

# AGRICULTURE

Paper 5038/11

Paper 11

## General comments

This year was the second time the revised syllabus for 5038 and 0600 was examined. The syllabus coverage was complete and the candidates' responses to the questions were good. Candidates had sufficient time to complete the paper.

Diagrams were used to help key candidates into the questions. Each structured question started with parts designed to differentiate at the lower grades, followed by a middle section aimed at the standard grades. The final parts, that included open-ended responses, were set for higher grades. The command words such as, 'state' and 'list' introduce low-level question parts. 'Suggest' and 'explain' indicate that higher-level answers are required.

In the revised examination, the multiple choice questions are spread within **Section A** of the paper. Candidates were not put off by this now familiar format. Some questions asked for labels to be added to diagrams and this command was often missed, possibly because candidates only look for spaces in which to write their answers.

**Section B** still requires longer answers involving extended writing, but the choice of **two** essays from five is a compromise between the previous IGCSE and O level examinations. There were some excellent accounts which showed a high level of knowledge and a good command of English. Candidates need to be advised to take note of the mark allocations for each question part. Marks are not transferred between parts.

Candidates are expected to have practical experience of agriculture and some questions examined this. For example, **Question 1(a)** tested the use of construction tools and **Question 3** tested the maintenance of garden tools.

The examination tested data response, for example **Questions 4(b) 6(a), 7(a) and 9(b)**. The data is designed to be unfamiliar so that the candidates answer from the given data rather than their own knowledge. The more able candidates dealt better with these questions, although it was encouraging that other candidates also attempted them.

## Comments on specific questions

### **Section A**

#### **Question 1**

A question based on the candidates' experience of using tools and building construction.

(a) This question was well answered by the majority of candidates.

Some candidates stated incorrectly that the screwdriver should be used to insert nails. A minority of candidates just named the tools without giving a use for each.

(b)(i) Only the strongest candidates were able to provide an explanation as to why one of the buildings will stay cooler. Good responses stated that thatch is an insulator and will keep out the heat better than an iron sheet roof. A common misconception was that thatch kept the building cool because it allowed the air to pass into the building. Not many candidates were able to identify that there was little difference in the conductivity of the materials that might be used for the walls or the floor.

- (ii) Good responses provided an understanding of the durability of the materials used in building **A** with regard to their resistance to named weather conditions or attacks by named pests. Weaker responses merely restated the information given in the question, i.e. that the materials were durable.

## Question 2

This question tested the candidates' practical experience of livestock health and farm hygiene.

- (a) Most candidates were able to provide the correct order of activities when cleaning a livestock house.
- (b) A range of livestock was offered by candidates. Strong candidates offered three qualified signs of good health for the appropriate animal. However, some responses were vague, using terms such as 'normal' or 'good'. Thus, 'urine is a normal colour' or 'good coat', scored no marks, while 'urine containing blood' or 'coat dull and dry in appearance', did gain credit.
- (c) Most candidates were able to state that the use of quarantine and isolation helps control the spread of disease. Better candidates were able to suggest possible treatments that could be used. The syllabus term '*notifiable disease*' did not appear to be well understood. Too many candidates stated wrongly that any disease should be reported to the authorities. Only the strongest candidates referred to the need to employ good farm hygiene techniques to combat diseases.

## Question 3

A straightforward question set on the practical care of farm tools.

- (a) (i) This question was well answered.
- (ii) Strong responses explained a rationale for removing mud from a spade involving preparation for future use, prevention of rust, or the prevention of transfer of disease bearing organisms. That oiling prevented rusting was well known. There were a few good explanations of how oiling eliminated one or more of the conditions needed for rusting. Weaker responses simply referred to following the stages shown in the diagrams in Fig. 3.1.
- (b) Many candidates were aware of the need to ensure that spade handles should be stored in the dry. Several responses described methods of covering the handle either using a named chemical preservative, e.g. creosote, or a more permanent method, e.g. painting.

## Question 4

This question linked animal nutrition to pasture quality. It included data analysis.

- (a) (i) Only a minority of candidates selected the major function of structure **X** as cellulose breakdown.
- (ii) Generally there was good understanding and knowledge of this subject matter.
- (b) (i) Most candidates were able to state the relationship between good pasture and higher milk production. Stronger candidates showed that they understood the economic rationale for using concentrates to promote milk production. A common misconception was that the concentrates were being used to fertilise the pasture.
- (ii) Candidates presented an understanding of the usefulness of controlling grazing via a number of appropriate methods. There was widespread appreciation of the role of fertilising pasture and the use of legumes or other species to improve pasture. Fewer candidates stated that irrigation would be helpful. A common misconception was that crop rotation would be beneficial.

## Question 5

A question centred on plant reproduction and genetics.

- (a) This question was overlooked, probably because it lacked answer spaces.

- (i) Most candidates were able to label an anther.
- (ii) Many candidates were able to label an ovule, but too many drew labelling lines that ended in the wrong general direction of the ovary, rather than specifically at an ovule.
- (b)(i) Most candidates provided the correct response for the definition of an allele.
- (ii) Candidates were able to provide an adequate explanation of genotype and phenotype but few followed the instructions in the question to refer to **Fig. 5.2**, and therefore did not provide suitable examples of genotype and phenotype.
- (c) This part was answered well. Both terms for the reproduction shown, asexual or vegetative, were given credit.

### Question 6

This was a data analysis question based on weed control and herbicides.

- (a) Most candidates were able to take the necessary information from the graph. The most common error was in part (ii) misreading the scale and giving 84 rather than 88 weeds per m<sup>2</sup>.
- (b)(i) There was extensive understanding of the concept of competition by most candidates.
- (ii) Strong responses referred to the likelihood of weeds harbouring pests and diseases. Many candidates did not follow the question, despite the emboldening, and provided another example of competition.
- (c)(i) This calculation was accessible to most candidates.
- (ii) Strong responses to storing in the original container included two reasons. A single response needed a detailed, qualified rationale for using the original container, to achieve two marks. Less good responses related only to the chance of other people mistaking the contents for edible items. Reasons for not spraying herbicides in windy conditions were well stated, but the arising consequences were not. Weaker responses merely stated that there was a greater chance of pollution from using the spray, but did not qualify as to how or why this might be so.

### Question 7

Based on farm economics this question combined data analysis and decision making, both higher level skills.

- (a)(i) Most candidates mistakenly thought that light is necessary for seed germination so selected option E.
- (ii) Relatively few candidates realised that oxygen or air is necessary for germination. Most candidates incorrectly thought that soil was the missing requirement.
- (b) There were relatively few candidates who appreciated that the size of the seed affected the sowing depth. There were even fewer answers that related seed size to the amount of stored energy in the seed and hence to sowing depth.
- (c)(i) Very few candidates appreciated that soil caps were on the surface of soil, with many confusing soil pans with soil caps. Another common misconception was that soil pans were a form of mulching.
- (ii) There was widespread appreciation of the reasons for covering seed-beds.

### Question 8

This was a question of increasing difficulty about fertilisers, ending with an open-ended response.

- (a) This multiple choice question was answered well. The most common misconception was to confuse hydroponics with aquaculture.

- (b) (i) This question was generally answered well, although a common error was to choose the highest level of 'P' which is not potassium.
- (b) (ii) Most candidates were able to state an advantage of using kraal manure, e.g. cheap or readily available. Fewer candidates were able to provide a valid disadvantage. Smell and problems with storage were the most common correct responses. Few candidates mentioned slow release or lack of specificity. Answers that stated they were less effective, or contained less chemical than inorganic fertilisers, were not credited.
- (c) (i) A majority of candidates correctly stated that the animal manure would increase the algal growth. Some thought that the manure was to feed the fish directly.
- (ii) The role of bacteria in the process of algal decay using up oxygen was not widely appreciated. The most common misconception was that increased algal growth would cause a lack of oxygen as the algae began to compete with fish for it.

### Question 9

This was a data response question on soil features which produced some encouraging responses.

- (a) (i) Most candidates correctly identified the reading on the pH meter as acidic.
- (ii) There were some strong answers showing understanding that fields might have areas of differing pH. Other answers referred to good scientific method repeating tests to achieve valid, repeatable results.
- (iii) Most candidates stated that liming would improve acidic soils.
- (b) (i) Many candidates correctly referred to suitable temperature and high rainfall. Few candidates referred to both. Incorrect responses ignored the data.
- (ii) Relatively few candidates identified a suitable month from the data, but instead used their own experiences of a different cultivar. Very few candidates appreciated the fact that the necessary conditions needed to last for the entire four month growth period.

### Section B

This section contained five long answer questions from which candidates had to choose **two**. In some Centres, attempts were made to answer all the questions and so wasted time.

All the questions had the same format, a description and then an explanation or evaluation. It is important that candidates relate their answers to the number of marks available. Two sentences will not achieve the seven or eight marks allocated for a description and a detailed half page on a definition will not score more than the maximum stated.

**Question 11** was the least popular choice. Similar question choices tended to be made within Centres, probably reflecting different teaching strengths.

All questions achieved marks over the whole range and no one question proved to be more difficult than any other.

There were some excellent diagrams used in support of descriptions in **Question 12** and **Question 14**.

A complete range of responses were seen and the best were clearly of an A\* standard.

### Question 10

- (a) Most candidates described some of the necessary preparations for sowing and planting. Some candidates went on to describe activities after sowing which did not gain credit.
- (b) (i) Many candidates were able to state a disease. Conversely, many candidates incorrectly stated either a deficiency or an attack by a pest. Equally inappropriate responses were 'fungi', 'bacterial' or 'viral' - a named disease was asked for by the question.

- (ii) Only the better candidates gave detailed responses of the signs of an infection by disease.
- (iii) Those candidates who were able to provide signs of infection for (ii) generally gave well qualified methods of preventing and controlling the disease. The other candidates, who had given general answers earlier, tended to provide a range of responses concerning plant hygiene measures, leaving the Examiner to select those appropriate for achieving marks.

#### Question 11

- (a) There was a good appreciation of the financial records that a crop growing enterprise should keep. Production records were less well described.
- (b) Good answers included reference to location, climate, water supply, demand for the product and availability of labour. The need for accessibility by road, storage facilities and methods of funding, were also considered.

#### Question 12

- (a) There was good understanding of the water cycle. Full descriptions were often backed by excellent diagrams. Some good candidates did not state that the process is driven by the Sun.
- (b)(i) The concept of irrigation was well understood.
- (ii) Most candidates were able to name a method of irrigation. There were few candidates who were able to provide details of the irrigation method chosen. Use of a watering can, suitable for a garden plot, was not considered valid for a field crop.
- (iii) Few candidates provided advantages and disadvantages that related specifically to their chosen method of irrigation. Generalised statements were not credited, e.g. 'water distributed to plants' and 'easy to use'.

#### Question 13

- (a) Photosynthesis was described well and usually in detail.
- (b)(i) Movement of products within the plant was also answered well, sometimes in far too much detail for the mark allocation. However, there was some confusion regarding the role of xylem and phloem.
- (b)(ii) Few candidates followed the instructions in the question and used named examples of storage organs to clarify their responses. The advantages of providing a dormant stage, providing food for next generation, or for dispersal by animals, were rarely mentioned.

#### Question 14

- (a) There were some very detailed accounts of weathering supported by some excellent diagrams. However, too many candidates simply referred to only biological, chemical or physical weathering, and so limited their answers.
- (b) Most candidates appreciated that decaying organic matter and living organisms increase the amount of nutrients in soil and improve its structure. Some described the role of organisms in aerating and draining the soil. Few candidates referred to the role of microorganisms in soil.

# AGRICULTURE

Paper 5038/12

Paper 12

## General comments

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Diagrams were used to help key candidates into the questions. Each structured question started with parts designed to differentiate at the lower grades, followed by a middle section aimed at the standard grades. The final parts, that included open-ended responses, were set for higher grades. The command words such as, 'state' and 'list' introduce low-level question parts. 'Suggest' and 'explain' indicate that higher-level answers are required.

In the revised examination, the multiple choice questions are spread within **Section A** of the paper. Candidates were not put off by this now familiar format. Some questions asked for labels to be added to diagrams and this command was often missed, possibly because candidates only look for spaces in which to write their answers.

**Section B** still requires longer answers involving extended writing, but the choice of **two** essays from five is a compromise between the previous IGCSE and O level examinations. There were some excellent accounts which showed a high level of knowledge and a good command of English. Candidates need to be advised to take note of the mark allocations for each question part. Marks are not transferred between parts.

Candidates are expected to have practical experience of agriculture and some questions had parts that tested this. For example, **Question 1** tested the use and maintenance of farm tools, **Question 2(a)** tested the use of tools and **Question 8** examined the recognition of animal health and farm hygiene.

Students' data response skills were also tested, for example **Questions 4(d), 5(a) and (b) and 6(c)**. The data is designed to be unfamiliar so that the candidates answer from the given data rather than their own knowledge.

## Comments on specific questions

### **Section A**

#### **Question 1**

A straight forward question set on practical experience of farm tools.

- (a) Many candidates did not identify the tools as a cultivator, planter and plough, although these are specifically mentioned on the syllabus. Weaker candidates named the tools rather than giving the function, as required by the question.
- (b)(i) This multiple choice question on tool maintenance was very well answered.
- (ii) Better answers gave two distinct ways that damage to wooden handles could occur. General answers that referred to 'not allowing handles to get wet' did not gain credit unless qualified by stating that this caused rot.

#### **Question 2**

This was another question testing practical experience of farm hand tools.



- (a) The uses to which the illustrated hand tools could be put when constructing a building were stated. The use of the spanner was the least well known. Allowance was made on the scheme for local names of nails and screws. Naming the tools without giving functions was credited.
- (b) Only the strongest candidates were able to provide an explanation as to why building **D** will stay cooler. Good responses stated that thatch is an insulator and will keep out the heat better than an iron sheet roof. A common misconception was that thatch kept the building cool because it allowed the air to pass into the building. Not many candidates were able to identify that there was little difference in the conductivity of the materials that were used for the walls or the floor. There were some good responses that showed an understanding about the durability of the materials used to construct building **E** with regard to their resistance to named weather conditions or attacks by named pests. Weaker responses merely restated the information given in the question stem that the materials were durable. The fact that building **E** had foundations was quoted by some and gained a mark.

### Question 3

This question tested knowledge of genetics and application of this knowledge to explain features of plant reproduction.

- (a) The parts of the flower were well known.
- (b) Better candidates provided the correct response for the definition of a gene, although Option **D** was a commonly cited distractor.
- (c) A more demanding multiple choice question requiring the working out of a genetic cross.
- (d) Even candidates who had correctly answered part (c), which required an understanding of the term *homozygous*, failed to adequately explain the difference between the terms *homozygous* and *heterozygous*. Only the best candidates correctly explained the difference by referring to dominant and recessive alleles. Some candidates used the symbols in part (c) to illustrate their answers.
- (e) (i) *Asexual* was a term that most candidates used correctly.
- (ii) The term *phenotype* was not well understood. Good answers related variations in the environment to differences in the plants.

### Question 4

This question started by testing recall of digestion which led on to data analysis and high level responses.

- (a) The correct response for where water absorption occurred was the large intestine leaving the small intestine as the site of fat absorption. Some candidates selected the small intestine as where water absorption occurs which is partially correct and was credited accordingly.
- (b) This was a higher order multiple choice question which required an understanding of the meaning of the term *fermentation*. Most candidates incorrectly selected 'metabolism'.
- (c) Almost every candidate identified calcium as the missing nutrient in the table but very few gave fertility as the function of vitamin E.
- (d) (i) Dry or fresh grass was recognised by many as a bulk foodstuff.
- (ii) Very few candidates identified both meat meal and sunflower cake as being high in energy and protein.
- (iii) Candidates needed to identify a foodstuff high in energy and protein and link these facets to the requirements of pregnant animals.
- (e) Few answers suggested that dry grass was a bulk food which acts to satisfy rumen activity. Most answers focused on the easy collection of dry grass for zero grazing.

### Question 5

This was a graph interpretation and data analysis question based on pest control. Candidates scored well.

- (a) (i) The correct reading of data from the graph was achieved by most candidates.
- (ii) A similar number of candidates correctly interpreted the leaf in Fig. 5.2 as being eaten by biting and chewing.
- (iii) Many responses linked the lost surface area of the leaf to less photosynthesis and food production. Fewer considered that the loss of water from the exposed surfaces might lead to wilting or provide a point of entry for disease.
- (b) (i) Many candidates extracted the correct answer from the table.
- (ii) This question required candidates to relate the way a pest feeds on a plant to its method of control.
- (iii) The most popular answer was that resistance had been achieved by the blue green aphids. This is not possible in only one generation. No one scored the mark available for stating that re-infestation may have happened, but several answers referred to the pesticide killing the aphid predator.
- (c) (i) The calculation was well done.
- (ii) Responses to this question were often carefully thought out and many achieved maximum marks.

### Question 6

This question tested soil analysis and pasture management.

- (a) (i) Better answers articulated the need for random sampling to ensure that different pH values in the pasture were covered in the test.
- (ii) There were many good responses which explained how stream water might contain impurities or chemicals that would affect the pH test.
- (iii) A surprising number of candidates gave a wrong answer. Orange might be expected as it indicates slight acidity, but the most common response was green, which indicates neutrality.
- (b) Most candidates achieved one mark for referring to a decrease in acidity that better supported pasture growth. Other marking points favoured by reduced acidity are: the encouragement of microorganisms, increased ion exchange and a better soil structure.
- (c) This was a challenging data analysis question which differentiated well between candidates.
  - (i) Candidates often failed to record the changes during the whole period or differentiate between the control and the effects of burning and grazing.
  - (ii) There were few answers worthy of credit. Some suggested the number of bushes were less in goat grazing areas as this would be occurring all the time.

### Question 7

- (a) This question was answered well. Candidates need to ensure that they follow the instructions given in the question, in this case to add a label line to the diagram; the lack of an answer space should not deter candidates from responding to the question.
- (b) (i) This question was often not attempted, perhaps because of the lack of an answer space. It is important that candidates follow the instructions in the question stem. It required the insertion of a label line pointing to the plumule on the diagram.
- (ii) Better candidates achieved the correct response of food storage. A common error was 'for protection'.



- (c) Candidates gave better reasons for poor germination of seeds planted at 1 cm depth than at 2 cm depth. Few candidates realised that the food store of a seed is finite and if planted too deep there are insufficient resources in the food store to sustain growth to the surface. Suggestions that there was insufficient air were credited, but lack of light was not.
- (d) Candidates produced statements of observation rather than explanations to support the candidate's observation.

#### Question 8

This question was based on personal experience of livestock management and was well answered.

- (a) The correct option was selected by most candidates.
- (b) The correct option was selected by the majority of candidates.
- (c) Many answers contained accurate symptoms and achieved full marks. Marks were lost if the signs of ill health were not relevant to the livestock chosen.
- (d) The term '*notifiable (scheduled) disease*' is specifically stated on the syllabus, but was only used in a few instances; candidates need to be familiar with this term. If the meaning was known, the example quoted was usually correct.

#### Question 9

- (a) A well answered, multiple choice question.
- (b)(i) Most candidates realised that option **D** showed the sack with the highest proportion of nitrogen.
- (ii) A good proportion of the candidates identified 'faster uptake' and 'higher levels of NPK' as advantages of using organic fertiliser. That they contained specific amounts of NPK which could target particular crops was often not cited. A lower level response suggesting 'no smell' was given one mark.
- (c) This part gave the candidates the chance to respond to a novel situation and their answers were most encouraging.
  - (i) The benefits to the farmer commonly stated were saving space and no mucking out. Good answers discussed the advantages of profits from a 'double' enterprise.

The benefits to the poultry commonly stated were security and well ventilated living conditions.

The benefits to the fish centred on their food source, with some candidates suggesting they might obtain shade from the poultry house.
  - (ii) There were many and varied suggestions as to the disadvantages from this system. Pollution of the water and rotting of the building legs were popular ones.

## Section B

This section contained five long answer questions from which candidates had to choose **two**. Centres, attempts were made to answer all the questions and so wasted time.

All the questions had the same format, a description and then an explanation or evaluation. It is important that candidates relate their answers to the number of marks available. Two sentences will not achieve the seven or eight marks allocated for a description and a detailed half page on a definition will not score more than the maximum stated.

**Question 11** on a livestock enterprise was the least popular choice. Similar question choices tended to be made within Centres, probably reflecting different teaching strengths.

All questions achieved marks over the whole range and no one question proved to be more difficult than any other.

There were some excellent diagrams used in support of descriptions in **Question 12** and **Question 14**.

A complete range of responses were seen and some were excellent.

### Question 10

- (a) Most candidates described some of the necessary requirements for harvesting and storage of a named crop.
- (b)(i) Many candidates were able to state an insect pest. Conversely, many candidates incorrectly stated either a disease or an attack by a slug. Equally inappropriate, were responses such as fungi, bacterial or viral; a named disease was asked for by the question.
- (ii) Only the better candidates gave detailed responses of the damage done by the named pest.
- (iii) Those candidates who were able to provide signs of damage generally gave well qualified ways to prevent and control the pest. The other candidates who had given general answers earlier tended to provide a range of responses concerning pest control measures leaving the Examiner to select those appropriate for awarding marks to.

### Question 11

- (a) There was a good appreciation of the financial records needed for a livestock growing enterprise. Production records were less well discussed.
- (b) Good answers included reference to location, climate, water supply, demand for product and availability of labour. The need for accessible markets by road and methods of funding were also considered.

### Question 12

- (a) There was fair understanding of the nitrogen cycle. Descriptions were often backed by good diagrams. However, the link through plants and animals was often not stated.
- (b)(i) The concept of crop rotation was understood.
- (ii) Many candidates were unable to convert a learned definition into a workable rotation plan. Candidates needed to suggest a suitable sequence: fallow / legume - leafy plant / cabbage - cereal / fruit - root / potato - fallow / legume.
- (iii) Few candidates provided advantages of rotation other than it helped pest control by breaking the life cycle of pests. Generalised statements for example, 'improves the crop yield' or 'controls diseases' were not worthy of credit. The significance of including legumes in the rotation to maintain nitrate levels was understood by some candidates.

**Question 13**

- (a) The function of xylem was described well.
- (b)(i) There were some very full accounts of the process of transpiration. However, the majority of candidates concentrated on just one aspect, usually the loss of water from the leaf. The process also involves the intake of water and water movement in the xylem.
- (ii) Few candidates gave the advantages of transpiration to the plant, limiting answers to just, 'enabling transport of materials'. With three marks awarded, candidates should have realised one comment was not enough. Other marking points were for photosynthesis, cooling, and providing turgidity.

**Question 14**

- (a) There were some very detailed accounts of how soil erosion occurs which were supported by some excellent diagrams.
- (b) Too many candidates simply referred to the causes of erosion that they had mentioned in part (a) giving the reverse as a solution, e.g. cutting trees down is solved by planting trees. Part (b) required references to agricultural practices and explanations of how they prevented erosion.

# AGRICULTURE

**Paper 5038/02**

**Coursework**

Some Centres fully met the marking criteria for the coursework by submitting substantial and well presented evidence for both elements, the practical exercises and the investigation. These Centres usually required little or no moderation of their marking and should be congratulated for adhering to both the marking criteria and to the coursework submission procedures.

However, it was often the case that the evidence submitted was insufficient to substantiate the marks awarded by teachers. This was particularly true of the marks for practical tasks. Less frequently, very little evidence of an investigation was provided, or the work submitted was decorative and lacked detail. In these cases, marks had to be moderated downwards.

Centres must take care to prepare candidates so that they are more aware of the marking criteria and fully address them. Issuing candidates with a copy of the marking criteria, and discussing these prior to beginning the coursework, is one strategy to use when preparing candidates for the coursework tasks.

Centres should heed the advice provided in the Coursework Training Handbook to ensure that their candidates fully meet the marking criteria. Centres are also strongly advised to both organise INSET through a cluster of schools and encourage at least one teacher to become an accredited marker (by following the procedures in the 0600 Coursework Training Handbook).

It is important to identify the level of demand presented by a topic when choosing practical exercises or topics for investigation. Candidates with the potential for top marks need to be advised to devise investigations which allow them to produce work which will access the mark criteria for a grade A.

Centres may benefit from recording and entering their candidates' work electronically, either on CD or memory sticks. Scanned work is quite acceptable and enables candidates to submit a mix of handwritten work, electronic work and photographs. Some Centres produced some fascinating video information and are advised to develop this further with annotation or by adding speech. The use of photographic and video evidence helps to motivate the candidates and annotation reinforces learning. Additionally, it reduces the cost of reprographics.

Moderators would like to congratulate teachers and candidates for their hard work, some of which was of a very high standard. It was most evident, across the ability range, that candidates were motivated and produced valuable coursework helping to prepare them for their future lives.

## **Practical Exercises**

Some Centres carried out an appropriate range of practical exercises and candidates clearly demonstrated their high standard of performance in these in a number of ways: within their investigation; by producing detailed diaries with entries made throughout the course, and containing critical reflections and/or annotated photographs; video clips, and PowerPoint presentations. Where some of the evidence for practical exercise skills is taken from the investigation, candidates need to identify this.

It would be expected that candidates would achieve good marks for these exercises, but not that all candidates would, for all practical exercises, have performed to the highest standard. Almost all Centres showed evidence of differentiation in their marking of practical exercises, but too many tended to award high marks with little or no evidence to justify such excellence. The highest marks should only be achieved by candidates of exceptional skill and ability who produce practical outcomes that fully meet all the marking criteria.

Centres are strongly advised to take note of the comments contained in the Moderators Report which addresses any specific problems that the Centre may have had. Candidates should be encouraged to collect evidence in the form of diaries containing constructive, critical reflection and annotated photographs, evidence or video clips.

### **Practical Investigation**

#### **1. The selection of relevant questions (Hypothesis) for the investigation**

Most candidates produced a hypothesis. It would be very helpful if Centres would annotate to indicate the type and amount of support given to candidates in forming their hypothesis. Only fully independent selection of a challenging hypothesis should be awarded full marks.

The most able candidates collected a good range of supportive background information and used this both to form their hypothesis and to describe the science that underpinned their investigation.

Many candidates tended to confuse planning and forming a hypothesis as being the same thing.

#### **2. The planning of the investigation and the principles on which it is based**

The plan needs to be clear and allow a reader to replicate the investigation. Thus, it should incorporate the necessary steps required to carry out the investigation, the resources required and the timescale for the investigation.

Many candidates would have benefitted from using background research to support both their plan and hypothesis. Some of the strongest candidates referred to their background research and hypothesis and used this to evolve a suitable plan for carrying out their investigation within the limitations of the available resources. It was extremely pleasing to read how some candidates had used their ingenuity, and that of their teachers and families, to gain access to livestock or land to carry out their practical investigation.

#### **3. The handling of evidence**

The data collected was often quite simple and only just sufficient to produce an appropriate analysis. Data needs to be recorded appropriately, and in sufficient detail. Candidates need to indicate any specific procedures which were used to make the collection of data accurate and reliable.

Presentation of data was often simplistic and candidates scoring the higher marks need to incorporate more than one method of expressing the outcome of their investigation. Tables, charts and graphs need to be clearly labelled and annotated to ensure the reader can fully understand what is being shown.

The most able candidates annotated their graphs and charts to identify anomalies or relevant points of interest, e.g. environmental events beyond their control: storms, droughts, wild animals, etc. This approach should be encouraged as investigative agriculture often presents variables which are beyond control, but which need to be considered when presenting information.

#### **4. The ability to make deductions from the evidence or the data acquired**

Candidates must be encouraged to do more than simply state or describe the results they have obtained. The strongest candidates fully explained their results and conclusions. Candidates need to draw conclusions and explain what their results show, and how these relate to their research and hypothesis, supporting their deductions with relevant underlying science. This should be with reference to their initial research which allowed them to formulate their original hypothesis. Too many candidates see experimental error, or natural events beyond their control, as spoiling or limiting their ability to draw conclusions and evaluate appropriately. Candidates should be encouraged to show and explain the importance of events beyond their control, and link these to the conclusions that can be drawn from such events. It is important that candidates identify and explain how error may have occurred and impacted on their ability to draw firm conclusions. Where candidates have done similar experiments, they should be encouraged to use each other's results to develop their conclusions and evaluations.

**5. The ability to recognise the limitations of the investigation**

This is an area where Moderators found marking to be very generous, usually because candidates made simplistic comments without an explanation as to why these limitations might have arisen in their work. Most failed to explain how future amendments could help to overcome the limitations and instead made general statements which were not developed sufficiently to address the marking criteria. Much more detailed, clearer explanations were required.

**6. Description of investigation, presentation, layout and originality (candidate's own work)**

Centres should be encouraged to present their work using appropriate subheadings. Photographs greatly improve the reports making it easier to see and understand the work undertaken and to show the outcomes. Effective annotation of such evidence aids learning and enhances the ability of candidates to draw accurate conclusions and explain the limitations of their investigation. Far too many candidates made basic errors, failing to include a list of contents, page numbers, or a bibliography, and few candidates correctly referenced secondary information.