BOARD OF STUDIES
NEW SOUTH WALES

# 2010 HSC Agriculture Paper 1
# Sample Answers

This document contains 'sample answers', or, in the case of some questions, 'answers could include'. These are developed by the examination committee for two purposes. The committee does this:

(a) as part of the development of the examination paper to ensure the questions will effectively assess students' knowledge and skills, and

(b) in order to provide some advice to the Supervisor of Marking about the nature and scope of the responses expected of students.

The 'sample answers' or similar advice are not intended to be exemplary or even complete answers or responses. As they are part of the examination committee's 'working document', they may contain typographical errors, omissions, or only some of the possible correct answers.

# Section I

## Question 1 (a)

***Sample answer:***

Eg Wool → Fineness: Less than 16 micron for the Italian wool market.

## Question 1 (b)

***Sample answer:***

Through statutory bodies, governments regulate the allocation of water for the production of rice. Less water allocation has led to a reduction in the production levels of rice in recent times.

## Question 1 (c)

***Sample answer:***

Crop with higher yield: Crop B

GM = Gross Income – Variable Costs

GM for CROP B = $(4.0 \times 150) – (85 + 35 + 50) = \$600 – \$170 = \$430$/ha

GM for CROP A = $(3.0 \times 220) – (75 + 45 + 20) = \$660 – \$140 = \$520$/ha

**Question 2 (a)**

***Sample answer:***

Farmers should wear personal protective equipment such as a face shield to avoid ingestion and contact with eyes, along with gloves and overalls to avoid contact with the skin.

**Question 2 (b)**

***Sample answer:***

Microorganisms in the soil are able to convert organic nitrogen (urea) to nitrate ($NO_3^-$). This occurs in stages where firstly urea is converted to ammonium ($NH_4^+$) and then to nitrite ($NO_2^-$) before conversion to nitrate ions ($NO_3^-$), which is the preferred form for use by plants.

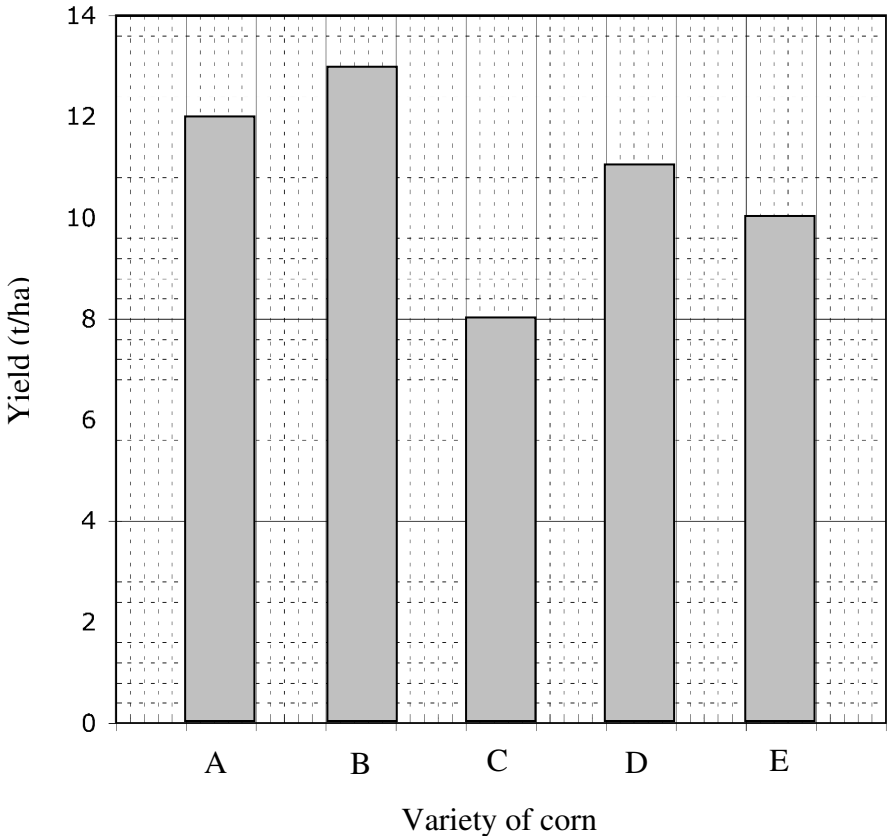
**Question 2 (c)**

***Sample answer:***

Farmers can plant legumes. Legumes are able to utilise atmospheric nitrogen ($N_2$), through a symbiotic relationship with *Rhizobium* bacteria in nodules of the legume roots, therefore increasing the level of readily available soil nitrogen such as nitrate.

**Question 3 (a)**

***Sample answer:***



### Question 3 (b)

***Sample answer:***

The researcher would have grown each variety of corn under similar environmental conditions. For example, all varieties provided with same levels of irrigation.

***Answers could include:***

- Replication of experimental plots
- Randomly allocating varieties to experimental plots

### Question 3 (c)

***Sample answer:***

Although it is the lowest-yielding variety, a farmer may choose variety C as it is the only variety that is suited to the environmental conditions on the farm (eg disease resistance, temperature, water requirements). Therefore, in these conditions it may out-yield other varieties grown in the trial conditions.

## Section II

### Question 4 (a) (i)

***Sample answer:***

Plant species A may be competing with plant species B for sunlight through climate modification (shading of species B).

***Answers could include:***

- Competition (for nutrients and water)
- Allellopathy
- Acting as an alternative host (eg disease-harbouring organism)

### Question 4 (a) (ii)

***Sample answer:***

Farmers could apply a selective herbicide (eg broadleaf) to the pasture. This may kill plant species A and therefore reduce the competition for nutrients with plant species B, leading to a greater proportion of species B in the pasture.

***Answers could include:***

- Grazing
- Slashing
- Chipping
- Biological control.

## Question 4 (b)

***Sample answer:***

Effect of planting density on lettuce size and yield (productivity). We found at low planting densities individual lettuces were bigger and total yield was low. At higher densities, lettuces were smaller. However, total yield (weight) was higher than at lower planting density. Higher seedling death rates occurred in higher planting density plots.

## Question 4 (c)

***Sample answer:***

Plants are able to breed asexually and sexually. Plant breeders have made use of both of these methods in developing new varieties of plants (crops, pastures, horticultural plants) that have higher yields or other advantageous traits such as disease resistance or quality characteristics, eg protein levels in wheat. Traditional methods such as budding, grafting and cross-pollination, following careful selection for heritable traits, have been advanced through the use of tissue culture and more recent advances in genetic engineering.

While still involving similar selection processes and crossing the 'best with the best' as basic plant-breeding principles, the development of genetically modified organisms (GMO) has been seen by some to be controversial and interfering with nature. In some circumstances, such as the development of a genetically modified form of canola, this has had an impact on consumer lobby groups that may limit potential markets. Issues involving regulation of food labelling may also impact on consumers choosing non-GMO products in the future. However, benefits such as higher yields and increased returns have led to the adoption of GM canola by many farmers in overseas countries and increasing levels of interest in Australia.

The development of genetically modified cotton has also led to varieties that are resistant to pests and also can allow better herbicide control (Roundup) in crops to increase yields. This can, however, be seen to lead to domination of certain agribusiness companies such as Monsanto, in terms of controlling markets and seed supply, as well as possible resistance development in some weed species, eg ryegrass.

Some plant breeders argue that advances in genetic engineering and the development of GMOs simply involve incorporation of favourable traits in much shorter time periods, with more efficiency than traditional methods used in plant breeding systems.

## Question 5 (a) (i)

***Sample answer:***

This diagram represents an inbreeding system that involves breeding closely related animals to concentrate the representation of a particular genetic trait(s) over a short time period.

**Question 5 (a) (ii)**

***Sample answer:***

Cross-breeding is the breeding of two distinct breeds creating greater genetic diversity than an inbreeding system. This breeding system may be used to take advantage of hybrid vigour (heterosis), where offspring from more genetically diverse parents (ie different breeds) that show specific desirable traits, express higher levels of the desirable trait and therefore show improved productivity eg selection for improved growth rates.

**Question 5 (b)**

***Sample answer:***

Part identified: A
Name of component: Fat

Animal 2 has higher levels of fat. This may be due to it being a female animal and Animal 1 being a male animal, as females tend to develop a higher proportion of fat than males of a similar age when provided with the same level of nutrition.

**Question 5 (c)**

***Sample answer:***

'Growth' is an increase in size of an animal (ie weight/height).

'Development' is a change in body composition of an animal that occurs over time (eg this may be the proportion of bone, muscle and fat).

Farmers feed young animals high levels of protein and energy to ensure growth is maximised. It is also important to include fats, vitamins and minerals as part of a balanced diet.

As animals mature, the farmer can modify the amounts of protein and energy in rations when growth begins to slow. Higher levels of energy can be fed to animals to increase the deposits of inter- and intra-muscular fat. This may assist in meeting market requirements for animal products or ensure that animals are in the correct state for breeding.

**Question 6 (a)**

***Answers could include:***

- Types of climatic information available may include:
  - Local/regional climatic information – radio/TV/local newspaper
  - State-wide – TV (nightly broadcasts)/newspaper
    – Bureau of Meteorology
  - Australia-wide – TV/newspaper
    – Bureau of Meteorology – Prediction models climatic data analysis
    – CSIRO – Prediction models climatic data analysis
  - Worldwide – SOI models and prediction
  - Indian Ocean dipole modelling

- Influences of such information on agricultural production
  - Short-term frame – flooding/hailstorms/severe weather warnings: farmers can respond within a short time frame by moving animals/moving pumps away from creeks
    – graziers' alert → don't shear sheep
    → provide protection for newborn lambs
  - Long-term – delay planting of crops if a dry period is predicted
    – seek alternative methods of production, plant different types of crops to match the predicted weather or climate

**Question 6 (b)**

***Sample answer:***

Pasture production system – Rabbits as pest.

Generally, IPM programs should incorporate the use of as many available control techniques as possible in an integrated multi-pronged approach to the control of a particular pest/disease. Rabbits can be a serious pest of agricultural systems by consuming pasture and/or crop species in a pasture production system, and by exacerbating soil erosion through burrowing. Various techniques involved in the IPM for rabbits include;

- Biological control using the *Myxomatosis* virus was initially very effective with a 95% mortality rate. However, as time progressed the effectiveness of the virus decreased as resistance built up in the rabbit population. The release of the *Calicivirus* was not as effective as the initial release of the *Myxomatosis* virus, but still decreased the rabbit population to some extent.
- Chemical control (eg baiting with Pindone or 1080) is very effective, but encounters environmental issues such as long residence times of residues and the inadvertent control of non-target species.
- Procedures such as ripping or blasting rabbit warrens can lead to soil degradation problems that may need to be addressed to stop the possibility of further erosion. Clearing other rabbit habitats such as fallen trees and bushes may also remove the natural habitat of native birds and insects.

– The construction of rabbit-proof fences is both expensive and time-consuming, as are legal controls such as enforcing the responsibility of landholders to destroy rabbits on their property.

**Question 7 (a)**

***Sample answer:***

Value-adding can be used to increase the levels of income available to the producer or processor of a product and can also increase consumer demand through promotion of an alternative product. For example, in the sales and marketing of beef, butchers may choose to cut and prepare beef ready to cook in the form of stir-fry strips. This may include addition of marinades and vegetables so the entire meal is ready to cook. This can allow a higher margin to be applied to the original beef product and also may involve an additional marginal return on the costs of additional ingredients.

**Question 7 (b)**

***Answers could include:***

| *Forward selling by contracts* | *Selling through cooperatives* |
|---|---|
| • Price may be locked in advance<br>• Level of guarantee gives securities to third parties eg banks/finance<br>• May allow for strict product specification<br>• Higher risk levels if product specification not met<br>• Individual negotiation of contract<br>• Individual may beat the benefits/losses through sales<br>• Contracts may be sold on or traded for alternative income<br>• Market guaranteed if times are bad | • Price subject to market rate at the time of sale<br>• No guarantee of final market price<br>• May be no need for product to be specified. Sell what is produced<br>• May be a market still available for product<br>• Security of group negotiation for potential markets<br>• The group/cooperative shares the benefits/losses of sales<br>• May sell/trade shares in cooperative<br>• No guarantees if market deteriorates at sale time |

**Question 8 (a)**

***Sample answer:***

Farmers can measure the lambing percentage of a mob of sheep in their flocks. They are able to do this by calculating (counting) the number of ewes mated (joined) from that mob and the number of live lambs born.

Farmers can then use this information to determine areas of their management that may need to be addressed, such as ram and ewe fertility and nutritional factors. If issues of fertility are identified, the farmer may use this information to select or cull animals according to performance. This information may also be incorporated into group breed plan systems to develop various indexes for use in breeding programs.

## Question 8 (b)

***Sample answer:***

Fertility of farm animals is closely governed by the level of nutrition supplied to them.

When an animal is supplied a suitable nutritional ration all body functions can proceed normally, including their fertility. However, when animals are given a low level of nutrition (in times of drought) their levels of fertility drop significantly as their body systems have only enough energy and protein for maintenance.

Animals given a high level of nutrition may also have a lowered level of fertility. Females given too much nutrition (feed) may become too fat and this affects their ability to conceive and fall pregnant (reduced fertility). The same can occur in males that are on a high level of nutrition. They can become fat and lazy and are less likely to mate with females, affecting fertility.

Farmers can increase nutrition by supplementary feeding of high protein and energy feeds, such as cracked lupins, prior to joining to increase the fertility of females (flushing). This can cause a female to increase her ovulation rate and the chance of her producing twins.

## Question 9 (a)

***Sample answer:***

Although native pasture species are often not as nutritionally rich and palatable as introduced pasture, they are better adapted to the environment and so are better able to provide a source of feed during times of drought.

In contrast, introduced pasture species can provide a more balanced and palatable feed source (eg grasses and legumes) during favourable growing seasons, and are better able to improve the soil nitrogen status.

## Question 9 (b)

***Sample answer:***

Both minimum tillage and crop rotations can affect the physical condition of the topsoil. In the case of minimum tillage, the reduced trafficking and mechanical disturbance of topsoil (compared to conventional cultivation) will reduce disaggregation and decrease the rate of organic matter oxidation, thereby improving the structural stability of the topsoil. Also, pore continuity will be better maintained, allowing infiltration rates to be maintained or improved. In some soils where minimum tillage replaces conventional cultivation practices (repeated tillage), some densification of the topsoil occurs before connected porosity is restored. Crop rotations can aid topsoil physical condition when shallow-rooted crops are rotated with tap-rooted crops, leading to the formation of biopores of different sizes and in different locations within the rhizosphere. Increased connectivity of the pore space leads to greater infiltration rates and better exchange of gases between the soil and the atmosphere.