LEAVING CERTIFICATE
AGRICULTURAL SCIENCE

National Workshop 4
Workbook

© PDST 2020

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Key Messages

1. By creating a learning environment that allows research, inquiry and self-directed learning, teachers will allow students to assume responsibility for planning, researching, monitoring and evaluating their own work and in doing so develop a positive sense of their own capacity to learn both individually and collaboratively.

2. The scientific method is integral to the process of writing scientific reports. Adopting this method will enable students to engage more successfully with aspects of the course including the recording of SPAs and the IIS.

3. Examining farm based case studies as a pedagogical approach can incorporate different aspects of each strand along with cross cutting themes which allow for differentiation, implementation of key skills, supporting literacy and numeracy concepts contained in and required by the specification.

The New Specification Aims

Leaving Certificate Agricultural Science aims to enable students to:

- Appreciate the natural environment and human interactions with it and the sustainable use of its resources, recognising the need for a rationale and balanced approach to the exploitation of these resources in a local and global context
- Recognise the need for, and global importance of, relevant strategies and policies to promote the agri-food industry while insulating it from future challenges (e.g. climate change, novel crop and animal diseases) and identify opportunities for innovation and entrepreneurship in the context of local, regional and world markets
- Develop their scientific knowledge and skills, in the context of agricultural practices, and increase their awareness of health and safety issues associated with these practices.

(Aims, Agricultural Science Specification 2018, Page 7)

Objectives

Students should:

- Develop an ecological awareness in the context of the provision of food and non-food materials
- Recognise the impact of various agricultural practices on the environment and appreciate how the application of science and technology affects the individual, the community and the environment
- Become aware of the contribution of agriculture to the economy of the locality and the nation and its importance in EU and world contexts
- Make informed evaluations of contemporary agricultural science issues locally and globally
- Understand that the study and practice of science are primarily co-operative activities which are subject to social, economic, technological, ethical and cultural influences, and legislative and economic considerations
- Develop independent thinking, problem-solving and self-directed learning skills through active engagement in their own learning and through project work
- Understand the need for safety in conducting laboratory and field investigations.

(Objectives, Agricultural Science Specification 2018, Page 8)

Overview of the specification

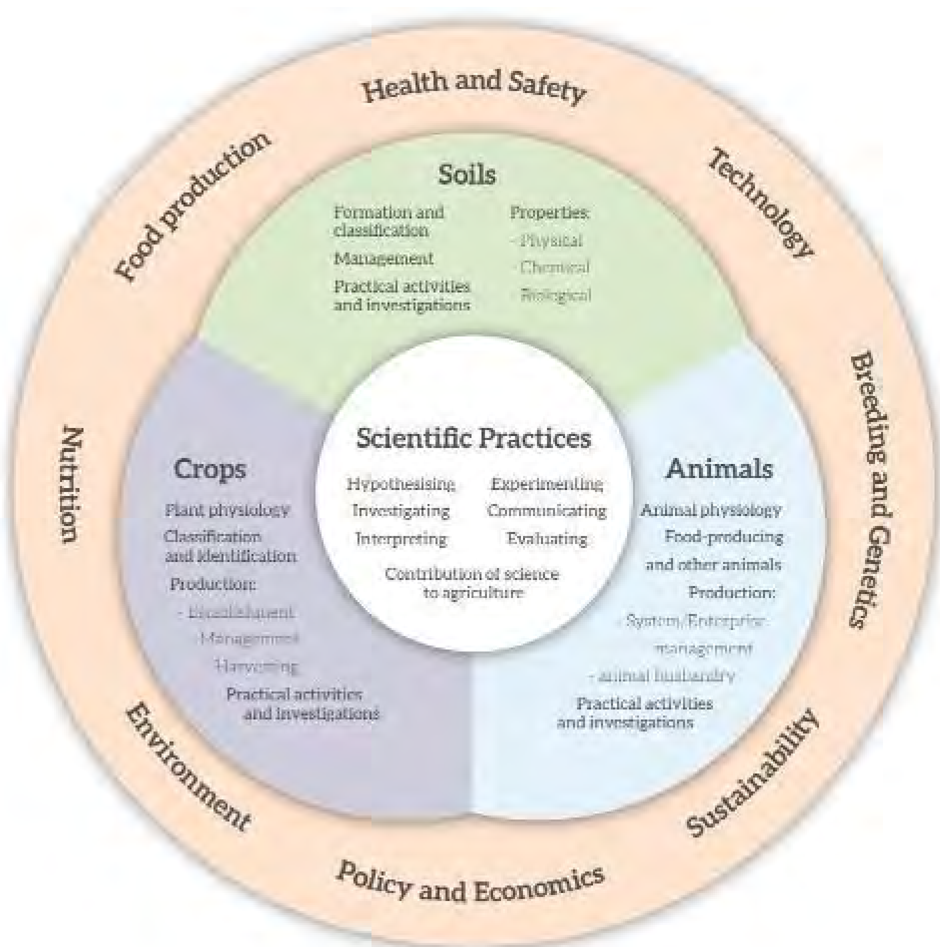


Figure 4: Structure of the specification

(Overview of the specification, Agricultural Science Specification 2018, Page 11)

3 Documents supporting the IIS

Specification 2018	IIS Guidelines December 2019	SEC IIS Brief December 2019
https://www.curriculumonline.ie/getmedia/9ad3071d-b58d-4988-9afc-f4e229ceb864/NCCA-Specification-for-Leaving-Cert-Agricultural-Science.pdf	https://www.curriculumonline.ie/getmedia/c509fc4d-848e-49b8-8c35-d7fc47683c85/AgScience-GL-Final-Dec-19.pdf	https://www.examinations.ie/misc-doc/EN-EX-25906961.pdf

PADLET QR CODE National Workshop 4 2020	How to use Adobe Spark https://youtu.be/GTFSVA3LVak

Supports Provided by the PDST

CPD Timeline September 2020 to May 2021

What does it mean to be scientifically literate?

Keywords:

Think - Pair - Share

Question	My thoughts/Ideas	My Partners thoughts/ Ideas	Combined Ideas
Oral Language			
Writing			
Reading			

Using Digital Technology to Enhance Literacy and Differentiation

Teagasc Article	Teagasc Article - Rewordify
Soil Carbon Sequestration Carbon sequestration describes the process of transferring carbon from the atmosphere to the terrestrial biosphere (soil or vegetation). Soils contain vast quantities of plant, animal and microbial residues in varying stages of decomposition and store more carbon globally than the atmospheric and living vegetation pools combined. Temperate grasslands have shown strong potential to store carbon belowground in roots and soil. However, there is still large uncertainty surrounding baseline soil C values and verifying the strength and permanence of carbon sequestered in different soil fractions. Research in Teagasc Johnstown Castle is focussed on assessing the *quantity* and *quality* of soil organic carbon (SOC) in agricultural soils as well as management, soil and climatic effects on C sequestration. Soil samples taken across a range of soil types as part of the Irish Soil Information System and SQUARE projects will be analysed. In addition, flux data from long-term eddy covariance towers will provide detailed information on carbon exchange at an ecosystem level and the drivers of carbon uptake and release.	**Soil Carbon (separation from others)** Carbon (separation from others) describes the process of moving (from one place to another) carbon from the atmosphere to the (on land) (locations on the Earth that support life) (soil or green plants). Soils contain huge amounts of plant, animal and microbial residues in different stages of rotting and store more carbon around the world than the (related to the air outside) and living green plants pools combined. (huge areas of grass) have shown strong possible ability to store carbon belowground in roots and soil. However, there is still large doubt surrounding (a measure of what occurs naturally/sports boundary line) soil C values and (checking for truth/proving true) the strength and (state of existing forever) of carbon separated/isolated in different soil fractions. Research in Teagasc Johnstown Castle is focussed on testing/evaluating the amount and quality of soil organic carbon (SOC) in farming-based soils as well as management, soil and (related to the Earth's weather) effects on C (separation from others). Soil samples taken across a range of soil types as part of the Irish Soil Information System and SQUARE projects will be analysed. Also, flux data from long-term little swirling water current covariance towers will provide described/explained information on carbon exchange at a community level and the drivers of carbon uptake and release.

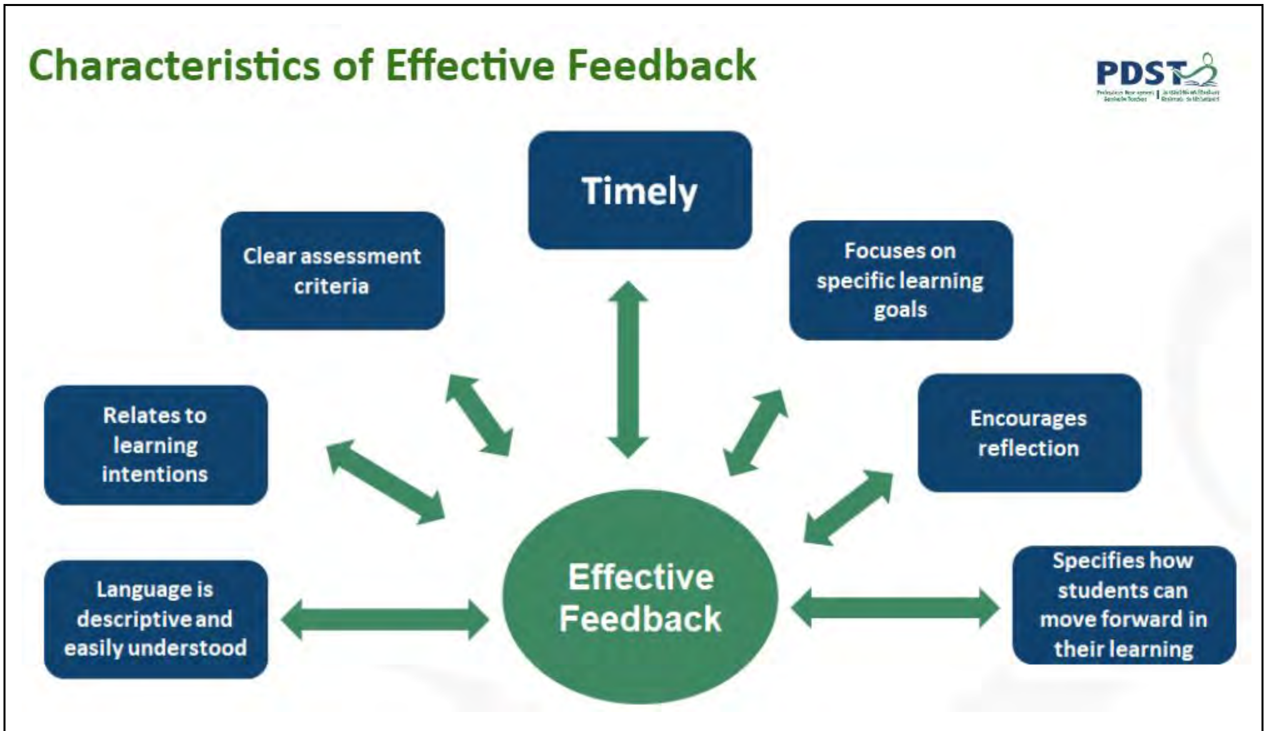
How are students finding the process of writing scientific reports?

What challenges are your students having with conducting background research and research questions?

Why are students having these difficulties with 1. Research and 2. Generating a research question ?

How can we help them going forward with this?

Formative Assessment



Formative Assessment

	Where the Learner is?	Where the learner is going?	How to get there?
Teacher	Clarifying, sharing and understanding learning intentions	Engineering effective discussions, tasks, and activities that elicit evidence of learning	Providing feedback that moves learners forward
Peer		Activating students as learning resources for one another	
Learner		Activating students as owners of their own learning	

(Wiliam, Thompson (2007), Leahy et al., 2015)

Features of Quality Rubric

	→ Progress →		
	X	Y	Z
Title, Aim, Links to cross cutting themes and Research	Title Introduction	Title Introduction Agricultural context	Title & aim Introduction - Agricultural context Link to cross cutting theme Sources of research include references)
Hypothesis and Prediction	No testable hypothesis Fail to make prediction	Generated a hypothesis not linked to experiment	Testable hypothesis Prediction linked to the experiment
Experimental design	No discussion of variables Outlined a simple plan. Equipment list A safety note Labelled diagram	Variables - independent, dependent, controls Equipment used Basic Method Health and safety Diagrams / photographs	Variables - independent, dependent, controls Equipment used Detailed Method Health and safety Fully labelled diagrams / pictures
Recorded Data (tables & graph)	Basic results table with no repeats or units. Untitled graph with no units on axis	Results table with units and repeats. Appropriate graph	Table with units with repeat results and mean calculated Appropriate graph (Scale Axis Label Title - SALT)
Analysis	Does not explain trends and patterns effectively Can't see relationship between variables Limited or no use of statistical analysis	Has put "graph into words" Limited explanations of trends and patterns. Some discussion of causation. Basic statistical analysis	Trends and patterns explained Use of primary data Causation % correlation Use of agricultural & scientific knowledge to explain trends Use of statistical analysis
Conclusion	Does not accept/ reject hypothesis Fails to draw conclusions linked to data collected	Accepts / rejects hypothesis Form conclusions based on evidence gathered	Accepts / rejects hypothesis Logical conclusions linked to data Discussed limitations & bias
Evaluation	Made a basic comment about the procedure and results obtained. Suggested a simple improvement to their method	Made relevant comments about procedure and results obtained. Suggested a number of improvements Discusses simple extensions	Made detailed comments about procedure and results obtained. Suggested a number of improvements to reduce errors (Systemic/ statistical errors) Comments on reliability of the data taking into account any anomalous results. Discusses possible extensions
Discussion (relevance to agriculture)	Arguments not linked to their findings Fails to see the agricultural significance of the SPA	Demonstrates knowledge and understanding with poorly constructed arguments	Clearly discussed opinions. Concise arguments in relation to results obtained and secondary findings. Significance for agricultural enterprise (link to secondary data)

Example X

3.3.2(i): Measuring the dry matter content of a named crop.

Title: To measure the Dry Matter content of Grass.

Safety: Choose a safe location to collect grass samples.

Wear heat resistant gloves when handling hot material from the oven.

Ensure the oven is free from combustible materials.

Prediction: I think grass is made up of 50% water and 50% Dry stuff.

Equipment:

Fresh Grass samples	3 Beakers	Oven
Electronic balance	Stop watch	Tongs
Tissue Paper	Scissors	

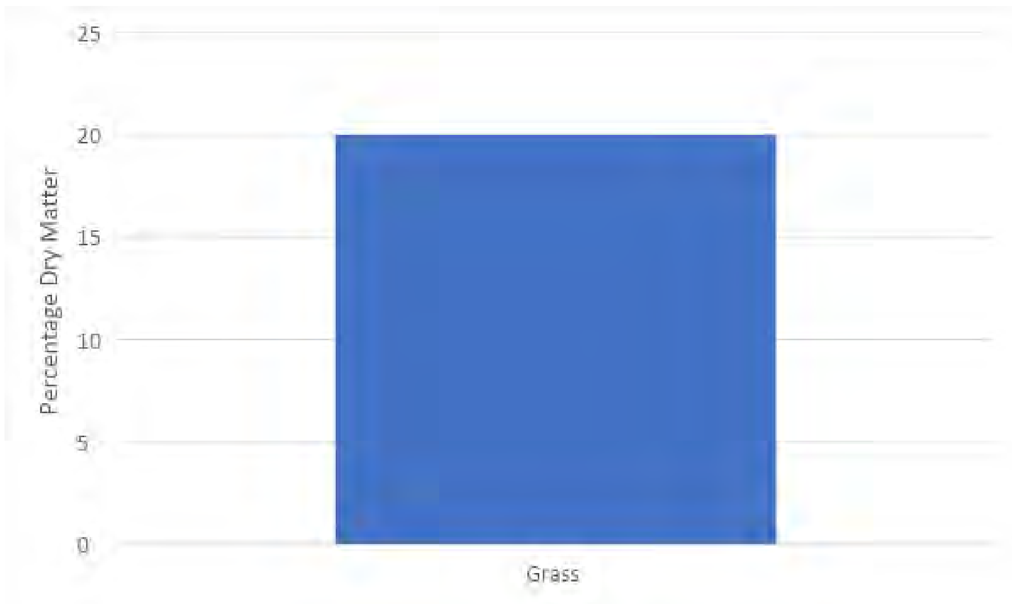
Method:

1. Collect fresh grass samples.
2. Weigh an empty beaker using an electronic balance and record the mass.
3. Add the sample of grass (50g) to the beaker.
4. Reweigh the beaker containing the grass sample and record the mass.
5. Place the beaker of grass in the oven at 100˚C for 15 mins.
6. Calculate the percentage Dry Matter of grass.

Results:

Mass of empty beaker:	280g
Mass of empty beaker + fresh grass sample:	330g
Mass of beaker + dried grass after constant mass was reached:	292g
Mass of dried grass only:	10g
Percentage DM: $\frac{\textit{Mass of dried grass}}{\textit{Mass of fresh grass}} x \frac{100}{1}$	20%

Graph:



Discussion: Dry Matter of grass was 20% Dry Matter.

Example Y

3.3.2(i): Measuring the dry matter content of a named crop.

Title: To measure the Dry Matter content of a named crop – Grass.

Aim: To calculate the percentage Dry Matter content of grass by comparing the mass before and after heat dehydration in an oven.

Research: Grass can be divided into its water and dry matter content. 100 kg of grass will contain approximately 83 kg of water. But it's the dry matter that contains the key nutrients that the animal needs. The dry matter can be divided into cell wall and cell contents. The cell wall of grass is the fibre content. While, the cell contents include sugar, protein, fats, minerals and other compounds.

From my research I can see that grass is roughly 80% water and 20% dry matter.

Hypothesis: Grass will contain 20% dry matter.

Safety: Choose a safe location to collect grass samples.

Wear heat resistant gloves when handling hot material from the oven.

Ensure the oven is free from combustible materials.

Equipment:

Fresh Grass samples	3 Beakers	Oven
Electronic balance	Stop watch	Tongs
Tissue Paper	Scissors	Heat proof gloves
Ruler		

Method:

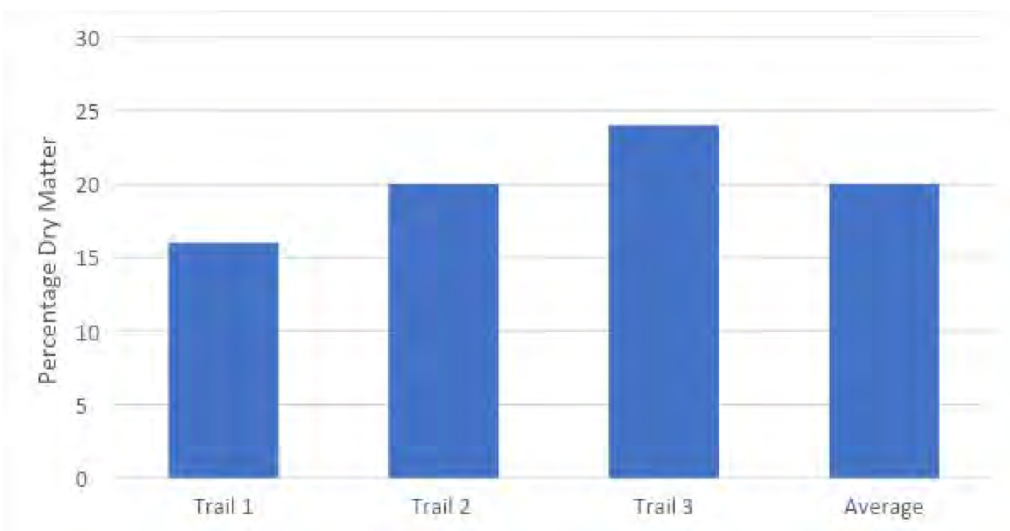
1. Collect fresh grass samples.
2. Dry off any excess water from the grass using tissue paper.
3. Cut the grass samples into short lengths of 30 cm.
4. Weigh an empty beaker using an electronic balance and record the mass.
5. Add the sample of grass (50g) to the beaker.
6. Reweigh the beaker containing the grass sample and record the mass.

7. Place the beaker of grass in the oven at 100˚C.
8. Remove the beaker from the oven using tongs, every 10 mins and reweigh, until a constant mass is reached.
9. Calculate the percentage Dry Matter of grass.
10. Repeat this for three samples of grass to get the average.

Results:

	Trial 1:	**Trial 2:**	**Trial 3:**	**Average:**
Mass of empty beaker:	280g	280g	280g	280g
Mass of empty beaker + fresh grass sample:	330g	330g	330g	330g
Mass of beaker + dried grass after constant mass was reached:	288g	290g	292g	292g
Mass of dried grass only:	8g	10g	12g	10g
Percentage DM: $\frac{Mass\ of\ dried\ grass}{Mass\ of\ fresh\ grass}\ x\ \frac{100}{1}$	16%	20%	24%	20%

Graph:



Analysis: From analysing my results I can see that the dry matter varies in different samples of grass. My findings are in line with my research, grass contains about 20% DM.

Conclusion: The data I have collected backs up my hypothesis. The Dry Matter content of grass was measured on average to be 20% Dry Matter.

Evaluation: My results seem good as they are all around the mean.
If I was to do this experiment again I would also use a digitally controlled oven to get a more accurate temperature.

Discussion: From my results the average Dry Matter of grass was 20% Dry Matter. This evidence proves my hypothesis to be correct.

From my research Dry Matter is composed of Protein, Sugar, Cellulose and Fibre.

There was only one independent variable so it is fair to say the investigation was a fair test.

This investigation could be extended to compare the Dry Matter content of grass, silage and hay.

Example Z

3.3.2(i): Measuring the dry matter content of a named crop.

Title: To measure the Dry Matter content of Grass.

Aim: To calculate the percentage Dry Matter content of grass by comparing the mass before and after heat dehydration in an oven.

Research: From my research Dry Matter is composed of Protein, Sugar, Cellulose and Fibre. Sugars and Protein are the parts of the Dry Matter that are easy for livestock to digest and are used to supply the animal's body with energy and protein. These Dry Matter components are very important to a dairy farmer, who needs cattle to have energy to produce milk that has a high protein content, which is required for cheese and yogurt production. Protein is also used by the animal's body to produce muscle, so farmers involved in meat production would want grass with a high level of these Dry Matter components. Cellulose and Fibre are more difficult to digest but still play an important role in the livestock's diet as they act as rough to prevent bloat. Sugars are made during photosynthesis, while grass makes protein from the nitrogen it absorbs through its roots. Slurry is a good source of nitrogen for grass. Sugar is converted to cellulose and fibre when the grass enters the reproductive stage of growth. They are used to build structures in the grass, like cellulose is used in plant cell walls.

Hypothesis: Grass will contain about 20% Dry Matter; as most living things are composed of about 80% water.

Prediction: I predict that the DM of grass will come in between 15 – 20%

Variables:

Independent variable:	**Dependant Variable:**	**Control variables/constants:**
The grass sample	*The final mass of the grass after being exposed to the heat.*	*Same beaker (500 ml)* *Temperature of oven (100˚C)* *Weighing intervals (10 mins)* *Weighing method (electronic balance)* *Length of grass (30 cm)*

Safety: Choose a safe location to collect grass samples.
Wear heat resistant gloves when handling hot material from the oven.
Ensure the oven is free from combustible materials.
Keep walkways and emergency exits clear
Wear safety glasses and appropriate PPE

Equipment: Fresh Grass samples, 3 Beakers, Oven, Electronic balance, Stop watch, Tongs, Tissue Paper, Scissors, Heat proof gloves, Ruler

Method:

1. Fresh grass samples were collected.
2. Any excess water from the grass was dried off using tissue paper.
3. Grass samples were cut into short lengths of 30 cm.
4. An empty 500 ml beaker was weighed using an electronic balance and the mass was recorded.
5. A sample of grass was added to the beaker.
6. The beaker containing the grass sample was weighted and the mass recorded.
7. The beaker of grass was placed in the oven at 100˚C.
8. The beaker was removed from the oven using a tongs, every 10 mins and reweighted, until a constant mass was reached. These masses were recorded.
9. The initial mass and final mass of the grass after being exposed to heat was used to calculate the percentage Dry Matter of grass.
10. This method was repeated for three samples of grass to allow for use of data based on an average.

Results:

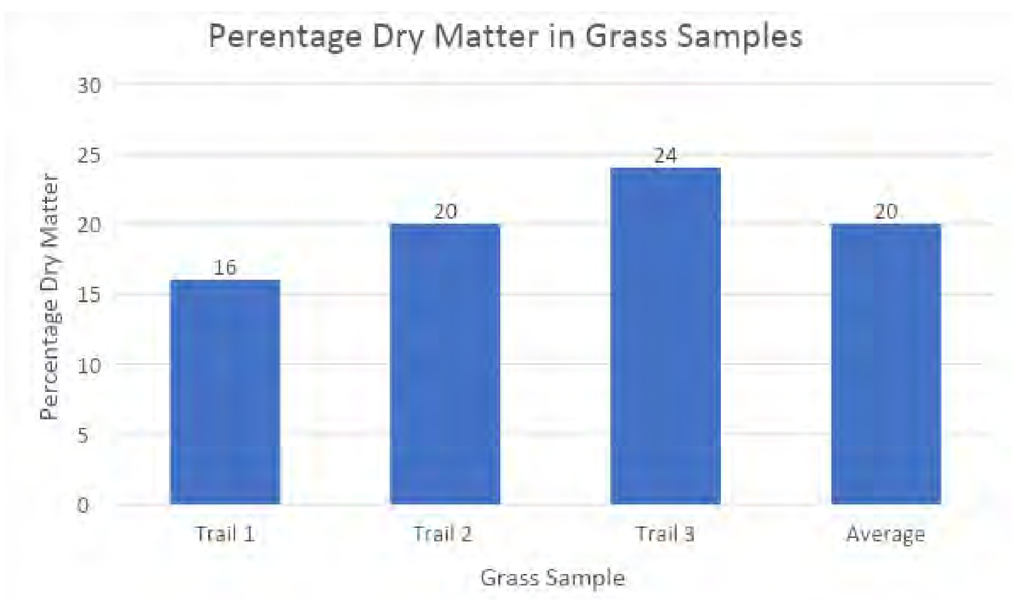
Table 1: Change in mass of beaker & grass sample while being exposed to heat.

	Time:	**10 mins:**	**20 mins:**	**30 mins:**	**40 mins:**	**50 mins:**	**Constant:**
Mass (g):	Trial 1:	300g	290g	288g	288g	288g	288g
	Trial 2:	300g	294g	290g	290g	290g	290g
	Trial 3:	302g	296	292g	292g	292g	292g

Table 2: Masses of samples required to calculate percentage Dry Matter.

	Trial 1:	**Trial 2:**	**Trial 3:**	**Average:**
Mass of empty beaker:	280g	280g	280g	280g
Mass of empty beaker + fresh grass sample:	330g	330g	330g	330g
Mass of beaker + dried grass after constant mass was reached:	288g	290g	292g	$\frac{288+290+292}{3}$ = 292g
Mass of dried grass only:	288-280 = 8g	290-280 = 10g	294-280 = 12g	$\frac{8+10+12}{3}$ = 10g
Percentage DM: $\frac{Mass\ of\ dried\ grass}{Mass\ of\ fresh\ grass}\ x\ \frac{100}{1}$	$\frac{8g}{50g}\ x\ \frac{100}{1}$ 16%	$\frac{10g}{50g}\ x\ \frac{100}{1}$ 20%	$\frac{12g}{50g}\ x\ \frac{100}{1}$ 24%	$\frac{16+20+24}{3}$ = 20%

Graph:



Analysis: From analysing my results I can see that the dry matter varies in different samples of grass from 16 – 24%. This is in line with my findings from my background research which told me that about 83% of grass is water and 17% is dry material.

Conclusion: I can conclude that my data backs up my hypothesis. The Dry Matter content of grass was measured on average to be 20% Dry Matter.

There were a few limitations to my experiment, these include the actual size of the grass blades. Whilst I took care to cut them all to a length of 30cm, their masses would have varied. This would affect the amount of DM

Evaluation: I am happy with my results as they are consistent with my research into grass. I think my results are accurate as they are quite closely grouped.

If I was to do this experiment again I would control the mass of the grass sample not just cut the grass all to 30cm. I would also use a digitally controlled oven to get more control over the actual temperature.

To extend this experiment I would like to investigate the DM in different grass types, for example compare the DM of rye grasses, timothy and cocksfoot and compare it to my sample.

Discussion: Based on the primary data collected from this investigation, it can be said that on average grass contains 20% Dry Matter. This evidence proves my hypothesis to be correct.

There were a number of precautions put in place to minimise uncertainty in the data collected. Statistical uncertainty was minimised as I used as large a sample size as possible and averaged the data collected.

Systematic uncertainty was minimised as the electronic balance was calibrated before conducting the experiment. Systematic uncertainty could have occurred when opening the door of the oven, as heat was being lost each time the door was opened and the temperature was not constant at 100˚C. This could be a source of error in my data.

The data collected by this investigation was quantitative as it deals with number values. Comparing the primary data collected from this investigation to theoretical data collected by others, it is fair to say that the data from this investigation is accurate, as both identify grass to grass to have an average Dry Matter of 20%. Comparing the primary data collected from the three trials, they are within +/- 4% of each other so it is fair to say the data is precise. There was only one independent variable so it is fair to say the investigation was a fair test.

Formative Comments

	Z	Y	X
Title, Aim, Links to cross cutting themes and Research			
Hypothesis and Prediction			
Experimental design			
Recorded Data (tables & graph)			
Analysis			
Conclusion			
Evaluation			
Discussion (relevance to agriculture)			

Pedagogical Reflection - how is your classroom different?

Five teaching techniques you have used in your classroom: • • • • •	
What changes have there been to your practice?	
What have you students learned? How do you know?	
What have you learned?	
What has been your greatest success? Your greatest challenge? **Is there anything you would do differently?**	
Have you noticed any changes in your classroom since you have begun engaging with the new specification? How is your classroom different?	

4 Teaching and learning

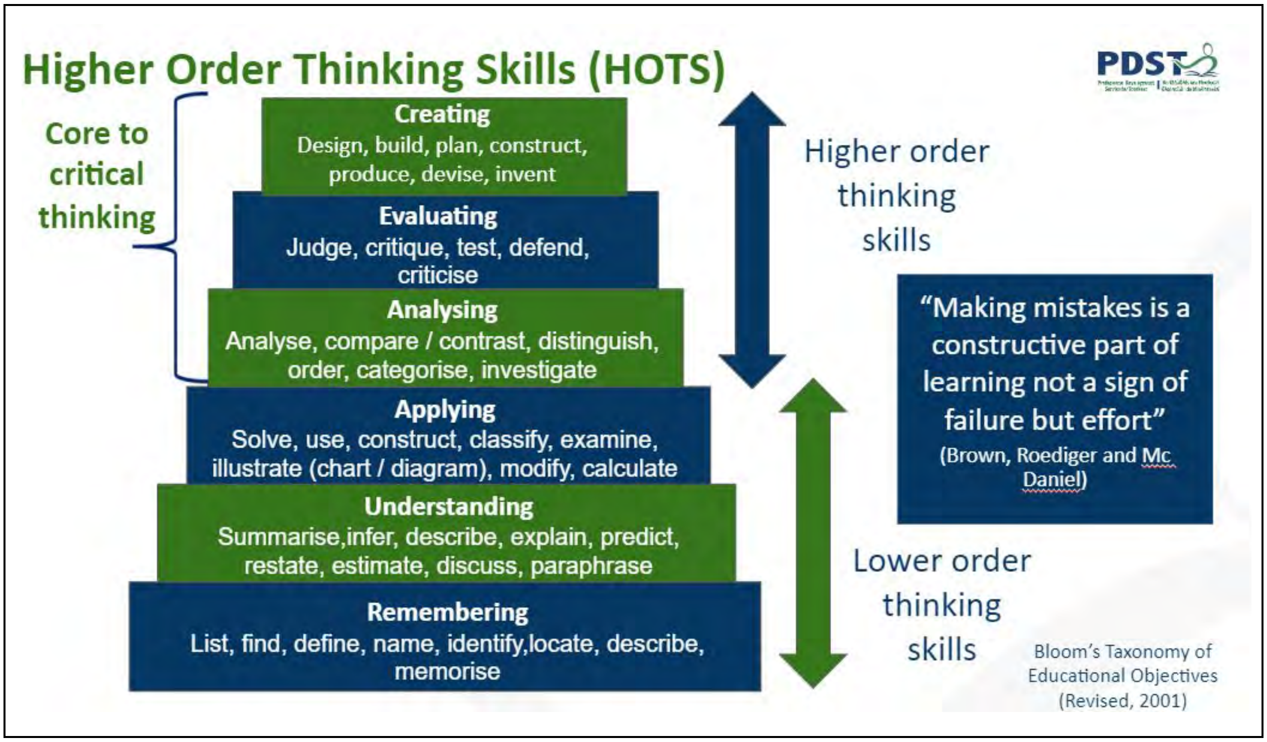
Senior cycle students are encouraged to develop the knowledge, skills, attitudes and values that will enable them to become independent students and to develop a lifelong commitment to improving their learning.

Leaving Certificate Agricultural Science supports the use of a wide range of teaching and learning approaches, emphasises practical experience of science for each learner. The importance of the processes of science as well as knowledge and understanding is reflected throughout the learning outcomes. As students progress they develop learning strategies that are transferable across different tasks and different disciplines, enabling them to make connections between agricultural science, other subjects, and their everyday experiences. Through engaging in self-directed activities and reflection, students assume responsibility for planning, monitoring, and evaluating their own learning and, in so doing, develop a positive sense of their own capacity to learn. By engaging in group work students develop skills in reasoned argument, listening to each other, informing one another about what they are doing, and reflecting on their own work and that of others.

Students integrate their knowledge and understanding of agricultural science with its ethical, social, economic and environmental implications and applications. Increasingly, arguments between scientists extend into the public domain. By critically evaluating scientific texts and debating public statements about science, students engage with contemporary issues in agricultural science that affect their everyday lives. They learn to interrogate and interpret data—a skill which has a value far beyond agricultural science, useful wherever data are used as evidence to support argument. By examining and debating reports about contemporary issues in science students develop an appreciation of the social context of science. They develop skills in scientific communication by collaborating to generate reports and present them to their peers.

The variety of activities that students engage in will enable them to take charge of their own learning by setting goals, developing action plans, and receiving and responding to assessment feedback. Students vary in the amount and type of support they need to be successful. Levels of demand in any learning activity will differ as students bring different ideas and levels of understanding to it. The use of strategies for differentiated learning such as adjusting the level of skills required, varying the amount and the nature of teacher intervention, and varying the pace and sequence of learning will allow students to interact at their own level.

Use of technology should be included to enhance student learning, for example by enabling students to work more efficiently or to complete work that otherwise could not be done. The portability of laboratory sensor systems makes them useful for work outside as well as inside the classroom, and ICT should be used to collect, record, analyse and display data and information. The increasing use of technology in agriculture and modern farming practice should be reflected in the study of agricultural science.


Higher Order Thinking Skills (HOTS)
PDST
Core to critical thinking
Creating
Design, build, plan, construct, produce, devise, invent
Evaluating
Judge, critique, test, defend, criticise
Analysing
Analyse, compare / contrast, distinguish, order, categorise, investigate
Applying
Solve, use, construct, classify, examine, illustrate (chart / diagram), modify, calculate
Understanding
Summarise,infer, describe, explain, predict, restate, estimate, discuss, paraphrase
Remembering
List, find, define, name, identify,locate, describe, memorise
Higher order thinking skills
"Making mistakes is a constructive part of learning not a sign of failure but effort"
(Brown, Roediger and Mc Daniel)
Lower order thinking skills
Bloom's Taxonomy of Educational Objectives (Revised, 2001)

Steps of critical thinking		
1. Identify the problem or question	Be as precise as possible: the narrower the issue, the easier it is to find solutions or answers.	The level of reseeding taking place on farms is far too low. Is reseeding good farm practice?
2. Gather data, opinions, and arguments	Try to find several sources that present different ideas and points of view	Teagasc research indicates a newly reseeded sward can increase annual DM yield by > 4 t DM / ha
3. Analyse and evaluate available data	Are the sources reliable? Are their conclusions data-backed or just argumentative?	Greater nutrient efficiency – more responsive to N (+24%) provided pH levels and P & K indices are correct
4. Identify assumptions	Are you sure the sources you found are unbiased? Are you sure you weren't biased in your search for answers?	Reseeding increases sward productivity by 25-30%
5. Establish significance	What piece of information is most important? Are all opinions and arguments even relevant to the problem you're trying to solve?	Teagasc estimates that every extra tonne of dry matter utilised is worth €183/t DM to a dairy enterprise and €105 for a dry stock farm. Very often it is possible to increase the grass harvested off a paddock by 4t DM/year. If this is achieved the cost of reseeding will be paid off in just over one year when it is reseeded.
6. Make a decision/reach a conclusion	Identify various conclusions that are possible and decide which (if any) of them are sufficiently supported. Weigh strengths and limitations of all possible options	Reseeding is one of the best-returning investments that a grassland farmer can make! Farms that carry out frequent grass reseeding, generally have a higher net profits

Question Stems for Students

Remembering	Understanding
• Who, what, where, why, when, which….? • Describe or define…? • Can you find….? • Can you list…? • Can you recall…? • Can you select…? • Label…?	• Describe in your own words… • Summarise ……. • Classify…. • Interpret…… in your own words • Compare and contrast…… • The main idea is…… • Can you explain what is happening…..? • Can you explain what is meant…..? • Which is the best answer….?
Analysing	**Applying**
• What conclusions can you draw from…..? • What evidence can you find….? • What is the relationship between…? • Classify or categorise the evidence…? • Can you make a distinction between ….? • Examine closely and explain how did…? • What is the function of…? • What ideas justify…?	• What examples can you find…? • What facts show that…? • How would you organise … to show…? • What would happen if…? • How could you use what we have learned today…? • How would you solve…. using what you have learned? • How would you show your understanding of….? • What approach would you use to….?
Evaluating	**Creating**
• Do you agree that…? • What would you advise…? • What do you think is the most important…? • Why do you think .. is/is not important….? • Prioritise…. • How would you rate…? • What would you recommend…? • How could you determine…? • What is your opinion of….? • How could you prove / disprove that….? • Can you assess the value / importance of..? • Would it be better if….?	• Can you propose an alternative…? • How could you adopt / modify…? • How could you test…? • What would happen if…? • Can you predict the outcome if….? • Can you think of an original way…? • What solutions would you suggest…? • What changes would you make to solve….? • How would you improve…? • What could be done to minimise / maximise ….? • Suppose you could… What would you do?

Project based Unit of Learning : Where is the money in reseeding?

CONTENT BASED LEARNING OUTCOMES	PRACTICAL BASED LEARNING OUTCOMES	LEARNING INTENTIONS
CONTENT BASED LEARNING OUTCOMES **3.3.1(a)** – The effect of soil quality on grass growth **2.3(a)** – Discuss the importance of good soil management in terms of soil testing and analysis of results and fertiliser application **2.2(a)** – What are the benefits of liming soil **3.3.2(a)** – Reseeding is good crop management. What is the impact of this on managing food producing animals? Stocking rates, grazing quality & fodder quality	**2.2.1(e)** – Testing soil pH **2.2.3(b)** – isolate and grow bacteria from clover root nodules **Own ideas** – Does soil pH affect the growth of various grass species? pH 6.3 – 6.5 favours rye grasses. pH < 6 favours bent grasses	Investigate how soil quality affect grass growth Explain why soils may need lime and fertiliser applications based on analysing soil tests. Discuss the effect of soil quality, soil preparation and sowing on the productivity of grass. Explain the reasons for reseeding grassland. Discuss the effect of seed selection on the productivity of grass. Produce written arguments to discuss financial viability of reseeding. Use secondary data discuss the impact of reseeding on managing food producing animals, grazing quality and fodder quality
Leaving Certificate Agricultural Science	**YEAR: 5**	**DURATION: 20 LESSONS**

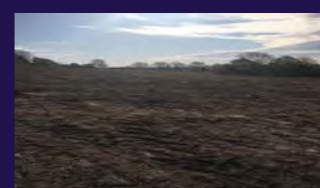
AIM: In this unit students will explore aspects of grassland management, good soil management, discussing the effect of soil quality and seed selection on grass productivity

Key Concepts and Processes:

KEY SKILLS	EXTENSIONS FOR IIS / POSSIBLE RESEARCH QUESTIONS
Processing information – analysing & concluding Critical & creative thinking – proving or disproving Working with others – group work Problem solving – applying solutions to new contexts	From conducting this unit of learning what possible research questions / SPA extensions, modifications or adaptations can you come up with? • What grass species would you recommend to give the best annual yields, persistency & PPD • Is re-seeding farm paddocks a sustainable farm practice? • How does soil pH affect optimum grass growth? • How does soil pH affect PRG v Bent grass growth? Does liming affect the amount of DM/ha/Yr

Making and Applying Decisions	Making Informed Choice about Grassland Reseeding Management	RESEARCH SOURCES
Students can make decisions on the benefits of reseeding and liming. Teagasc states it is possible to increase grass harvested off a paddock by 4 t/ DM /Yr. How can this be achieved? What are the benefits of liming?	Throughout your project you should make decisions on: • Why do farmers reseed • Is it financially beneficial to reseed • Reliance on imported feed • Grazing & stocking rates • Winter fodder (quantity & quality) Profitability of the farm	• Teagasc • Agri aware • Agri land • Farmer Journal Teagasc papers estimate that every extra tonne of DM produced is worth €183 per t/DM to dairy farmers and €105 per t/DM to dry stock farmers.
Cross Cutting Links	**Assessment**	**Student Experience**
• Sustainability • Breeding & Genetics • Policy & Economics	Q & A, Formative and summative assessment, use of plenary, questioning, peer assessments, self-assessments	A student in the class is reseeding 5 ha of grassland at home. They are going to provide pictures and data relating to varieties, fertiliser used etc. and build a case study to share their experience with the whole class.

Reseeding Storyboard

Reseeding Grassland – Steps to Produce Good Quality Grassland			
			
Permanent pasture prior to reseeding. Soil test carried out – pH 6.0 and soil index of 2 for P & K	**Field was sprayed with total herbicide**	**Grass dying off**	**Land being ploughed**
			
Spreading 2 ton / acre lime on land	**Land being harrowed**	**Sowing grass seed and clover mix and 150 kg 10:10:20 / acre (based on soil results)**	**Field after rolling**
			
Grass emerging	**Perennial RyeGrass and Clover mix**	**Sheep grazing – light and increase tillering**	**Fertilising the land post grazing**

Project based Unit of Learning :		
CONTENT BASED LEARNING OUTCOMES	PRACTICAL BASED LEARNING OUTCOMES	LEARNING INTENTIONS
Leaving Certificate Agricultural Science	YEAR:	DURATION: LESSONS
AIM: In this unit students will		
Key Concepts and Processes:		
KEY SKILLS	EXTENSIONS FOR IIS / POSSIBLE RESEARCH QUESTIONS	
Making and Applying Decisions	Making Informed Choice about Grassland Reseeding Management	RESEARCH SOURCES
Cross Cutting Links	Assessment	Student Experience

Additional Information:

Professional Development Service for Teachers | An tSeirbhís um Fhorbairt Ghairmiúil do Mhúinteoirí

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An Roinn Oideachais agus Scileanna
Department of Education and Skills

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