AGRICULTURE

The number of candidates presenting for Agriculture in 1996 was 1722, of whom 1376 presented for 2/3 Unit and 345 for 3 Unit. This report should be read in conjunction with the 1996 2/3 Unit (Common) and 3 Unit Higher School Certificate Examination papers.

2/3 UNIT (COMMON)

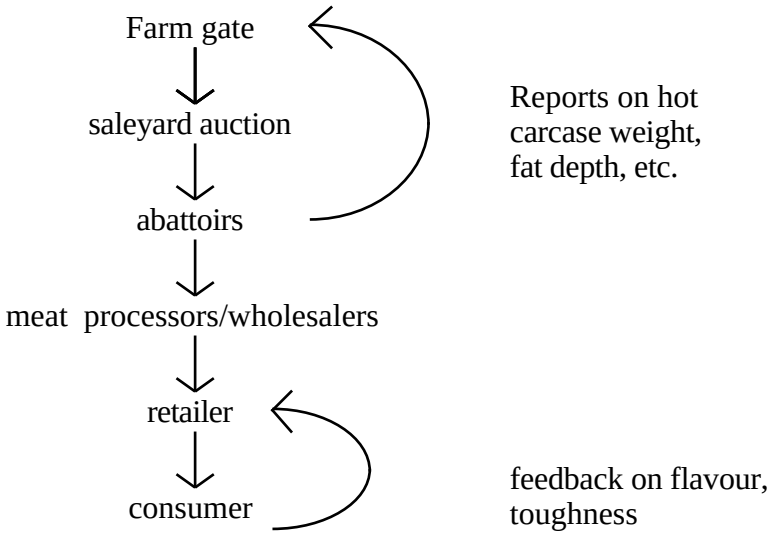
Portions in italics are typical of either low or high scoring types of responses to the questions.

SECTION I

Question 1

No marks were awarded for naming the farm product studied.

(a) (i) The majority of candidates were able to draw and label a flow chart. High scoring candidates listed for their named farm product, *method of transport of product, point of sale, any processing, point of storage, different products/makers, point of retail sale* and, lastly, *the consumer*. The number of links in the chain were dependent on the product. The higher scoring candidates were able to give a relevant example of feedback. Most commonly the feedback related to *quality* or *market specification*. For example:



(ii) Most candidates were able to list two service industries involved in the post-production processing/handling of their nominated farm product. Generally these service industries included *transport*, e.g. *refrigerated tankers for milk*, and the *selling agent*, e.g. *local stock and station agent.*

Poor students failed to understand the meaning of *post-production* and gave steps in the production of the product or listed irrelevant industries/organisations.

(iii) Higher scoring candidates named ONE strategy or technique employed by their nominated service industries, and also clearly described the specific strategy/technique and the way in which it ensures a high quality product, e.g. *milk tanker drivers test milk for "off" flavours before collection from on-farm vats.*

Poorer scoring candidates merely named a strategy or technique without describing how it ensures high quality.

(iv) This part of the question was poorly answered. Higher scoring candidates were able to name and describe government legislation or policies that are relevant and unique to the marketing of the product named, for example, *in beef production, abattoirs and overseas processors test carcases for chemical residues; if these are contaminated, producers can be fined - markets can be lost.* Poor responses discussed the effect of taxes which were not specific to their named industry.

(b) (i) This question required candidates to show their understanding of how the quality of the product can be increased or the efficiency of production can be improved by the strategies adopted by the farm manager. The better scoring candidates described a management tool that improved the quality of the farm gate product, e.g. *in relation to milk production - increased volume of roughage in the ration increases butterfat*. Poorer responses either discussed processes that operate after the product has left the farm or attempted to discuss ways of increasing quantity of output rather than quality or efficiency, e.g. *increase area planted.*

(ii) Many candidates were able to list *types* of information that affect decisions about *on-farm* production of the specific product, e.g. *weather maps,* used by farm managers. Most, however, were unable to list the *sources* of information, e.g. *Bureau of Meteorology, Department of Agriculture, Cooperative Research Centres.*

Question 2

(a) The majority of candidates correctly identified *gully erosion* and *tree decline* as a problem evident from Figure 1. A minority incorrectly stated a climatic problem, e.g. *drought*. No marks were awarded for simply identifying a problem.

The higher scoring responses stated two possible causes of the problem, and described the mechanism by which each of these degrade the land. For example, *overstocking removes the vegetation cover, increasing run-off leading to gully erosion; over-clearing removes vegetation cover increasing run-off, thereby contributing to further gully erosion.*

Lower scoring candidates often stated a cause, e.g. *overstocking,* but failed to explain how it affects the degradation problem named.

(b) Most candidates correctly identified two practices evident from Figure 2, e.g. *planting trees* and *construction of a dam.*

Some, however, stated practices that were not clearly evident from the diagram, e.g. *minimum tillage* or *installing irrigation systems*. These responses were not awarded marks.

(c) Those who gained maximum marks chose a correct practice nominated in part (b) and described clearly how this practice influences several of the biological, physical and/or economic factors contributing to the sustainability of the farm. For example, *planting of trees and pastures provides ground cover which reduces water run-off and improves pasture production and long-term profitability.*

(d) Although many candidates indicated an understanding of the fact that short-term profits may be foregone or that implementing sustainable improvements is costly, few realised that the former could be a consequence of pursuing long-term sustainability. The following is an example of a response scoring full marks:

> *The family would have to consider implementing expensive sustainable practices in order to remain viable in the long-term, while at the same time maintaining an adequate income and a quality of life in the short-term.*

(e) Most candidates could name an off-farm source of assistance that might have been used to carry out the improvements, e.g. *Landcare groups, District Agronomist*, etc. Unacceptable answers did not state a person or organisation that could provide assistance (i.e. the *source*), but named the type of assistance given, e.g. *bulldozer, dam construction.*

Question 3

(a) Most candidates correctly calculated the mean protein percentage for the control group as being 3.2%.

(b) Those who scored full marks incorporated a correct understanding of the use of standard deviation to interpret the data, e.g. *Standard deviation is a measure of spread about the mea; the low standard deviation in the supplemented group for milk production indicates more reliable data than in the control group.*

Lower scoring responses either defined *standard deviation* without referring to the experiment or did not understand its role as a tool for analysis and made incorrect statements, e.g. *standard deviation is the difference between the cows' production* or *is the standard deviation difference between the means.*

(c) In better responses reference to specific experimental results were accompanied by relevant supporting statements, for example, *farmers who wish to raise protein percentage should use the supplement (provided cost vs return is favourable). The standard deviation of the production data suggests that the supplement does not reliably increase milk production.* Lower scoring responses did not make a recommendation but merely referred to trends in the data.

(d) The higher scoring answers referred to a change such as *replication* and *standardisation* and supported it adequately, stating, for example, *An improvement in the experiment would be to introduce a further replication, say 20 in each group, to achieve more reliability and lower standard deviations.*

SECTION II

Question 4 (72% of candidates attempted this question)

(a) (i) Almost all candidates were able to interpret the table correctly and identified the history of *paddock D* as causing the greatest disease. The letter *D* or *Wheat Lupins Lupins* was accepted.

(ii) 1. Two-thirds of the candidature correctly answered the question by recommending *a minimum of 2 years between lupin crops*. *2-3 years* was also accepted.

2. Full marks were awarded to those who could relate yield and disease loss to the crop rotation, e.g. *lupin yield increases due to breaking the disease cycle by using suitable crop rotations*. Good marks were also awarded to candidates who used specific data from the table to support their recommendation. Alternatively, a small percentage of candidates were awarded marks for discussing aspects of improving both soil structure and soil nutrients. Many candidates were unable to make a connection between disease and its effect on yield.

(iii) The majority scored full marks in this part of the question. Marks were awarded to those who were able to state *leguminous crops are able to fix atmospheric nitrogen into an available form for subsequent crops*. In the better responses students also stated *an increase in available nitrogen increases soil fertility and thus increases yield*.

(b) (i) 1. Most candidates were able to state that an increase or decrease in disease organism population could increase or decrease disease risk, for example, *removing rotting fruit from orchards can lower disease risk.*

2. This question was answered in a number of ways. Most stated *some plant varieties are resistant to certain diseases*. Others stated *specific plant varieties used in crop rotation or companion planting are effective in decreasing disease risk.*

Note: When answering both parts 1 and 2 many candidates failed to name specific examples and were awarded only half of the marks allocated per part.

(ii) In high scoring responses candidates stated that *climate, soil type, plant variety and disease organism population contribute to disease risk. Disease risk is a factor which contributes to disease severity. Seasonal weather and crop management also influence the severity of disease but not the risk of disease.*

Most candidates, however, could only relate increase of disease risk as increasing disease severity. Some simply defined each term.

(iii) Full marks were awarded to those who nominated seasonal weather as a factor affecting the severity of a named crop disease. For example, *warm, humid conditions lead to an increase in the severity of rust in wheat.* In poorer responses students mentioned aspects of seasonal weather conditions, but failed either to link this to a disease or named a crop.

(c) (i) The majority of candidates were able to name at least one practice that farm managers should employ when using chemicals, e.g. *spraying on days that are free of wind.*

(ii) Most candidates did not answer this part of the question well. They could relate the practice to a safety issue on a farm, but failed to explain how it ensures the safety of the wider community. The majority simply explained the named practice, and were unable to relate this practice to the safety of the wider community. In a good explanation for not spraying on a windy day, candidates stated *wind could carry the spray into waterways and contaminate drinking water and/or the food chain.*

(d) (i) Almost all candidates successfully calculated the percentage of sheep affected by the old variety of lupins. A range from 4 to 4.2 was acceptable. Those who wrote only the correct formula also scored full marks.

(ii) Most candidates did not answer this question well, the best stated: *plant geneticists would select plans low in toxin for breeding. A suitable breeding technique, e.g. inbreeding or cloning, could then be used to increase the number of these plants rapidly. Analysis, testing and further breeding would need to continue until a less toxic variety was developed.* The majority simply stated a breeding system or technique, e.g. *genetic engineering*; many did not relate this breeding system to developing less toxic varieties.

(e) In low scoring responses students simply referred to husbandry practices, e.g. *adequate food, water and shelter.* Higher scoring candidates stated *the aim of experiments using farm animals must be ethical and moral, Animal Ethics Committees must be notified, sound husbandry practices must be employed, minimal numbers should be used, levels of pain and suffering must be considered.*

Question 5 (81% of candidates attempted this question)

The majority of students demonstrated an ability to interpret trends on graphs and showed an understanding of marketing.

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The question was divided into several parts. Some candidates were unable to recognise the fact that each part was distinct and tried to answer some parts with information based on a previous but unrelated part, e.g. answering part (c) with respect to the product named in part (b).

(a) (i) The majority of candidates were able to identify correctly the increasing and decreasing trends of each graph. Higher scoring answers included descriptions of each graph, e.g. *Graph 1 shows steadily increasing costs of production, Graph 2 shows that prices have fluctuated and show an overall decrease.*

(ii) The majority of candidates were able to suggest two relevant causes for the irregular shape of Graph 2. The wide range of acceptable responses included such statements as *supply and demand, climatic effects, and international trading.* Higher scoring responses linked each suggestion to price fluctuation, e.g. *consumer preferences are influenced by marketing/advertising/promotions, health issues and cultural balance. This causes fluctuations in demand which affects prices received for products.*

(iii) Using brief and general statements, such as *use new technology*, most candidates were able to describe in part an appropriate strategy for cost reduction. In the better responses they clearly described two or more relevant strategies for each part of the question, and included examples.

1. *Costs:* *Improve efficiency by introducing new technology such as genetic modifications which resist disease, e.g. Potato Leaf Roll Virus resistant plants,* or *soil testing to reduce use of fertiliser.*

2. *Prices:* *Reduce price risk for farmers by contract selling, e.g. sell meat to large supermarket chain, produce high quality product for niche markets.*

(iv) Here many candidates showed poor understanding of social and economic concepts, and offered answers which only described the graphs rather than answering the question. The *cost-price squeeze* was central to better responses, with elaboration in terms of consequences to rural communities. These candidates discussed *economic hardship, rural decline, increasing debt, smaller rural towns, unemployment, suicide.*

(b) (i) No marks were awarded for naming the animal product. A small number of candidates incorrectly answered this part by referring to a plant product. The majority, however, were able to identify an animal product, with better responses naming a product specific to a market. Whilst many could identify criteria used by the market to determine quality, the better candidates were able to outline a specific market requirement, e.g. *marbling score for Japanese ox is 2-4 on a scale of 1-5.*

(ii) The responses to this part were frequently unrelated to the specifications identified in 6 (i). Lower scoring responses offered only a single strategy, whereas higher scoring answers outlined at least two strategies for one of the specifications, e.g. *For marbled beef use Angus bloodlines for genetic predisposition to marbling, and finish on grain in a feedlot.*

(c) Many candidates had only limited understanding of the terminology used in the question and responses varied from a simple list to a comprehensive description of at least two factors. High scoring responses described factors such as *cost/price analysis, availability of resources* and *expertise.*

(d) The majority of candidates correctly named a farm product but no marks were awarded for naming such a product. There were many poorer responses which simply outlined either the production cycle or marketing opportunities of a farm product without establishing a relationship between them. The best responses clearly indicated a marketing opportunity, which was met by a specific production practice within an accurate cycle.

For example, *Product - potted plants. Growers of poinsettias induce these short-day plants into flowering by using light manipulation, so that they will be ready for the Christmas market*.

Question 6 (68% of candidates attempted this question)

(a) (i) The majority obtained marks for noting that *pH has decreased*, but many failed to note time as a factor. High scoring responses stated: *subclover reduces pH (increases acidity) rapidly in the first 20 years and the rate of decline reduces over the next 50 years to a minimum of pH 4.8.*

(ii) The majority of candidates obtained maximum marks by stating examples of the effects of low soil pH on plants such as *yellowing leaves, stunted growth due to poor nutrient uptake,* and *plant death due to nutrient toxicity from minerals such as aluminium*.

(iii) Most candidates were able to state management techniques such as *adding lime, planting acid-tolerant species,* but had difficulty in outlining how these techniques overcome acidity, e.g. *addition of lime to decrease acidity or neutralise the pH* or *grow a specific acid-tolerant species,* i.e. *ryegrass*.

(b) (i) Most candidates stated only one conclusion about drench usage and worm resistance drawn from Table A, e.g. *worms develop most resistance when drenched only with Drench A.* The better candidates also stated: *using Drench A and B alternatively offers the best protection against worms.*

(ii) The majority of candidates had some concept of the *passing of genetic information and hence resistance from one generation to the next*, but lacked knowledge of the practical causes of worm resistance on farms, e.g. *incorrect dose, some animals missed during drenching* or *continual usage of one drench.*

(c) Most candidates were able to list broad management strategies for increasing the effectiveness of a chemical pest control program, e.g. *biological control, IPM*, etc, but failed to use specific examples or to outline how such strategies improve the chemical pest control program.

(d) The greater number of candidates scored low marks for this question. They noted the *on-farm* effects of the over-use of fertilisers rather than the effects on the wider ecosystem such as *run-off into waterways and river systems which leads to algal blooms and contamination of drinking water*.

(e) This question was well answered, with the majority of candidates scoring full marks. The better answers described strategies such as *green manuring, ploughing-in of a leguminous crop increases soil organic matter and improves water-holding capacity. Minimum tillage techniques,* e.g. *use of stubble to mulch next crop, improves soil structure.* Those scoring lower marks stated or discussed *chemical* factors instead of *physical* factors.

(f) Most candidates were able to describe the benefits to soil fertility of soil microbes, namely *fix nitrogen and decompose OM* and also of invertebrates, namely *they aerate soil and their custings increase fertility.*

Question 7 (90% of candidates attempted this question)

(a) (i) This was generally satisfactorily answered. High-scoring candidates drew at least three specific conclusions that were correct, e.g.

Ewes on high quality pasture need less supplementary feeding in early and late pregnancy.

Ewes carrying twins need a higher level of supplementary feeding regardless of pasture quality.

Ewes in late pregnancy need a high level of supplementary feeding regardless of pasture quality.

Mid-range candidates usually were able to name two of the above examples.

Low-scoring candidates were unable to distinguish between pasture quality and supplementary oats.

(ii) Almost all candidates were able to calculate the supplementary requirements for 300 ewes in late pregnancy and to include the appropriate units.

(100 x 1000g) + (100 x 500g) = 150,000g or 150 kg.

(b) This question was generally poorly answered because of the overuse of generalisations. A good response included at least three specific reasons for the importance of a high plane of nutrition for pregnant farm animals. For example:

- *foetal growth enhanced in last weeks*
- *prevent pregnancy toxaemia*
- *increase survival rates of offspring.*

In an average response candidates listed up to two reasons.

A poor response contained only one reason which was very general, e.g. *because the mother was eating for herself and the baby.*

(c) (i) The majority of candidates were able to interpret and describe both trends on the graph and consequently scored full marks, e.g.

Location A - *in just over 20 years the water-table rose about 11 metres to the surface.*

Location B - *small fluctuations in water-table depth which was generally constant at 16 metres below the surface over 20 years.*

Some confused the trends described and stated that the water-table depth was increasing. Poor responses failed to interpret the information provided in the graph.

(ii) Generally this section of the question was not as well answered as the previous part.

High-scoring candidates clearly explained why the two trends were occurring, e.g.

Location A - *Removal of deep-rooted trees (which acted as pumps via evapo-transpiration), replaced by shallow-rooted crops and pastures. Possible increase in irrigation of crops and pastures.*

Location B - *a cover of deep-rooted trees and vegetation has been maintained, with no interruption to the balance between evapo-transpiration, precipitation and the water-table.*

Mid-range students found it difficult to explain why the water-table was rising under cleared agricultural land, and why it might remain stable under trees. Answers were vague and generalised, e.g. *trees lower the water-table.*

Low-scoring candidates made irrelevant or poorly substantiated conclusions, e.g. *maybe they had animals in Location A to drink it all.*

(iii) The majority of candidates were able to identify a single problem likely to occur as a result of a rising water-table at Location A, e.g. *an increase in salinity.*

Higher-scoring candidates listed at least two likely changes, e.g. *A rising water-table leads to salinity, waterlogging, stagnation, decrease in nitrogen fixation, mineral deficiency and pH changes.*

Mid-range students could list only one of the above changes.

(iv) Good responses could list at least two practices that could reverse the rising water-table at Location A. Examples include *reafforestation, pumping, drainage, deep ripping* and *plant deep-rooted species.*

Some students suggested practices which would cope with the situation, e.g. *planting saltbush*. Such practices do not reverse the trend.

Mid-range students could list a single practice to reverse the rising water-table trend, e.g. *plant trees to lower the water-table.*

(d) (i) This question was generally poorly answered, showing that students had a poor understanding of the need for a withholding period.

A good candidate was able to indicate that *chemicals have a residual effect that could be potentially toxic to consumers.*

Many students could only reword the question.

The poorer responses confused the *withholding period* with the *use-by-date.*

(ii) The better candidates could give an extensive list of personal safety equipment and recommend a range of precautions, e.g. *read the label, store chemicals appropriately, know emergency procedures,* etc.

In average responses students could list only some items of personal safety equipment, e.g. *face mask, overalls,* but failed to outline personal safety precautions to be used when handling chemical pesticides.

Poorer candidates could, at best, only generalise or give vague responses.

(e) This question was poorly answered, and reflected a poor understanding of gross margin analysis in farm decision-making.

The better students stated *gross margin = total income-variable costs. Gross margins are used to compare different enterprises on the same farm or similar enterprises on different farms. They are calculated on a units of production basis, e.g. per ha or per head.*

In mid-range responses candidates often gave only the gross margin formula.

Poorer candidates often included fixed costs, false implications of profit or incorrect use of gross margin as a planning tool.

(f) This question was very poorly answered, although good candidates could clearly explain that ruminants differ from monogastrics in that:

- *ruminants use microbes to produce protein (protozoa, fungi, bacteria)*
- *ruminants upgrade low quality protein*
- *ruminants produce protein from non-protein nitrogen sources, e.g. urea.*
- *monogastrics cannot synthesise proteins and need essential amino-acids supplied in their diet.*

Average students could list one or two of the above points.

SECTION III : Electives

Again this year, in the extended free-response parts of each question in this section, many candidates appeared to have little in-depth understanding of the content of the specific elective. As a result many responses lacked specific examples. High-scoring candidates planned their extended free responses and used simple diagrams and graphs to illustrate those responses.

Question 8 : Plant Production (12% of candidates attempted this question)

(a) (i) The majority of candidates achieved high marks by naming and clearly describing one technique for manipulating a named plant species. For example:

> *Grafting citrus trees - root stocks are selected from species resistant to root diseases, e.g. common lemon, scions from high producing and sweet species, e.g. Valencia, are grafted onto the rootstock.*

Some gave unnecessarily lengthy explanations of the processes on which the technique was based.

(ii) Few candidates had difficulty in stating two reasons for using the specific technique such as *higher production, higher quality* and *less incidence of disease.*

(iii) High-scoring candidates described several criteria for evaluating the effectiveness of the techniques named, e.g. *fruit colour, size, yield* and *gross margin*.

(b) (i) The majority of candidates recognised and correctly labelled A = *root hair*, B = *phloem*, and C = *xylem* on the diagram. Some confused the location of xylem and phloem.

(ii) The majority of students described the process of uptake of nutrients from the soil into the plant root, citing *diffusion, active transport across cell membranes as the means by which soil nutrients enter the plant root*. The better candidates recognised the fact that *nutrients have to be in solution*. Lower marks were awarded to students who confused the processes of diffusion and osmosis, or merely gave a description of transpirational pull.

(c) The better candidates gave examples and explanations of several soil and water management practices for manipulating plant growth, e.g. *mulching - for water retention and soil temperature change, irrigation, fertilisers, conservation, tillage*, etc. The poorer candidates used fewer examples, or gave explanations application to either soil or water, but not both.

(d) In this extended answer, many candidates appeared to have only a superficial understanding of the concepts of plant variety rights (or plant breeding rights). Very few described their views on the issue and, consequently, many did not support their opinions.

A number of high-scoring candidates pointed out that *the 1994 Legislation actually refers to Plant Breeders Rights (PBR) NOT Plant Variety Rights (PVR)* as in the Syllabus and question. Highest scoring candidates clearly explained PBR/PVR as *a patent on plant genomes objectively described and distinct, in which the owner reclaims fees/monies from sale of plants/name and unauthorised propagation is illegal for 20/25 years*. Candidates scored lower marks if they elaborated vaguely on only one point.

Any justified view/opinion scored high marks, e.g. *I support PVR as it encourages private enterprise to breed cultivars adapted to farm conditions* OR *I do not support PVR as it interferes with the right of farmers to grow crops of their choice due to the huge cost of PVR seeds*. A large number of candidates made no attempt to present their view.

Those who described well two examples which addressed PVR issues scored full marks whether they followed on from their opinion or not, saying, for example, *PVR is useful in integrated production systems, i.e. systems which are a package of plants/technology/fertilisers/pest control. PVR restricts genomes available to farmers, perhaps contributing to future problems associated with genetic monoculture.*

Question 9 : Animal Production (35% of candidates attempted this question)

(a) (i) 1. The majority of candidates were able to identify *maize* as the feed best suited to rations for pigs.

2. Most were able to state *"maize has the highest metabolisable energy"*. Higher scoring candidates added: *High ME is important as it is the energy which is 'usable' by the animal, i.e. after urine, faeces, CH_4 have been lost.*

(ii) A small percentage of students scored well in this question. Poor responses merely stated *the animals' digestive systems were different*, or *one was a monogastric, the other a ruminant*. Higher-scoring candidates stated *pigs have monogastric digestive systems, cattle are ruminants. Much of the energy from maize will be lost in cattle digestion as methane from microbial fermentation in the rumen.*

(b) (i) Most candidates stated the following advantage of increasing ovulation rates in animal-production systems, *increased ovulation rates would improve the output of the system, there is a greater rate of conception, which increases the number of offspring and improves profit.*

(ii) The majority of candidates were able to name two techniques or management strategies for increasing ovulation rates, such as *flushing, hormone injection, use of Boorola sheep*, etc. The better candidates were then able to link each technique with increased ovulation, e.g. *In sheep, injection of Fecundin leads to a greater number of twins*. Poorer-scoring candidates confused the function of hormones such as progesterone and prostaglandin.

(c) (i) Most candidates could name the two main types of rumen micro-organisms, viz. *bacteria* and *protozoa*. Answers not accepted included: fungi, rhizobia and microbes.

(ii) Few candidates scored high marks for this question. The better candidates differentiated between digestion of protein and the synthesis of amino acids and gave a clear explanation of the role of micro-organisms in the synthesis of amino acids, for example, *microbes are able to break down feed proteins and they can reincorporate simple nitrogenous substances (e.g. ammonia) into microbial protein. This microbial protein is digested and absorbed by the small intestine.*

The reconstruction leads to both essential and non-essential amino acids being formed.

Low scoring answers simply stated: *micro-organisms break down food into simple substances to be absorbed in the intestine.*

(d) In answering this question a significant number of candidates showed a sound knowledge of market requirements, for example, *many feed-lots use Angus cattle to produce marbled beef for the Asian market.*

(e) In describing the immune response following vaccination, the majority of candidates had some idea of the purpose of vaccination. Many, however, spent some time in describing the technique and purpose of vaccination, rather than concentrating on the immune response.

The best candidates were able to outline the response as involving:

- *the production of antibodies, memory cells, T/B lymphocytes*
- *the role of antigens in antibody production, the role of macrophages*
- *the need for booster shots to maintain resistance.*

Marks were also awarded for reference to factors such as:

- *vaccination being an active form of immunity*
- *time-lag involved in the body's response*
- *the relationship between antibodies and time of vaccination as shown on a graph*.

In discussing other management procedures designed to prevent disease, the better candidates could list and discuss a number of relevant management procedures, e.g. *drenching to control internal parasites such a sliver fluke, hygiene in milking sheds to prevent mastitis, quarantine/isolation to prevent the spread of disease.*

Higher-scoring candidates were able to list not only a number of practices but could also explain how the procedure prevents disease, e.g. *maintaining hygiene in the dairy prevents the build-up of bacteria in pipes and reduces the spread of mastitis.*

Question 10 : Land Management (53% of candidates attempted this question)

(a) Candidates scoring highest marks nominated at least one farming practice that causes the specific problem and then described how that practice leads to the specific type of land degradation.

(i) Erosion
Causes listed included *over-grazing, over-cropping and poor cultivation practices.* These were linked to the action of wind and water in removing topsoil.

(ii) Irrigation salinity
The better responses stated: *excessive irrigation* causes *water-tables to rise which brings salt to the upper horizon of the soil.*

(iii) Soil structural decline
The better responses stated: *excessive cultivation or cultivation when too wet or dry causes breakdown of soil aggregates or soil compaction.*

Many candidates, however, did not show an understanding of soil structural decline.

(b) (i) Full marks were awarded to candidates who named two specific organisations or groups involved in Landcare programs. Acceptable responses included: *NSW Department of Agriculture, Barellan Landcare Group, Department of Land and Water Conservation, Streamwatch, Local Councils.* Non-specific *groups* were not acceptable, e.g. farmers and Greenies.

(ii) Most candidates could outline the role of one association identified in (i) which is involved in Landcare, e.g. *Department of Landcare and Water Conservation advising and educating farmers about soil degradation problems.*

(iii) The majority could name a relevant Landcare action, e.g. *tree planting programs*. The better candidates then discussed one or two results of this action, e.g. *erosion reduction, improved wildlife habitats.*

(iv) This part was very poorly answered. A number of candidates tried to explain why the wider community should participate in Landcare programs rather than explaining the benefits to the community at large of a Landcare ethic. The better responses described benefits such as *improved aesthetic values, cleaner waterways for recreation, cheaper food in the future* and *long-term employment opportunities.*

(c) This question was poorly answered by the majority of candidates. The best not only explained what is meant by *land capability assessment* but also explained the features used to classify land, e.g. *soil characteristics, topography, climate* and *other constraints.* The better responses also named a system, e.g. *the Soil Conservation Services 8 Class System* and described *the practices and uses recommended for land types.*

These candidates were able to describe how sustainability was enhanced, e.g. *maximising productivity and profitability, preventing land degradation, improved efficiency,* etc. The

better candidates described specific practices used by farmers for this purpose, e.g. *contour banks, crop rotations, fencing off degraded areas.*

Poorer responses simply stated that land capability assessment enhances sustainability but did not explain how. These students simply inferred that a system exists and were not specific about how it can be used as a guide to types and levels of production required to maintain sustainability.

SECTION IV : Extended Free Responses

Question 11 (31% of candidates attempted this question)

(a) A well constructed response related at least two sustainable farming practices directly to an identified animal or plant production system. For example, in wheat production: *Minimum tillage reduces soil structure decline which, in turn, leads to good germination and optimal crop growth rate and yield. Minimal use of herbicides and pesticides, and use of integrated pest management techniques, are sustainable farming practices and require knowledge of the complex interactions between plant, resource, microbial and socio-economic sub-systems.*

(b) Here candidates were not required to relate their response to the production system named in (a). The better candidates clearly identified and explained economic, social and environmental pressures and related these to sustainable practices. In their responses, these candidates discussed aspects such as:

> Economic: *Monoculture practices reduce soil nitrogen and lead to reduced yield and quality of wheat grain and, therefore, lower return to the producer.*
>
> Social: *The attitude of Landcare groups lead to the wheat farmers' reducing cultivation, introducing stubble mulching and incorporating sound rotational practices.*
>
> Environment: *Excessive use of fertiliser and over-cultivation lead to silting and eutrophication of waterways, resulting in algal blooms. Farmers respond by minimising fertiliser application and cultivatio*n.

Poorer candidates failed to relate their responses to sustainable and productive practices and did not discuss the three pressures stated in the question.

Question 12 (44% of candidates attempted this question)

(a) High-scoring candidates were able to name and accurately describe three techniques used in animal production systems, e.g. *artificial insemination, embryo transfer, selective breeding.*

In average responses candidates correctly named three techniques and offered some description.

Low-scoring candidates simply listed three possible techniques.

(b) Here the best candidates could name several examples of objective measurements in determining the effectiveness of their named techniques, e.g. *increased lambing percentages and weaning percentages, increasing protein and butterfat percentages, reductions in fibre diameter, growth rates (200 day, 400 day, 600 day)* and described how they would be used to guide future breeding programs.

In the middle range of responses candidates simply named several examples of objective measurements but failed to link them to future breeding programs or used only one example of an objective measurement.

Low-scoring candidates did not mention specific objective measurements.

(c) The best candidates evaluated all three techniques nominated in part (a). They commented on the *relative costs, rate of potential improvement, how widely the techniques were used, and their degree of technical difficulty in relation to commercial production,* as well as indicating *drawbacks*, e.g. *reduction of gene pools.*

Mid-scoring candidates gave some information on rates of improvement for each technique, e.g. *artificial insemination uses only superior males, whereas embryo transfer uses superior males and females to increase the rate of spread of superior genes.*

Poorer candidates simply wrote of a technique that improves rate of reproduction or spread of superior gene types.

Question 13 (13% of candidates attempted this question)

The majority of candidates scored well in this question, demonstrating thorough knowledge of the concepts of physical and chemical properties of a soil as specified in the Syllabus.

(a) The best candidates were able to name and define the terms *structure and texture* as being *the physical properties of a soil,relating these to the soil's water holding capacity, pore*

size/aeration, drainage, etc. They described the chemical properties of soil, including pH level and cation exchange capacity and relating these to nutrient availability and soil fertility.

The best candidates related these properties to a particular soil they had studied, e.g. Cumberland Clay Loam, and scored higher marks than those who simply referred to sandy soils, clay soils, etc.

Many students did not identify the properties correctly as being *physical* or *chemical*, and wrote in general terms which resulted in lower scores.

(b) This section was answered well, with students being able to identify farming practices that enhance the physical and chemical qualities of their chosen soils, e.g. *green manuring, crop rotation, minimum tillage*, etc, and reduce soil properties, e.g. *over-cultivation and monocultures*, etc.

The better responses included a detailed description of how each practice changed the physical and/or chemical nature of the soil.

Poor responses simply listed practices without relating them to the way(s) in which they improve or reduce the properties of the soil.

Question 14 (12% of candidates attempted this question)

(a) The majority of candidates were able to illustrate the nitrogen cycle successfully in a simple diagram. Many diagrams presented included little detail of the processes inherent to the cycle and simply stated the basic steps and reserves within the cycle, e.g. *N in atmosphere, legumes with nodules, OM in plants and animals, N in free-living bacteria, nitrate/nitrites*. Poorer responses listed some of the processes but gave no indication of pathways or linkages between processes.

Higher scoring responses clearly stated a large number of the *reserves of nitrogen*, provided details of the processes within the relevant pathways of the diagram and indicated the nature of the changes.

(b) (i) Nitrogen fixation: Many candidates had a poor understanding of how microbes fix atmospheric nitrogen into a form available to plants.

Higher scoring candidates discussed the *role of both symbiotic and free-living organisms in the cycle*, e.g. *clostridia, cyanobacteria, blue green algae*. They were also able to explain in detail symbiotic nitrogen fixations, e.g. identifying species, plant host specificity (including strains), the mechanics of the infection process on legume roots and how the nitrogen is made available to plants.

(ii) Mineralisation: Most candidates had a poor understanding of the role of mineralisation, viz, in *changing complex organic N into simple inorganic nitrogen molecules*, e.g.

Organic N÷NH_3÷NH_4÷NO_2÷NO_3
Organic N÷ammonia÷ammonium ion÷nitrite ion÷nitrate ion

The more complete answers correctly named and sequenced the specific bacteria involved, e.g. *nitrosomonas, nitrobacter.*

(c) Most candidates were able to list techniques used by farmers, e.g. *stubble retention, reduced tillage, adding organic matter such as poultry litter*, to alter nitrogen levels in the soil but many could not link them to either fixation or mineralisation.

Better responses detailed several techniques that farmers use and linked them appropriately to either fixation or mineralisation, saying, for example,

Fixation: Inoculation and lime pelleting of legume seeds to increase soil biological activity, and indicating how *the rate of N fixation increased with specific reference to the symbiotic relationship.*

Mineralisation: Farmers use management techniques such as green manuring, composting and reduced tillage to improve soil structure and organic matter content which leads to increased soil biological activity, with the result that organic nitrogen is converted to nitrate through the processes of ammonification and nitrification.

3 UNIT (ADDITIONAL)

SECTION I

Question 1 : Compulsory

(a) High-scoring responses stated at least four issues considered by researchers, for example, *animal welfare research, ethics, relevance, feasibility, costings* and *environmental issues.* They then outlined how these issues should be considered before undertaking the research.

Lower-scoring candidates described research without addressing issues arising from such research. Candidates in this category showed a poor understanding of the terms *outline* and *issue*. In their answers some used examples of experimental procedure rather than issues of importance to be considered before undertaking the research.

(b) Higher-scoring candidates were able to relate the impacts of specific agricultural research to the whole of Australian agriculture rather than simply on farm. The better responses included a detailed discussion of the impact of their stated area on Australia's export markets, employment, productivity, sustainability, etc.

Poorer responses either discussed only one impact, listed issues only, or merely described the specific research. The responses of a number of candidates were poorly set out.

SECTION II

Question 2 : Animal Breeding and Reproduction

(a) 54 candidates attempted this question.

(i) Most students referred to their chosen livestock enterprise throughout the question.

The majority understood that objective measurements are recorded as figures and relate to productivity, e.g. milk production/lactation, birthweight, liveweight at 200 days.

The better responses explained how the use of objective measurements such as EBVs increases productivity. Some candidates further related these measurements to specific aims such as producing to market specification or improving the herd. For example, choose a sire with low birthweight EBV for a herd of heifers to reduce the incidence of dystocia or choose a sire with a high EBV for 200 day liveweight to produce cattle for the vealer market.

Low-scoring responses listed examples of objective measurements, but did not discuss how they related to breeding. Some of these responded only in general terms.

(ii) Most students understood the value of visual appraisal in complementing the use of objective measurements when selecting breeding stock.

The better responses included examples of non-measurable characteristics such as conformation and structural soundness, and discussed their influence on reproductive performance and productivity.

Low-scoring responses used examples such as a *good looking* animal and did not make links to a breeding program but instead to the show ring, auction or eye appeal.

(iii) Few candidates demonstrated a sound understanding of heritability. High-scoring responses linked low heritability with slow genetic improvement.

(b) 154 candidates attempted this question.

(i) In higher-scoring responses candidates clearly identified a range of breeding and reproductive techniques that have an impact on reproductive efficiency, e.g. artificial insemination, embryo transfers, synchronisation, pregnancy testing, etc. Candidates discussed examples in detail, although many failed to link them to the way in which they improve efficiency of reproduction.

(ii) The best responses showed an understanding of how breeding and reproductive techniques have an impact on product quality and specification, e.g. selection of high producing sires and dams to ensure milk protein and butterfat percentage. Poor responses failed to supply examples to illustrate the techniques suggested.

(iii) Responses in this section were generally poor. The concept of animal adaptability appeared to confuse the majority of candidates. Higher marks were awarded to those who were able to describe breeding/reproductive techniques that resulted in animals that are more adapted to the environment, e.g. *crossbreeding Bos taurus and Bos indicus to achieve heat tolerance and tick resistance in arid areas of Northern Australia.* The majority of candidates referred adequately to relevant examples, e.g. beef, dairy and poultry systems to illustrate their answers.

Question 3 : Horticulture

(a) 11 candidates attempted this question.

(i) The better candidates clearly identified a wide range of horticultural marketing strategies and briefly discussed these in relation to their specified product, e.g. packaging and direct marketing of wines, convenience products in potatoes, and centralised markets and computerised selling in flowers.

Less adequate responses described marketing ideas in general terms, without specific examples, or their concept of marketing strategies was too narrow.

(ii) This section was not answered as comprehensively.

The majority of students failed to demonstrate the connection between specific examples of market feedback and resulting horticultural product development.

The better responses gave clear examples, e.g. *following wine tasting, consumer attitudes are used as a guide to select grape varieties to plant.*

(iii) Many students failed to identify the potential economic relevance of the product and its impact on the wider economy both domestically and internationally (export). These responses were expressed in general terms. The better responses gave examples and indicated issues such as *employment, market expansion* and *balance of trade*.

(b) 26 candidates attempted this question.

(i) Most candidates were able to name and describe at least two technological innovations introduced to improve the quality of a specific horticultural crop, e.g. *"A" frames for bananas and genetic engineering of peaches.*

The better candidates described the innovation in detail and related it to the quality of the product, e.g. *genetically engineering peaches to produce fruit that displays favourable characteristics* such as *firmness, colour and taste to meet consumer demand*.

(ii) Most candidates acknowledged and discussed the role of the manager and his/her ability to manipulate parts of the horticultural production system. The majority were able to name and describe two such manipulations, e.g. *timing or practices, selection of variety* and *disease management.*

The better candidates discussed each manipulation in detail, relating it to a specific aspect of increased productivity.

Question 4 : Alternative Agricultural Systems

(a) 72 candidates attempted this question.

(i) The better candidates were able to name an alternative agricultural industry and could describe the factors used in its planning and establishment.

The better candidates discussed several factors affecting possible markets and prices for their named enterprise, e.g. *range of products, prices, markets, value, niche markets,* etc.

Poorer candidates generally either described the topic or listed only a few points; many failed to identify specific examples of alternative enterprises.

(ii) This section was generally poorly answered. The majority of candidates referred in general terms to climate suitability for the enterprise and did not consider any other aspects.

In the better responses candidates were able to discuss several different environmental constraints which included *local environmental impact, climatic limitations or even local Council requirements.*

(iii) Most candidates were able to provide information on management skills or knowledge required to establish the named enterprise. The better students could describe many management skills, e.g. breeding, nutrition, disease, economic factors, handling techniques, training and knowledge. A number simply listed management skills and knowledge, failing to describe them in relation to an example.

Many candidates did not relate their discussion to the general planning and establishment theme of the question.

(b) 43 candidates attempted this question.

The majority were able to distinguish between traditional (e.g. beef cattle/wool production) and the more recently established agricultural systems.

(i) Nearly all candidates identified factors that have led to changes in marketing and production, such as *consumer demand, new export markets, government policies, public health awareness* and *competition from newly developed products*.

They were also able to discuss the changes that have occurred in production as a result of *technology, genetics, the environment,* etc.

A small number of candidates found difficulty in understanding the term *traditional* and used a more recently established agricultural system as their example.

(ii) On the whole, the candidates had a better understanding of the way in which the specific products are currently being produced and marketed. They were able to describe in detail the current methods of production, e.g. *beef feedlotting or intensive Sharlea sheep production.* They also provided detailed descriptions of current marketing procedures for beef or super-fine wool and outlined the need for producers to meet specific market requirements.

(iii) Most candidates had an appreciation of the areas of research needed to make these changes possible. Some typical examples of such areas included *medical/health, market specifications, cultural demands, animal nutrition, genetics* and *environmental impact.*

Question 5 : Technological Perspectives in Agriculture

(a) 9 candidates attempted this question.

On the whole this question was poorly answered. Candidates clearly lacked specific knowledge about recent technological advances such as *computer applications, post-harvest treatments, mechanisation, farm chemicals, satellite monitoring,* etc.

(i) The majority could not describe some recent technologies that have led to changes in production and marketing in an animal or plant product. Higher scoring candidates described recent technological advances such as satellite surveying and CALM.

(ii) Most candidates were unable to evaluate the impact of the technologies on the production and marketing processes in terms of productivity, product quality and the environment. The better responses included details of their impact on productivity and product quality, but no candidate could evaluate their impact on the environment.

(b) 12 candidates attempted this question.

The majority of those attempting this question showed a poor understanding of the role of computers and software in farm management and marketing.

(i) In describing the criteria the farmer would need to consider before purchasing a computer, the higher-scoring responses included:

cost/benefit to the farmer
availability of technical support
the farmer's computer literacy
availability of relevant programs involving software application
the usefulness of peripheral devices such as modems, CD ROMs, scanners, etc.

(ii) Most candidates showed a sound understanding of this part. Higher scoring answers included clear examples of the role computers can play in management and marketing decisions, e.g. *the use of spreadsheets, databases for financial management, herd recording* and *CALM*, etc.

(iii) This section was poorly answered. Candidates appeared to have little understanding of how a farmer might evaluate the benefits of computers and software programs in the management and productivity of the farm. Acceptable answers included *comparisons between pre-computer purchase and post-computer productivity performances*. In addition, some candidates addressed the *factor of time-saving with reference to farm management and increased record-keeping efficiency.*

Question 6 : Pasture Production

(a) 45 candidates attempted this question.

(i) The majority of candidates identified the fact that the establishment and management of a program for a pasture involves *some degree of soil preparation followed by sowing, fertilisation and irrigation where available.* The more able candidates identified a number of different establishment techniques including *sod seeding* or *broadcasting into inaccessible areas*. Higher marks were awarded to those who were able to show an understanding of seed treatments and the importance of species selection and mix to produce *year round* pasture. Many high-scoring responses discussed the use of native species, e.g. *danthonia*; good productive, palatable natives included in the mix of introduced species. Good candidates then went on to describe good management programs in which the care of the pasture plants and grazing management were complementary. The better answers discussed the *importance of pest management, soil fertility management, rotation and specific grazing methods such as strip, cell and zero grazing*. Very high scoring candidates described a calendar of operations in which the timing of management options was set out.

(ii) Although many candidates were able to list relevant problems, few could adequately identify problems directly associated with the system described above. Examples of specific problems included *soils lacking in nitrogen-fixing bacteria so that there was a need to inoculate the legume seeds. High levels of legumes can cause bloat in cattle if grazing is not managed carefully. Farmers overcome this problem by using non-bloating clovers or bloat bombs.*

(iii) The higher scoring candidates linked the *work of researchers and farmers* and *evaluated their work with possible outcomes.* The majority of candidates, however, failed to evaluate or even identify the work of farmers or researchers in trying to overcome problems. The better-scoring answers included *plant breeding, genetic engineering and chemical pesticide development.* Some candidates described the *work of farmers in field-testing of alternative species (such as natives) to overcome the problems identified.*

(b) 82 candidates attempted this question.

(i) Most candidates answered this question in very general terms, describing a general pasture management program without linking it to aspects of soil fertility, suitable species mix, species maintenance or production levels. Candidates did not respond to three aspects individually but, rather, combined them into one response. Common strategies cited included: adding fertiliser, green manuring, including legumes, weed control and undersowing. Candidates were able to list a range of

pasture management procedures but did not explain how these were linked to maintaining a suitable species mix.

(ii) Many candidates only listed desirable characteristics without linking them to pasture species or evaluating the species for specific characteristics if they had linked them. The better candidates approached this question by listing pasture species, describing and evaluating each or by listing characteristics, giving examples and describing the role or importance of each. The main characteristics listed included: *palatability, digestibility, level of toxicity, protein level, grazing response, fertiliser response, persistence, food bulk and seed production.*

Generally part (ii) was better answered than part (i) since responses there were better organised.

Question 7 : Coping with Climate

(a) 19 candidates attempted this question.

This essay was generally poorly answered since most candidates lacked specific knowledge of the climatic factors which influence agriculture in a region.

(i) Candidates generally used the extremes of climates, e.g. droughts and floods, as the major influence on agriculture in a specific region. The better responses noted that the *prevailing climate of an area determines the type of agricultural enterprise undertaken* and that *factors such as early frosts can influence the timing of management decisions.*

(ii) Many students were able to identify management practices that are used to overcome unpredictability of climate, e.g. *making silage, irrigation systems*, etc. Only the higher scoring answers, however, described these practices; in them candidates described how *farmers plan for climatic extremes and use technology in forecasting*.

(iii) Few candidates were able to evaluate any practice in terms of economic and environmental factors. Some attributed poor management practices such as clearing and over-irrigation to a rise in the water-table and salinity. Better scoring candidates *weighed the cost of overcoming climatic variations against the benefits in increased or regular production*. Top marks were awarded to those who also described how *some management practices which were implemented to overcome climatic variation also improved a farm's sustainability*.

(b) Candidature 1.

(i) This question was well answered by this candidate, who gave an exhaustive list of methods of collecting data from *old rainfall records* to *current satellite forecasting*, describing many in detail.

(ii) The candidate's management plans ranged from *fodder storage* to *diversity*, including *investing in off-farm enterprises*.

(iii) The candidate stated that management practices that modify the effects of climate can be considered as *investment in the future and sustainable farming practices*.

Question 8 : Agribusiness

(a) 15 candidates answered this question.

There were many answers that did not indicate the depth of knowledge expected in this topic. Poorer responses confused technical terms or applied them incorrectly.

(i) A number of candidates simply listed *types of budgets*, described a wide range of methods, *cashflows, profit and loss statements* and *enterprise budgets*, etc. In the better responses candidates showed how they are used to analyse a farm's financial situation.

(ii) Without referring to specific types of finance, such as *overdraft* and e*quity loan* as being available for a farm's operation, many responses simply listed lending institutions. Better responses described *forward selling, cooperatives and alternative financing methods*.

(iii) The concept of strategies was not clearly understood. Poorer responses renamed points from part (i), such as *types of budget*, while the better responses expanded beyond these to include *using accountants to prepare an in-depth application to the bank, trading use of machinery and labour for cash, finance, government grants, second incomes*, etc.

(b) 7 candidates attempted this question.

The quality of responses covered a wide range.

(i) Many students missed the connection between *changes* in the selected industry over a period of time in relation to world markets.

The better candidates gave responses that covered a range of aspects such as *market specifications, improved quality, chemical free/fat content, etc, feeding methods to suit market requirements, promotion and advertising.*

(ii) This question showed that students had a better understanding of changes at the farm level. Their examples of these changes were more relevant and better described, and showed them to be a direct response to specific requirements in the world market, e.g. *marbling for Japanese beef.*

Question 9 : Whole-Farm Planning

(a) 47 students attempted this question..

The majority had a broad understanding of the underlying principles of whole-farm planning.

(i) The higher scoring candidates had a clear knowledge of the steps involved in developing a whole-farm plan. They listed the steps in the correct sequence, giving clear outlines of what each step involved. Lower scoring candidates listed the steps involved in developing a whole-farm plan, but failed to outline what was involved in each step and/or had the steps in the wrong order.

(ii) In the best responses in this section two well described examples of key biological features were given as well as two examples of key physical features. These features were linked to their contribution to enhancing the sustainability of the farm. Candidates whose answers were not as good failed to link the factors described to the sustainability of the farm. They described only one or two key features or tended to make broad and generalised remarks, e.g. *Looking after the environment makes farms more sustainable.*

(iii) This section was generally not answered as well as the two previous sections. The best candidates discussed the length of time a Whole-Farm Plan takes to implement and the need for setting each stage of the plan in priority. They discussed the need to budget a projected cash flow in both worst case and best case scenarios, i.e. the equity of the farm, the viability of loans from different sources and the availability of tax rebates and grants from CCM, CALM, TCM, Landcare, etc. Although most lower scoring candidates discussed the long-term nature of Whole-Farm Planning and the need for the farmer to budget carefully, they failed to discuss how this was to be done.

(b) 74 candidates attempted this question.

(i) Higher scoring candidates were able to evaluate the benefits of trees in a whole-farm plan by clearly naming, describing and explaining five or more benefits and giving several examples. Lower-scoring candidates simply listed several benefits but failed either to describe or explain them adequately and gave few or no examples.

(ii) This question was generally poorly answered by all candidates. Those who scored higher marks were able to discuss the enterprise selection based on land-use classes, e.g. Class 1 - arable, to Class 5 - non-arable land.

In discussing the management of the enterprise, sustainable management techniques such as *minimum tillage, direct drill* and *contour banks* were linked to the land-use classes. The majority of candidates used many examples to demonstrate linkage between enterprise selection and management.

The lower-scoring candidates were unable to list or describe the land-use classes and failed to link it with management techniques associated with those classes. Their use of examples was very limited.

3 UNIT RESEARCH PROJECT

General Comments

The 3 Unit Research Projects are marked as a complete piece of work, using the criteria set out in the Syllabus. It is important that a project should be well integrated so that the different sections within the report refer, where appropriate, to each other and to the nature of the investigation. For example, the research question should be linked to some brief background explanation of why the investigation is important or should indicate the context in which it is being asked; the literature review should be linked to known information about the research question; literature about the research methodology should be consistent with the methodology section; the conclusion should refer to the research question and the literature review, as well as the results. Many projects are obviously written as individual parts at different times and fail to link together as a consistent piece of work. It is emphasised that whilst drafts of the parts are usually written separately, students should put the final report together as one piece of work.

As an overall set of criteria for assessment, the following may help teachers when providing advice to students:

(a) An excellent project includes all sections, each section is complete in terms of its purpose;

- the report is well integrated and consistent throughout;
- a high level of communication makes the meaning, actions and outcomes of the study clear and unambiguous;
- the conclusion and recommendations show considerable analysis and reflection, and are consistent with the research question that began the study.

(b) A good to average project includes all sections, some of which may not be complete in terms of its purpose or may contain some irrelevancies or inaccuracies:

- integration of sections may have inconsistencies requiring the reader to make assumptions or requiring the need to read around the project to understand the meaning, actions and outcomes of the study;
- the conclusions and recommendations are consistent with the research question that began the study.

(c) An average to poor project may have some sections missing or, although all of the sections appear, some of them are poorly done:

- sections may not be well integrated and there may be obvious errors in the methodology, data analysis or conclusions;
- communication of the investigation is either very basic or there is some difficulty in understanding the aspects of the meaning, actions or outcomes of the study;
- the conclusions and recommendations are likely to be superficial or inconsistent with the research question that began the study.

(d) A poor project will have significant gaps in basic requirements of the report:

- it will most likely contain errors of fact, methodology or conclusions;
- communication is often unclear in terms of purpose and/or expression;
- conclusions and recommendations are usually superficial and often inconsistent with the research question that began the study.

As in previous years, the projects continue to investigate a wide range of production problems and, increasingly, perspectives related to marketing, farmer decision-making and rural issues

associated with agriculture. Most projects are now word processed which improves the setting out; spelling and typing errors which can be readily removed using a spell check detract from these projects, however.

Specific Comments

(a) **Topics**

A number of projects were not agriculturally orientated, resembling geography projects involving measuring environmental indicators with no reference to agriculture. Such projects can be related to agriculture in terms of the impact of agriculture on the ecosystem. Merely to measure water quality factors, or air quality factors, however, without setting the operation into an agricultural context, reduces the value of the project.

(b) **Animal Welfare**

Some projects set up experiments in which invasive actions or administering of toxic or potentially toxic materials to animals was investigated. This sort of work is outside Animal Welfare guidelines for schools and consequently contravenes government legislation. **Care should be exercised to ensure that such projects involving animals are not undertaken**.

(c) **Process Diary**

This aspect of the 3 Unit Project is not always being used. A one or two page summary of activities is **not** a process diary. Usually, where diaries are extensive, cumulative and interactive between student and teacher, the finished project is well constructed. In many cases the Process Diary has been able to provide information to clarify material which has been unclear or is apparently missing. In these cases the diary can indicate what the student has been doing and thus provides a better insight into the project. Where there is no diary (or only one or two pages), this kind of clarification cannot be done and students may not be able to achieve the marks they could have gained.

(d) **Literature Review**

The number of projects with well constructed literature reviews continues to increase. Four main problems still persist:

- the construction of an annotated bibliography rather than a review of the literature;
- scanning in or reproducing diagrams directly from publications without acknowledging the source;

- too much obvious paraphrasing;
- failure to reference facts, ideas or procedures. All material taken from other sources should be referenced in the Literature Review and in the Reference List at the end of a project.

(e) **Graphs**

The ability to generate graphs using computers has led to problems with the use of graphs. Beyond the usual problems of incorrect labelling of axes, the following have occurred due to the computer graph explosion:

- production of three different graphical forms for reporting each treatment. Consequently if, for example, there were three treatments we can find up to 9 different graphs (pie, bar and line). Where three treatments are compared they are best compared by using one graph with the three treatments shown - this provides a visual comparison which is the reason for using a graph.
- graphs of all the individual data for each set of treatments in a trial. Such material is meaningless and shows a lack of understanding of statistics and sample populations.

(f) **Synopsis of Abstract**

A number of students do not understand the role of this section. Some students use the synopsis or abstract as the aim and procedure, or as a general introduction. It is, rather, a quick overview of the investigation, results and conclusion. Summarising in this way is an important skill in scientific writing. Consequently it should not be written until the project is complete - it is a complete summary.