Coimisiún na Scrúduithe Stáit
State Examinations Commission

LEAVING CERTIFICATE EXAMINATION 2015

AGRICULTURAL SCIENCE

CHIEF EXAMINER'S REPORT

Contents

1. Introduction

This report should be read in conjunction with the examination papers and the published marking schemes. These are available on the State Examinations Commission's website www.examinations.ie

1.1 Syllabus Structure

The examination in Agricultural Science is based on the syllabus published in *Rules and Programme for Secondary Schools*. The syllabus may be found on the website of the Department of Education and Skills at www.education.ie by following the link pathway 'Publications and Media Library', 'Syllabuses and Prescribed Material', 'Senior Cycle', and scrolling to 'Agricultural Science'. This syllabus was introduced in 1969 and first examined in 1971. As was the norm at that time, it outlines the subject content and the broad structure of the assessment but does not include aims, objectives or learning outcomes. There is no difference in syllabus content between Ordinary level and Higher level. Over the years, depth of treatment in the cognitive domain of learning has been established at each level by custom and practice from past examination papers and marking schemes and the major learning objectives of knowledge, comprehension, application, analysis, synthesis, and evaluation inferred accordingly where appropriate and relevant. The State Examination Commission's document 'Leaving Certificate Agricultural Science Practical Coursework Assessment Guidelines for Teachers' (revised in 2012) is issued annually to assist teachers in guiding candidates in the completion and presentation of their practical coursework. It is available at: https://www.examinations.ie/exam/LC_2013_Agricultural_Science_Practical_Coursework_-_Revised_Guidelines_For_Teachers.pdf.

1.2 Assessment

There are two assessment components – a practical coursework component, allocated 100 marks (25%), and a terminal written paper of two and a half hours' duration, allocated 300 marks (75%). The assessment of the coursework is based on common criteria and standards for both levels. The coursework is marked by the candidate's own teacher, subject to moderation by external examiners appointed by the SEC. The written paper is set and marked externally by the SEC and there are separate written papers for each level. At Ordinary level, the examination paper consists of two sections – Section One (120 marks) and Section Two (180 marks). In Section One, candidates must answer six questions from seven (20 marks each). These are questions that either require the candidate to select the correct answer,

(true/false, multiple-choice, or list-matching questions) or elicit short answers. The answers are written in designated spaces on the question paper. Section Two consists of longer questions and candidates must answer three questions from six, (60 marks each). The Higher-level examination paper is not divided into such sections. Candidates must answer six questions from nine. Question 1 is allocated 60 marks and all other questions are allocated 48 marks each. This means that candidates who do not answer Question 1 can score a maximum of 288 marks on the written paper. Question 3 includes a choice between two options and there is internal choice in other questions.

2. Participation Trends

2.1 Overall candidature

Table 1 gives the overall Leaving Certificate Agricultural Science candidature for the last five years. There was a decrease from 2014 to 2015 in the size of the subject cohort, both in terms of absolute number and as a percentage of the overall Leaving Certificate candidature. This decrease is a change to an established trend that saw the total Agricultural Science candidature increase every year for the previous twelve years; from just under three thousand (2890) in 2002 to just under eight thousand (7926) in 2014.

Year	Agricultural Science Candidature	Total Leaving Certificate Candidature*	Agricultural Science as % of total Leaving Certificate candidature
2011	6473	51149	12.7
2012	6889	49360	14.0
2013	7414	49957	14.8
2014	7926	54025	14.7
2015	7672	55044	13.9

* This total includes school candidates, repeat candidates, external candidates and VTOS/PLC candidates. Leaving Certificate Applied candidates are excluded from all totals.

Table 1: Leaving Certificate Agricultural Science candidature, 2011 to 2015.

2.2 Candidature at each level

Table 2 compares the number and percentage of candidates taking Agricultural Science at Ordinary and Higher levels in the years 2011 – 2015. The proportion of candidates taking the Ordinary level examination has grown steadily from 18.3% to 20.9% since 2011.

Year	Total Agricultural Science candidature	Number at Ordinary level	Number at Higher level	% Ordinary level	% Higher level
2011	6473	1186	5287	18.3	81.7
2012	6889	1302	5587	18.9	81.1
2013	7414	1463	5951	19.7	80.3
2014	7926	1597	6329	20.2	79.8
2015	7672	1605	6067	20.9	79.1

Table 2: Number and percentage of candidates at each level, 2011 to 2015.

2.3 Gender balance

Tables 3 and 4 show the balance between female candidates and male candidates in Agricultural Science at each level. The data show that between 2011 and 2015 the preponderance of male candidature over female candidature, while declining slightly at each level, was greater at Ordinary level than at Higher level.

Year	Total Ordinary level	Female Candidates	Male Candidates	Female as % of total	Male as % of total
2011	1186	285	901	24.0	76.0
2012	1302	393	909	30.2	69.8
2013	1463	408	1055	27.9	72.1
2014	1597	408	1189	25.6	74.4
2015	1605	418	1187	26.0	74.0

Table 3: Gender composition of Ordinary level cohort, 2011 to 2015.

Year	Total Higher level	Female Candidates	Male Candidates	Female as % of total	Male as % of total
2011	5287	2106	3181	39.8	60.2
2012	5587	2256	3331	40.4	59.6
2013	5951	2384	3567	40.1	59.9
2014	6329	2554	3775	40.4	59.6
2015	6067	2502	3565	41.2	58.8

Table 4: Gender composition of Higher level cohort, 2011 to 2015.

3. Performance of Candidates

3.2 Ordinary Level

The distribution of grades awarded at Ordinary level over the last five years is given in Table 5 (lettered grades) and Table 6 (sub-grades).

Year	A	B	C	A B C	D	E	F	NG	E F NG
2011	0.3	7.4	32.4	40.1	40.8	13.8	4.6	0.8	19.2
2012	0.3	8.9	36.1	45.3	37.8	12.4	4.2	0.2	16.8
2013	0.3	8.2	32.1	40.6	41.6	14.1	3.6	0.3	18.0
2014	0.6	9.9	31.8	42.3	39.0	14.3	4.0	0.4	18.7
2015	0.3	9.5	33.8	43.6	37.6	13.8	4.4	0.5	18.7

Table 5: Percentage of candidates awarded each lettered grade in Ordinary level Agricultural Science, 2011 – 2015.

Year	A1	A2	B1	B2	B3	C1	C2	C3	D1	D2	D3	E	F	NG
2011	0.0	0.3	0.4	1.9	5.1	7.5	11.6	13.3	12.4	13.6	14.8	13.8	4.6	0.8
2012	0.0	0.3	1.0	2.8	5.1	9.1	12.4	14.6	12.8	13.9	11.1	12.4	4.2	0.2
2013	0.1	0.2	1.2	2.4	4.6	7.7	10.7	13.7	14.4	11.5	15.7	14.1	3.6	0.3
2014	0.3	0.3	0.8	3.5	5.6	8.4	11.1	12.3	12.3	12.7	14.0	14.3	4.0	0.4
2015	0.1	0.2	1.1	2.7	5.7	9.7	13.6	10.5	12.9	11.2	13.5	13.8	4.4	0.5

Table 6: Percentage of candidates awarded each sub-grade in Ordinary level Agricultural Science, 2011 – 2015.

These data show a broadly stable grade distribution at Ordinary level Agricultural Science from 2011 to 2015.

The distribution of sub-grades by gender over the last five years is given in **Table 7** (female candidates) and **Table 8** (male candidates).

Year	A1	A2	B1	B2	B3	C1	C2	C3	D1	D2	D3	E	F	NG
2011	0.0	0.4	0.7	3.5	11.2	8.1	9.8	12.3	9.8	10.5	13.0	13.7	5.3	1.8
2012	0.0	0.8	1.5	3.1	5.9	9.2	13.5	17.0	10.4	13.7	10.7	10.4	3.6	0.3
2013	0.2	0.0	1.0	2.9	5.1	8.6	8.1	17.4	15.9	11.8	13.2	12.3	3.4	0.0
2014	0.7	0.5	1.5	4.2	8.6	10.3	10.0	12.3	8.8	11.5	13.7	14.5	3.2	0.2
2015	0.2	1.0	2.2	3.1	10.0	12.7	14.8	11.2	12.9	8.1	10.5	10.3	2.9	0.0

Table 7: Percentage of female candidates awarded each sub-grade in Ordinary Level Agricultural Science, 2011 – 2015

Year	A1	A2	B1	B2	B3	C1	C2	C3	D1	D2	D3	E	F	NG
2011	0.0	0.2	0.3	1.3	3.1	7.3	12.1	13.7	13.2	14.5	15.4	13.9	4.3	0.6
2012	0.0	0.1	0.8	2.6	4.8	9.1	11.9	13.5	13.9	14.0	11.2	13.3	4.5	0.2
2013	0.1	0.3	1.2	2.2	4.5	7.3	11.8	12.2	13.7	11.4	16.6	14.8	3.6	0.4
2014	0.1	0.3	0.6	3.3	4.6	7.7	11.4	12.3	13.5	13.1	14.0	14.2	4.3	0.5
2015	0.0	0.0	0.8	2.5	4.2	8.6	13.2	10.3	12.9	12.3	14.6	15.0	5.0	0.7

Table 8: Percentage of male candidates awarded each sub-grade in Ordinary Level Agricultural Science, 2011 – 2015

Caution should be exercised in interpreting the above statistics, as the numbers of candidates involved are small, which means that the distributions are subject to more random variation than is the case for larger cohorts. Nonetheless, despite the fact that a higher proportion of female candidates than male candidates in the subject cohort opt for Higher level, the female candidates at Ordinary level still generally outperform their male counterparts (in terms of the percentage scoring at or above any given grade).

3.3 Higher Level

The distribution of grades awarded at Higher level over the last five years is given in Table 9 (lettered grades) and Table 10 (sub-grades).

Year	A	B	C	A B C	D	E	F	NG	E F NG
2011	13.4	24.3	27.9	65.6	25.8	7.3	1.1	0.1	8.5
2012	10.3	25.9	29.6	65.8	25.8	7.3	1.1	0.0	8.4
2013	10.0	27.0	32.6	69.6	23.8	5.5	0.9	0.1	6.5
2014	10.9	26.5	29.9	67.3	24.6	6.8	0.9	0.1	7.8
2015	11.3	28.1	28.5	67.9	24.0	6.7	1.3	0.1	8.1

Table 9: Percentage of candidates awarded each lettered grade in Higher level Agricultural Science, 2011 – 2015.

Year	A1	A2	B1	B2	B3	C1	C2	C3	D1	D2	D3	E	F	NG
2011	6.7	6.7	7.7	8.2	8.4	8.9	9.6	9.4	9.3	7.7	8.8	7.3	1.1	0.1
2012	4.5	5.8	7.2	8.6	10.1	10.1	10.0	9.5	9.4	8.1	8.3	7.3	1.1	0.0
2013	3.9	6.1	7.5	8.8	10.7	11.2	11.0	10.4	8.5	7.5	7.8	5.5	0.9	0.1
2014	4.7	6.2	7.2	9.5	9.8	9.4	10.6	9.9	8.8	7.0	8.8	6.8	0.9	0.1
2015	4.5	6.8	8.9	9.4	9.8	9.7	9.4	9.4	8.3	7.3	8.4	6.7	1.3	0.1

Table 10: Percentage of candidates awarded each sub-grade in Higher level Agricultural Science, 2011 – 2015.

These data show broadly stable grade distribution at Higher level Agricultural Science from 2011 to 2015.

The distribution of sub-grades by gender over the last five years is given in **Table 11** (female candidates) and **Table 12** (male candidates).

Year	A1	A2	B1	B2	B3	C1	C2	C3	D1	D2	D3	E	F	NG
2011	10.3	9.3	10.6	9.5	9.4	9.5	8.9	8.4	7.7	5.6	5.7	4.4	0.7	0.0
2012	6.2	7.5	9.1	11.0	10.8	10.9	8.8	9.1	7.6	6.6	5.9	5.5	1.0	0.0
2013	4.9	7.6	8.9	9.4	11.7	11.2	10.5	9.1	7.6	6.4	6.8	5.1	0.6	0.0
2014	6.0	7.9	8.8	10.5	10.6	9.9	11.2	8.7	7.4	6.1	6.8	5.4	0.7	0.1
2015	5.9	8.6	10.2	10.5	11.2	9.8	9.2	8.3	8.1	6.0	6.2	5.0	1.0	0.0

Table 11 Percentage of female candidates awarded each sub-grade in Higher Level Agricultural Science, 2011 – 2015

Year	A1	A2	B1	B2	B3	C1	C2	C3	D1	D2	D3	E	F	NG
2011	4.3	5.0	5.8	7.3	7.8	8.6	10.1	10.2	10.3	9.1	10.9	9.2	1.4	0.1
2012	3.4	4.7	5.9	7.0	9.6	9.5	10.7	9.8	10.5	9.1	9.9	8.6	1.2	0.0
2013	3.2	5.1	6.5	8.4	10.1	11.3	11.4	11.2	9.1	8.3	8.4	5.8	1.0	0.1
2014	3.9	5.1	6.1	8.9	9.3	9.1	10.2	10.8	9.9	7.6	10.2	7.7	1.1	0.2
2015	3.5	5.4	7.9	8.7	8.9	9.7	9.6	10.1	8.5	8.3	9.9	7.9	1.5	0.2

Table 12 Percentage of male candidates awarded each sub-grade in Higher Level Agricultural Science, 2011 – 2015

Trends in the Higher-level gender data are more clear-cut than at Ordinary level. It is clear from these data that, over the five years reported upon, female candidates consistently outperformed their male counterparts at all points in the grade distribution (in terms of the percentage achieving at or above any given grade). This is again despite the fact that a higher proportion of female candidates than male candidates in the subject cohort opt for Higher level

4. Analysis of Candidate Performance

4.1 General Commentary on Engagement and Performance

4.1.1 Practical coursework component

Although the distinct examination components are not separately graded, the marks for the practical coursework component are captured and recorded. These data show a small gradual decrease in the level of performance in the period 2011 to 2015. Nevertheless, the overall standard remains high, and the great majority of candidates at both levels score significantly better in the coursework component than they do in the written component.

There was wide variation in the range of material presented by candidates and in the standard of the material examined. However, the trend noted in the 2010 Chief Examiner's report on the 2010 Agricultural Science examinations regarding the narrowing of the range of presented topics, largely to those directly suggested by syllabus headings, continues. Although the coursework provides an opportunity for candidates to demonstrate, if they wish, their experience with crops and livestock other than the specific ones that need to be studied for the written examination, there are now very few projects presented for assessment on such topics. Some of the more commonly presented topics in 2015 were: dairying, beef, sucklers, and calf-rearing in the animal section, and barley, potatoes and grass in the crops section. Sheep, pigs, wheat and oats were encountered less often. Some less common project topics included: oilseed rape, forage rape, maize, mushrooms, strawberries, bee keeping, and buffalo rearing.

While the range of acceptable topics is very wide, it is not limitless. Once again this year, some projects were presented on farm machinery, REPS, and farm safety. Projects on these topics cannot gain any marks under the regulations, a situation that is made clear in the guidelines.

Examples of good practice included:

- the use of photographs taken by candidates themselves, including photographs showing them working at their own practical experience projects;
- keeping an annual farming diary;
- the compiling of weed collections and/ or collections of agriculturally relevant invertebrates from the local environment;

- the inclusion of such relevant items as mart receipts, factory grades, feed labels and fertiliser samples;
- comprehensive farm layout plans;
- well laid out, properly written up and dated contemporaneous records of the school-based laboratory and field practical activities.

The weakest areas continue to be:

- poorly executed farm plans;
- poorly presented laboratory notebooks – many lacking results, conclusions, discussion, or dates;
- the scientific investigations on genetics, ecology, microbiology, and animal physiology, where evidence from monitors suggests that the required practical work is not being done.

Despite the revision in 2012 of the 'Leaving Certificate Agricultural Science Practical Coursework Assessment Guidelines for Teachers', many candidates continue to cover only one crop instead of the required two. Plant identification is generally weak, as is invertebrate identification. There is sometimes a lack of recorded evidence of work done. Monitors continue to encounter widespread use of material downloaded from internet sources, and some candidates, during interview, demonstrate poor knowledge of the contents of their own projects.

4.1.2 Written component

Table 12 shows the rank order of candidate answering in the 2015 Ordinary level Agricultural Science examination from the point of view of attempts per question and average marks earned per question. These data are taken from a random sample of 80 examination scripts (5.0% of the total candidature).

Question number	Maximum marks per question	Topic	Rank order by % attempts	Average mark	Rank order by average mark
Section One: Best six questions to count.					
1	20	Plant structure and function	= 2 (96%)	9.7	4
2	20	Organisms of agricultural importance	7 (85%)	4.1	7
3	20	'True or false' questions from across the syllabus	1 (100%)	12.0	2
4	20	Cereals	5 (90%)	7.2	5
5	20	Ecology	= 2 (96%)	14.8	1
6	20	Cattle diseases	6 (88%)	5.9	6
7	20	Scientific reasons for agricultural practices	4 (94%)	11.6	3
Section Two: Best three questions to count.					
8	60	Grassland	3 (55%)	28.9	3
9	60	Cattle	1 (79%)	30.3	2
10	60	Soil	5 (50%)	24.3	6
11	60	Farm animal digestive systems	6 (20%)	25.3	5
12	60	Genetics	4 (49%)	34.8	1
13	60	(a) Sheep (b) Potatoes (c) Dairying (d) Pigs. Any 2 from (a), (b), (c), (d).	2 (66%)	26.9	4

Table 12: Rank ordering of attempts and marks per question, Ordinary level Agricultural Science, written, 2015.

Table 13 shows the rank ordering of candidate responses to questions in the 2015 Higher level Agricultural Science written examination from the points of view of attempts per question, and average marks earned per question. These data are taken from a random sample of 320 examination scripts (5.3% of the total HL candidature).

Question number	Maximum marks per question	Topic	Rank order by % attempts	Average mark	Rank order by average mark
1	60	Various topics from across the syllabus. Short responses. Any 6 parts to be answered from 10.	1 (99%)	32.6	5
2	48	Soil	9 (38%)	14.9	10
3 Option One	48	Potatoes	10 (27%)	20.6	8
3 Option Two	48	Dairying	6 (73%)	26.7	4
4	48	Laboratory or field practical activities. Any 2 from 4.	8 (42%)	32.2	1
5	48	Sheep	4 (77%)	28.6	2
6	48	Crops/ plant physiology	5 (75%)	18.6	9
7	48	Genetics	7 (72%)	21.6	7
8	48	(a) N-cycle (b) Grassland (c) Distinguishing between terms. Any 2 from (a), (b), (c).	3 (77%)	23.9	6
9	48	Scientific explanations. Any 4 from 5.	2 (81%)	28.1	3

Table 13: Rank ordering of attempts and marks per question, Higher level Agricultural Science, written, 2015.

4.2 Meeting Syllabus Objectives

The Agricultural Science syllabus was introduced in 1969 and was examined for the first time in 1971. More modern syllabuses are usually formulated to focus explicitly upon a range of learning outcomes and assessment criteria that reflect a variety of objectives in the cognitive and other domains. Older syllabuses, such as that for Agricultural Science, are not presented with an explicitly stated focus on such objectives.

The syllabus for Agricultural Science lists subject areas and topics to be studied by candidates preparing for examination. The syllabus indicates no difference in content between Ordinary level and Higher level. The understanding at the time of publication of these older syllabuses was that differentiation between the levels was to arise from the depth of treatment of the material at each level in the examination, with the Higher-level paper involving greater demand than the Ordinary-level one. Over the years, depth of treatment at each level has been established by custom and practice, and the major learning objectives of knowledge, comprehension, application, analysis, synthesis, and evaluation have been inferred accordingly where appropriate and relevant.

The SEC annually issues 'Leaving Certificate Agricultural Science Practical Coursework Assessment Guidelines for Teachers' (revised in 2012). This document is intended to assist teachers both with directing candidates in the completion and presentation of the practical coursework component, which makes up 25% of the terminal assessment, and with assessing candidates' coursework. The practical coursework is assessed at a common level.

Comprehensive engagement with the practical coursework component, as indicated in the syllabus and as outlined in the 'Guidelines' document, develops candidates' skills in and appreciation of agricultural science, thereby addressing the psychomotor and affective domains of educational attainment, respectively. Candidates' engagement with the affective domain (in particular, their development of an appreciation of the subject and its value) is largely evidenced by the high standard of very many individual practical agricultural experience projects. This contributes to high marks in that section of the coursework, and such standards are persuasive of candidates' full participation in the practical experience of agriculture over the whole two years of the course, as specified in the guidelines.

Despite the absence from the syllabus of explicitly stated aims and objectives for learning, the written examination at both levels has developed over the years to assess candidates' knowledge and comprehension of the scientific principles that underlie contemporary agricultural methods and practices, within the confines of the syllabus. Within the cognitive domain, the written examination, especially at Higher level, further interrogates candidates' ability to apply their learning to new or unfamiliar agricultural situations, to analyse important concepts in the context of agricultural science, and tasks candidates in particular contexts to use the high-order skills of synthesis and evaluation in responding to stimulus material in some parts of some questions on the examination papers.

In the 2015 written examinations, candidates' grasp of basic agricultural science knowledge was reasonably good at Higher level and considerably less so at Ordinary level. It was also evident from the standard of answering that some Higher-level candidates would have been better advised to take the Ordinary level paper. Candidates' understanding of their agricultural science knowledge as outlined in the syllabus was markedly different between Ordinary level and Higher level, and also between the responses of the less successful and the more successful Higher level candidates.

In general at Ordinary level, the answering in Section Two, which gives candidates more latitude to formulate their answers than the more structured Section One, was quite unfocused and dealt in vague generalities rather than addressing particular questions as asked. Across the Ordinary-level paper, questions that sought to elicit candidates' comprehension of the scientific reasoning behind particular processes or the details of laboratory practical activities were quite poorly answered, such as Question 8 (c) (*a laboratory or field experiment to estimate percentage dry matter in a silage sample*), and to a certain extent Question 7 (*scientific reasons for: sheep culling; drying off in calving cows; thinning forest plantation trees after twenty years; spreading lime on some soils; taking great care when agitating slurry*). Similarly, Ordinary-level questions that required any significant depth of understanding of particular concepts or practices were also poorly answered, including Question 4 (*identification from a photograph, followed by: time of sowing, end use, seeding rate, and yield for one cereal crop from: barley, maize, oats, wheat*), Question 6 (*causative microorganisms of certain cattle diseases*), and especially Question 10 (*soil composition, and earthworm influence on soil*).

Two further areas of notable weakness in the answering of Ordinary-level candidates were the understanding of diseases affecting farm animals or crops and the reasons for the agricultural importance of particular invertebrates; here Questions 2 and 6 are cases in point. However, questions that sought candidates' knowledge of farming practices at procedural level were reasonably well answered, including Question 8 (b) (*details of hay and silage making with understanding of advantages*), Question 9 (c) (*precautions when buying in replacement heifers, keeping livestock diseases off a farm*), Question 11 (c) (i) (*early calf diet to develop the rumen*), and Question 13 (*detailed examination of any two from: sheep; potatoes; milk; pigs*).

The standard of Ordinary level candidates' answering in questions that dealt with application of agricultural knowledge was mixed. The high standard of answering in the part of Question 5 that dealt with the use of various instruments relevant to habitat study was enough to give this question the best average mark in Section One. However, the part of Question 6 that dealt with the application of knowledge to predicting the best ways to prevent and/or treat certain cattle diseases was answered so poorly as to give this question the second-lowest average mark in the same section. Approximately half of all Ordinary-level candidates attempted Question 12, and those who did so demonstrated good application of their genetics learning in solving the problems posed in parts (b) and (c), to the extent that this question was the highest-scoring question in Section Two. The answering of the analysis question in part (a) (ii) of Question 8 at Ordinary level (*distinguishing between the conformation of beef and dairy cattle breeds*) varied significantly between candidates.

At Higher level, questions which sought straightforward information were generally well answered, but questions that tested deeper understanding were less well answered except by the highest-scoring candidates. The areas in which Higher-level candidates demonstrated the greatest knowledge and understanding of the syllabus were broadly twofold: first, in the animal production topics such as sheep, dairy, beef, and particularly calf-rearing, this being in evidence in particular in Question 3, Option Two (*detailed examination of management of calf husbandry*) and Question 5 (*detailed examination of sheep reproduction and management of breeding*). Second, in describing laboratory experimental procedures, such as in Question 4, parts (a) and (d) (*laboratory methods to determine the percentage mineral ash in freshly-cut grass and show the presence of micro-organisms in an animal foodstuff, respectively*).

The standard of answering in genetics, Question7, which has traditionally been the principal topic in which candidates are asked to demonstrate synthesis and/or evaluation in their responses, continues to improve, and candidates who attempted this question generally did best when applying their learning to solve the problem given in part (b). However, the topical part (c) of Question 7, which asked candidates to discuss the advantages of using sexed semen rather than conventional semen in the context of increasing milk production, was considerably less well answered than parts (a) and (b), which were more traditional in their approach and layout.

Higher-level candidate answering was weak in describing the procedures of outdoor/field experiments, in describing the life-cycle of the potato blight fungus, and particularly in

responding to any questions to do with soil. The questions that illustrated these weaknesses were Question 4, parts (b) and (c) (*field methods to assess the effects of overgrazing on the botanical composition of a pasture sward and to examine the effect on yield of growing different varieties of a named crop*); Question 3 Option One (b) (*life cycle, symptoms, and prevention and control of Phytophthora infestans*); Question 1 part (d) (*formation of a gley soil*); and Question 2 (*soil texture and temperature; podzol soil; cation exchange and CEC*). The main question on soil, Question 2, was the second-least-often attempted in the Higher level paper, at 38% attempts, and the lowest-scoring, at an average of 14.9 marks out of 48 (31%). This seeming aversion to soil as a topic was echoed at Ordinary level, where Question 10 was similarly the second-least-often attempted, at 50% attempts, and the lowest-scoring, at an average of 24.3 marks out of 60 (41%).

At Higher level, the analysis-focused parts of Question 3 Option One (*various aspects of the use and importance of seed potatoes*) and Option Two (*management of dairy calves*) demonstrated a very mixed standard of answering. In general, the Option One question on potatoes was poorly answered, as well as being the least-often attempted question on the paper. This was unusual for a question on crops, which has been well attempted in recent years. However, the Option Two question, which interrogated similar cognitive skills to those in Option One, this time on the management of dairy calves, was more popular and significantly better answered than the similarly-pitched parts of Option One. The answering in the analysis-focused part (c) of Question 8, in which candidates were asked to distinguish between the meanings of agriculturally significant terms, met with limited success, as many candidates did not engage sufficiently with the meaning of both terms in the pairs of terms under consideration.

There was evidence at both levels of a poor ability of some candidates to read questions thoroughly and lay out their answers efficiently. This manifested itself as candidates not following the directions in particular questions, most often in one or both of two ways: not giving the required number of answers when a particular number was sought, or in many cases, offering answers that were entirely irrelevant to the question asked. Also, at both levels, significant weakness was demonstrated where candidates were required to explain or understand specialised terminology in the course of responding to questions.

5. Conclusions

5.1 Practical coursework component

- The standard of practical coursework in 2015 remains generally very high, with most candidates at both levels scoring significantly better in the coursework component than in the written component. Despite this, evidence continues to show that, in a significant number of centres, the practical coursework is not being treated with the importance that is its due, as outlined in the syllabus.

- The trend showing the narrowing of the range of topics presented by candidates for the practical experience project, largely to those directly suggested by syllabus headings, continues. This trend was also noted in the chief examiner's report on the 2010 Agricultural Science examinations.

- Again in 2015 some projects were presented on farm machinery, REPS, and farm safety. These topics cannot be awarded any marks under the regulations.

- Many candidates continue to cover only one crop instead of the required two in the practical coursework component. The revision in 2012 of the 'Leaving Certificate Agricultural Science Practical Coursework Assessment Guidelines for Teachers' makes it clear that two crops must be covered in this section.

- In some centres, there was a lack of recorded evidence of work done in both the practical experience and the scientific investigations parts of this component.

- The SEC's monitors continue to encounter widespread reproduction or otherwise uncritical use of material downloaded from internet sources, and some candidates, during interview, demonstrate poor knowledge of the contents of their own projects.

5.2 Written component

- The great majority of Ordinary level candidates (about 95%) attempted the required three questions in Section Two, with about 20% attempting four or more questions.

- There was a significant decrease in the number of candidates who attempted all nine questions on the Higher level paper this year (six being required). The norm was for candidates to attempt seven.

- In questions with an internal choice, more Higher-level candidates than usual attempted all three parts of Question 8 and all five parts of Question 9, where two and four parts were required, respectively.

- At Higher level, Question 1 was attempted by almost all candidates and, in general, six or more parts were attempted.

- Candidates' mastery of basic agricultural knowledge, within the confines of the syllabus, was generally good at Higher level but considerably less so at Ordinary level. A similar dichotomy was evident in candidate responses where the higher categories of learning objective, such as comprehension, application, and analysis were required.

- At both levels, but especially at Higher level, the genetics questions are generally the principal ones in which the highest-order learning objectives of synthesis and/or evaluation are regularly encountered. The particular type of learning involved in deducing possible genotypes and phenotypes in unseen reproduction situations involving agriculturally important crops and/or livestock species usually means that only a minority of either the Higher level or Ordinary level cohorts engages meaningfully with this aspect of genetics.

- At Ordinary level there was considerable evidence of poor examination technique and general ill-preparedness for the examination.

- Significant weakness was demonstrated at both Ordinary level and Higher level in candidates' ability to explain and/or understand specialised terminology in the course of responding to questions.

6. Recommendations to Teachers and Students

- Teachers should be fully conversant with the contents of the document 'Leaving Certificate Agricultural Science Practical Coursework Assessment Guidelines for Teachers', as revised in 2012, that issues to schools in April every year.

- Teachers should ensure that their students fully engage in the practical aspect of Agricultural Science across the full range of topics outlined in the syllabus, including animal physiology, genetics, ecology, and microbiology.

- Teachers should encourage their students to cover all syllabus topics in appropriate depth in the light of contemporary agricultural practice.

- Teachers should provide their students with the opportunities to carry out appropriate practical activities in field and laboratory and ensure that students understand the reasons behind the various steps in each activity.

- Teacher should advise students to be judicious in their use of materials downloaded from internet sources in their projects

- Teachers should advise their students of the importance of understanding the concept of a control in an experiment and the difference between the result and the conclusion of an experiment, and encourage them to accurately describe these concepts in relevant examination responses.

- Teachers should advise their students of the value of taking due time and care to read and evaluate questions in order to choose the best ones to attempt, based on each student's strengths.

- Teachers should help their students to practise the careful reading of questions in order to ascertain and give priority in their responses to the information or analysis actually sought.

- Teachers should provide their students with the opportunities to be well practised in following instructions in questions.

- Teachers should advise their students not to rely on any key word (or form of such a word) included in a term when they are asked to define or explain the meaning of the term. For example, if a 'deficiency' is to be defined or explained, perhaps in the

context of a deficiency disease such as grass tetany, one must not rely in one's answer on the word 'deficient' or any of its forms, as this is then a form of "circular reasoning".

- Teachers should provide their students with the opportunities to be well practised in explaining the meanings of terms and the difference between terms that have the potential to be confusing e.g. 'top dressing' and 'topping'.

- Teachers should help their students to understand the importance of drawing labelled diagrams when describing an experiment.

- Teachers should advise their students of the importance of giving accurate specific figures or narrow ranges where appropriate in examination responses, e.g. for birth-weights, live-weight gain, yields, age at slaughter, and similar criteria.

- Teachers should advise their students that Question 1 in the Higher-level examination carries more marks than any other question and that it should therefore always be attempted.

- Teachers should advise their students that they should attempt at least the required number of questions and parts of questions in order to maximise their marks.

- Teachers should advise their students, especially at Higher level, not to give minimalist answers to questions on complex topics, and particularly when answering questions that ask for "scientific explanations".

- Students should engage fully with all parts of the practical coursework component of the syllabus: plant and animal identification, scientific investigations in laboratory and field, and especially the practical experience project, all of which should be carried out on a continuous basis over the prescribed two years of the course.

- Students should develop good habits of neatly and systematically recording all aspects of their practical work according to current best practice and under the guidance of their teacher.

- In the period immediately prior to the examination, students should use past examination papers for practise.

- Students should practise reading questions carefully in order to make sure that the questions being answered are the ones that were actually asked.
- Students should carefully attend to the particular instructions in each question.
- Students should practise drawing large, tidy, accurate diagrams and labelling the parts of those diagrams clearly.
- Students should learn to explain the difference between potentially confusing terms.
- Students should learn to define terms without relying on key words from the term.
- Students should learn the reasons behind all steps in practical activities.
- Students should learn the significance of a control in scientific experiments, understand the difference between the result and the conclusion, and use these concepts accurately in examination answers.
- Students should become familiar with and learn agricultural science terminology appropriate to the syllabus and examination requirements.