Coursework Handbook

Cambridge IGCSE® and O Level Agriculture

0600 and 5038

For examination from 2020

Cambridge Secondary 2

CAMBRIDGE International Examinations

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Contents

Introduction

The purpose of this handbook

This handbook provides a guide to the coursework components of Cambridge IGCSE Agriculture (0600) and Cambridge O Level Agriculture (5038).

Part 1 of the handbook aims to:

- show how aspects of the practical work might be evidenced
- provide exemplars to motivate and give ideas to learners
- expand on guidance offered in the syllabus regarding coursework assessment
- provide marked exemplar investigations (incorporating some practical exercises) to guide teachers.

Effective delivery will help learners access the full range of marks available for the coursework element and facilitate a deeper understanding of the core knowledge within the syllabus.

Once they have worked through the advice in this handbook, teachers should be able to effectively prepare learners up to the planning phase before learners complete their tasks independently as part of the formal assessment.

This handbook should be used in conjunction with the Cambridge IGCSE (0600) and Cambridge O Level (5038) Agriculture syllabuses. Please ensure that you refer to syllabuses dated to the year in which the examination will be set.

Section 1: Agriculture practical coursework, an overview

1.1 The importance and benefits of coursework

Before considering the actual tasks prescribed in the syllabus, it will be useful to understand why coursework is such an important part of the learning process and a valuable form of assessment in IGCSE and O Level Agriculture.

The practice of vocational Agriculture is essentially a mixture of knowledge, understanding and practical tasks. Learners become more capable in the practical tasks intrinsic to the subject through the hands-on experience that comes with the practical exercises and project. In turn, the outcomes of this learning can be assessed, forming a vital part of the balanced and complete assessment of Agriculture at this level. Coursework is carried out by learners during the course to best meet the requirements prescribed in the learning content and the assessment objectives in the syllabus.

Benefits:

- Coursework is hands-on as part of the process of 'learning by doing'. It helps to develop a range of skills, some of which can be transferred from one learning experience to another, to employment or further education on leaving school.
- Coursework provides opportunities for learners to develop personal attributes (self-discipline, teamwork, cognitive and motor skills).
- Teachers share in the assessment process which increases their expertise and professional experience and increases motivation.
- Learners' best work may be chosen for assessment.
- Learners are motivated by practical work helping to enhance their understanding of the more theoretical parts of the syllabus.
- Coursework tasks can be adapted to meet the needs and ability of the learners and the resources of the Centre.
- Coursework therefore provides a more representative view of the learner's achievement rather than relying entirely on external written examination.

1.2 Requirements of the syllabus for practical coursework

The guidance below expands on information drawn from the syllabus where it relates to the coursework component (Paper 2). For full technical details always consult the latest syllabus document which is available on our public website www.cie.org.uk and on Teacher Support http://teachers.cie.org.uk

Paper 2 assesses practical and organisational skills and these abilities essential to the study of agriculture that are not suitably measured by examinations on theory.

The coursework consists of at least **four discrete practical exercises and one practical investigative project** which takes the form of a report. At least one of the practical exercises is to be carried out in each of the four terms of study (i.e. they are to be spread evenly over the course). The purpose of this is to enhance the learning and understanding of the subject through its application and practice.

1.3 The relationship between the assessment objectives and the components

The approximate weightings allocated to each of the assessment objectives are summarised in the tables below.

Assessment objective	Approximate weighting
AO1 : Knowledge with understanding	30%
AO2: Handling information and problem solving	40%
AO3: Experimental skills and investigations	30%

Teachers should take note that there is a greater weighting of 70% for skills (including handling information, problem solving, practical, experimental and investigative skills) than for knowledge and understanding. Teachers' schemes of work and the sequence of learning activities should reflect this balance, so that the aims of the syllabus may be met, and the candidates are fully prepared for the assessment.

Assessment objective	Paper 1 (marks)	Paper 2 (marks)
AO1 : Knowledge with understanding	43	0
AO2: Handling information and problem solving	57	0
AO3: Experimental skills and investigations	0	90

Paper 2

Total marks: 90 (Practical skills 60, Investigative skills 30)

Weighting: 30% (Practical skills 20%, Investigative skills 10%)

Careful selection of suitable practical exercises and investigative project topics will help to ensure that the learning outcomes for the related sections of the syllabus are enhanced. The quality of learning and teaching will benefit from the effective integration of practical work into the Centre's scheme of work.

1.4 Health and safety

When planning practical work, teachers should make sure that they do not contravene any school, education authority or government regulations. Within the legal framework of the individual nation, the teacher will be likely to be held responsible if anything goes seriously wrong with health and safety in such coursework. It is thus very important for the teacher to make sure that health and safety is given a high priority.

The teacher should make sure that the proposals of the learners are safe. This should not be used as an excuse to avoid or reduce practical work. For example, the use of a rotavator or mechanical tiller could be seen as potentially risky. However its use is also very relevant to the study of agriculture, an excellent skill for practical assessment and highly motivating for learners, who enjoy developing competence in using such machinery. Thus, the teacher's role is not to prevent learners from doing things because they are not safe, but to find ways of doing things that are safe, so that learners can be enabled to enjoy the course and be assessed doing interesting and engaging activities.

In agriculture there are many potential risks and hazards which must be closely monitored, including:

- use of machinery and dangerous physical environments
- use of chemicals including pesticides, other agrochemicals and laboratory chemicals – teachers must be alert to hazards such as toxicity, corrosiveness and flammability
- contact with livestock, both in terms of physical risks (e.g. biting, trampling) and biohazard risks (e.g. infection)
- security (as far as possible) around the site of any practical work to avoid results being destroyed or risks to members of the public
- potential conflicts with local or national regulations regarding water use, pesticides or agrochemicals

Another area of health and safety that should be carefully monitored by teachers is that of the welfare of animals. Candidates should ensure the provision of good basic care, adequate clean water, food and bedding for livestock and avoid any procedures that might alarm, hurt or harm them. Furthermore, it is a requirement of the Practical Investigation Report that candidates provide evidence that they have 'understood relevant principles'; clearly health and safety forms one of these principles. For this reason it is vital that good practice in health and safety should be included by learners within their project plan, throughout their practical work and in their explanations in the report.

1.5 Using the mark schemes

The total mark available for the 4 practical exercises is 60. For each practical exercise task the total is 15 marks, with 3 marks being available for each of the 5 assessment criteria.

The practical investigation is marked out of a total of 30 marks with 5 marks allocated for each of the 6 assessment criteria.

The total mark awarded to a candidate is the sum of the marks for all the exercises (a mark out of 60) and for the practical investigation report (a mark out of 30).

The mark schemes are in 3 bands, arranged in ascending order so that each band describes a more assured performance than the one before it.

Read and annotate the work and then make a 'best fit' judgement as to which band to place it in. Very often you may see qualities that fit more than one band, so always use two bands at least and come to a decision between them. You can trade off the strengths and weaknesses in the work against the criteria in the different bands. Lastly, give a specific mark from your chosen band.

If all the criteria in a band fit your judgement, award the highest mark for that band and check the band above, just in case. If most of the criteria fit your judgement, award a mark nearer the bottom and check the band below, just in case.

When you assess all of your own Centre's coursework assignments, place them in rank order, and award the marks accordingly, paying special attention to the borderlines. Try, where possible, to differentiate between assignments that lie within the same band.

Be careful not to crowd many of your candidates onto a single mark, particularly the bottom mark of a band. The graph of your distribution of marks should be smooth rather than have points like a pagoda. Where an excessive number of candidates are placed on one mark, an external moderator will rarely agree that the work of each is of the same quality.

1.6 Annotation

It is essential that there is proof of the teacher's judgement (in the form of annotations) on every assignment or stated clearly on an additional sheet. There should be a comment on the strengths and weaknesses at the end of each piece. This annotation is crucial for moderation as it helps to explain the marks that the teacher has given. Annotation should clearly relate to the assessment criteria. (In addition, the Individual Candidate Record Card for the Practical Investigation has a space for comment.)

1.7 Grade descriptions

These can be used to help confirm that your marking decisions are discriminating at a level appropriate to the candidate's real ability.

Criteria for the standard of achievement likely to have been shown by candidates awarded Grades A, C, and F are shown below. The standard of achievement required for the award of Grade C, include the criteria for Grade F. Similarly, the standard of achievement required for the award of Grade A includes the criteria for Grade C.

A **Grade A** candidate should be able to:

- relate facts to principles and theories and vice versa
- state why particular techniques are preferred for a procedure or operation
- select and collate information from a number of sources and present it in a clear, logical form
- solve problems in situations that may involve a wide range of variables
- process data from a number of sources to identify any patterns or trends
- generate a hypothesis to explain facts, or find facts to support a hypothesis.

A **Grade C** candidate should be able to:

- link facts to situations not specified in the syllabus
- describe the correct procedure(s) for a multi-stage operation
- select a range of information from a given source and present it in a clear, logical form
- identify patterns or trends in given information
- solve a problem involving more than one step, but with a limited range of variables
- generate a hypothesis to explain a given set of facts or data.

A **Grade F** candidate should be able to:

- recall facts contained in the syllabus
- indicate the correct procedure for a single operation
- select and present a single piece of information from a given source
- solve a problem involving one step, or more than one step if structured help is given
- identify a pattern or trend where only minor manipulation of data is needed
- recognise which of two given hypotheses explains a set of facts or data.

It is expected that candidates will demonstrate background knowledge of, and/or an increased depth of knowledge, in the physical, chemical and mathematical concepts and processes listed in sections 6.1 and 6.2 of the syllabus.

1.8 Planning coursework in your Centre

1.8.1 Preparing for the practical exercises and the investigation

The skills required for IGCSE/O Level Agriculture form a natural hierarchy. A basic knowledge of Mathematics and Science is essential for carrying out exercises and investigations and for communicating the methods, data and results of these. Although learners may have gained these skills in other, related lessons, it is advisable to ensure a level of competency for the purposes of Agriculture by building them into the course early on.

Potential learning tasks early in the course to prepare for the practical exercises and project:

- reading straightforward information from graphs, charts and tables
- completing graphs and tables
- reading and following instructions
- performing basic observations and interpretation
- translating a problem to a relevant practical activity and establishing conditions necessary to provide a solution
- working in a way that enhances the learners' ability and allows them to perform agricultural skills in a competent way to produce good, fair, accurate and reliable scientific outcomes
- practicing agricultural skills in activities such as digging, hoeing, animal husbandry etc.

Areas where learners need to be well prepared as they tend to find these aspects more challenging:

- interpreting readings on graphs or scales
- interpreting data with experimental error
- interpreting data with more than two variables (common in applied agricultural investigations)
- employing more advanced scientific skills above the basic type of task
- solving practical problems which include more than two independent variables
- operating more complex mechanical cultivators and tractors

1.8.2 Setting tasks

It is essential to set tasks that allow learners to demonstrate all levels of success and that are appropriate to where they are in the course.

You should consider the following key points when setting the practical exercise tasks and the investigation.

Task setting

1. The learners should have an opportunity to practice and gain a skill before being assessed in it.
2. The assessment should be based on the principal of positive achievement.
3. Learners should be given an opportunity to demonstrate what they understand and can do.
4. The work must allow learners to respond at the levels given in the assessment criteria.
5. Work should be differentiated for the learner. Not all such work needs to contribute to formal assessment (some can form as a pathway for learning).
6. The practical exercises need to be spread over four terms. The investigation may involve more than one term and practical exercises can be incorporated into the investigation.
7. Assessments should normally be undertaken by the person or teacher responsible for teaching the learners.
8. Practical exercises should provide opportunities for learners to demonstrate all five of the skill areas specified in the assessment criteria (see Section 2.3.2 of this handbook). It is recognised that assessing all five areas may not, in every case, be possible if a practical is being targeted at a particular main skill. It is not essential to test all candidates on the same exercises.
9. It is important to make sure that all practical exercises are sufficiently complex to meet the assessment criteria.
10. Teachers should be prepared to take advantage of local opportunities to assess their learners as they help in the community, e.g. with large-scale harvesting, drainage or irrigation schemes, fencing, land reclamation, etc.
11. When assessing group-based work, the teacher must ensure that the individual contribution of each candidate can be assessed.
12. Assessment for some skills will not always generate written work from the candidate; such work can simply be observed by the teacher.
13. Other skills will generate practical work and this will produce evidence for moderation.

1.9 How can a school best accommodate the practical coursework?

The specific requirements for delivering the coursework are necessarily open, providing the candidates can carry out sufficient practical work to meet the needs of the specification.

It will be more difficult to deliver the syllabus without easy access to a school farm or a friendly local farm willing to accommodate your learners.

A school garden or small plot of land would allow most practical activities to take place and allow demonstration of most practical skills. Local visits might be required to allow access to livestock and to allow learners to perform some practical skills.

Some Centres might find it useful to share resources or have projects where livestock can be borrowed and kept for short periods in school so avoiding the complications of long-term care and supervision of livestock. Poultry are one of the easiest animals to manage in this way. Short-term loan or short lifetime breeding or rearing-to-slaughter programmes could also be used.

Animals such as cattle, sheep and goats that are allowed to roam freely on communal grounds can be used for practical exercises such as vaccination, dosing for worms or hoof-checking with the permission of their legal owner.

Ideally, Centres need to have:

- an area for both laboratory-based and field-based agricultural practical work which is secure and offers protection from animals and human activity
- an outdoor teaching area and experimental garden, ideally with small individual beds
- access to water and shade
- an area suitable for propagation and for growing plant seedlings
- somewhere secure to store chemicals and agrochemicals in accordance with local and national regulations
- somewhere safe and secure to store tools and machinery
- a safe area within a laboratory environment where learners will be able to leave their experiments for long-term observations and recording.

Fieldwork is a valuable way to enhance the understanding of agricultural practices and to develop the skills required for the coursework in this qualification.

This could support practical exercises in:

- investigating local soils and rocks
- visiting different types of farm e.g. field crops, fish farms, cattle farming, ostrich farm etc.
- visits to local abattoir, packing sheds or storage houses, and other agricultural enterprises
- visits to or visits from vets, farm livestock sonographers etc.

1.10 Scientific laboratory and classroom access

Overall delivery of the syllabus in relation to laboratory work can be approached in a number of ways. It can take the form of either a long-term experiment that can be set up and established in advance by teachers or technicians, or it can be a series of independent experiments coordinated with any practical work and designed to fulfil any remaining syllabus requirements that fall outside these.

The amount of time required to deliver the course in a laboratory needs to be considered when constructing a scheme of work.

Some laboratory time is required to carry out certain practical exercises and to support the development of the practical investigation. The amount of time required depends on the approach and flexibility of the teachers involved.

Learners will be expected to demonstrate an understanding of:

1. temperature, pressure, evaporation and relative humidity
2. the terms element, mixture, compound, atom, molecule and ion
3. the terms acid, base and pH value
4. energy transfer/conversion

Practically speaking, learners need to be able to perform practical scientific tasks such as: weigh and measure with appropriate scales, rulers or weigh-bands; use sieves and mix soils and compost; measure soil pH with soil indicator; be able to heat and dry soil and burn humus and carry out plant investigations including observations and experiments on photosynthesis and transpiration.

1.11 Practical coursework planning checklist

Teachers should bear in mind the following when planning their scheme of work for the coursework element.

1. Timings of the year; how much teaching and practical time will be available.
2. When set holidays occur.
3. The number of learners in the group and the rough areas of practical study they wish to pursue.
4. When school/local farm facilities will be available, or community activities occur, that can be used for practical experience throughout the course.
5. When the growing season/breeding season falls in relation to all the above timings.
6. When laboratory facilities will be available throughout the course.
7. Work out animal and plant-related practical tasks according to those generic areas you want everyone to cover (perhaps groups in a rotating system to access facilities?) and add in the individual requirements of learner choices.
8. When equipment requirements will be identified and any necessary purchases made.

In addition, teachers should also:

- work out when the theoretical work can be carried out in class and in the lab around the growing/breeding seasons
- coordinate with Mathematics (especially graphs) and Science lessons that cover the required skills
- arrange meeting to set practical work, go through the requirements of the assessment criteria to focus tasks
- consider whether practical investigations chosen by learners can be supported by some of the practical exercises
- try to identify investigations using crops which have a short lifecycle to fit within your time availability
  - choose plants or animal investigations where candidates are able to achieve positive success, e.g. radish or potatoes grow well, and crops such as potatoes or tomatoes are good at being pest resistant and are therefore more likely to succeed
  - encourage investigations where at least some of the data is quantitative and easy to collect
  - give qualitative data a numerical value to allow ease of analysis
- arrange regular meetings of involved staff to review the delivery of coursework and plan 'next steps'
- include all dates identified for the above activities to take place on a yearly schedule and share this with involved staff and other stakeholders.

Section 2: The practical exercises

2.1 Introducing the practical exercises

The practical exercises should ideally be drawn from as many sections of the syllabus as possible. The course ranges widely over subjects such as soil and crop management, livestock husbandry and farm infrastructure and, as far as the resources and facilities permit, it is appropriate (although not obligatory) for the practical exercises to come from a variety of syllabus areas.

Centres are free to carry out more than four practical exercises, submitting only those they consider to be the best four.

In addition, they may be organised in such a way that (up to a maximum of) three practical exercises can be used as part of the Practical Investigation itself. For example, a candidate might investigate the effect of fertilizer on the growth of cabbages, involving:

1. preparing the seed bed, (term 1)
2. planting and spacing the cabbages and applying the fertiliser, (term 1)
3. then harvesting and measuring the cabbage yield (term 2).

However, the incorporation of practical exercises into the investigation is entirely optional and at the teacher's discretion. If this is done, these three practical exercises may have been done in the same term of study, or perhaps, as in the example above, spread over just two terms. This means that, to fulfil the requirement for the practical exercises to be spread over four terms, two (in the example above) or three further practical exercises will be necessary.

Given the choice of investigation topic, the abilities of each individual candidate and the resources/facilities available to the school, the teacher will need to consider the most effective way to meet the syllabus requirements in the case of each candidate and in the time available.

2.2 Evidence to support the practical exercises

In order to enable both internal and external moderation of the teacher-marked practical work, certain forms of evidence need to be included in the coursework portfolio. The syllabus leaves this part really open but makes reference to it in the recording of the marks for **technique** and **quality**.

A key part of the evidence will be **records generated by teacher observation** of the skills being demonstrated. However, tick-sheets and teacher-dated records merely documenting the practical tasks that have been carried out do **not** provide suitable evidence for moderation since such evidence does not show the *candidate* performing the task. Authentic evidence showing that the *candidate* has carried out the practical tasks, and when this work was done, is required. The preferred forms of evidence are those generated by the candidate and those showing the candidate *carrying out the work*. Photographs or video clips of the candidate doing the task, taken either by the teacher or the candidate, are partuclarly useful forms of evidence.

Evidence generated by the learner may encompass a range of sources. A diary is good practice and part of normal agricultural work. Candidates should be encouraged to make observations relevant to the task. Photographic evidence is useful and best annotated by the learner. Photographs or video clips also prove to be highly motivational as well as good evidence of performance. Reflective comments on the activity/task/exercise could include a brief, constructive, critical comment by the learner, either in the form of annotations on other evidence or as a record of reflection. Teachers can also annotate (in red ink) learner-generated evidence to support the mark awarded.

Both learner and teacher-generated evidence for both parts of the coursework should make up each individual candidate's portfolio. It is important to do this for every candidate so that whichever samples are selected for the external moderation sample they will contain all relevant information and evidence. In addition candidates and teachers should put in the same effort to collect and organise each portfolio in the interests of fairness and effective standardisation and moderation.

The kinds of evidence for internal and external moderation can take many forms, such as the examples given below.

Possible items to include in a practical coursework submission:

- a photocopy of the relevant parts of the teacher's mark book
- tables containing, for example, teacher-dated records of work
- marksheets for each individual candidate or for a class of candidates, with teacher-dated records of skill achievement
- ticksheets, both a blank example and filled-in, teacher-dated copies
- skills descriptions clearly linked to the syllabus requirements and to the ticksheets or other teacher records
- spreadsheets or other electronic tables containing teacher records of skill demonstration by candidates
- teacher's mark schemes and worksheets clearly linking to the syllabus and to the ticksheets or other teacher records
- authentic records generated by the learner's activities
- photos of the learner carrying out the activity which can be in any convenient format, e.g. jpeg, gif, bmp or png
- photos incorporated into a word document or PowerPoint presentation which will facilitate the addition of annotations and critical reflections by the learner about the skills that are illustrated by the photo. Alternatively, the photos can be printed out and annotated by hand before being scanned or re-photographed in order to show the annotations and critical reflections
- short sections of video of the learner carrying out the activity (at best, no longer than one minute per activity) on a flash drive/memory stick, CD or DVD – no fancy editing or titles required, but learners may wish to add annotations or critical reflections in the form of audio or added written commentary in the video or as a supporting work document or PowerPoint presentation associated with the video
- original diaries or notes recording the learner's activities – these do not need editing or writing up neatly, but should be the authentic records kept by the learner at the time.

Continuous assessment entails keeping a record for each candidate, showing the operations carried out and the marks awarded. The aim should be to produce portfolios that indicate the task, its descriptors and related mark scheme, the way the candidate understood it and carried it out including his/her own reflections (e.g. photo-diaries with comments) and any records of data collected. The key issues in such evidence are:

- **validity** – the evidence must directly relate to the criteria being assessed
- **authenticity** – the evidence must have been collected at the time that the activity was being carried out
- **reliability** – the evidence must have been collected in such a way that the moderator can be certain that the candidate actually carried out each activity successfully.

The complete schedule of all marks will need to be submitted either to the ministry in the candidate's home country or to Cambridge, as appropriate. The moderator will need to see evidence that the teacher has marked fairly and consistently.

When submitting evidence, it will be found most convenient to use a USB flash stick, a CD or DVD. Some evidence will exist electronically already (e.g. photos, video, spreadsheets, PowerPoint presentations and word processed document, but evidence that is in hard copy can readily be scanned or photographed to digitise it for submission. Set the scanner to a low resolution (75 or 100 ppi/dpi) and save the images as JPEGS optimised for smaller files to give acceptable results and files that are not too large.

If material must be submitted as hard copy, please include only material that is relevant, necessary and authentic.

2.3 Guidance on the practical exercises

The practical exercises should be spread over four terms.

It is important that the practical exercises are first taught as part of the delivery of the relevant syllabus area.

It should **not** be assumed that the learners know how to apply the skills that are being tested. First, learners must be taught how to apply the skills. Then, and only then, should they be allowed to demonstrate their mastery of the skill, whilst being assessed.

The school must ensure sufficient time for the practical work and clearly identify such activities in their scheme of work. It is best not to consider the investigation topic until sufficient theory and related topics have been taught to accommodate in-depth study, linking different aspects of agricultural theory to the investigation.

Ideally, Centres' practical tasks should differentiate over the full ability range. Some practical exercises do differentiate, for example long-term work like the feeding and maintenance of chickens or monitoring plant growth. These are more demanding than, for instance, a lab-based soil settlement exercise. The former gives opportunities for testing all five assessment criteria so helping differentiation, the latter does not. This exercise, however, could be used with a worksheet that offered options and extension work to test initiative and enable access to the higher marks.

2.3.1 Examples of tasks suitable for the practical exercises

Vegetable production, animal husbandry, soil and crop husbandry offer many opportunities for learners to develop assessable skills. Once the skills are confidently demonstrated by the learners, the teacher can take the opportunity to assess the candidates' practical work.

Examples of suitable tasks associated with crop production

- digging to produce a rough tilth
- ploughing
- testing the soil pH in a plot using distilled water, barium sulphate and Universal Indicator
- using a Tulgren Funnel (or similar) and a key to identify soil organisms found in a plot
- measuring the humus and water content of soil
- testing samples from different water sources or water treated in different ways
- preparation of a seed bed
- seed sowing (drills left open for checking depth and spacings)

- fertilising (calculation of quantities, placement, top dressing)
- transplanting and shading
- mulching
- weeding
- pruning
- crop protection (spraying, pest and disease control)
- harvesting and storage of crops

Examples of suitable tasks associated with livestock/poultry production

- care of livestock, including provision of clean water, food and bedding
- maintenance of cages, pens, nest-boxes, etc. in a clean and tidy condition
- use of an incubator/management of broody poultry to hatch eggs
- use of a brooder/management of surrogate mothers to raise young poultry
- herding
- tending animals to minimise the risk of disease (including: disinfection of living areas; identification of diseased animals; isolation; seeking expert medical advice when required, e.g. consulting a veterinarian; administering appropriate treatment etc.)
- harvesting the product (including: egg collection; cleaning and grading; milking; collection of honey or silk etc.)
- upkeep of living areas (including: boundary maintenance, e.g. fences and hedges; repairs; pasture management etc.)
- husbandry (including: selecting animals to breed from; provision of suitable areas for birthing/hatching/care of young; involving experts where appropriate etc.)

2.3.2 Syllabus criteria for the assessment of practical exercises

Each practical exercise should be marked using the following criteria:

1. Responsibility	the ability to assume responsibility for the task in hand, and to work from given instructions without detailed supervision and help
2. Intiative	the ability to cope with problems arising in connection with the task, to see what needs to be done and to take effective action
3. Technique	the ability to tackle a practical task in a methodical, systematic way, and to handle tools skillfully and to good effect
4. Perseverance	the ability to see a task through to a successful conclusion with determination and sustained effort
5. Quality	the ability to attend to detail, so that the work is well finished and is well presented

2.3.3 Interpreting the marking criteria for the practical exercises

The tables that follow show the further breakdown of these marking criteria, as they are stated in the syllabus. Alongside each criterion below you will find a commentary to assist teachers, assessors and moderators. This gives an indication of the standard you should expect to see in a learner's work at each level for each skill area.

1. Responsibility marks	Marks	
• Follows written or verbal instructions without the need for help	3	**Works independently, can read and interpret instructions. Follows all relevant safety procedures. Suggest noting in diary (when involved in group-based tasks) how the candidate led and/or intervened. A mature, responsible learner with regard to practical work.**
• Carries out appropriate safety procedures		
• Assumes responsibility easily and leads in group work		
• Follows written or verbal instructions with a little help	2	**May need some clarification or some guidance, especially to ensure all necessary safety procedures are followed. Needs reminding to record or apply procedures to the working situation. Responsibility for task and for others is clearly evident.**
• Is aware of the need for safety procedures but has difficulty recognising them without guidance		
• Shows responsibility for the work		
• Follows written or verbal instructions with considerable help	0–1	**A candidate who generally needs support, guidance and frequent reminders about safety but who does attempt the given task.**
• Shows little regard for safety procedures, even when told		
• Shows some responsibility for the work		

2. Initiative marks	Marks	
• Offers solutions or explanations to unexpected problems	3	**As problems arise, candidate is able to amend or change a procedure (e.g. if the soil was too wet to cultivate, decided not to proceed that day.** **Is able to anticipate potential difficulties *e.g. that the tractor may need new tyres, the oil may need changing or spark plugs may be fouled, if the tractor won't start).** **Suggest such details are recorded in diary or records.**
• Recognises, and is able to anticipate, problems		
• Solves problems without help		
• Comments on imperfections of experimental methods or results		
• Offers solutions or explanations to unexpected problems after seeking advice	2	**Discusses problems and listen to open-ended advice and is then able to amend, using the general advice (not instructions).** **Able to work to solve problems having sought appropriate advice. Suggest should record faults and be self-criticising.**
• Solves problems with help		
• Recognises faults in experimental methods, given some pointers		
• Is uncertain how to proceed and requires considerable help	0–1	**As problems arise, candidate is able to amend or change a procedure (e.g. if the soil was too wet to cultivate, decided not to proceed that day).**
• Recognises only the most obvious errors in experimental methods after considerable guidance		

3. Technique marks	Marks	
• Approaches tasks methodically and systematically	3	**Is well organised to carry out the task, confident and competent in the use of tools and equipment. May modify approach, as needed, to the actual conditions and equipment available. Takes out/returns equipment correctly. Uses measuring/weighing equipment accurately.**
• Handles tools/apparatus skilfully and confidently		
• Carries out practical procedures with dexterity		
• Handles tools/apparatus effectively	2	**Uses tools safely and is able to achieve the desired result. If not perfect, the results of their efforts will have a positive outcome.**
• Carries out practical procedures adequately		
• Handles tools/apparatus clumsily	0–1	**Poor use of tools and equipment. Holds or operates tools and equipment in unusual way or not in the most effective way. Has to be reminded and made to clear up tools.**
• Carries out practical procedures with difficulty		

4. Perseverance marks	Marks	
• Completes all the required practical tasks and attendant written work • Has a positive attitude and is well motivated	3	**Record diary and or photographs annotated in an effective and well-detailed format. Really well-motivated and gets on with the task in a determined way. Always cheerful and wants to get on or spend extra time on the task.**
• Completes the required practical tasks and attendant written work with a little encouragement • Carries out repetitive procedures willingly	2	**Generally records work effectively, only needing some prompting to finish written or practical aspects of the task. Is always happy to do additional work if requested.**
• Does not complete the required practical tasks and attendant written work • Is somewhat disinterested/impatient when carrying out work and is disinclined to repeat procedures	0–1	**Only performs part of the practical task. Written evidence is scant by nature. Lacks interest, can't really be bothered to carry out any additional work that might improve the outcome.**

5. Quality marks	Marks	
• Performs practical work thoroughly, pays attention to detail and produces a very good final result	3	**Careful work, performed to a high level of skill. Work of almost a professional quality resulting in the expected outcome. The outcome could be shown with pride to a specialist. All necessary work detailed as a record of the task with observational information including reflections on the task (possible with photographic illustration).**
• Produces accurate, clear and neatly presented written work		
• Performs practical work thoroughly for the most part and produces a satisfactory-to-good result	2	**Task performed to an adequate standard (e.g. the crop sown would germinate in a regular way even if not a perfect finish). The record of the work is sufficiently clear to explain the nature of the task and includes some appropriate observation/ comment.**
• Produces mostly accurate and clearly presented written work		
• Performs practical work in a rushed and superficial way and shows little concern for the finished product	0–1	**Poor finish, incomplete work, (e.g. if seeds sown, not all would germinate).** **Work not complete, basic.** **Note: the written work should not be marked down if the candidate has poor/untidy handwriting, providing it is reasonably detailed and contains an appropriate record.**
• Produces inaccurate and poorly presented written work		

2.4 Examples of evidence for the practical exercises

Ways to evidence practical exercises are open to the teacher. However, evidence should be seen as an important way to support the teacher's assessment marks while motivating learners and not imposing excessive paperwork. It should, most importantly, be seen as a way to foster good learning, motivating learners and allowing them to share learning within the teaching group.

Some suggestions to enhance the evidence provision and learning opportunities for practical exercises as stand alone exercises, or exercises which could be incorporated into the investigation topic, are shown below. Please note that any errors in these candidate submissions have not been corrected.

2.4.1 Caring for livestock

I am trimming the feet of the ewe removing overgrown hoof material and cleaning out mud and dirt. When I finished trimming I gave it a spray of antibiotic spray which is coloured purple so that it is easy to see which feet and sheep have been treated.

Having caught the ewe I decided to get Rob to hold her while I clipped her rear hoof which was quite badly overgrown and needed spraying with antibiotic.

A simple but effective way to evidence skills.

2.4.2 Using tools and machinery effectively with regard to safety to carry out routine agriculture task within the centres practical area farm or garden.

This is me after starting the school tractor and collecting some manure from the pig's house. Before I started the tractor I checked the oil and water. I also checked the PTO cover was in place. The tractor was running quite poorly and had been slow and hard to start, I reported this to the farm manager.

Reversing after dropping the manure.

The farm manager checking my driving skills and ensuring I knew how to operate the tractor in a safe way. Ploughing was quite difficult as the tractor started to wheel spin quite easily making it hard to keep in a straight line.

I am concentrating quite hard to keep straight.

Task reflection.

This was a fun task. I prepared a risk assessment and I learnt how to start and drive the tractor. Check it was safe to use and carry out two practical activities. I had problems with starting the tractor and it kept stalling so I reported this to Mr Bert the Farm manager.

Collecting manure from the pigs was good for saving time as some times we do it with wheel barrows. I made one mistake allowing the others to throw their forks onto the manure rather than laying them in safely. It was not easy because the tractor was difficult to start and kept stalling on me not my fault . Reversing the trailer was quite difficult but I started to master it. I really needed more time to get more skilled at this .

Ploughing was really hard the tractor was working better but the soil was really too wet . I told sir but he said we had to do our best because we had exams next week.

Mr Bert told me later he had found the trouble with the tractor a blockage in the fuel line . He thanked me for reporting it before it became a real problem.

The above is an example from a UK Centre. The task reflection element enhances the thinking about the processes involved and the skills required as related in the taught theory topics.

2.4.3 Field sampling and soil analysis pH testing

Finding out about the pH on the sand dunes nr the beach by our school. We compared the 3 main dunes the one on the left is by the shore and is neutral with apH of 7.0 but as we moved inshore the soil had a pH of 4.0 we used the barium sulfate soil test. The area was grazed by goats from school. The best grasses grew near the sea.

I took each sample 50 m further in land and took 3 samples of soil at each point scraping off the top 10 mm of soil and mixing all 3 samples and then put 20 mm of soil into the barium sulfate tube.

- The shoreline with a pH of 7.0 caused by calcium from shells
- The third tube shows the pH has fallen to 5.0 by the final tube on top of dune 3 the pH had fallen to 4.0.
- The Triassic Sandstone beds are very calcifuge (acid) .
- Interesting point if a shell was dropped by a bird the pH was noticeably higher in the area.
- To avoid this problem we always mixed six trowels of soil from each dune area and carefully scraped off the top half centimetre before sampling.

2.4.4 Animal husbandry and harvesting

I am shown hear winnowing our family rice crop, the weather had been not good for drying but as the crop fully dries the seeds fall away easily. It is a very labour intensive process and time consuming. It is important that the crop is fully dry less than 18% moisture in theory I can tell by rubbing the grain between my fingers, smell and the ease in which it separates.

Me looking after my water buffalo I am allowing it to graze the stubble from our village rice crop. Each day I check his feet and coat and lead him out giving him as much line as possible. I keep him away from the cows and moving to see he gets the best of the re growth on the old rice crop.

It can be seen that when moving the buffalo I have to be quite positive and keep the lead short and assert myself with the beast.

I normally sort the buffalo out before school and move them when I get back at 1300 hrs . This activity is easier than cutting the grasses from the roadsides and between fields which I do when the rice crop is growing.

This allows assessment away from the school and in positive ways, supporting community activity.

2.4.5 Diary extract

Date	Activity. Sowing and cultivating a row of carrots
April 12	Prepared the soil forked over weeds and compressed
April 6	The rain stopped so made seed bed with fine tilth made seed drill and sowed seeds 20mm deep
May 12	Most seeds germinated
May 26	Carefully weeded, quite easy to tell the weeds carrots 35mm
June 8	Weeded again weeds quite thick used hoe and then hands
June 26	Thinned I had got some patches quite thick
July 10	First harvest left some to grow on leaving more space to grow big

2.5 Specimen practical exercises

The following suggestions could be adopted or amended for use in your school.

2.5.1 Seed bed preparation for maize production

Seed bed preparation for maize production	
Tools and materials required	• Hoes, spades, garden fork, watering can, measuring tape and strings
Instructions to the learner	• The work is to be carried out in groups • Each group should prepare a plot for planting maize crops • Measure the seed bed (about 1.5m x 2m) • Dig and level the seed bed • Apply the fertilisers/ordinary manure /compost • Water the seed bed • Measure the distance between the rows (90cm)
Written task	• Determine the number of rows per seed bed and draw them • Measure the distance between the seed beds (30cm) • Show all your calculations and findings in the space provided • Calculate the area in m^2 • How many rows will you have in the area of 1.5m x 2m? • How many plants will you plant in one row? • Find the total number of plants per plot

2.5.1 Seedbed preparation for maize production (continued)

Marking points	**Responsibility**
	• Follow instructions correctly • Measure the distance between holes and rows correctly
	Initiative
	• Levelling of the seed bed and raising up of the sides of the seed bed • Breaking of crumbs to a fine tilth
	Technique
	• Measuring correct amount of fertilizer • Digging technique
	Perseverance
	• Willingness to complete task within the given time • Level of concentration at different stages of seedbed making
	Quality
	• The quality of the work done, i.e. the seed bed being properly measured with regard to width and length, the levelling of the seed bed and the mixing in of the fertilizers

2.5.2 Identification of soil profile

Identification of soil profile	
Tools and material required	• Spades, measuring tape/metre stick, rope, pencils, pieces of paper, pegs and a rake
Instructions to the learner	• Learners to work in groups • Select and clear the area to work on • Measure the area 1.5m x 1m • Dig a hole 1m deep • Identify the different layers of soil
Written task	• How many layers are there? • How many metres/centimetres thick is each layer? • Draw and label the visible layers.
Marking points	**Responsibility** • Follow written and verbal instructions • Punctuality • Safety measures followed **Initiative** • Ability to solve unexpected problems (removing roots and rocks, etc) • Filling in of hole after the exercise • Identification of soil layers in terms of colour and/or organic content **Technique** • Correct method of measuring • Handling of tools **Perseverance** • Positive attitude towards work • Ability to complete work within a given time **Quality** • Neatness of drawing • Appearance of hole

2.5.3 Milking cows by hand

Milking cows by hand	
Tools and material required	• Milking can, water, iodine, milking cup, rope, etc.
Instructions to the learner	• Learners should work in groups • Bring animals silently to the milking area • Give feeds to the animals • Clean the udder of the cows and dry the teats before milking • After milking dip teats in iodine • Weigh the milk and keep the records • Store the milk safely
Written task	• Why do we need to dip the teats in iodine after milking? • Draw a graph to show milk production for each cow • Why is it necessary to keep the cow calm during milking?
Marking points	**Responsibility** • Carries out the work without help • Carry out appropriate safety procedures **Initiative** • Washing of hands and teats/udder before milking • Cleaning of tools and safe storage of tools **Technique** • Handling of cows, i.e. tying the legs before milking (safety precaution) • Milking techniques • Cleaning of udder • Dipping teats in iodine **Perseverance** • All parts of the milking process completed successfully **Quality** • Graphs correctly plotted and drawn • Cleanliness of the milk • Accurate weighing

2.5.4 Laying of water pipes

The school garden is far from the water source (taps) and the agricultural learners will use this opportunity to lay pipes, from the water source to the garden. Learners should work in groups.

Laying of water pipes	
Tools and material required	(See 'Written task' below)
Instructions to the learner	• Measure the distance between the water source and the garden • Determine the distance each group has to cover • Clean and dig trenches • Lay down pipes • Connect pipes to the tap • Test flow of the water to determine the leaking areas • Cover the trench with soil
Written task	• Identify the materials which you will need to carry out this task • What effect has slope on the flow of water?
Marking points	**Responsibility** • Following instructions correctly • The ability to organise themselves within a group **Initiative** • Identification of the correct tools and materials • Ability to detect problems and solve them, e.g. obstacles such as rocks, tree roots, etc. • Ability to vary the depth of the trench to encourage water flow • Selection of proper tools to use **Technique** • Handling of tools in the proper way • Digging skills to allow the flow of water • Ability to join pipes together **Perseverance** • All required practical tasks and written work to be completed • Positive attitude towards work given **Quality** • Accurate measuring of distance • Correct filling of the tap and pipe • Appearance of the area on completion • No leakage found

2.5.5 Transplanting, shading and irrigating of tomato seedlings

Transplanting, shading and irrigating tomato seedlings	
Tools and material required	• Hand trowels, watering cans, water, measuring tape, sticks, leaf twigs, wheelbarrow, head pans and blades
Instructions to the learner	• Transplant healthy seedlings after watering and when they have developed about four leaves and are approximately 10–12cm in height • Mark out the planting distances and depths, which should be 5cm deep and 90cm apart • Pack the seedlings carefully into a wheelbarrow or head pan and take to the garden • Carefully place the seedlings in the holes • Irrigate immediately and provide shade
Written task	• Why were the seedlings nursed before being transplanted? • Suggest two reasons why some of the seeds did not germinate in the nursery? • Give two reasons or advantages of irrigating the seedlings after transplantation • What caused the wilting of some transplanted seedlings? • Suggest two reasons for maintaining planting distances in the garden • Why should young seedlings be shaded after transplanting?

2.5.5 Transplanting, shading and irrigating of tomato seedlings (continued)

Marking points	
	Responsibility
	• Following instructions without assistance • Participation and teamwork • Taking safety precautions e.g. handling tools
	Initiative
	• Solving problems without help, e.g. how to carry the seedlings • Method of applying manure or humus in each hole • Designing and making strong and suitable shading
	Technique
	• Proper handling of trowel whilst digging the holes for transplanting • Correct carrying and removal of seedlings from the nursery; putting them in the planting hole with balls of earth clinging to them • Careful irrigation to prevent damaging the tender leaves and prevent waterlogging
	Perseverance
	• Required number of seedlings transplanted • Irrigation carried out • Shade constructed • Worksheet complete (marking)
	Quality
	• Accuracy of planting distances and straight row planting • Cleaning the area • Plant survival rate

2.5.6 Branding of calves (marking)

Branding of cows	
Tools and material required	• Firewood/charcoal, branding iron, rope, crush-pen
Instructions to the learner	• Bring the calves to the crush • Sort out the calves to be branded from the rest • Get calves into position • Start branding the calves
Written task	• What is the purpose of marking (branding?) • Describe the technique used for marking/branding • What will be the ideal age or time for branding a calf? • Why is it important to inspect the animal after branding? • Why is branding done on the lower part of the hind leg?
Marking points	**Responsibility**
	• Safe handling of calves and consideration shown for animals • Follow written instructions • Cleaning of tools
	Initiative
	• Selection of the correct tools • Arrangement of tools for ease of carrying out work • Detecting the degree of heat of the iron • Application of water on the branding iron to cool it
	Technique
	• Handling of the cows during actual branding • Handling of tools skilfully • Working with accuracy (right position and correct force)
	Perseverance
	• Participation in all tasks • Patience and willingness to complete the task • Cleaning up after work • Inspection of the animal over the next three to four days
	Quality
	• Speed of sorting calves into position • Quality of mark/brand made • Visibility of brand numbers

Section 3: The Practical Investigation

3.1 Introducing the practical investigation

The syllabus provides a clear explanation of the work required and the evidence that must be gathered and presented for the practical investigation.

In the syllabus, **Section 5.2.4** lays out the framework within which the practical investigation is to be carried out. The purpose of the project is that learners will develop skills in investigation which will then be assessed against Assessment Objective AO3: experimental skills and investigations. There is a 1000 word limit for the project and this limit should be adhered to tightly. Please note that any work that is beyond 110% of the total required (i.e. 1100 words in this case), will be ignored for assessment purposes.

3.2 Principles

In the syllabus, **Section 5.2.5** explains the sort of work that is required for the project to test investigatory skills.

This syllabus section sets some important principles for the work, which are discussed below.

- The investigation should be the work of the individual candidate; group-work is not suitable and any attempt to use group-work will inevitably penalise individual candidates.
- The research part of the project should be practical in nature, involving measurement and observation by the individual candidate which will produce primary data on which the conclusions can be based. Secondary research, such as research on the internet or from books, should not be the major source of data for the investigation, although it may be very useful in putting the preparations and drawing of conclusions in context.
- This should be a **major** piece of work. The syllabus specifies that it should take about 3½ hours of work in class along with associated homework time.
- This should be a good opportunity for the candidates to learn independently, guided and supported by the teacher, working as a facilitator. The role of the teacher should thus be encouraging the candidate rather than directing.
- The investigation should be prepared for properly – candidates will need to learn how to do investigatory work **before** they can do the project successfully.
- The project should be on a topic chosen by the candidate where possible. Some candidates may need considerable support to enable the selection of a suitable topic. Other candidates may be unable to make appropriate choices themselves. Such candidates will need to have suitable problems selected for them, as permitted by the syllabus.
- This investigation should be based on a problem that the learner sets out to solve. This should be expressed as a question or as a hypothesis. Simpler projects will tend to be based on questions. More sophisticated learners will prefer to express their predictions and expectations in terms of a hypothesis. Such hypotheses will involve the relationship between an identified independent variable and an identified dependent variable. Such candidates will recognise, that to make a fair test, they should control other environmental variables as far as possible.
- Field studies may involve a type of experiment (naturalistic experiment). In this case, natural variation in a variable, such as trampling or soil moisture, is used as the independent variable. Control of variables such as soil pH and temperature is achieved by measuring such variables in order to confirm that there are no significant differences between them at sites chosen to give suitable values for the independent variable. This will ensure that such field studies produce worthwhile numerical data for analysis. Field studies that produce observations alone are much more difficult to analyse effectively.

- Some candidates will peform experiments in environments which can be better controlled (such as pots in a glasshouse or chickens in several different runs). These will also work best if conducted in the form used by scientific investigators (as described above) rather than as purely observational studies, so that candidates are able to make worthwhile analyses and conclusions.

3.3 Selecting suitable questions and hypotheses

Teachers should provide advice for learners in selecting suitable questions and hypotheses – for example, within agriculture the learner should pick a general topic of interest to them. They should write down questions that they might want to answer. Such questions usually start with words such as: how, what, when, who, which, why, or where. The learner may prefer to begin with a question or with a hypothesis which is just a prediction based on knowledge and understanding. The learners should consider whether it is possible to design a fair test to answer the question in which only one factor or variable is changed and all other conditions are kept the same. The learners should also consider whether their question or hypothesis involves factors or variables that can easily be measured, giving numerical results.

3.4 Dealing with problems that do not get solved and hypotheses that turn out to be incorrect

The syllabus offers guidance on how to support learners who do not solve the problems that they set out to solve. In such a case, the role of the teacher is to provide encouragement to the learners to view this as a learning experience and to report what they attempted and why it did not work as expected, in order that they can be fairly assessed. It is expected that a well-written and well-explained project that did not succeed in solving the problem intended will gain high marks.

Other learners may come up with data which contradicts the hypothesis that they set out with. In other words, they do provide a solution to the problem, but it is not the solution that they were expecting. Rather than trying to change or manipulate the data to fit the original hypothesis, learners should explain the results in terms of challenging the original hypothesis. Learners should be aware that professional agricultural scientists often find results that do not support their hypotheses, and that such results are the first steps towards making new, better hypotheses. Learners might be encouraged to consider suggesting new hypotheses that could be tested and alternative measurements that could be made if they had time. It should be clear to learners that such research is an ongoing process of discovery, and that finding a hypothesis to be untrue can lead them to more suggestions and questions. As an assessor, the teacher is interested in the processes that the learner uses rather than the success or otherwise of their hypotheses.

3.5 Suitable topics

Section 5.2.6 of the syllabus gives a list of the kinds of work that will raise suitable problems for appropriate practically-based investigatory projects in the context of the considerations about questions and hypotheses given above. This is not designed to be an exhaustive list – many other projects are possible. It is also not designed to be a restrictive list – learners should be encouraged to work on other suitable topics if that is their preference. In selecting suitable projects, as described above, one consideration should be whether the information gathered has any impact on yield of produce and on cost-effectiveness of potential treatments. Such work has a clear agricultural, commercial purpose, and also produces numerical data which is the preferred outcome of the investigative experimental work involved. Some general topics might be suggested and where candidates have excellent ideas that unfortunately cannot be accommodated, teachers should suggest alternatives. The candidate should then be allowed to incorporate some of their original ideas into a plan worked around what is appropriate and practical for delivery within the school.

The teacher needs to think carefully about the timing of the course especially in relation to the growing season and holidays to ensure that the syllabus content relating to the investigation topics is adequately covered.

Local agricultural or environmental problems might prove to be motivational in identifying a useful, productive and worthwhile investigation.

3.6 Group work

Group work has a potential role in the data-gathering phase of the practical projects where field trials are involved. It must be emphasised that the practical report must be the work of the individual candidate. However, it is possible to use group-work in this way in order to provide more data. It is vital for each individual candidate involved in this process to identify the individual treatments and results that they themselves contributed to the overall group results.

Candidates should be encouraged to take specific responsibility for a section of data collected. This can be highlighted in tables and their role in this aspect of the work should be clearly indicated.

Animal investigations may also require a collaborative approach to obtain sufficient useful data and ensure safe and high-quality animal husbandry skills.

Teachers will need to be aware of the timings of such exercises in order to achieve an even distribution of practical work over the four terms and to make sure that each individual learner carries out sufficient practical work and has sufficient opportunities for individual practical assessment.

3.7 Summarising data: tables and graphs

In the Practical Investigation there is a need for concise summaries of data. The purpose of such data summaries is to enable rapid visualisation of the meaning of the data. So learners should be encouraged to ensure that any tables, charts, illustrations and graphs have a clear purpose in illustrating the interpretation of the data obtained. This is explored in more detail in section 3.10 below.

3.8 Explanations, evaluations and conclusions

Another area of importance is that of expressing reasoning in the report. Reasons should be given for any decisions made regarding the specific treatments, measurements and observations made.

Similarly, where decisions are made about which data can and cannot be relied upon and which data should be included in the analysis, there should be clear explanation and reasoning so that the reader can understand why data was included or excluded in further analysis.

Once the meaning of the data has become clear to the learners, indicating to them whether the data supports the hypothesis or does not, the learner should clearly explain the reasons behind the conclusions drawn. This should include explaining how the conclusion was reached, i.e. the specific reasons why the information obtained in the study lead the learner to draw a particular conclusion. It should also involve the learner attempting to explain the reasons for the data found.

The learner's conclusions will need to summarise the extent to which their results support or refute their original hypothesis. Learners will need to include facts and information from background research to help explain their results. This may be in terms of a question originally posed, or may involve a statement about the relationship between the independent variable and dependent variable.

Agriculture is a commercial enterprise, and thus cost-effectiveness is a key issue in agriculture. Learners should be encouraged to think about the economic impact of the information that they have obtained, and to give an assessment of the potential impact of their findings on cost-effective agriculture.

3.9 The role of the teacher

Section 5.2.7 of the syllabus sets out the role of the teacher as guide and facilitator rather than as director.

However it also makes clear that learners who need more support should be given more support.

This will be reflected in the assessment, so those learners who are able to be more autonomous in getting on with the work without significant support from the teacher, will get higher marks than the learner who has had difficulty understanding the requirements of the project during the preparatory work beforehand, and needed support at each step of the journey.

The timing of the various practical exercises and projects is crucial to ensure that all of the learners acquire the skills to the best of their ability in the time available. The learners must also meet the syllabus requirements in terms of both the range and extent of the work they carry out and the evidence they submit. Practical exercises should be carried out over a sufficient number of terms. It is the teacher's responsibility to make sure that the learners have both the time and the opportunity to fulfil the assessment criteria as successfully as capability and development allows.

3.10 The report

Section 5.2.8 gives a very clear description of the nature of the report required and the content of each section.

It makes clear that there are certain sections that must be present: Title, Contents, Introduction, Methodology, Presentation of data findings, Findings and conclusions. Every report should be prepared to the same high standard irrespective of whether it is in the moderation sample required by Cambridge. The exam board could ask for any, or all, of the other projects at any time up until the point where the regulations allow them to be either disposed of or returned to candidates. This is well after the results have been released and any reports and re-marks completed.

It would be sensible if the title included a clear indication of the question or hypothesis that underlies the project. The **title** must be visible from the front of the project along with the candidate's name, candidate number, school/Centre name and Centre number, so that the assessor and moderators can immediately see the nature of the project report without having to open the covers. This means that it is unwise to put the projects into any kind of folder as it makes them unreasonably bulky and difficult to transport and means the moderator has to open each one to find out who wrote it and what it is about.

The **contents list** must have page numbers, which means, of course, that the pages of the report must be numbered clearly. The section titles mentioned in the syllabus should be clearly indicated in the contents list, along with any other sections included. The assessor and moderators need to find it easy to navigate around the report and this means that any tables, charts, graphs, diagrams and illustrations should also be detailed in the contents list and provided with titles and page numbers.

The purpose of the **introduction** is to summarise the plans for the investigation.

- This means that it should contain a statement of the question or hypothesis underlying the investigation plus a brief outline of the way it is to be answered or tested. Key dates indicating when the actual practical work was carried out and the location in which it took place should also be included.

- It should be remembered that the word limit for the whole report is only 1000 words, so the introduction should be concise if the word limit is not to be exceeded.
- Any acknowledgements should also be included in the introduction (for example, if laboratory technicians helped get apparatus ready or if a local farmer permitted the work to be carried out on their land with their livestock. The acknowledgements do not contribute to the word count, so that if there are a number of people or organisations to acknowledge, this will not cause unfairness to the candidate.
- Any secondary sources of information used, (textbooks, websites, etc.) should also be included here in a resource list or bibliography, (which also does not contribute to the word count). Such references are vital for indicating the source of ideas and methods selected by the learner. They suggest reasons and explanations for decisions made and the extent to which a learner researched other investigations in the past. They also indicate that the learner has checked the validity of other work.

The Plan and the hypothesis should be distinctly different.

The **methodology** section of such a report is often called 'The Methods' by scientists. It refers to the ways in which the investigation was carried out. The learner needs to describe, concisely, how any planning or pre-sampling was carried out, how the data was collected, and how any measurements (e.g. of temperature, pH or other variables) were made, and how any problems in obtaining data were overcome. (For example, if apparatus was made or adapted to allow measurements to be made). The section will include any numerical and graphical methods used, for example in calculating percentage yields of different crops or cost-effectiveness of a treatment regime. If any statistical methods are used to simplify data, such as standard deviation, standard error, mean, median, quartiles, etc., these should be outlined as well.

The **presentation of data findings** section should indicate the results. This should include tables of raw data, not re-written but presented exactly as they were recorded during the investigation. Not all such tables need to be presented but a sample will give the assessor and moderator a clear picture of the likely reliability of the data. Such data tables do not form part of the word count.

The purpose of any other tables, graphs, charts and illustrations that might be included here is simple. In deciding whether or not a particular presentation should be included, the learner needs to ask themselves just one simple question: "Does this table/graph/chart/illustration help the reader to understand what the data means?" If the answer to this is no, then the learner should not include the this table/graph/chart/illustration. If the answer is YES, then the learner could usefully include the this table/graph/chart/illustration, if something else does not show the same thing better.

All such presentations of data should be clearly labelled with a title, making clear what is being shown and what it means. Learners should take care that obvious things such as graph axes and units of measurement are suitably labelled to avoid careless loss of marks. Ideally, candidates should annotate their graphs and charts to identify anomalies or relevant points of interest.

A word on the use of graphs in the investigative report

The section below provides clear and reliable advice regarding the use of graphs which are so important in presenting the evidence. It was developed by a practicing Agriculture teacher delivering the Cambridge syllabus and is designed to be given directly to learners to assist them in constructing their investigation reports.

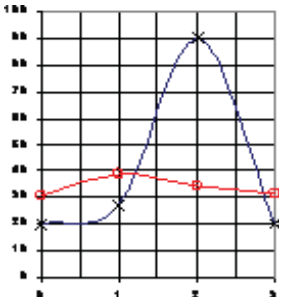
Using graphs and charts

Deciding which form of representation to use

In deciding whether to include a table/graph/chart/illustration, ask yourself the following question: does the table/graph/chart/illustration **help the reader to understand what the data means?**" If the answer to this is no, then do not include it. If the answer is **YES**, then this table/graph/chart/illustration should be included if something else does not show the same thing better.

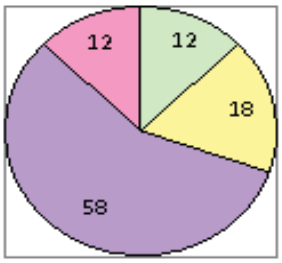
Which type of representation should I use?

Graphs – should be used to show relationships between numerical variables, e.g. weight of pullet and weight of eggs produced.



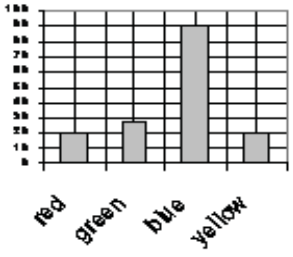
- The independent variable will be plotted on the *x*-axis (horizontal axis) and the dependent variable plotted on the *y*-axis (vertical axis).
- Each axis will be labelled with the physical quantity and the appropriate SI unit, e.g. time / min.
- The graph is the whole diagrammatic presentation. It may have one or several curves plotted on it.
- Curves and lines joining points on the graph should be referred to as 'curves'.
- Points on the curve should be clearly marked as crosses (x) or encircled dots (⊙). If a further curve is included, vertical crosses (+) may be used to mark the points.

Pie charts – may be used when you want to draw attention to relative amounts or percentages. It works well with percentages between 10 and 90%, but bar charts are better for smaller percentages.



These should be drawn with the sectors in rank order, largest first, beginning at 'noon' and proceeding clockwise. Pie charts should preferably contain no more than six sectors.

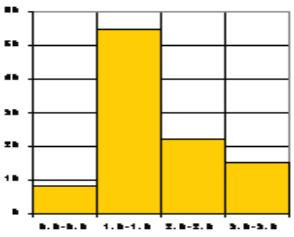
Bar charts – these are drawn when one of the variables is not numerical or has discrete values, e.g. number of eggs of different colours, or frequency of occurrence of nests with different numbers of eggs.



They should be made up of narrow blocks of equal width that do **not** touch.

They can be plotted horizontally or vertically.

Histograms – are the most rarely required kind of graph. They are to summarise distribution data visually. They can only be used when it is possible to calculate a frequency for a series of classes of a continuous numerical variable, e.g. the frequency of chickens with different masses or frequency of occurrence of stems of different lengths. The blocks should be touching.



This advice on graphs should be made available to the learners and should be incorporated into the delivery of the theory content of the course so that learners become familiar with their use. This could also be an opportunity for close cooperation with the mathematics department within the school/college so that delivery can be coordinated across the two subjects. The use of graphs and charts should form a valuable and natural part of reporting on the investigation and practical exercises. It should be understood as the most effective way of demonstrating the significance of results to others, i.e. illustrating what the results actually mean.

A frequent weakness in coursework evidence occurs when large amounts of data have been collected and presented appropriately by learners but they have failed to use the information in their analysis. Encouraging selection of appropriate graphs, coupled with annotation of the actual graphs and charts will encourage productive use of the information which has been collected and presented.

The **findings and conclusions** section of the report should be a few short paragraphs and should bring the whole piece of work up close to the 1000 word limit without exceeding it. This is often the longest single section in the report, containing a few hundred words of concise explanation of what the results actually show that is explaining what the results actually mean. The extent to which the results succeed or fail to answer the original question or test the original hypothesis should be included. Learners should not be frightened of explaining that they did not succeed in what they set out to do but learned some other things instead, even if that is only to learn how to do such a project better next time. Limitations in the methods and in the results (such as problems with reliability or with control of variables to make it a fair test) are worth mentioning. This allows learners to make suggestions on how to improve methods and also how to make results more reliable through use of a fairer test.

If the teacher or anyone else gave assistance and help during the work, this should be described – this description does not contribute to the word count. It is vital that this be included so that the assessor and moderators can make a fair judgement on how much of the work in the report is the candidate's own work.

3.11 The assessment criteria

In the syllabus, **Sections 5.2.9** and **5.2.10** lay out the assessment criteria for assessing the reports. We have reproduced them below for convenience but you should always refer to the syllabus (for the year in which your learners will sit the examination) as the definitive source of authority for all technical and academic aspects of the qualification.

3.11.1 Criteria for the assessment of the practical investigation

The practical investigation should be marked using the following criteria.

Marking Criteria

Criteria	Marks available
1. The selection of relevant questions (hypothesis) for the investigation	5
2. The planning of the investigation and the principles on which it is based	5
3. The handling of evidence	5
4. The ability to make deductions from the evidence or the data acquired	5
5. The ability to recognise limitations of the investigation	5
6. Description of practical, presentation, layout and originality (candidate's own work)	5

Interpreting the marking criteria for the practical investigation report

1. The selection of relevant questions (hypothesis) for the investigation	Marks
• Relevant questions (hypothesis) selected without guidance, appropriate and clearly stated	5
• Relevant questions (hypothesis) selected without guidance, appropriate but poorly expressed	4
• Relevant questions (hypothesis) selected with guidance, appropriate and clearly stated	3
• Relevant questions (hypothesis) selected with guidance, appropriate but poorly expressed	2
• Relevant questions (hypothesis) selected with considerable guidance	1
• Relevant questions (hypothesis) provided for the candidate	0
2. The planning of the investigation and the principles on which it is based	**Marks**
• Investigation well-planned, without guidance, showing evidence that the relevant principles are understood	5
	4
• Investigation adequately planned, with some guidance, relevant principles understood	3
	2
• Investigation plan sketchy, plan produced with considerable guidance or no evidence that principles are understood	1
• Investigation plan provided for the candidate	0
3. The handling of evidence	**Marks**
• Results presented neatly and clearly in a table, appropriate method of analysis chosen, graphs and/or histograms accurate and correctly presented (i.e. correct scale, axis, 0 plot, labelling, etc.)	5
	4
• Results presented neatly and clearly in a table, inappropriate method of analysis chosen, graphs and/or histograms inaccurate and incorrectly presented	3
	2
• Results not presented in a table, inappropriate method of analysis chosen, graphs and/or histograms inaccurate and poorly presented	1
	0
4. The ability to make deductions from the evidence or the data acquired	**Marks**
• Comprehensive deductions based on the evidence, conclusions given with reasons	5
• Several deductions based on the evidence, conclusions given with reasons	4
• Few deductions based on the evidence, one conclusion given	3
• Few deductions based on the evidence, no conclusions given	2
• One deduction, no elaboration	1
• Tasks carried out with considerable help, inaccurate observations and records	0

5. The ability to recognise limitations of the investigation	Marks
• All major limitations identified, assessed and improvements suggested	5
	4
• Several limitations identified, assessment superficial, no improvements suggested	3
	2
• One or two limitations identified but no assessments or improvements given	1
	0
6. Description of investigation, presentation, layout and originality (candidate's own work)	**Marks**
• Clear, full description of the aims and nature of the topic; work neat and well presented; layout as required by the syllabus; candidate's own work	5
	4
• Description of the aims and nature of the investigation given; lacking in either neat presentation or layout not as required by the syllabus; candidate's own work	3
	2
• Outline only of the aims and nature of the investigation; poorly presented; layout not as required by the syllabus; candidate's own work	1
	0

The tables that follow show the further breakdown of the marking criteria for the investigation report, as they are stated in the syllabus. Alongside each criterion below you will find a commentary to assist teachers, assessors and moderators. This gives an indication of the standard you should expect to see in a candidate's work at each level for each skill area.

Further guidance on marking

1. The selection of relevant questions (hypothesis) for the investigation	Marks	
• Relevant questions (hypothesis) selected without guidance, appropriate and clearly stated	5	**Candidate arrives at a suitable topic with an appropriate and workable investigation, expresses it concisely and clearly.**
• Relevant questions (hypothesis) selected without guidance, appropriate but poorly expressed	4	**Candidate has the idea and chooses the topic without help but not very clearly explained.**
• Relevant questions (hypothesis) selected with guidance, appropriate and clearly stated	3	**Needed help to arrive at a topic to investigate but then well-explained and understood.**
• Relevant questions (hypothesis) selected with guidance, appropriate but poorly expressed	2	**Needed help to arrive at a topic to investigate and not able to explain clearly.**
• Relevant questions (hypothesis) selected with considerable guidance	1	**Candidate needed to be given lots of prompting and guidance towards a workable investigation.**
• Relevant questions (hypothesis) provided for the candidate	0	**Candidate unable to come up with a suitable investigation, so needed to have one set.**

2. The planning of the investigation and the principles on which it is based	Marks	
• Investigation well planned, without guidance, showing evidence that the relevant principles are understood	5	**A clear workable plan is constructed with all major considerations included in an appropriate way, well understood and comprehended in all ways and well-researched.**
	4	**Better than 3 marks but not sufficient to confidently meet 5 marks.**
• Investigation adequately planned, with some guidance, relevant principles understood	3	**Needed help to arrive at a topic to investigate but then well-explained and understood.**
	2	**Better than 1 mark but not sufficient to confidently meet 3 marks.**
• Investigation plan sketchy, plan produced with considerable guidance or no evidence that principles are understood	1	**Candidate needed constant support to produce a plan and did not really understand how the plan related to the investigation.**
• Investigation plan provided for the candidate	0	**Unable to formulate any aspect of a plan: basically told what to do, step-by-step.**

3. The handling of evidence	Marks	
• Results presented neatly and clearly in a table, appropriate method of analysis chosen, graphs and/or histograms accurate and correctly presented (i.e. correct scale, axis, 0 plot, labelling etc.)	5	All graphs, charts and tables labelled correctly and clearly. Candidate selected the most appropriate forms and uses sensible scales and methods to express the information clearly, annotates diagrams, charts and or photographs.
	4	Insufficient for 5 but better than 3.
• Results presented neatly and clearly in a table, inappropriate method of analysis chosen, graphs and/or histograms inaccurate and incorrectly presented	3	Some inaccurate graphs or charts and not always in the most appropriate form or scale, stome poorly labelled.
	2	Insufficient for 3 but better than 1.
• Results not presented in a table, inappropriate method of analysis chosen, graphs and/or histograms inaccurate and poorly presented	1	No results tables or simply graph or chart included of dubious or no relevance.
	0	No attempt to show results in any form.

4. The ability to make deductions from the evidence or the data acquired	Marks	
• Comprehensive deductions based on the evidence, conclusions given with reasons	5	**Candidate makes full use of data and quotes from charts and graphs explaining findings and identifies any anomalous results attempting to explain these in a scientific way. Logical and supported conclusion ideally referenced to secondary information.**
• Several deductions based on the evidence, conclusions given with reasons	4	**Makes at least two relevant comments on the results and how they relate to the data and expected outcomes. Conclusion explained.**
• Few deductions based on the evidence, one conclusion given	3	**Some deductions relate to aspects of the data and enables one simple conclusion to be drawn, e.g. the graph showing yield showed that nitrogen fertiliser improved productivity by 30 per cent.**
• Few deductions based on the evidence, no conclusions given	2	**Some attempt to use evidence collected from the investigation to make some deduction, e.g. Plot A grew better than Plot B without fertiliser.**
• One deduction, no elaboration	1	**One simple relevant statement relating to the investigation (e.g. they grew faster with feed).**
• Tasks carried out with considerable help, inaccurate observations and records	0	**Candidate given help but not able to record or use the results/findings in a worthwhile way.**

5. The ability to recognise limitations of the investigation	Marks	
• All major limitations identified, assessed and improvements suggested	5	Makes comments about all major factors which might limit the validity or effectiveness of the investigation, suggests and explains amendments for possible improvement.
	4	Not sufficient to meet 5 but better than 3.
• Several limitations identified, assessment superficial, no improvements suggested	3	Limitations, e.g. we only were able to use six maize plants, not really developed, supported or justified.
	2	Better than 1 but insufficient for 3.
• One or two limitations identified but no assessments or improvements given	1	Mentions at least one limitation but with little or no explanation (e.g. we only had a few plants).
	0	No evidence

6. Description of practical, presentation, layout and originality (candidate's own work)	Marks	
• Clear, full description of the aims and nature of the topic; work neat and well presented; layout as required by the syllabus; candidate's own work	5	See syllabus sections which must be fully addressed. Focus on making the report look professional and comprehensive making full use of scientific information and relevant financial and environmental aspects.
	4	Less than 5 but more than 3.
• Description of the aims and nature of the investigation given; lacking in either neat presentation or layout not as required by the syllabus; candidate's own work	3	Gives aims and objectives; not presented in a very professional way but with signs of attempting to use appropriate headings.
	2	More than 1 but less than 3.
• Outline only of the aims and nature of the investigation; poorly presented; layout not as required by the syllabus; candidate's own work	1	Aims lack detail, simple statement; layout not clear and as specified, substantial lack of page numbers, content, sub-headings, naming or numbering of charts and tables, photographs or illustrations not really linked to the report.
	0	Very poorly presented and lacking any logical structure.

The scheme of assessment is intended to encourage positive achievement by all candidates.

Section 4: Administration and moderation of practical coursework

4.1 What comprises a candidate's practical coursework submission?

The work for submission will be compiled over four terms and should be assembled into a folder for each candidate. Preferably this should be electronic but hard copy is permitted if this is problematic. It should comprise both teacher and learner-generated material constituting the kinds of evidence listed in Section 1 of this handbook, for the practical exercises, along with the Practical Investigation Report, in each case. For both parts of the coursework there should be Individual Candidate Record Cards for each candidate. All evidence should be clearly labelled.

Each teacher involved in the assessment should put the folders of their marking group together, placing the Coursework Assessment Summary Form first with all of the marks carefully transferred from each individual candidate. The candidates should be listed in candidate index number order to allow for easy transfer of marks onto the computer-printed coursework mark sheet (MS1) later on. The MS1 should be sent to the examinations officer in each Centre in early October.

Work should, if possible, be submitted in the form of an electronic folder which can be put onto a memory stick/flash drive or CD. The electronic folder is the most convenient and secure format as it allows copies to be kept, avoiding expensive photocopying and postage for heavy paperwork. However, if you are unable to send your submissions electronically you can still send them as hard copy folders. We advise that you keep a copy of all work.

The coursework must be the candidates' own work. Where shared data has been used it must be clear what the individual candidate contributed to the collection of that evidence and it is vital that such data sharing is acknowledged. The analysis and all further manipulation and use of the data must be unique to the individual candidate. Where information from secondary sources has been used, the source must be given and any short direct quotes must be clearly shown as quotations. Longer quotations are unacceptable and will be identified as plagiarism. The reports must be in the candidate's own words except for short quotations as mentioned above. It is the Centre's responsibility to check that all work is the candidates' own work.

Further details are given in Section 4.4 below.

4.2 Internal standardisation during the course

Where more than one teacher is involved in the marking of the practical coursework component, standardisation is essential. All teachers involved in the marking must have a common understanding of the mark scheme so that assessment can be carried out consistently. Each school appoints an internal moderator from amongst the more experienced teachers delivering the subject and it is their task to ensure the quality of the marking. We strongly advise Centres that they should hold an initial meeting (an example is described below in the section on the practical exercises) at the point at which the practical exercises are set for each group of learners in order to become familiar with the assessment criteria and understand what is required of their learners through the practical coursework component.

In IGCSE Agriculture there are two aspects to the practical coursework component, the practical exercises and the practical investigation.

4.2.1 Practical exercises

The assessment process for the practical exercises requires teachers to keep a record for each individual candidate, showing the operations carried out and the marks awarded, e.g. in the form of individual learner ticksheets/marksheets. Learner-generated evidence, such as photo-diaries including reflective comments should also form part of the submission. (A full list of the types of evidence that can be submitted for these practical exercises is available in sub-section 1.1 of this handbook.) These submissions from the teacher and from the candidate, are gathered together in folders representing the wtrk of each individual candidate.

As the practical exercises take place throughout the duration of the course, we recommend that for Centres with more than one teacher assessing the practical exercises, an initial meeting (run on the lines below) is held. Further meetings should be held at points in the course when sufficient amounts of evidence become available.

Initial meeting

- The meeting should discuss points arising from the reading of the assessment criteria in the syllabus (plus the relevant sections on assessing the practical exercises in this handbook), by all the people involved in making this assessment (assessors).
- A well-prepared average candidate is selected and asked to perform selected skills (from the suggestions in the syllabus and this handbook). Each assessor then independently marks the candidate on the skills that are being demonstrated using the standard ticksheet or marksheet adopted by the Centre.
- The marking of each marking point is shared and discussed in relation to the assessment criteria. This should enable the assessors to become skilled in fair, standardised assessment, and the internal moderator to identify any assessors who might need further support and training.

Meetings held at points when there is sufficient new evidence

- The internal moderator selects a sample of the work (say 10 folders) representing the full range of abilities across the Centre, marks them and keeps a note elsewhere of the marks and any comments so that the samples themselves remain clean for copying.
- This sample of ten should then be copied and marked by everyone who will be involved in the assessment.
- Any discrepancies with the marks of the internal moderator should be discussed and agreement should then be reached on how to apply the assessment criteria. Teachers can then use the sample of ten as a benchmark for the rest of their marking.

The practical exercises have their own assessment criteria which can be found in section 5.2.2 of the syllabus. When carrying out their own marking, teachers should annotate the evidence of the practical exercises at the time that each exercise is completed, indicating why those marks were given through short comments directly related to the assessment criteria. These annotations will be very useful to the external moderator at Cambridge.

4.2.2 The practical investigation

In the case of the practical investigation report, full submissions are only likely to be available at the end of the course. The same sort of process can be followed at that time, perhaps meeting to discuss the assessment criteria in the syllabus and the content of the relevant sections of this handbook, then marking a sample of ten of the reports representing the full range of abilities, which have first been marked by the internal moderator. Again, the practical investigation has its own assessment criteria which can be found in section 5.2.9 of the syllabus.

4.3 Internal moderation at the end of the course

Once the marking of all candidate submissions has been carried out at the end of the course, the **internal moderator** should sample the marking of each teacher by selecting a number of folders from their work and checking that the marking sufficiently differentiates and that it abides by the standard established in the standardisation meetings.

If the marking appears reliable and well-standardised with the moderator, no further changes are necessary – the marking should be accepted.

If there is a *discernible pattern* of either leniency or severity in anyone's marking perhaps across the mark scheme as a whole or just in relation to a particular section, then it may be possible to 'scale' the marking of that teacher by adjusting all their marking by the same proportion (in the area affected) without having to re-mark every submission individually.

However, if *no pattern is discernible* in the erroneous marking of any given teacher then additional samples should be taken until there is no further remaining doubt or until all affected submissions are re-marked.

Notes of any particular difficulties should be kept so that further training and support can be given over the next year and to inform discussion at the meetings to ensure that standardisation and fairness improve year-on-year.

A reliable rank order can then be established in the marking of the Centre.

At this point all Individual Candidate Record Cards can then be finalised and the Coursework Assessment Summary Form carefully completed. Indications that internal moderation has taken place should be evident on the Individual Candidate Record Cards where marks have been amended.

Always get another person to check your work when transferring figures from one document to another.

The sample to be despatched to Cambridge should be prepared as instructed in the *Cambridge Administration Guide*. It will always contain the evidence from candidates with the highest and lowest mark. It is also desirable that, if the work of any particular candidates has caused special difficulties in assessment for any reason, this evidence be submitted as part of, or in addition to, the sample.

4.4 External moderation

Once the internal moderation has been completed and the mark sheets and Individual Candidate Record Cards finalised, you will need to prepare a sample of coursework to be sent to either the Officer responsible for moderation of examinations at the Ministry of Education or to Cambridge as appropriate.

- If you are a UK Centre, at present, Cambridge will send a list of selected candidates from which to make up the moderation sample. As well as the candidates that we have selected you will also need to include at least one candidate on the highest mark and at least one on the lowest mark in your sample, (providing these are not already on the list).
- If you are an International Centre you will need to select your own sample.

The sample should be selected to represent the full ability range of the Centre, covering the whole mark range, with the marks spaced as evenly as possible from the top mark to the lowest mark. If appropriate, the samples should be selected from the classes of different teachers. It is possible that a second sample may be requested so please retain all records and supporting written work until after the publication of results.

All the coursework that contributed to the final mark for the selected candidates must be sent to the external moderator. Please check the information in Section 3 of the *Cambridge Administrative Guide* (either UK or International version) to establish the number of portfolios required in the sample.

What goes into the sample?

- Coursework Assessment Summary Forms covering the entire cohort from your Centre.
- Coursework samples from across the range of marks and from multiple teachers where appropriate, each including their Individual Candidate Record Cards.
- Instructions given by teachers to learners for the assessed practical work.
- Mark schemes for each practical exercise or practical investigation where these have been customised for specific tasks or where they have been annotated to help justify any marking decisions that have been made.
- The second copy of the Internal Assessment Mark Sheet (MS1) from your MIS system or CIE Direct internal marks report.
- Any materials used to implement the internal moderation process (e.g. spreadsheets and notes).

Remember that electronic submission of coursework is preferred either on USB Flash drive/memory stick, CD or DVD. Evidence in hard copy can be scanned to digitise it. You should send the candidates' portfolios plus a general folder containing the administrative forms and internal moderation materials, etc. These can include items such as spreadsheets, notes and other materials that were used during internal moderation. If it is not possible to send the submissions electronically then you can send them as hard copy.

Always check the latest version of the *Cambridge Administrative Guide* and the *Cambridge Handbook for Centres* for the most recent information on procedures and for key administrative deadlines as these may vary from time to time.

In order to enable external moderation of the teacher-marked practical work, certain forms of evidence need to be submitted as part of the coursework portfolio. Both candidate and teacher-generated evidence for **both parts** of the coursework should make up each individual candidate's portfolio. It is important to do this for every candidate so that whichever samples are selected for the external moderation sample they will contain all relevant information and evidence. In addition candidates and teachers should all have put in the same effort to collect and organise each portfolio in the interests of fairness and effective standardisation and moderation.

4.5 Individual Candidate Record Cards

Teachers need to supply these for each candidate, detailing their marking for both the practical exercises and the practical investigation. Here are a few things to bear in mind to ensure a smooth process.

- When completing the record card please take care to make the description as detailed as possible.
- Ensure that all details are completed in full.
- Keep a copy of all forms completed for your records as a back-up.
- Storing work electronically is preferred. Please keep it suitably backed up. Candidates should be encouraged to keep their own copy.

4.6 Coursework Assessment Summary Form

Once marking is complete, the Coursework Assessment Summary Form must be used to summarise the marking for the group or cohort. This information must be transferred carefully from the Individual Candidate Record Cards and should be checked by another person.

Cambridge IGCSE® Agriculture

Please follow these instructions carefully before completing the PDF *Individual Candidate Record Cards* provided below.

1. This form is an interactive PDF and may be completed in one of three ways:
   - on-screen and then printed out
   - on-screen and then printed out; add any internally moderated marks by hand
   - printed out and completed on paper by hand.

Cambridge recommends that, wherever possible, this form is completed on-screen. The form will add up the candidates' marks for you and eliminate the risk of calculation error.

2. Additional copies of this form can be downloaded from the samples database www.cie.org.uk/samples.

3. To help you fill in the candidate names and numbers on this form, you may wish to ask your exams officer to follow the step-by-step guide that is available on the *Coursework Assessment Summary Form.*

4. Completing the *Individual Candidate Record Card:*
   - Complete the information at the top of the form.
   - Mark the Coursework for each candidate according to the marking criteria in the Syllabus booklet.
   - Enter the marks in the appropriate spaces.
   - If you are completing the form on paper by hand, add up the marks and write the total in the 'Total Mark' column. If you are completing the form on screen, the marks will be added up for you and the total will automatically appear in the 'Total Mark' column.
   - Include the details of the teaching group or set for each candidate. The initials of the teacher may be used to identify the group or set.
   - It is essential that the marks of candidates from different teaching groups within each Centre are moderated internally.
   - In the column called 'Internally Moderated Mark', enter the total mark awarded after internal moderation has taken place.
   - Transfer the marks to the *Coursework Assessment Summary Form,* for component 06, in line with the instructions given on that document.

5. Both the teacher completing the form and the internal moderator should check the form and complete and sign the bottom portion.

6. **Please keep a copy of the *Individual Candidate Record Card(s)* for your records.**

CAMBRIDGE International Examinations

Individual Candidate Record Card
Cambridge IGCSE
Please select Syllabus and Component below
Agriculture 0600/02

Please read the previous printed instructions and the General Coursework Regulations before completing this form.

Centre Number						**Centre Name**		**Exam Series**		**Year**				
Candidate Number						**Candidate Name**			**Teaching Group/Set**					

Brief description of Practical Exercises undertaken	**1 Responsibility – following instructions**	**2 Initiative – coping with problems**	**3 Technique – tackling tasks systematically and skilfully**	**4 Perseverance – seeing a task through to the end**	**5 Quality – attending to detail**	
Marks to be transferred to Coursework Assessment Summary Form	0 **(max 12)**	0 **(max 12)**	0 **(max 12)**	0 **(max 12)**	0 **(max 12)**	**TOTAL MARK** 0 **(max 60)**

CAMBRIDGE International Examinations

Example Individual Candidate Record Card – Individual Research

Cambridge IGCSE® Agriculture

Please follow these instructions carefully before completing the PDF *Individual Candidate Record Cards* provided below.

1. This form is an interactive PDF and may be completed in one of three ways:
   - on-screen and then printed out
   - on-screen and then printed out; add any internally moderated marks by hand
   - printed out and completed on paper by hand.

Cambridge recommends that, wherever possible, this form is completed on-screen. The form will add up the candidates' marks for you and eliminate the risk of calculation error.

2. Additional copies of this form can be downloaded from the samples database www.cie.org.uk/samples.

3. To help you fill in the candidate names and numbers on this form, you may wish to ask your exams officer to follow the step-by-step guide that is available on the *Coursework Assessment Summary Form.*

4. Completing the *Individual Candidate Record Card:*
   - Complete the information at the top of the form.
   - Mark the Coursework for each candidate according to the marking criteria in the Syllabus booklet.
   - Enter the marks in the appropriate spaces.
   - If you are completing the form on paper by hand, add up the marks and write the total in the 'Total Mark' column. If you are completing the form on screen, the marks will be added up for you and the total will automatically appear in the 'Total Mark' column.
   - Include the details of the teaching group or set for each candidate. The initials of the teacher may be used to identify the group or set.
   - It is essential that the marks of candidates from different teaching groups within each Centre are moderated internally.
   - In the column called 'Internally Moderated Mark', enter the total mark awarded after internal moderation has taken place.
   - Transfer the marks to the *Coursework Assessment Summary Form,* for component 06, in line with the instructions given on that document.

5. Both the teacher completing the form and the internal moderator should check the form and complete and sign the bottom portion.

6. **Please keep a copy of the *Individual Candidate Record Card(s)* for your records.**

CAMBRIDGE International Examinations

Individual Candidate Record Card – Individual Research
Cambridge IGCSE
Please select Syllabus and Component below

Please read the previous printed instructions and the General Coursework Regulations before completing this form.

Centre Number		Centre Name		Exam Series	Year
Candidate Number		Candidate Name		Teaching Group/Set	

Brief description of Investigation undertaken, comments on	Skills	Marks to be transferred to Coursework Assessment Summary Form
	1 Selection of questions (hypothesis)	/5
	2 Plan and principles of investigation	/5
	3 Handling evidence	/5
	4 Deductions	/5
	5 Recognitions of limitations	/5
	6 Description of investigation	/5
		Total Mark (max 30) 0

CAMBRIDGE International Examinations

Example Coursework Assessment Summary Form

Cambridge IGCSE®/ Cambridge International O Level Agriculture

Please follow these instructions carefully before completing the PDF *Coursework Assessment Summary Form* provided below.

1. The form is an interactive PDF and may be completed in one of three ways:

- on-screen and then printed out.
- on-screen and then printed out; add any internally moderated marks by hand.
- printed out and completed on paper by hand.

Cambridge recommends that, wherever possible, the form is completed on-screen. The form will add up the candidates' marks for you and therefore eliminate risk of calculation error.

2. Additional copies of this form can be downloaded from the samples database www.cie.org.uk/samples.

3. To help you fill in the candidate names and numbers on this form, you may wish to ask your exams officer to follow this step-by-step guide to access candidates' entry data. You will only be able to use this method after all your entries have been submitted to Cambridge. Please check that your Centre can access CIE Direct.

- Log on to CIE Direct (https://direct.cie.org.uk) and go to the 'Administer exams' section, then to 'internally assessed marks' and select the current series.
- Select the relevant component from the list to see all the entries for that component.

4. Completing the *Coursework Assessment Summary Form*.

- Complete the information at the top of the form.
- List the candidates in an order that will allow ease of transfer of information to Cambridge at a later stage (i.e., in candidate number order, where this is known).
- Indicate the teaching group or set for each candidate. The initials of the teacher may be used to indicate group or set.
- Transfer each candidate's marks from his or her *Individual Candidate Record Card* to this form.
- Where there are columns for individual skills or assignments enter the marks initially awarded (i.e. before internal moderation took place).
- If you are completing the form on paper by hand, add up the marks and write the total awarded *before* internal moderation took place in the 'Total Mark' column. If you are completing the form on screen, the marks will be added up for you and the total will automatically appear in the 'Total Mark' column.
- In the column headed 'Internally Moderated Mark', enter the total mark awarded after internal moderation has taken place.

5. Both the teacher completing the form and the internal moderator should check the form and complete and sign the bottom portion.

6. **Please keep a copy of the *Coursework Assessment Summary Form(s)* for your records.**

External Moderation

A sample of candidates' work must be submitted to Cambridge for external moderation. Details of the work to be submitted may be found by visiting the samples database at www.cie.org.uk/samples. Teachers should work with their exams officer to make sure the correct coursework is submitted along with the supporting forms according to the instructions in the *Cambridge Administrative Guide*.

CAMBRIDGE International Examinations

Coursework Assessment Summary Form
Cambridge IGCSE
Please select Syllabus and Component below

Please read the previous printed instructions and the General Coursework Regulations before completing this form.

Centre Number						Centre Name		Exam Series	Year				

			Practical exercises					Investigation							
Candidate Number	Candidate Name	Teaching Group/ Centre Set	1 Responsibility (max 12)	2 Initiative (max 12)	3 Technique (max 12)	4 Perseverance (max 12)	5 Quality (max 12)	1 Selection of questions (hypotheses) (max 5)	2 Plan and principles of investigation (max 5)	3 Handling evidence (max 5)	4 Deductions (max 5)	5 Recognition of limitations (max 5)	6 Description of investigation (max 5)	Total Mark (max 90)	Internally Moderated Mark (max 90)
														0	
														0	
														0	
														0	
														0	
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														0	
														0	
														0	
														0	
														0	

Name of teacher completing this form		Signature		Date	
Name of internal moderator		Signature		Date	

CAMBRIDGE International Examinations

Section 5: Exemplars for marking practice

The following exemplar materials have been reproduced to provide as authentic an experience as possible of marking candidates' work. You will therefore find errors in layout, spelling and grammar uncorrected and as they appear in the original work.

- Look at the three exemplars and mark them using the mark schemes in Section 2 of this handbook or from Section 5 of the syllabus.

  Exemplar 1: Adlib feeding versus restricted feeding on layers

  Exemplar 2: The effects of ethylene on the ripening of green bananas

  Exemplar 3: Investigating the performance of Hercules which is a summer variety of cabbage, when grown in winter.

- Compare your mark with those suggested in the text boxes.
- Try to identify what has caused any discrepancies between the two.

5.1 Exemplar 1

TOPIC: ADLIB FEEDING VERSUS RESTRICTED FEEDING ON LAYERS

List of Tables and Graphs

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CHAPTER I

INTRODUCTION

1.0 Background Information

Layers are chickens that are kept for their eggs. Under poultry production, layers can be kept in the deep litter and in the battery cage system if you want the eggs to be safely laid. Layers require a regular supply of food daily in order for them to grow and develop normally. Chickens can be fed in two ways: by making sure feed is available at all times (adlib feeding) or by giving a measured amount (restricted feeding). The feed given to layers depends on their age. Layers are fed layers mash which gives extra protein and minerals for them to produce quality eggs.

Chickens (layers) have a definite calcium appetite, energy appetite(grain) and protei n appetite(high protein poultry ration), Ruff (2006).A layer which lays an egg each day will eat far more calcium than one which lays an egg a week. Adlib offers chickens as much (balanced, high-quality) chicken feed as they want, and settle for whatever amount of foraging they discover on their own. Restricted requires the chickens to be fed less feed amounting to 120grams per day (Ngugi, 1 978).

The most popular egg producing breeds are the leghorn, Ancona and Minorcan, The white leghorn is the most common basis for the development of layer hybrids because of i ts weight and high egg production. Mature cockerels and hens weigh approximately 2.7kg and 1.8kg. Hybrid layers come into lay at the age of 1 8 to 22 weeks, and remain productive for at least nine months if they are well managed (Macmlillan, 2008).

1.1 Purpose of the study

The purpose of the project was to find out feeding system which is best suitable for layers. The researcher wanted to study and rate the percentage of eggs laid weekly under adlib feeding against to that of restricted feeding. It was to confirm if restricted feeding is the best feeding method to conduct to layers and would there be any change in the number of eggs produced.

1.2 Justification

Is the feed being wasted when overfeeding the layers or is it worth it? The study will help us see the right feeding system to use when keeping layers.

Will the layers grow and lay well as it happens with restricted feeding? This study was to help the researcher see the effect of feeding amounts given to layers and determine the importance of feeding layers with the rightful amounts of mash. Farmers overfeeding the layers would realize that it is wastage of feed.

1.3 Objective

To describe the effects of restricted and adlibtum feeding on the laying percentage of layers.

1.4 Hypotheses

1.4.1 Main hypothesis

Restricted feeding increases the laying percentage of layers than adlib feeding.

1.4.2 Alternative hypothesis

Adlib feeding increases the laying percentage of layers than restricted feeding.

1.5 Limitations of the study

There are certain problems that had effects on the study:

The was lack of enough space which caused poor air circulation in the poultry house.

The poultry house would get dirty very easily and bad odour would accumulate the house.

There were late delivering of orders (feed) and these would get the layers stressed.

A lot of people entering the poultry house disturbed the layers when trying to lay, with the noise.

CHAPTER II

LITERATURE REVIEW

Feeding chickens

Layers normally exhibit two peak feed consumption periods-one at the time of lay and the other late in the afternoon. Hybrid layers reach peak egg production after 5–8 weeks and will continue to lay for about 300 days. They begin to lay about an hour after first light and light encourages feeding, the provision of additional light in the moming and again in the evening should encourage layers to eat during the cooler periods. Laying birds should receive 12–14 hours of light per day for optimum egg production (Macmillan, 2008). Fresh, clean water must always be available, in addition to feeding practices people entering and exiting the poultry house should disinfect their shoes.

Restricted feeding

Pellets/crumbles-the feeding of these is to some extent advantageous, there is less wastage. Birds cannot select out specific feeds and are therefore likely to obtain all the nutrients included in the ration. However, the feeding of pellets does tend to increase the incidence of cannibalism. Cannibalism is caused to due to a deficiency in the diet or to sheer boredom.

Ngugi at Eastern African for agriculture (1990) stated that diets need to be limited for the older birds. Young chicks that are well reared, start to lay eggs at 22–24 weeks old. He further mentioned that birds should well fed, given a proportion of grit in the diet to produce strong egg shells. Farmers feed layers' mash only to their laying bird, which contains 11–12% protein, given an amount of 120 grams of layers mash per day. They must also be provided with grit.

It is claimed that the best feeding to use is restricted feeding, because the layers are limited to a certain amount of feed. Care is taken as to how much feed is used. It increases the chances of higher profits because less food is consumed; therefore less money is used to buy it. At the same time more feed means higher egg production and excellent production and excellent performance by chickens.

Adlibtum feeding

Adlibtum feeding consumes feed faster, at large amounts and unnoticeably, more than necessary food in short period of time. Adlib feeding is not a good idea. Birds must search and dig for

their food (Ruff, 2006). He stated that if you are fattening layers for the table then limiting the feeds would help because as you feed them they gobble up the food quickly. Three good feeds a day would fatten an Indian bird. Adlib has always been believed to be a waste of feed whilst restricted feeding would lead the chickens to starvation.

House keeping systems

During the laying period the birds may be kept in a house with a battery cage system, or in a deep litter house. If they are kept in deep litter houses, nests or laying boxes must be provided. Each layer requires a floor space of 0.3 min deep litter houses (Macmillan Agriculture, 2008).

During the laying period the birds must be kept in a house with a battery cage system, or in a deep litter house. If they are kept in deep litter houses, nests or laying boxes must be provided. Layers require a floor space of 0.3 m in deep litter houses. On this period layers are fed Layers mash, which contains 11–12% protein. They must also be provided with grit (Sakira, W.A,1981).

In record keeping, each day there must be recordings for eggs laid, food eaten, egg sales and deaths and culls if any. The laying percentage can also be calculated once a week, this gives a guide to how well the hens are laying. In 1 938, the first trough chain feeder was introduced, becoming the standard for the poultry industry. This way chickens were able to get the amounts of feed they needed. Adlib feeding (deep litter), the layers suffer from large differences in weight gain. Competition is too high so chickens have to run to the feed as it's dropped on the ground pans. For the health of the chickens and well being, during winter they can be provided with green supplements like second cut alfalfa hay that's been soaked overnight in fresh water.

If hatchability percentages are above 65% of all eggs set are obtained, then it's considered that the minimum percentage is satisfactory.

CHAPTER III

METHODOLOGY

3.0 Procedure and layout

To carry the project, the researcher had 32 layers.

Sixteen (16) layers were kept in the deep litter and the other 16 in the battery cage system for restricted feeding. Deep litter, chickens were overfed with no strict measurements.

In the battery cage they were given a measured amount of 120gm including water in both systems. Before settling in the birds, the room had to be cleaned.

1. Selection of question/hypothesis

Hypothesis clearly expressed and shows evidence of a candidate working independently.

It can be helpful if when marking teachers give an annotated comment to confirm this hypothesis was formulated without direct support.

Award 5 marks

We would fill in sow dust in the deep litter system and place inside two nest boxes, placed the feeder and waterer.

In the battery cage, blocks were placed on the floor and filled the circle with sow dust; this was for ensuring that the droppings settle on the sow dust.

3.1 Data collection

Record keeping with layers is essential in order to keep a check on how well your enterprise is doing. A good layer should lay one egg per day.

Deep litter was recorded as a whole group, and in the battery cage per individual. Eggs were collected daily for eight (8) weeks, and at the end of each week the laying percentage was calculated.

2. Planning

The plan produced lacks some in depth and detail but covers all the main aspects even identifying limitations of the procedure at this stage. The plan is workable, producing a range of excellent data.

Own plan produced without guidance not quite sufficient for 5 marks.

Award 4 marks

3.2 Data presentation

Weeks	Deep litter egg percentage	Battery Cage egg
1	11.6	53
2	43.8	92
3	59.8	89.3
4	59.8	91
5	64.3	99.1
6	57.1	99
7	72	93.0
8	56.3	96.4
Average	59.5	96.6

Fig 1: A Table showing Percentage on the egg production compared

3.3 Data analysis

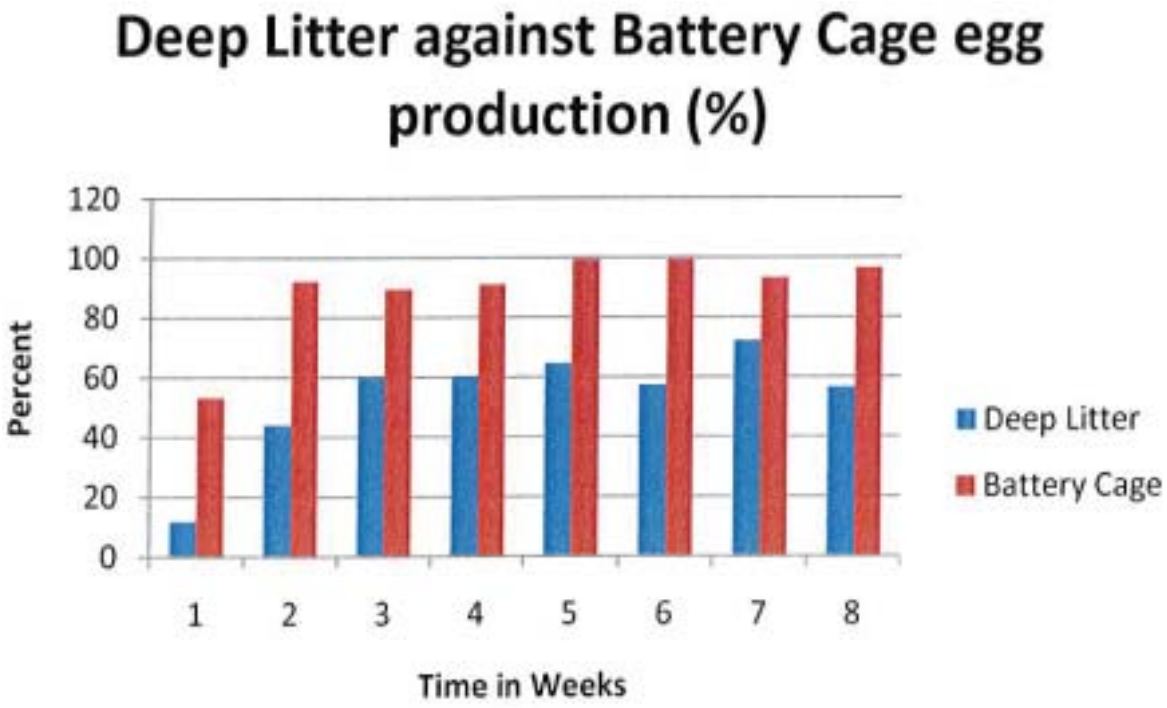


Fig 2: Percentage egg production between the Deep and the Battery systems

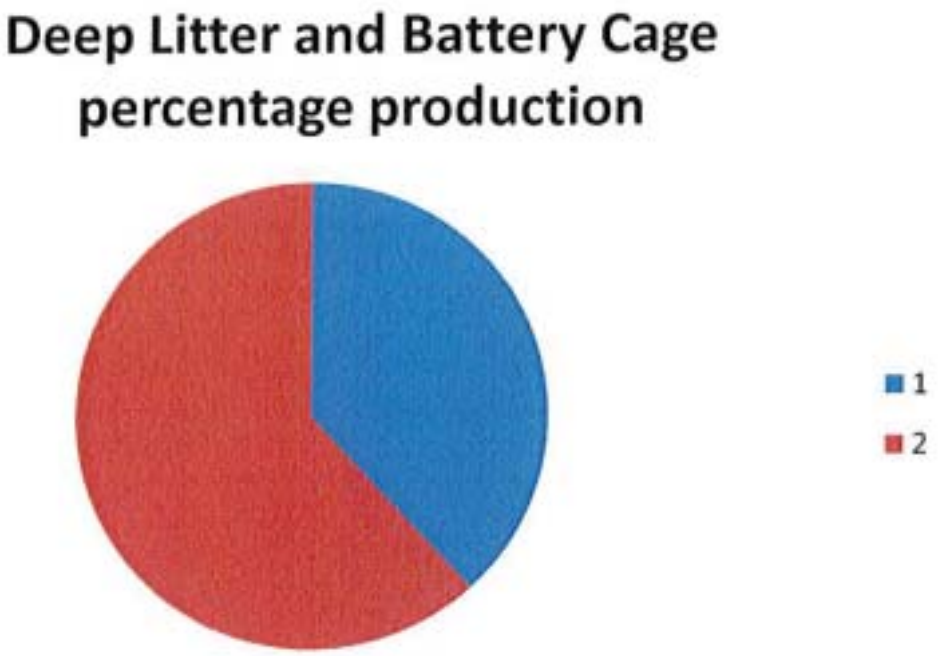


Fig 3: A pie Chart showing percentage in egg production between the two systems

No.1 represents Deep Litter. No. 2 represents Battery Cage.

A the end of the research as shown by the charts Fig 1 and Fig 2 above, the total average number of eggs recorded in the restricted feeding was 99.6% and in the ad-lib feeding the total was 59.5%. The mass of each layer in the battery cage was 2.7kg, whilst in the deep litter they ranged from 3.0 to 3.2kg. Average difference between the two was 40.1 percent.

It was observed that the deep litter chickens were of bigger mass (3–3.2kg) than the battery cages ones (2.7kg). This could be that the deep litter ones got a lot of feed than the cages which were restricted in feed. The total average difference in egg production between the two systems was 40.1 percent.

3. Handling of Evidence

Neat, well-presented tables of results with appropriate graphs using suitable scales and proportions.
The graphs clearly show the outcome of the study. Pie charts helpful and easy to interpret.
Work appears accurate and labelled.

Ideally it would be good to see more tabulated data at this stage but it is evident in the remaining text.
The graphs have been commented on effectively.

Award 5 marks

CHAPTER IV

Findings and discussions

Two samples were made in the findings. One was layers in a cage feed and others in deep litter feed. After eight weeks (8) of sampl ing, the results were as shown in the ta ble below.

Fig 4: Egg production in percentage and quantity

Egg Production On Chicken Layers (%)			Number Of Eggs Produced	
Age In Weeks	BatteryCage(%)	Deep Litter(%)	Restricted Feeding (Battery)	Ad lib Feeding(Deep Litter)
Week 1	53.0	11.6	59	13
Week 2	92.0	43.8	103	49
Week 3	89.3	59.8	100	67
Week 4	91.0	59.8	102	67
Week 5	99.0	64.3	111	72
Week 6	99.0	57.1	110	64
Week 7	93.0	72.0	104	81
Week 8	96.4	56.3	108	63
Total eggs produced			797	476
Difference on total number of eggs produced			321	
Total percentage (%)			99.6	59.5
Difference (%)			40.1 (%)	

The Data in the above table is represented by the charts below

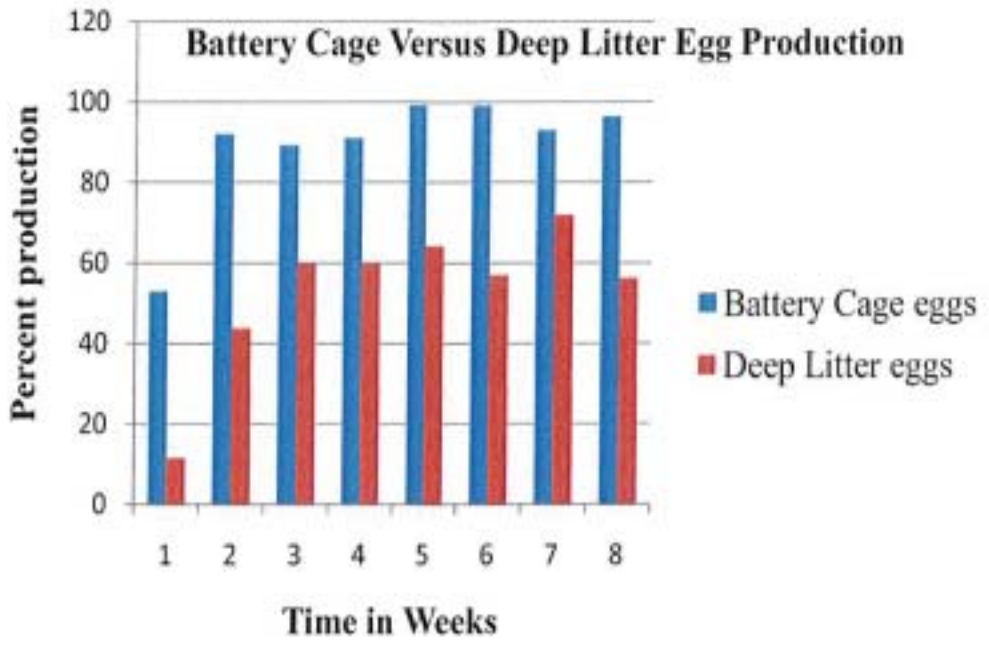


Figure 5: Bar chart showing eggs produced per week

The above bar chart compares egg production in percentage between the Restricted Feeding Battery Cage and Adlib Feeding on Deep Litter.

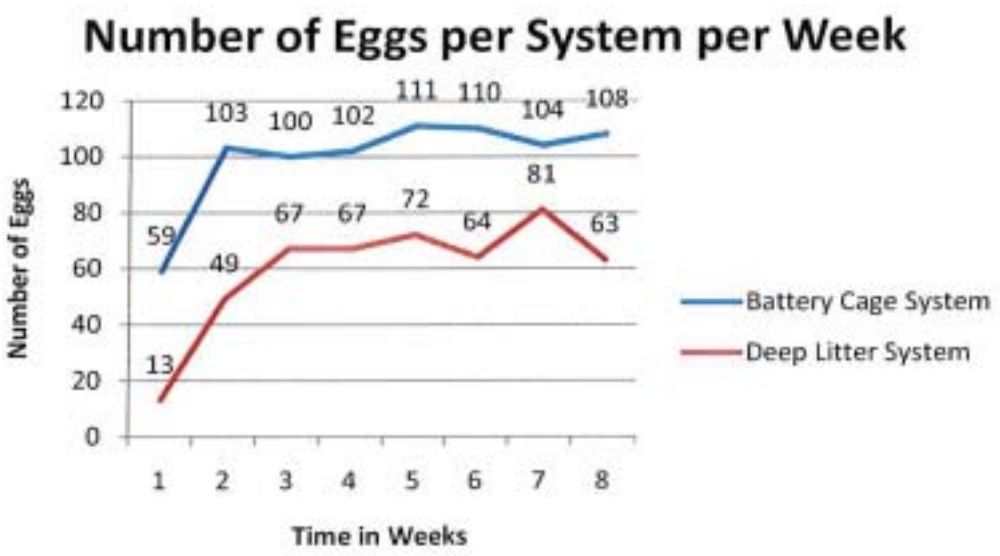


Fig 6: The line graph above shows the egg production in percentage between the two feeding types.

During the first week the number of eggs produced using the restricted system were high with 59 eggs laid, compared to the adlib system which had a very low number of 13. Percentage became 53 against 11.6. The average percent on Battery Cage system was 99,6% while on the Deep Litter it was only 59.5%. The percentage difference is 40.1%. The total difference on number of eggs produced is 321 eggs.

CHAPTERS

Findings

The difference between the two systems was that; the restricted fed chickens produced a lot more eggs. The layers were always lively, and healthy. Less is more and with the layers they were able to produce the best results, whilst adlib fed animals gained a lot weight because of the overfeeding, they became lazy, moving from average weight of 2.5 kg to 3.2 kg. They became unhealthy and lost appetite.

The duration of the project was 2-3 months, from February to early April. Eggs were collected twice a day. A daily record keeping of the numbers of eggs produced daily were recorded. **Adlib** feeding consumes feed faster, at large amounts and unnoticeably, more than necessary food is used in a short period of time, thus increasing the expenses for buying feed. **Restricted** feeding is the best method of feeding to use because chickens are limited to a cet1a in amount of feed. Care is taken as to how much feed is used. It increases the chances of higher profits because less food is consumed; therefore less money is used to buy it.

Based on literature findings, restricted feeding is considered to be the best feeding system to use on commercial layers. The research shows that the total average number of eggs produced using the restricted feeding is 99.6% compared to the adlib feeding which is 59%. This shows a huge difference between the layers percentage and thus proves that adlib feeding is not a productive feeding system to use in layers. Adlibtum feeding consumes feed faster and more than necessary in a short period of time.

4. Making deductions

Comprehensive conclusion, related to the evidence, explained and linked to previous research in an appropriate way. The data has been sensibly selected and appropriate graphs and charts drawn and whole data brought together in an analytical way.

Award 5 marks

CHAPTER SIX

Summary

The duration of the research from data collection, to compilation, up to conclusion took nine (9) months, that's from February to early October. Adlib feeding consumes feed faster, at large amounts and unnoticeably. The chickens are offered as much feed as they want, and settle for whatever amount of foraging they discover on their own, this maximizes production and profitability. The layers become bad layers, unproductive layers and the fats in their bodies are found to be harmful towards human beings. Most layers go a day without lying which is a sign of abnormality. To ensure that a laying flock produces at its highest level, the birds should be well fed, given a proportion of grit in the diet to produce strong egg shells. Restricted feeding is the best method of feeding to use because chickens are limited to a cet1ain amount of feed.

Conclusions

Layers should be fed 120 g of feed per day. This increases the chances of higher profits because less food is consumed, therefore less money is used to buy it. Adlib feeding is not a profitable system. The overfeeding is wastage at the end of it all. They should not waste feed because they are not only wasting money but they are also killing the layers. The types of records kept for a layer's enterprise include; vaccination and production records, egg production records and financial records. Layers record consists of number and value of layers as they stat1 laying, number of eggs collected per day, dail y food consumption and number

of dead and culled hens. After collecting these records, the researcher can make periodic calculations which give him an overall picture of the performance of the enterprise .e.g. Percentage egg production. A high standard of hygiene should be maintained. Feed and water troughs should be cleaned regularly. Where birds are kept, people entering and leaving the house should disinfect their feet. Unfortunately the unproductive layers were not culled.

Recommendation

Farmers are recommended to use restricted feeding to their layers in order to produce the best results in egg production. Restricted feeding does not waste the feed and provides the layers with the right amounts of food they need to stay active throughout the day. They should also make sure water i s available at all times to provide a balanced diet for the layers. Farmers are advise to disinfect the poultry house regularly to avoid diseases. The litter is to be turned at least once a week for health purposes.

Limitations evaluation several problems have been identified within the text including different people being involved. The Pens not being the same.

However from observation the birds all appeared to behave in a similar way and have remained healthy. The investigation was carried out with birds being exposed to the same photoperiod and so this should not have had an adverse effect. Rats taking eggs could easily affect the results but we kept a good check and appear to have had no problems from rats or other vermin.

The results and conclusions appear to be reliable although the investigation in scientific terms is quite small and needs to be replicated several times and ideally in identical environmental conditions.

I am confident with the report in as much as within the limits the results and conclusions are supported by my research.

5. Limitations

The report shows awareness of potential problems and these are addressed within the text and plan as much as within the conclusion and evaluation. The limitations are not fully appreciated and therefore only some are covered and only in outline.

Award 4 marks

Acknowledgement

I would like to thank my Agriculture teacher Mr R.I Lamini for guiding me while compiling the project, without him it would have been very difficult.

Secondly I would like to thank my father Augustine Nuhirwa for the effort he put in making my project be a success.

I would also like to pass my sincere gratitude to my friends Igyelwa Latsenjwa, Mosipho Hongwee, and Mongcebo Lixumalo for the great teamwork and making the project possible.

References

Watson, J.M. (1986 Modern Agriculture, Macmillan Boleswa Publishers (Pty) Ltd.

Sakira, W.A. (1981) O'Level Agriculture Principles and Practise.

Aves, John P.(1998) Poultry Maskew Longman (Pty) Ltd.

6. Description, presentation

A well organised report not exactly as specified so unable to award full marks however the general standard of the report is better than the expected standard criteria for 3 marks so

Award the intermediate mark of 4

Overall mark 27

The work is typical in that its design has to be limited by the Centre's resources and the need to involve other students on the same course. It is essential to ensure such work is the candidates own work. Ideally candidates should identify where data is collected by them or others.

The work is a low A grade example.

Such work could also potentially be used as assessment for practical exercises indicated by the use of words such as I watered, cleaned, checked. Such candidate activities could be used to assess routine care, cleaning, feeding and maintenance of livestock.

A practical exemplar

My practical exercise task: collect milk from the farm cattle (suckler cows)

Hand milking our cows Feb 26th 2012

This task presented me with several skills to demonstrate .

1. Collecting and cleaning the milk bucket so that it was suitable for collecting drinking milk.
2. Approaching the animal and checking her while keeping her quiet and content.
3. Checking the milk quality and for disease before collecting it .(because she was also feeding her calf this reduced the risk of diseases like mastitis.)
4. Milking is a skill i find easy as I have done it all my life some of the class find it hard to get the cow to let down milk.
5. Keeping the cow calm involved me talking to her all the time and not frightening the calves.

Possible way to record teacher assessment for a practical exercise

Additional notes could be added to the specific mark scheme if not clear from the task. However these are *practical* exercises so written evidence should support the activities only as far as the task requires. For example, a diary of milking and the milk collected. Simply marking when and where exercises take place (as well as noting any specific points) allows the teacher to track and evidence candidates' assessment.

1. Responsibility marks	Marks	Additional Guidance
Follows written or verbal instructions without the need for help	3	No need for written instruction once demonstrated performed competently Works safely within local norm unable to use protective footwear
Carries out appropriate safety procedures		
Assumes responsibility easily and leads in group work		
Follows written or verbal instructions with a little help	2	All covered
Is aware of the need for safety procedures but has difficulty recognising them without guidance		
Shows responsibility for the work		
Follows written or verbal instructions with considerable help	0–1	All covered
Shows little regard for safety procedures, even when told		
Shows some responsibility for the work		

2. Initiative marks	Marks	Additional Guidance
Offers solutions or explanations to unexpected problems	3	Adapted to finding the cow and getting her into a comfortable position to milk her. Remembered to bring a lid for the bucket Aware to collect only a little as the milk will not keep and it would deprive her fast growing calf
Recognises, and is able to anticipate, problems		
Solves problems without help		
Offers solutions or explanations to unexpected problems after seeking advice	2	All covered
Solves problems with help		
Recognises faults in experimental methods, given some pointers		
Is uncertain how to proceed and requires considerable help Recognises only the most obvious errors in experimental methods after considerable guidance	0–1	All covered

3. Technique	Marks	Additional Guidance
Approaches tasks methodically and systematically	3	Very organised Collected own equipment without reminder and collected a lid for bucket owing to the flies and dust from the wind and cattle moving in the drought conditions
Handles tools/apparatus skilfully and confidently		
Carries out practical procedures with dexterity		
Handles tools/apparatus effectively	2	All covered
Carries out practical procedures adequately		
Handles tools/apparatus clumsily	0–1	All covered
Carries out practical procedures with difficulty		

4. Perseverance marks	Marks	Additional Guidance
Completes all the required practical tasks and attendant written work	3	Most work completed but lacking depth Very positive attitude to practical task
Has a positive attitude and is well motivated		
Completes the required practical tasks and attendant written work with a little encouragement. Carries out repetitive procedures willingly	2	All practical work completed Photograph and recorded the milk collected on 6 occasions
Carries out repetitive procedures willingly		
Does not complete the required practical tasks and attendant written work	0–1	All covered
Is somewhat disinterested/impatient when carrying out work and is disinclined to repeat procedures		

5. Quality	Marks	Additional Guidance
Performs practical work thoroughly, pays attention to detail and produces a very good final result	3	Not fully met
Produces accurate, clear and neatly presented written work		
Performs practical work thoroughly for the most part and produces a satisfactory to good result	2	Fully met as required by the task
Produces mostly accurate and clearly presented written work		
Performs practical work in a rushed and superficial way and shows little concern for the finished product Produces inaccurate and poorly presented written work	0–1	All covered
Produces inaccurate and poorly presented written work		

Practical Exercise Marks awarded for task 24 out of 25

5.2 Exemplar 2

THE EFFECTS OF EHTYLENE ON THE RIPPENING OF GREEN BANANS

Abstract

This study was conducted to see the effect of ethylene on the ripening of bananas.

The results were such that the presence of ethylene increased the rate of ripening; this was shown by the number of days taken by the banana to ripen. In the presence of light the rate of ripening further increased but in darkness the rate of ripening decreased. Light and ethylene improve ripening rapidly and are vital for the whole ripening process to occur.

TABLE OF CONTENTS

CHAPTER 1

Introduction

Plant tissues communicate by means of hormones. Hormones are chemicals that are produced in one location that have an effect on cells in a different location. Most plant hormones are transported through the plant vascular system, but some like ethylene are released as a gas.

Ethylene gas (C2H4) is an odourless, colourless gas that exists in nature and is also created by man-made sources. Not easily detectable, it exists where produce is stored. In nature, the largest producers are plants and plant products. For instance, fruits, vegetables and floral products which produce ethylene within their tissues and release it into the surrounding atmosphere. It is also a by-product of man-made processes, such as combustion.

This gas is a ntural plant hormone. It is produced and released by rapidly-growing plant tissues. It is released by the growing tips of roots, flowers, damaged tissue and ripening fruit. The hormone has multiple effects on plants. One is fruit ripening when fruit ripens; the starch in the freshly part of the fruit is converted to sugar. (www.catalyticgenerators.com/whatisethylene.htm).

Fruit Ripening Process by Ethylene

Enzyme action causes the ripening responses which are as follows. Firstly, chlorophyll is broken down and new pigments are made so that the fruit skin changes color from green to red, yellow or blue. Acids are then broken down so that the fruit changes from sour to neutral. The degradation of starch by amylase produces sugar. This reduces the mealy quality and increases juiciness by osmosis. Next will be the breakdown of pectin between the fruit cells, unglues them so they can slip pass each other resulting in a softer fruit. Lastly, the enzymes also breakdown large organic molecules into smaller ones that can be volatile and u can detect as an aroma.

LIMITATIONS OF THE STUDY

While conducting this research, there were numerous limitations including time being a problem factor and also obtaining information about ethylene as a compound was not an easy feat. We encountered difficulties with our colleagues as they would eat the bananas used for the experiment.

Purpose of study

The purpose of the study was to observer the role of ethylene and its effects on produce. In addition, to measure the effect of ethylene gas on the quality and ripening process and lastly, the efficiency of the gas in the ripening of the fruit.

Justification

Bananas are a small growing agricultural industry in Swaziland. IT is at a stage whereby the use of chemicals can be managed by the use of natural gases given of by plants such as ethylene. In addition, the cost of importing bananas from South Africa is an expense to the government resulting in this expenditure being passed on the consumer. If those costs were absorbed by the use of ethylene, these could go towards training local farmers and improving on their capacities & to grow more and lessen importation levels. Furthermore, empowering local farmers to grow more and use natural treatments, one provides employment, enhances skills and provides additional revenue for people. Moreover, more costs are incurred while transporting these bananas from South Africa to Swaziland due to rotting before reaching the intended market. Also some bananas may reach the intended market damaged or not fresh resulting in huge losses.

Furthermore, it causes no health risks as compared to artificial ripening agents such as calcium carbide. Once this chemical dissolves in water, it produces acetylene which is believed to affect the nervous system.

Problem statement

Small scale farmers in Swaziland lack knowledge on the ripening effect of ethylene and how they can use it on a larger scale than the time consuming traditional ways of ripening fruit.

Ethylene can be manufactured in a laboratory through the dehydration of alcohols, manufactured ethylene can be sold to these farmers to cut down on the time spent waiting for fruit to ripen and waiting for a specific season to grow specific fruits. This will in turn increase profits and in the long run boost the ailing of economy of Swaziland.

Objectives

This study was guided by the following objectives:

1. To determine the rate of fruit ripening caused by ethylene on the bananas under the different
2. To determine the effect of ethylene on the quality of the banana.
3. To determine the effect of the gas on the taste of the banana.

Hypotheses

Main hypothesis

Increasing levels of ethylene on fruit produced, increases the ripening rate.

Alternative hypothesis

Increasing levels of ethylene on fruit produced, does not increases the ripening rate.

Definitions

Ethylene gas: It is a simple hydrocarbon gas (H2C = CH2) that is ripening fruits make and shed into the atmosphere.

Hormone: a chemical substance produced in the plant that encourages growth or influences how the cells and tissues function.

Ripening: A process in fruits that causes them to become more palatable.

1. Selection of question/hypothesis

Question selected without help, well expressed and supported by evidence which was explained.

Award 5 marks

CHAPTER II

Literature Review

Discovery of ethylene

The role of ethylene and its effects on produce were discovered by Rudolf who was a commercial farmer in the eighteenth century. He would store his newly harvested green lemons in sheds kept warm by kerosene heaters until they turned yellow and ripened enough to market.

When new modern heating systems were tried, the lemons no longer turned yellow in time.

Research soon found that the important factor in the ripening process was small amounts of ethylene gas given off by the burning kerosene in the heaters. (www.ethylene.com)

Ethylene as a plant hormone

The biological agent that initiates this ripening process after the fruit is mature is naturally produces ethylene (Koel-beck and Cain, (1984)). Askay (1996) found that it is not emitted by the plant naturally and cannot activate the ripening of nearby fruits; rather it is used as a hormone within the plant.

Significance of a plastic bag

Qubasilar (1973) reported that, sealing fruits in a bag (transparent plastic) enocourages them to ripen since the plastic bag traps the gas released by the fruit which will be used for immediate ripening of the produce.

Liebig (1899) reported that covered fruit ripening bowls increase the ripening process. The bowls increase ethylene and carbon dioxide gases around the fruit which promote ripening.

Folklore says that sealing fruits in a bag encourages them to ripen. IT is the bag that traps ethylene released by the fruit and the ethylene enhances ripening. The Greek philosopher, Theo Prates later recognized that sycamore fig do not ripen unless scrapped with an iron claw. 23 centuries later, we know that wounding induces ethylene production resulting in fruit ripening.

Ethylene as a healthier alternative

Esmail (2006) revealed that ethylene was healthier ripening agent compared to other agents such as calcium carbide which affect the nervous system and found to b e carcinogenic.

Effectiveness of ethylene

Lincoln (2009) discovered that ethylene gas is effective at 0.1 to 1ppm; one part of ethylene per million parts of air that's one cupful of ethylene gas in 62,000 gallons of air is enough to promote the ripening process. It is estimated that the total bananas produced in the world is at 20 million tons at which Africa provides 50 percent whilst Asia and America 25% percent each by means of ethylene stated Linnaeus (2001).

Economic benefits of ethylene

The even and controlled ripeness that ethylene initiates prevents post-harvest losses of up to 50% confirmed Rodenburg (2007). Douglas (1910) discovered that oranges cause bananas to ripen naturally. He also confirmed that, bruised or damaged fruit give more of ethylene gas resulting in fast ripening. In agreement with this statement, the more gas, the faster chlorophyll is broken down resulting in pigment changes.

Application of ethylene

Additional externally applied ethylene merely accelerates the normal ripening process.

Numerous studies have shown that there are no important biochemical's, chemical or physiological differences between fruit ripened where the naturally produced ethylene has been the triggering mechanism or where additionally externally applied ethylene has triggered the process in the mature but unripe fruit disclosed Justus (2002).

Effects of ethylene

Other effects of ethylene include epinasty, hook closure maintenance, initiates germination in grains, activates dormant buds (potatoes in storage), stem elongation in deep water rice, induces flowering in pineapples, promotes female expression in flowers and lastly, it stimulates leaf senescence.

Illumination gas in Ethylene

Ethylene is the biological active component of illumination gas, when they noticed that illumination gas was responsible for the horizontal growth of etiplated pea seedlings which had been cultivated, (Neljubob, 1986).

Emmition of ethylene

It is also known that ethylene is synthesized in response to different types of stress such as wounding, very low and high temperatures, flooding or drought, treatment with other hormones, heavy metals and attack by pathogens stated Pech (1992). Yang and Hoffman (1954) also discovered that the ethylene biosynthesis has now been completely elucidated due to advance in the techniques of biochemical analysis.

Ethylene receptors

Several theories on ethylene signal perception and transduction have been proved to explain the mechanism by which ethylene receptors could promote signal transduction through a cascade involving several components reported Zarembiniski and Theologis (994). Giovannoni (2004) and Alonso (2005) concluded that there are strong indications that the ethylene receptors act as a negative regulator of the ethylene signal transduction pathway.

Chapter III

Methodology

Research Type:

This was an experimental research aimed at determining the effect of ethylene on the rate of fruit ripening and the quality of the banana.

Experiment layout

Since this experiment is based on the effect of ethylene on produce, the experiment will be carried out as follows. Four bananas, apples and eight pears under normal conditions will be the control experiment observed against four bananas and eight pears in a transparent sealable plastic bag, bananas in a refuse bag with the pears and bananas in a box with pears as the experiment.

Equipment

- Sealable transparent plastic bags and two refuse bags.
- Four unripe bananas.
- Eight ripe pears or apples
- Knife
- Boxes X2
- Scale
- Record sheets

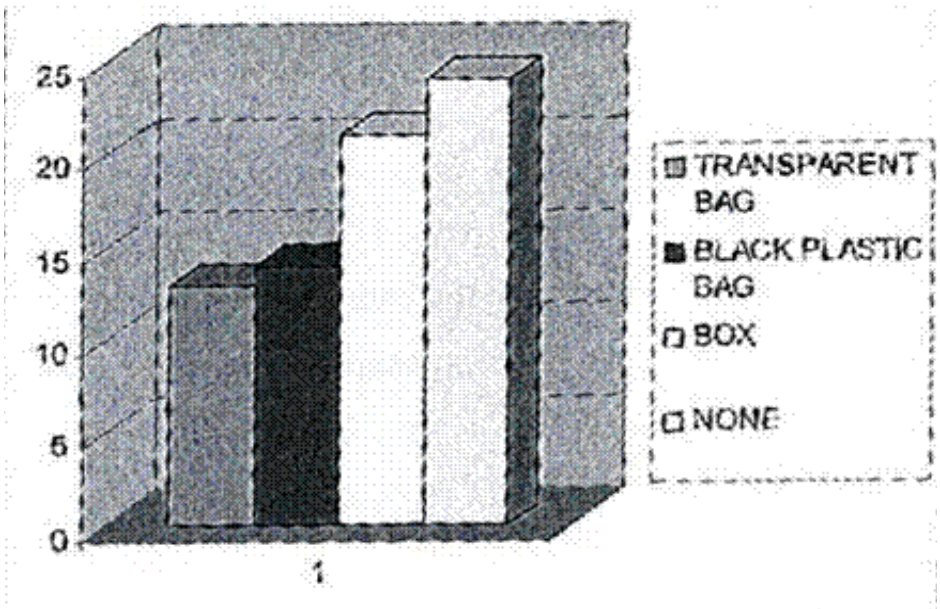
2. Planning

The plan is not fully explained and does not clearly show how levels of ripeness could be assessed. However the research is used to design the experiment. The design has allowed sufficient data to be collected and would allow the reader to perform a similar experiment so can just award 3 marks.

Award 3 marks

1/4 (extent of ripening on Banana)				1/2 (extent of ripening)	
		number of days taken		Experiment	Total number of days taken
		2		Banana + apple + light	3
	Banana + apple	2		Banana + apple	2
	Banana + light	13		Banana + light	7
	material	experiment		Banana + apple + light	3
Transparent Plastic	Black refuse	Banana+ Apple+ light	Transparent Plastic	Banana + apple	4
	Banana + light	10		Banana + light	
box	Banana + apple + light	4	box	Banana + apple + light	10
	Banana + apple	5		Banana + apple	5
	Banana + light	9		Banana + light	11
Not in any material	Banana + apple in cardboard	9	Not in any material	Banana + apple in cardboard	11
	Banana + light	9		Banana + light	2
	Banana	17		Banana	2

BAR CHART SHOWING THE EFFECTIVENESS OF THE EQUIPMENT USED



3. Handling of Evidence

A well presented and informative table of results. Not easy to interpret the validity or purpose of the information. The bar chart axis not clearly labelled.

Award 4 marks, as just better than the criteria for 3 marks

Experiments carried out in plastic bag

Banana and apple in black refuse bag (in light)

Light and temperature are one of the most important factors in fruit ripening, this experiment proved this in that the banana took the shortest time to complete the ripening process compared to all the other bananas in the various experiments. The light and temperature provide the banana with enough energy to ripen. Another factor leading to this rapid ripening is the fact that the ripening agent ethylene released by the ripened apple was not lost to the atmosphere but trapped in the bag. The bag was black, which means it had the ability to trap heat energy within the bag, thereby enhancing ripening process.

Banana and apple in transparent bag (in light)

As in the experiment above, the amount of time taken for the banana to ripen was quicker compared to the other experiments. This is because the experiment was exposed to light, providing the banana with enough chemical and heat energy to carry out chemical reactions. The plastic bag trapped the ethylene released by the ripened apple, which speed up the process.

Banana in plastic bag (in light)

This banana took a longer time to ripen because of the absence of the ripened apple to release ethylene to speed up the ripening process, all other factors existing, without ethylene ripening was negatively affected.

Banana in black refuse bag (in darkness)

This banana took a longer time to ripen compared to the banana in the transparent plastic bag because it was not exposed to light and did not have exposure to ethylene from a ripened apple, therefore ripening was disrupted.

Experiments conducted in a box

Banana and apple (one in light and the other in darkness)

These experiments took the same number of days because the box blocked out any light from coming through. Even though the apples were present these banana took longer to ripen because of their lack of exposure to light for energy to carry out chemical reactions for ripening to complete.

Banana without apple (one in light and the other in darkness)

These bananas took even longer than the bananas in the previous experiment because of the absence of the ripening factor, ethylene. The difference in exposure to light was not visible as the box limited the amount of light available to the banana in the experiment conducted in light.

Experiments conducted without any other materials besides the apple/banana

Banana on its own (light)

This banana ripened rapidly, even rotting after a few more days because of the over exposure to light, the direct exposure to light, the fruit had too much light energy to make use of, hence excessively speeding up the ripening process.

Banana on its own (exposed to a balanced environment) … Control experiment

This banana took the longest time to ripen compared to all the other bananas in the various experiments due to the fact that it was not exposed to ethylene as a ripening agent and also light was not directly exposed to it thereby reducing temperature and slowing the ripening process.

CHAPTER VI

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

SUMMARY

The presence of ethylene coupled with light energy greatly enhance the ripening process in fruit, even with all conditions present, the absence of either one of the is a limiting factor to the ripening process but to get the best yield they both emus b provided in moderation as too much exposure to either will lead to rotting. Research conducted on the taste of the banana indicated that the bananas exposed to light and ethylene were sweeter, easier to peel and had a sour smell. The bananas not exposed to light and ethylene were harder to peel and their flesh was firmer, harder to bite into.

CONCLUSION

The presence of ethylene significantly speeds up the ripening process in fruit; coupled with light energy the speed is further improved. This knowledge can be used to use Ethylene nationwide to ripen citrus fruits in Swaziland, Swaziland is mostly recognized for growing field crops, and the use of ethylene nationwide would help Swaziland diversify whilst at the same time bringing more revenue into the country.

4. Making deductions

The conclusion appears to be more related to the research than directly linked to the data from the investigation. Two main deductions given that are sufficiently related to the investigation.

Award 4 marks

Recommendations for future research

The study can be further continued to;

1. Investigate the effect of ethylene in vegetable production.
2. Investigate how ethylene can be produced industrially.

5. Limitations

This part has not really been addressed by the report. Although suggestions for future investigation are made they do not relate closely to the actual investigation. The candidate has not shown an awareness of the qualitative nature of the report.

Award 1 mark

6. Description, presentation

Generally meets the desired structure with some omissions. The report is neat and logical. The investigation is discussed in a way which shows a mature understanding and application of the topic in a broad context not just linked to the actual practical of the investigation.

Award 4 marks as better than the criteria for 3 marks.

Overall mark 21

The report is just a C grade and although it has aspects of work more typical of a good B grade candidate the work is mixed and not a well constructed investigation lacking a scientific approach.

It has not been related to a practical exercise although it could be with some additions. It could have been used to support assessment of practical exercises based around work on harvesting times and marketing the produce.

5.3 Exemplar 3

TOPIC: Investigating the performance of Hercules which is a summer variety of cabbage when **grown** in **winter**.

CHAPTER 1

INTRODUCTION

a) Background

b) Statement of problem c) Specific objective

d) Hypothesis

e) Importance of project f) Limitations

g) Defination of term

CHAPTER 3

METHODOLOGY

a) Plot selection

b) Plot layout

c) Planting

d) Plot mantainance

e) Data collection

f) Data analysis

CHAPTER4

RESULTS AND DISCUSION

CHAPTER 5

SUMMERY, CONCLUSION AND RECOMENDATION

CHAPTER 1

INTRTRODUCTION

BACKGROUND

Cabbage is the ancestor of cauliflower and broccoli. It was a wild plant that grew on the coasts of Europe and North Africa. Cabbage is generally a cool season crop which is always grown from seed which are sown in seedbeds and later transplanted. Cabbage being cool season crop that grow best in winter months, due to market demand in summer varieties with heat tolerance have been bred and such varieties are now available in seed markets such as Grandslam, Hercules, topmost. Also varieties like Hercules, big copper, brano, star and green star were found to be resistant to diseases and that why cabbage can be grown any time of the year in almost all areas in Swaziland. It is grown mainly for salads and also cooked for its great supply of vitamins and minerals which improves ones diet. It responds well to kraal manure applied before planting and when you have used the manure synthetic fertiliser should be reduced by about 25%. Cabbage grows well in PH of about 5.5 and 7.0. When growing cabbage even if the temperatures are a few degrees below freezing, it will not adversely affect the crop. The spacing is usually 60cm apart and 60cm between the rows. Cabbages are ready for harvesting about 3-4 months after sowing.

STATEMENT OF PROBLEM

Famers have a tendency of choosing seedlings at random not considering varieties that will suit their places and season. The intention of this project was to find out if a summer variety of cabbage (Hercules) can perform in winter so that farmers may be selective or not when choosing varieties of seedling or seeds. For example you want to plant cabbages in the Low yield where temperatures are a bit higher even in winter the question which variety to use.

SPACIFIC OBJECTIVE

The specific objective project; was: to find the performance of Hercules which is a summer variety when grown in winter

HYPOTHESIS

H.0 The summer variety of cabbage can perform better in winter.

H.1 The summer variety of cabbage cannot perform better in winter.

1. Selection of question/hypothesis

Hypothesis is well expressed after some discussion. Some initial guidance given so the candidate's mark was restricted.

Award 3 marks

IMPORTANCE

The importance of this project is to alert tamers whether to choose or not when buying varieties of cabbage to grow in a particular area or season

LIMITATIONS

The limitations of this project were;

1. LAND – The land the project was to be carried on was too small in that way the results were not going to be more reliable.

2. ASCARCITY OF WATER – the water source was far from my plots.

3. MONEY – the money was insufficient to carry the project in different areas.

DEFINATION OF TERMS

1. Ancestor – a person in your family who lived a long time ago.
2. Demand – a firm request.
3. Tolerance – the willingness to accept.
4. Adversely – not likely to produce a good result.
5. Cultivars – a type of plants that have been deliberately developed to have particular features.

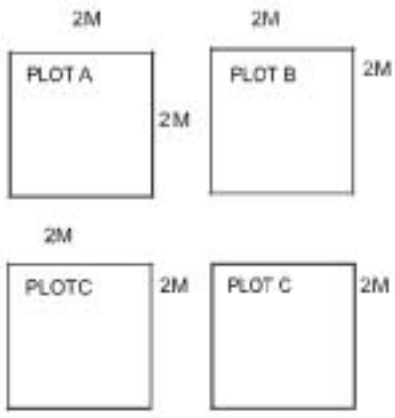
CHAPTER 3

METHODOLOGY

PLOT SELECTION

Plots were selected at random to avoid biasness.

PLOT LAYOUT



KEY: In all the plots cabbages were planted

PLOT PREPARATION

Four plots marked 2m by 2m and 45cm between the plots which was a pathway. A spade was used to dig the soil. Large lumps of soil were broken using the edges of a spade. A fork was used for making fine tilth and levelling was done using a rake. 60g of Fertiliser 2:3:2(22) was broadcasted in all the plots.

2. Planning

Planned without guidance and adequately explained so award the intermediate mark.

Award 4 marks

PLANTING

Planting rows were marked using a string tied between two sticks. Planting stations were marked 60cm by 60cm inter row and intra row. 10g of 2:3:2(22)+0.5%zn was applied in each planting station and filled the holes with water, after it was drained the seedlings were submerged into the holes, they were deep to their first set of leaves and watered.

PLOT MAINTENANCE

The plots were watered twice or thrice a day depending on the weather, if it was hot and windy watering was done 3 times a day and when they were below and at average watering was done 2 times a day. After a week some weeds germinated and they were removed using a hand fork and a layer of mulch was applied. Watering rate was increased when the cabbages began to form heads. 3g of LAN was applied as a top dress 10cm away from the plant as rings.

DATA COLLECTION

The data was collected by measuring the length of leaves every after a week and measuring the circumference of the head and measuring the mass at harvesting.

DATA ANALYSIS

The data was analysed using the average height and masses.

CHAPTER 4

RESULTS AND DISCUTION

NUMBER OF WEEKS	LEAF LENGTH (CM)	CIRCUMFERENCE OF LEAF (CM)	MASS AT HARVESTING
1	2.1		
3	4.5		
6	6	7	
8	10.2	13	
12	12.1	15	
18	15.4	17.8	

Samples of 5 cabbages were chosen at random for mass measurements after harvesting and the average mass was calculated.

0.9kg

1.2kg

0.85kg

1.3kg

1.6kg

The average mass was 1.134kg

3. Handling of Evidence

Results appropriate but only presented as a table and no graphs or charts used.

Award 2 marks

From the results obtained during the study it could be clearly stated that Hercules a summer variety of cabbage cannot grow better in winter even if you have applied all the conditions necessary for plant growth this is witnessed from the tables above. The growing rate was very slow due to low temperatures and short day lengths. The heads grew at a low rate. At harvest the heads were too small and the leaves were thick and dark green, the plant was short and the stem was thick. When the heads were measured they weighted less than the expected mass of summer which is 2–4kg yet not even one reached the maximum mass which is evidence to a literature by commercial vegetable production Swaziland 1996\7 which say matching the proper cultivar to the season is essential in cabbage production as cabbage varieties differ considerable to with stand summer and winter temperatures and their resistance to diseases. As summer varieties were made to with stand summer temperatures when grown in winter where there are low temperatures and short day lengths it is going to be unable to manufacture enough food due to short day lengths.

CHAPTER 5

SUMMERY, CONCLUSION AND RECOMANDATIONS

SUMMERY

The purpose of the study was to find out whether the growing of cabbage which is a summer variety in winter can be profitable or not. The study was conducted practically as an experiment to achieve the objection in hand the experiment was conducted in four plots with the same amount of fertiliser applied. Watering was done daily and it was well maintained which include weeding, mulching and top dressing. Data was collected every a week. The results showed that Hercules does not perform better in winter.

CONCLUSION

From the results obtained it was discovered that the summer variety (Hercules) was not able to perform better in winter when all the necessary conditions were applied.

4. Making deductions

Several deductions based on the evidence and an appropriate conclusion drawn but insufficient detail for 4 marks. See the recommendation: had this been developed the candidate could easily have gained more marks for this area.

Award 3 marks

RECOMENDATIONS

As a recommendation it can be clearly stated that farmers must be more careful when choosing varieties of seeds or seedlings to grow particular area or season because matching a cultivar a wrong season or place may affect production which may cause total inputs to be more than total returns because of low quality production

REFRENCE

1. Commercial vegetable production Southern Africa 1996\7

2. Vegetable research and development in Southern Africa March 8–9 (1999)

5. Limitations

The candidate identified these at the planning stage and made reference to them in arriving at the conclusion. No improvement other than implied in the initial identification regarding scale of the investigation.

Award 2 marks

6. Description, presentation

The work was presented in an interesting and clear way but with some partial omissions the work is the candidates own work and clearly motivated and answering the original question.

Award 3 marks

Overall comment

A sound investigation but limited. It would be hoped that up to two such areas in different places would be used by better candidates so that the candidate can have an opportunity to access other areas of the syllabus.

The work is typical of D/E grade work. Had the candidate spent a little more time fully addressing the marking criteria, this work could have easily gained a few more marks making it C grade.

This could also be easily adapted, allowing practical exercises to be assessed for preparing soil, sowing seeds as well as transplanting and growing plants. The photographs could easily be used to evidence practical exercises.

Award 17 marks

Cambridge International Examinations
1 Hills Road, Cambridge, CB1 2EU, United Kingdom
tel: +44 1223 553554 fax: +44 1223 553558
email: info@cie.org.uk www.cie.org.uk