general overview of what is involved, however they failed to link this to scientific research and its value to improving productivity.

Question 14

'Manage the microbes to maximise money.'

		Marks
(a)	*Describe, using examples, how micro-organisms benefit agricultural systems.*	***8***
(b)	*Describe, using examples, how micro-organisms have negative effects on agricultural systems.*	***7***

6% of candidates attempted this question.

(a) Most candidates were able to name a specific micro-organism and describe the role of that organism within the plant, animal or soil, eg Rhizobia in nodules on roots of legumes fix nitrogen.

Better candidates could describe a range of micro-organisms and link their role within the plant or animal to the beneficial effects (economic, managerial) on the broader agricultural system such as reducing the need for fertiliser application.

The poorer responses could not differentiate between micro and macro-organisms, but generally could describe their beneficial effects on a plant, animal or soil system. These candidates had difficulty linking these effects to a benefit for an agricultural system.

(b) Better candidates could name and describe the role of a range of micro-organisms both on a specific plant, animal or soil and their negative effects on a whole production system. They were able to give a detailed account of the negative effects of both host and the whole system level, eg disease, lost production, higher cost of production.

Poorer candidates again had difficulty naming a micro-organism and describing the negative effect on either a host or an agricultural system.

3 Unit (Additional)

Written Examination

Section I - Short-response Answers (20 marks)

Question 1

Agricultural research is sometimes questioned on the basis of methodology, data analysis and ethics.

Discuss these issues, using specific examples to describe:

		Marks
(a)	*appropriate methodology;*	*3*
(b)	*valid data analysis;*	*3*
(c)	*ethical considerations.*	*2*

(a) Higher scoring candidates were able to recognize that appropriate, valid and reliable research methodology includes key components. These candidates discussed research they have studied where appropriate replication, randomisation, standardisation and/or selection of qualitative research techniques was used.

Lower scoring candidates did not mention specific examples of research methodology or the factors that make it appropriate.

(b) The majority of candidates simply reworded the question and did not demonstrate an understanding of the methods of data analysis and tests of significance. The better responses demonstrated an understanding of how agricultural researchers processed and tested their data and use this analysis to find significant differences between treatments. Some candidates were able to draw on their own work to describe the role of student t-tests and ANOVA.

(c) This section was generally well answered. Candidates showed a general awareness and ability to nominate ethical issues related to agricultural research.

Better candidates discussed the implications of these issues. Aspects of issues such as genetic engineering, animal welfare and company-funded research were discussed.

Section II

Question 2 – Animal Breeding and Reproduction

EITHER

Marks

(a) Assess the impact of modern technology on:

(i) methods used to select breeding stock; ***4***

(ii) reproductive efficiency; ***4***

(iii) the gene pool of farm animals. ***4***

OR

Marks

(b) Female reproductive systems of farm animals may be managed by farmers.

(i) Using examples, explain ways in which hormones can be used to manipulate the function of the female reproductive systems of farm animals. ***6***

(ii) Discuss the ethical issues that may confront researchers and farmers when considering the commercial implementation of hormone treatments. ***6***

(a) 95 candidates attempted this question.

(i) Most candidates were able to describe at least one technology and its impact on selection of breeding stock, eg EBVs, ultrasound, wool testing (fibre diameter).

Better candidates were able to assess the impact of two or more technologies on the selection of breeding stock.

The poorer responses only listed technologies or described them in broad terms without assessing their impact on the selection of breeding stock.

(ii) Most candidates were able to describe one or two modern technologies, eg AI, ET, synchronisation of oestrus, and could assess the impact of one of these on reproductive efficiency.

Most candidates were able to identify one impact of technology on the gene pool. Better candidates were able to substantiate and assess two impacts on the gene pool, eg AI improves the gene pool as bulls from all over the world can be used, however, AI may cause the gene pool to narrow due to extensive use of a limited number of superior sires.

Poorer responses had a limited understanding of the term ‘gene pool’ and did not assess the impact of any technology on it.

(b) 45 candidates attempted this question.

Most candidates were able to name several hormones of the female reproductive system and describe how farmers manipulated them.

Better candidates were able to name several hormones, give their function, how farmers manipulated them and a consequence of the manipulation.

Poorer candidates were able to list a couple of the hormones and describe in very general terms only some of the consequences of the manipulation.

Most candidates were able to name and describe an on-farm ethical issue, such as possible contamination of food by residual hormone, and discuss its implications. Few discussed ethical problems confronting researchers, such as accurate reporting of findings. Better candidates were able to name, describe and discuss several on-farm ethical issues and issues relating to research. A few low scoring candidates had little understanding of ethical issues and confused them with cost benefits.

Question 3 – Horticulture

EITHER

Marks

(a) In the horticultural industry, local and overseas market standards and specifications may differ. These specifications have to be met before Australian horticulturists can successfully compete.

(i) Discuss the implications of the above statement for the manager of a horticultural enterprise. ***6***

(ii) Outline the essential practices that should be implemented to deliver the products, to ensure consumers receive the product in the desired condition. ***6***

OR

Marks

(b) (i) Using examples, explain management techniques that may be used to control diseases in horticulture. ***8***

(ii) Analyse the factors managers must consider when attempting to balance economic viability and environmental sustainability. ***4***

(a) 8 candidates attempted this question.

This question was generally answered poorly and lacked specific examples that illustrated the points being made.

(i) Most candidates were unable to identify a management implication associated with the differences between local and overseas market standards and specifications. Higher scoring responses clearly indicated an understanding of the concept of cause and effect and were able to provide examples to discuss their point. For example, if the standards are not met in terms of being disease free, and a disease is detected, fumigation will be required or the market/country could reject the product. This has consequences in terms of products such as cut flowers, eg carnations. There is the possibility of inspection by AQIS during the growing period to meet the protocols of the country of destination.

(ii) Many candidates simply listed practices that followed a logical production sequence and could be applied to any unnamed commodity enterprise. Better responses outlined the essential practices for a specific product and identified both pre- and post-harvest strategies which ensure the product is delivered in an appropriate condition. These candidates stated that, for example, in the production of cut flowers there is pre-harvest disease control that includes IPM, harvest techniques minimise petal damage and achieve desired stalk length, post-harvest dipping increase product longevity, inspection for quality assurance and the maintenance of standards, and the role of quarantine and its restrictions on product movement for certain commodities both locally and overseas.

(b) 10 candidates attempted this question.

(i) Most candidates were able to briefly describe a number of relevant management techniques used to control diseases in horticulture. Low scoring responses simply discussed a range of management techniques from the same broad control strategy, eg chemical.

The better responses gave detailed descriptions plus practical examples of techniques from a range of broad control strategies (eg chemical, biological, cultural, mechanical etc). The best responses linked a range of techniques to provide an integrated approach to pest management, citing examples (eg dak pots, pheromones, chemicals and removal of affected or fallen fruit to control fruit fly).

This section was generally poorly answered. Most candidates did not outline relevant factors or provide practical examples linked to either economic viability or environmental sustainability.

Higher scoring candidates were able to critically analyse factors from both economic viability and environmental sustainability aspects. They cited ‘real world’ examples and gave relevant discussion of factors from each.

Question 4 – Alternative Agricultural Systems

EITHER

Marks

(a) Some new enterprises in Australia have attracted large financial investments but have failed to yield appropriate returns.

For an alternative enterprise you have studied, describe:

(i) investigations you would carry out before investing in such an enterprise; ***6***

(ii) specific knowledge and skills you would require to manage such an enterprise. ***6***

OR

Marks

(b) Innovation by farmers is often the key to success in existing agricultural enterprises.

For an existing agricultural enterprise you have studied:

(i) describe ONE such successful innovation the farmer has implemented; ***3***

(ii) outline the steps the farmer took prior to developing this innovation; ***4***

(iii) discuss the factors that have made the innovation successful. ***5***

(a) 72 candidates attempted this question.

Overall, this question was answered poorly.

(i) The majority of candidates was able to list a range of relevant investigations, such as potential return on investment, marketability of production. Higher scoring candidates provided further descriptions as to why the investigation should be conducted, or alternatively, how the investigation would be carried out. For example, potential return on investment is important to determine profitability, losses or gains and can be performed by evaluating setting up costs, current and predicted market prices.

Poorer candidates did not supply any reasoning as to why these investigations are necessary prior to investment or how they would carry them out.

(ii) The majority of candidates was able to list areas of knowledge needed to manage an enterprise, with better candidates being able to supply specific detailed information on their selected alternative system.

Few students supplied a range of specific skills relevant to the named alternative system.

(b) 20 candidates attempted this question.

(i) Most candidates were able to describe an innovation that a particular farmer had implemented. Better candidates described in detail the innovation and went on to discuss how the innovation was successful for the farmer, eg an oyster farmer is now using a rotating grower tumbler to produce oysters which are uniform in shape, demand a higher market price (restaurant-specific) which increases the profitability of his oyster operation.

(ii) Most candidates could provide one or two steps the farmer took before adopting the innovation. Better candidates described a larger number of steps including environmental impact assessment, resources needed, predicted costs and possible returns, changes to current management operations and need to review new knowledge.

(iii) This section was answered well by most candidates. Better candidates presented a wide range of factors clearly showing how these factors contributed to the success of the innovation by improving production and/or profitability.

Question 5 – Technological Perspectives in Agriculture

EITHER

Marks

(a) Technological developments in recent years have had a significant impact on agricultural production in Australia.

Assess the impact of each of the following developments on production systems you have studied:

(i) satellite monitoring; ***3***

(ii) expert systems; ***3***

(iii) post–harvest treatments; ***3***

(iv) farm chemical applications. ***3***

OR

Marks

(b) Using examples, discuss the role of computer–based technology on modern Australian agriculture. In your discussion you should refer to:

(i) farm planning and decision making; ***4***

(ii) data analysis and farm management; ***4***

(iii) product marketing. ***4***

(a) 2 candidates attempted this question.

Candidates needed to assess the impact on production systems by four different developments. Candidates did give detailed answers on satellite monitoring and farm chemical applications. However answers for expert systems and post-harvest treatments showed a lack of understanding about the developments and how they are used.

(i) Candidates nominated uses of satellite monitoring for soil fertility testing, plant nutrient deficiencies, monitoring crop areas to regulate percentage cropping, eg cropping percentages being restricted in the western land.

(ii) Candidates were expected to state that, for example, AUSPIG is a computer software program developed by CSIRO as an expert system for Australian pork producers. It assists farmers to make decisions about rations, levels of feeding and the most profitable weight of a pig to produce.

(iii) Post harvest treatments include tender-stretching, flushing and cyrovac. All these were mentioned in relation to beef harvesting.

(iv) In the area of farm chemical applications recent developments have been in the field of monitoring devices for spray equipment and programs such as 'Herbiguide'. Candidates were expected to state that, for example, these programs provide information, including weed identification and herbicide application rates, to assist farmers optimise their production.

(b) 6 candidates attempted this question.

(i) The higher scoring candidates were able to identify at least three ways in which computer based technologies can be used in farm planning and explained how they were used. Examples included the use of paddock programs that record details of fertiliser application rates, crop yields, sprays and chemicals used and their rates. These students explained how these records can be used in farm planning and decision making.

Poor responses were only able to list a number of computer records without explaining how they helped in farm planning and decision making.

(ii) The higher scoring candidates were able to identify at least three ways in which the farmer analyses data as a tool to help farm management. Examples include the use of fleece weights and fibre diameter in microns to select replacement ewes or to decide which rams should be culled. Student also mentioned the use of financial programs to develop partial budgets and cash-flow projections. The lower scoring candidates did not show a clear understanding of the link between the use of data analysis as a tool to help a farmer make farm management decisions.

(iii) The candidates who achieved the best results were able to list at least three methods of computer-based product marketing and explained how each method was used. Examples described included CALM, futures trading and forward contracts.

Low scoring candidates merely gave a general application of computer-based technology without giving specific examples or explanations.

Question 6 – Pasture Production

EITHER

Marks

(a) Long–term persistence is an important characteristic of successful pasture species.

(i) Using specific examples, discuss features of pasture plants that ensure their long–term sustainability. ***6***

(ii) Outline management practices farmers can use to encourage the long–term persistence of desirable pasture species. ***6***

OR

Marks

(b) Successful pasture management requires an appropriate pasture composition to suit a range of environments on the farm.

(i) Using specific examples, discuss the advantages and disadvantages of native and introduced pasture species. ***6***

(ii) Describe how environmental factors influence the distribution of pasture species. ***6***

(a) 16 % of candidates attempted this question.

(i) Most candidates were able to describe a range of plant features such as shallow or deep rooted, free-seeding viable seed production and disposal. The better candidates were able to give appropriate examples of pasture species, describe their specific features and relate this to their long-term sustainability or persistence. These candidates were able to provide a good range of examples. Poorer candidates found it difficult to link the features of a named pasture species to its ability to persist or ensure long-term sustainability.

(ii) Most candidates were able to discuss grazing strategies as one management practise. The better candidates provided a range of practices including fertilisers, irrigation, slashing, pest and weed control as management strategies and were able to relate these to encouraging persistance of desirable pasture species.

b) 15% of candidates attempted this question.

(i) Nearly all candidates named examples of both introduced and native pasture plants. A small number classified plants incorrectly. Most gave a general list of advantages and disadvantages of both groups. The better candidates were able to give specific features of particular species then relate these features to its advantage or disadvantage. Poorer candidates limited their response to a brief mention of either the feature or the advantage/disadvantage.

(ii) The majority of candidates named several environmental factors influencing pasture plant distribution. Poor candidates could not relate these factors to how the distribution was affected. Better candidates demonstrated a knowledge of Australia's climatic regions and the effect of these on plant distribution. These candidates also mentioned non-climatic features.

Question 7 – Coping with Climate

EITHER

Marks

(a) *Figure 1* [please see examination paper] *compares rainfall during El Niño and La Niña episodes to average rainfall.*

A farmer receives information that an El Niño cycle is occurring.

(i) *Describe possible strategies available to the farmer.* ***6***

(ii) *Evaluate the effects of these strategies when incorporated into a farm management plan.* ***6***

OR

Marks

(b) *The following questions relate to Figure 1 above.*

(i) *Describe methods that may be used to collect climatic data.* ***4***

(ii) *Explain the possible effects of either El Niño or La Niña episodes on:* ***8***

1 the local economy;

2 the national economy.

(a) 3 candidates attempted this question.

(i) Better responses identified at least 2 possible strategies to cope with the El Niño cycle (eg fodder conservation, water conservation, decreased stocking rates, growing drought-resistant species) and provided a detailed description of each.

Poor responses listed strategies but were unable to supply an adequate description of them.

(ii) The better responses evaluated the effects of the identified strategies in terms of production and linked them to farm management planning, eg the use of drought resistant species enabled stock to be maintained throughout the period of El Niño.

(b) 6 candidates attempted this question.

(i) Better responses were able to describe methods of collecting climatic data, by stating, for example, that meteorological stations collect daily weather data (maximum and minimum temperature, humidity, rainfall, wind speed and direction) and these data, when analysed, provide information on the prevailing or long term weather conditions of an area, that is, its climate.

Poor responses simply listed instruments used to collect data on the weather, eg thermometers, raingauge and anemometer.

(ii) Good responses gave detailed explanations of either El Niño or La Niña, clearly linking their effects on both the local and national economies. For example, El Niño produces significantly lower than average winter rainfall that adversely affects the production of winter cereal crops. This reduces both yield quality and quantity leading to a downturn in both the local and national economies. La Niña, on the other hand, by providing higher than anticipated winter rainfall, can improve winter cereal production boosting both the local and national economies. Unfortunately, La Niña, by producing much higher than average spring/summer rainfall, can make the harvest of winter cereals difficult during this time causing low yields and poor quality grain which adversely affects both economies.

Poor responses simply listed examples of the effects on the climate but did not link these effects to the local and national economies.

Question 8 – Agribusiness

EITHER

Marks

(a) A farmer has to diversify to remain viable.

(i) Using examples, discuss the practical and economic implications of diversification. ***6***

(ii) Describe the information a farmer would require before seeking finance for a new venture. ***6***

OR

Marks

(b) Farm decision making can be influenced by a number of advisory services. Discuss the role of these services in:

(i) farm management; ***6***

(ii) marketing. ***6***

(a) 8 candidates attempted this question.

(i) Candidates displayed limited knowledge of the practical and economic implications of diversification. Better candidates discussed implications such as changes to farm infrastructure, time and labour demands, environmental effects, development costs, time-lag for income, proximity to markets and transport links. These candidates supported their discussions with relevant examples.

(ii) Most candidates only considered information of a financial nature. High scoring candidates included consideration of land capability, environmental sustainability, market availability and trends as well as current research and linked these factors to the financial information required including cash-flow, development budgets and gross margins.

(b) 4 candidates attempted this question.

(i) Higher scoring candidates named at least two advisory services that influence farm management. These candidates discussed in detail the services offered by such agencies as the NSW Department of Agriculture and, using specific examples, described the impact on farm management. Low scoring candidates merely stated an advisory service but did not explain how it influences farm management.

(ii) High scoring candidates explained how services such as stock and station agencies, food companies and the Australian Meat and Livestock Corporation influence marketing of specific agricultural products. Low scoring candidates simply nominated advisory services but failed to describe their impact on the marketing of specific products.

Question 9 – Whole-farm Planning

EITHER

Marks

(a) Whole-farm planning assists farmers to match their basic land resources with appropriate land usage. For a farm you have studied:

(i) describe methods used to assess the land resource; ***3***

(ii) discuss your findings about existing land use practices; ***3***

(iii) explain why the farm–management plan you developed should lead to improved land usage. ***6***

OR

Marks

(b) A farm is part of a wider physical and social environment.

Using examples, describe how:

(i) actions at the farm level can affect the wider community; ***6***

(ii) off–farm agencies, including all levels of government, can affect farm decisions related to whole–farm planning. ***6***

(a) 36 candidates attempted this question.

(i) The higher scoring candidates described a number of assessment methods such as land capability and erosion assessment, testing for soil pH and salinity levels. Most candidates stated one simple assessment method, eg do a soil test.

The majority of candidates showed an understanding of the use of land capability assessment and the different classes of land. Many did not discuss the methods used to assess the land such as aerial mapping, paddock walks, soil analysis and salinity tests.

(ii) Most candidates were able to discuss the different land use practices that have resulted in either a decrease in sustainability, such as over-cropping and over-cultivation, excessive clearing of trees and overstocking. Some stated factors such as the use of minimum tillage and the planting of trees that improve the sustainability of the farm. Lower scoring candidates did not relate examples to

the farm they studied and simply listed the practices without expanding on their effect on the land.

(iii) The higher scoring candidates were able to explain in some detail the management plan of the farm that they studied. They were also able to relate the effects of the farm plan in improving the land usage and sustainability. Most of the candidates were able to discuss at least five aspects of the plan.

Many of the candidates were able to list a few aspects of their farm management plan but did not fully explain how these aspects would help improve the overall land usage. The lower scoring candidates did not show a clear understanding of the farm management plan and were not able to link it to the farm they had studied.

(b) 40 candidates attempted this question.

(i) Most candidates could describe several on-farm practices that had either a positive or negative effect on the wider community. Many could explain how the practice affected the wider physical environment. The better candidates were able to include effects on the social environment.

Low scoring candidates were able to describe several on-farm practices without relating to the wider environment.

(ii) The majority of students could name several off-farm agencies relating to whole-farm planning. Many candidates described how these agencies could influence improvements on farms. Very few candidates could relate the functioning of the agency with the ability of the farmer to make decisions relating to whole-farm planning.

3 Unit Research Project

Again this year, the projects covered a very wide variety of agricultural topics. While most projects were of the quantitative analysis type, there was an increasing number of the qualitative type, in particular, surveys. Some candidates successfully combined the two methodologies in their project.

General Comments

Text

Although word processors have greatly improved the presentation of reports, the absence of careful proof-reading before submission of the project is of concern.

Candidates should utilise the spellcheck facility of the word processing program. Grammar should also be checked carefully.

Print spacing

It is recommended that students use double spacing in their submitted reports. This makes reading and therefore marking the reports much easier for the examiners.

Diagrams and Data Tables

In general, diagrams and data tables are well presented and relevant. A few students included large quantities of raw data in the text, and did not provide a concise, tabulated summary of data.

Graphs

Many candidates produced large numbers of computer–generated graphs which were unnecessary and irrelevant.

Graphs should be checked carefully before including in the report. Many graphs were incorrectly labelled and some were drawn using exaggerated scale. Students should be wary of including graphs that show large differences between treatments, when in reality the difference is only minimal.

Anonymity

Some students are still identifying themselves by accidentally including their name and/or their school's or teacher's name in the report or process diary.

It should be made clear to all candidates that this contravenes the rules for the Major Research Project in Agriculture. Projects must only be identified by the Candidate Number and Centre Number.

Presentation

Candidates should not present individual pages of the report in plastic sleeves. Reports should be spiral bound with the provided coversheet prominent.

Report Length

Many candidates are far exceeding the recommended length of 3000-5000 words. Although there is no penalty for exceeding this limit, it often indicates that the student has merely supplied superfluous and irrelevant information. Students should be encouraged to be selective about the information they incorporate in their report, particularly in regard to the literature review.

Photographs

Photographs can be relevant and valuable inclusions in a report, however, they should not be over used. Photographs should only be used when and where they add to what has already been described. All photographs should be referred to in the body of the text.

Student Process Diaries

Where substantial and thorough diaries were submitted the project generally tended to be of higher quality. Some diaries far exceeded the length of the report. Some candidates did not submit a diary at all.

The process diary should document the student's thoughts and actions relevant to the project. It should not simply list a series of events in chronological order. Photographs, relevant pamphlets, raw data, details of contacts made, comments from teachers and experts are suitable for inclusion in the process diary. These tend to add to the authenticity of the final report.

B. Comments on specific sections

Abstract/Synopsis

For most projects the research topic was quite clearly stated in the synopsis. Some candidates failed to establish a purpose for their investigation; this demonstrated the lack of initial planning and preparation. Better candidates included the major findings of their investigation in the abstract.

Literature Review

In most cases, the literature review was of a satisfactory standard. The best of these were concise. They were directly related to the research problem and discussed recent, relevant investigations. Some candidates included far too much information, much of which was removed from the actual topic under investigation or irrelevant. It should be noted that only information that directly addresses aspects of the research question should be included in the review of literature.

Students should cite reference sources correctly. Even personal communication with researchers who have conducted previous, similar work should be cited. Citation of references used in the review of literature should be included in the bibliography.

Methods

In some reports this section was inadequate as it contained insufficient detail and explanation on how such critical factors as replication, randomisation and standardisation were achieved.

Some projects tested multiple variables within the one experimental design. This was often due to a non-specific or poorly considered research question. In a number of cases, the degree of replication was insufficient leading to insignificant results and meaningless recommendations.

The major problems in this section included inappropriate and irrelevant questions, poor sampling techniques resulting in bias and designs that precluded adequate analysis.

Results

This section of the report should include concise, relevant, tabulated information. Many reports include large volumes of raw data and too many meaningless computer-generated graphs. Raw data should be provided in the appendix, not in the body of the report. Only graphs that are relevant, drawn to an appropriate scale, labelled clearly and referred to in the text of the report should be included.

Data Analysis

Statistical analysis of results was poorly handled in many projects. Again, this year, some candidates did not demonstrate a clear understanding of their statistical analysis or presented manipulated data with no explanation of how or why it was derived. Better projects had a clear and concise description of the statistical technique that was used to analyse the data. Many of the better projects used only simple biometric techniques and these candidates displayed a good understanding of the findings of the analysis.

Conclusion and Recommendations

Some candidates handled these sections very well. They included a concise summary of the research results and made pertinent recommendations for further research. A few weak projects included conclusions that contradicted the actual results and analysis of data.

Notes on Surveys

Students undertaking surveys need to use the scientific approach they would use if conducting an experiment or field trial. Some of the major problems included:

- biased selection of respondents;
- insufficient number of respondents for significant data analysis;
- biased wording of questions;
- insufficient piloting of survey prior to distribution to respondents.

Students should be directed to references that have information on population sampling, questionnaire design, survey design etc. One such useful reference is: J. S. Croucher (1998) *Introductory Mathematics and Statistics for Business*.

3 Unit Project Marking

General Comments

Marking is holistic and based around key criteria which have been constructed from the syllabus outcomes. Good projects name the following characteristics:

- a consistent story line;
- component parts are clearly linked;
- the component parts achieve their purpose;
- appropriate methodology;
- accurate data analysis;
- relevant literature review and referencing;
- appropriate referencing.

Purpose of each section of the project:

(i) Abstract

In 250-300 words students should be able to conceptualise the whole project – ie indicate what was investigated, how it was investigated, the conclusions and possible implications.

(ii) Introduction / Research Question

This section should link the investigation to some context or reason. At some point a clear statement of aim or research question should be clearly articulated. This provides the basis for the subsequent storyline and both the content and processes in the subsequent sections.

(iii) Literature Review

The clear purpose of the literature review is to find out what is already known about the research question (aim) being investigated and the appropriate methodology to use. It should be directly related to the research question.

(iv) Method

The method section should define the paradigm (quantitative or qualitative), justify the methodology in relation to the research question and provide a clear description of the procedures used so that a reader could be informed in sufficient detail to be able to repeat the investigation.

(v) Results

This section should use the accepted method of reporting the data collected, considering the paradigm being used. For example a quantitative study would be expected to report data in tabular and graphical form, while qualitative data can be reported in a number of acceptable forms such as diary or descriptive report form.

(vi) Data Analysis

This section will vary significantly in material, depending upon the research paradigm used; however its purpose should be to re-sort, order and manipulate the data into a form which can

facilitate some answer to the research question. The form of analysis should be justified, appropriate, valid and reliable.

(vii) Conclusion

The conclusion should draw a clear statement from the analysis in relation to the research question, evaluate its significance and critically reflect on the conclusion and methodology. In particular, students might reflect on improvements/problems associated with the methodology, the conclusion in relating to existing knowledge (literature review) and any local 'beliefs' about the expected results. Comments on the ethics or responsibility of the researcher/research results and conclusions is also appropriate here.

(viii) Recommendations

This component should extrapolate the conclusion to the wider agricultural context, whilst noting that recommendations based on a single trial always have limitations. Recommendations may also suggest further research and/or problem research methodologies that could be pursued to further elucidate the question being investigated.

Descriptors

The following points broadly describe the characteristics of projects common to each mark range.

A. Mark Range: 16 – 20

- All sections included and all sections achieve their purpose to a high level.
- The project maintains a strong and consistent storyline throughout.
- The project shows a high degree of interaction and relationship between sections.
- Conclusions are reflective, evaluative and show insights beyond the obvious.
- The project displays a high level of communication.
- The research shows originality in terms of some of the following aspects:
    - the research question
    - methodology
    - linking the project to a local problem
    - insights in the conclusion.

B. Mark Range: 11 – 15

- All sections included and most achieve their purpose.
- The project maintains a consistent storyline.
- The project shows some degree of interaction between sections.
- The project may show some originality.
- Conclusions clearly state the obvious and show some evaluation.
- The project displays good communication.

C. Mark Range: 6 – 10

- Most sections included and some sections achieve their purpose.
- The project is not always consistent throughout.
- Virtually no integration of the sections occurs.
- Conclusions state the obvious only.
- The project displays a reasonable communication.
- No originality.

D. Mark Range: 0 – 5

- Significant omissions, most sections do not achieve their purpose.
- Little consistency throughout the project.
- No integration of sections.
- Often incorrect, poorly stated conclusions.
- Poor communication.
- No originality.