



## Learning Outcomes Poster

### Strand 1 – Scientific Practices

Students should be able to:

#### 1.1. Hypothesising

- Use observations as the basis for formulating a hypothesis
- Apply their knowledge and understanding of Agricultural Science to develop arguments or draw conclusions related to both familiar and unfamiliar situations
- Compile and interpret data or other information gathered from print, laboratory, and electronic sources (including websites), to research a topic or solve a problem
- Make a prediction based on the hypothesis

#### 1.2. Experimenting

- Design, manage and conduct practical investigations
- Identify variables and select appropriate controls
- Collect, organise, interpret, present and analyse primary and secondary data with and without the use of technology
- Describe relationships (qualitatively and/or quantitatively) between sets of data, recognising the difference between causation and correlation
- Distinguish between statistical and systematic uncertainty and identify appropriate methods to reduce these
- Recognise uncertainty as a limitation of the process of measurement
- Appreciate the difference between accuracy and precision
- Conduct an open-ended investigation

#### 1.4. Communicating

- Communicate the procedures and results of investigations by displaying evidence and information in various forms, including flow charts, tables, graphs, and laboratory reports
- Discuss, debate, reflect on and critically evaluate the outcomes of investigations, their own and those of others
- Read and evaluate scientific information related to agriculture, drawing on a variety of sources: media, websites, agri-food events and other agricultural resources—including people involved in the agri-food industry

#### 1.3. Evaluating Evidence

- Critically examine the scientific process that was used to present a scientific claim
- Appreciate the limitations of scientific evidence
- Make judgements and draw informed conclusions arising from the result of the investigation—their own and those of others—and consider the reliability and validity of data
- Make predictions on the behaviours of systems based upon interpretation of numeric, graphic and symbolic representations
- Evaluate ethical issues related to agricultural practices

#### 1.5. Working Safely

- Identify health and safety hazards associated with agricultural practices and discuss controls and precautions necessary to prevent accidents, injury and ill health
- Discuss the health and safety considerations of using agricultural machinery and equipment
- Recognise the need for safe work practices in all agricultural activities

### Strand 2 - Soils

Students should be able to do:

#### 2.1 Formation & Classification

- Describe the factors involved in soil formation
- Describe the different soil types/groups and soil profiles and their distribution in Ireland
- Compare soils with respect to their varied properties and land use potentials

#### 2.2 Properties

##### 2.2.1. Chemical

- Examine the chemical features of soil including plant-available nutrients, pH and liming, cation exchange, and flocculation
- Conduct an investigation into the chemical properties of soil to
  - **Demonstrate cation exchange capacity (CEC) \***
  - Show flocculation \*
  - Determine the pH \*

##### 2.2.2. Physical

- Examine the physical features of soil, including structure, particle size, texture, drainage, temperature, and the impact of compaction, organic matter loss, erosion, sedimentation and weathering
- Determine and compare the total pore space in a compacted soil and an uncompacted soil
- Investigate the texture of soil by
  - Sedimentation \*
  - Using a soil sieve \*
  - Hand testing \*
- Compare the capillarity and infiltration rate of a compacted soil and an uncompacted soil \*
- Calculate the percentage water content of a soil sample \*

##### 2.2.3 Biological

- Examine the biological features of soils including microbiome, earthworm activity, organic matter, the nitrogen cycle and the carbon cycle
- Isolate and grow bacteria from clover root nodules \*
- Appreciate the importance of the rhizosphere and the relationship between soil fungi and roots and the impact of that relationship on productivity
- Determine the percentage organic matter in a soil sample and convert that to organic carbon \*
- Relate organic matter content to soil structure and other physical and chemical properties in soils of differing management (for example, conventional continuous tillage vs. permanent grassland)
- Show the activity of earthworms in a soil and estimate the number of earthworms in a pasture \*

##### 2.2.4 Management

- Discuss the importance of good soil management in terms of drainage, soil health and fertility, soil sampling, testing and analysis of results, fertiliser or slurry/manure application, sustainable land use and management, impact of animals on the chemical, physical and biological properties of soil, soil compaction, pollution and conservation, maintenance of soil organic matter and soil carbon sequestration, and impact on water quality, air quality and greenhouse gas emissions
- Identify health and safety hazards associated with soil management and discuss controls and precautions necessary to prevent accidents, injury and ill health
- Appreciate the need for safe work practices, including the safe handling, use and storage of chemicals, slurry/farmyard manure and machinery

### Strand 3 – Crops

Students should be able to:

#### 3.1 Plant Physiology

- Relate the main structures of the plant to its fundamental processes: photosynthesis, respiration, transpiration and nutrient absorption
- Describe the principles of genetic improvement and selection:
  - performance testing
  - physical traits
  - progeny testing
  - genotyping and genomic selection
  - natural selection
- Understand the principles of genetic engineering, identifying genes in characterised crop genomes and understanding how they produce proteins to tackle specific crop diseases

#### 3.2 Classification / Identification

- Apply their knowledge of structure and function to identify a variety of grasses, cultivated crops and weeds
- Distinguish between annual, biennial and perennial lifecycles
- Explain the importance of plant breeding and seed variety

#### 3.3. Production

- Describe the growth cycle of grass and of another food crop (forage or for human consumption) **and of an energy or catch crop**
- Discuss strategies for crop protection against diseases (fungal, bacterial or viral)

##### 3.3.1. Establishment

- Discuss the effect of soil quality, seedbed preparation, seed selection and sowing on the productivity of a crop
- Understand how a variety of soil factors influence productivity
- Investigate the effect of weather and soil conditions on the percentage germination of an agricultural seed \*
- **Compare plant uniformity from certified and uncertified seed\***
- **Compare establishment for grass with that of one other crop \***

##### 3.3.2. Management

- Evaluate the impact of different crop management practices on food-producing and other animals
- Identify farm health and safety hazards associated with the management of crops, and discuss the controls and precautions necessary to prevent accidents, injury and ill health on the farm
- Compare conventional and organic food production
- Investigate the botanical composition of an old permanent pasture or a new ley\*
- Recognise the purpose of crop rotation and the benefits of, and alternatives to, crop rotation as a means of indirect disease control
- Appreciate the role of innovation and biotechnological applications in crop development and management
- Discuss the various factors involved in crop management, including application of nutrients to match crop requirements
- Investigate the effect of nutrients on the growth of a sample of different plants and measure the biomass of these plants above and below ground \*
- Measure the dry matter (DM) content of a named crop \*
- Evaluate the ethical and economic considerations and arguments arising from biotechnological applications as applied to crop management, for example the genetic enhancement of crop varieties against pests and diseases using traditional biotechnology and more recent technologies such as genome editing
- Investigate the complexity associated with the genetic inheritance of traits by hybridising two varieties to determine the rate of transfer of the required trait (e.g. petal colour) to the next progeny\*
- Discuss the implications of sustainable development for crop production
- Appreciate the need for compliance in relation to notifiable diseases
- Evaluate the use of chemicals for controlling disease in crops

##### 3.3.3. Harvesting

- Discuss harvesting techniques and storage methods for grass and another food crop (forage or for human consumption) **and an energy or catch crop**
- Investigate two factors which affect crop preservation
- Recognise the need for safe work practices, including the safe handling, harvesting and storage of crops

### Strand 4 - Animals

Students should be able to:

#### 4.1. Physiology

- Compare the ruminant and monogastric digestive systems, including the role of microorganisms
- Describe the mammalian reproductive cycle and methods of fertilisation of any two farm animals
- Explain the importance of genetics in food-producing and other animals
- Describe the principles of genetic improvement and selection:
  - performance testing
  - physical traits
  - progeny testing
  - genotyping and genomic selection
  - natural selection
  - genetic engineering

#### 4.3. Production

- Discuss the importance of nutrition and ration formulation to meet the protein, energy and performance requirements at different growth/development stages of cattle, sheep, and one of the following farm animals: pigs, poultry, horses
- Describe the nutritive properties of food constituents and their function in growth and development
- Compare two different systems of animal production for a chosen enterprise
- Discuss the attributes of Irish food based on grass-fed animals
- Investigate the factors that determine the output and quality of produce from a chosen enterprise (breed variety, nutrition, housing, management)
- Use secondary data to determine the daily live-weight gain (DLG) and the feed conversion rate (FCR) of a selected animal
- **Interpret secondary data relating to (DLG) and (FCR)**
- Investigate the quality of a sample of milk over time \*
- Using secondary data, compare the percentage of water and solids in two different milk samples (a.m./p.m.)
- Recognise the role and importance of innovation and biotechnological applications in animal science
- Appreciate the challenges of sustainable intensification
- Discuss the environmental implications of animal production
- Identify the potential hazards (physical, biological, health) associated with working with farm animals, and safe work practices/controls

#### 4.2. Classification / Identification

- Describe the characteristics of common types, breeds and crosses of cattle, sheep, and one of the following farm animals: pigs, poultry, horses

##### 4.3.1 System / Enterprise

- Describe the scientific principles underlying the management of the lifecycle of a selected farm animal, including the dietary requirements at different growth/development stages
- Recognise the importance of market trends and requirements, including value-added/niche markets/artisan produce/export markets
- Use secondary data to discuss the impact of milk quality on milk price
- Appreciate the impact on farm economics of different animal production systems

#### 4.3.2. Management

- Discuss management practices for
  - handling and housing farm animals
  - optimal animal health and welfare
  - slurry/farmyard manure
  - delivering sustainable and environmentally friendly production systems
  - ensuring quality, safe and traceable food for the consumer
- Appreciate the role of policies related to traceability and animal welfare, and their connection with the food-supply chain

##### 4.3.3. Animal Husbandry and Health

- Discuss the factors to be taken into account when considering the welfare of farm animals
- Describe a farm that they have studied in terms of:
  - farmyard layout (sketch) in which they identify and discuss potential hazards on the farm and how they may be managed
  - best layout practice, encompassing economic, health and safety, social, and environmental sustainability aspects
- Recognise the potential hazards to humans of animal diseases
- Identify the main diseases that can affect ruminant and monogastric farm animals, and discuss their transmission and control
- Appreciate the need for compliance in relation to notifiable diseases

