

TURF MANAGEMENT CURRICULUM

Unit 1: Overview of the Turfgrass Industry

OVERVIEW

Summary

Students will gain an understanding of the relevance and importance of the turfgrass industry. They will learn of the major uses of turfgrasses and the economic role they play in the United States. Students will develop this understanding by examining the history of turfgrass management and describing industry innovations and developments over time. Students will then examine employment opportunities in the turfgrass industry.

Content to Be Learned

- The role of turf grasses.
- The diversity and importance of the turfgrass industry.
- The history of the turfgrass industry.
- Opportunities in the turfgrass industry.

Practices

- Obtaining, evaluating, and communicating information regarding the developments in the field of turfgrass management.
- Analyzing and interpreting data to develop an explanation of the importance and economic impact of turfgrass and the turfgrass industry in the United States.

Crosscutting Concepts

- Cause and effect.
- Patterns.

Essential Questions

- How have developments in the turfgrass industry lead to increased economic impact over time?

Standards

No Standards Applicable

Unit 2: Turfgrass Classification, Anatomy, and Physiology

OVERVIEW

Summary

Students will learn the common and scientific names of the agriculturally important turfgrasses. Students will also learn the important industry terms to refer to turfgrass species. Additionally, students will be able to describe the structure and function of the plant structures unique to grasses and how they function in the lifecycle of the grass plant.

Content to Be Learned

- Classification of grasses.
- Life cycle of grass plants.
- Functions of grass plant structures.
- Grass plants reproduction - sexual and asexual.

Practices

- Constructing an explanation for the importance of taxonomic names when referring to plants and organisms in general.
- Asking questions about the form and function of plant anatomical structures.
- Obtaining, evaluating, and communicating information on the lifecycle of grasses and how it can be manipulated to best serve the purpose of the grass.

Crosscutting Concepts

- Structure and function.
- Energy and matter.

Essential Questions

- How is binomial nomenclature useful in describing living things world-wide, despite language differences?
- How can an agricultural product like turfgrass have such a large economic impact?

Agriculture, Food and Natural Resources (AFNR) Career Cluster Content Standards

- PS.01.01. Performance Indicator: Classify agricultural plants according to taxonomy systems.
 - PS.01.01.01.a. Explain systems used to classify plants.
 - PS.01.01.01.b. Compare and contrast the hierarchical classification of agricultural plants.
 - PS.01.01.02.b. Identify agriculturally important plants by common names.
 - PS.01.01.02.c. Identify agriculturally important plants by scientific names.
- PS.01.02. Performance Indicator: Apply knowledge of plant anatomy and the functions of plant structures to activities associated with plant systems.
 - PS.01.02.02.a. Identify the components, the types and the functions of plant roots.
 - PS.01.02.02.b. Identify root tissues and explain the pathway of water and nutrients into and through the root tissues.
 - PS.01.02.03.a. Identify the components and the functions of plant stems.
 - PS.01.02.04.a. Discuss leaf morphology and the functions of leaves.

- PS.01.02.04.b. Explain how leaves capture light energy and allow for the exchange of gases.
- PS.01.02.05.a. Identify the components of a flower, the functions of a flower and the functions of flower components.
- PS.01.02.05.b. Identify the different types of flowers and flower forms.
- PS.01.03. Performance Indicator: Apply knowledge of plant physiology and energy conversion to plant systems.
 - PS.01.03.01.a. Explain the basic process of photosynthesis and its importance to life on Earth.
 - PS.01.03.03.a. Define primary growth and the role of the apical meristem.
 - PS.01.03.03.b. Explain the process of secondary plant growth.
 - PS.01.03.03.c. Relate the principles of primary and secondary growth to plant systems.

Next Generation Science Standards (NGSS)

Students who demonstrate understanding can:		
HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]		
The performance expectation above was developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> :		
Science and Engineering Practices Developing and Using Models Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. <ul style="list-style-type: none"> • Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system. 	Disciplinary Core Ideas LS1.A: Structure and Function <ul style="list-style-type: none"> • Multicellular organisms have a hierarchical structural organization, in which any one system is made up of numerous parts and is itself a component of the next level. 	Crosscutting Concepts Systems and System Models <ul style="list-style-type: none"> • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales.
Connections to other DCIs in this grade-band: N/A		
Articulation of DCIs across grade-bands:		
MS.LS1.A		
Common Core State Standards Connections:		
ELA/Literacy -		
SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-2)		

* The performance expectations marked with an asterisk integrate traditional science content with engineering through a Practice or Disciplinary Core Idea.

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Unit 3: Warm and Cool Season Grasses

OVERVIEW

Summary

Different types of grasses have unique characteristics that allow them to thrive in some areas and not in others. In this unit, students will differentiate between warm and cool season grasses as well as the characteristics that make them unique. Students will also be able to select specific species of grasses for different applications such as golf courses, athletic fields, parks and playgrounds, etc., and justify their choices based on knowledge of these unique characteristics of turfgrasses.

Content to Be Learned

- Certain turf is adapted to the warm season zone in the United States.
- The important characteristics of the warm season turf grasses.
- The proper conditions for the use of each type of warm season grass.
- Characteristics turf manager selects the best species and cultivar for a particular site.
- Explain why certain turf is adapted to the cool season zone in the United States.
- Describe important characteristics of the cool season turf grasses.
- Analyze the proper conditions for the use of each type of cool season grass.

Practices

- Obtaining, evaluating, and communicating information on the specific requirements of cool and warm season grasses.
- Constructing an explanation describing which types of turfgrasses are best for different applications.
- Using models to illustrate the differences between a variety of turfgrasses.

Crosscutting Concepts

- Structure and function.

Essential Questions

- What drives the evolution of organisms to allow them to adapt and survive in different regions?

AFNR Standards

- PS.02.01. Performance Indicator: Determine the influence of environmental factors on plant growth.
 - PS.02.01.02.a. Describe the effects air, temperature and water have on plant metabolism and growth.
 - PS.02.01.02.b. Determine the optimal air, temperature and water conditions for plant growth.

Unit 4: Soil and Turfgrass Soil Requirements

OVERVIEW

Summary

Soil health is critical to the growth of any plant. In this unit, students will be able to describe the components of healthy soil and describe general soil characteristics (texture and structure). They will also be able to explain how texture and structure affect plant growth. Additionally, students will learn the basic principles of soil fertility and its impact on plants as well as soil pH by taking and analyzing soil samples. Once the quality of soil has been determined, students will be able to prescribe nutrient and pH amendments for unhealthy soil.

Content to Be Learned

- The components of soil.

- Soil characteristics such as texture and structure.
- Texture and structure of soil affects plant growth.
- The soil profile.
- Undesirable soil conditions and improvements made by modifying the soil.
- Effective methods of soil modification.
- Organic matter sources that can be used to improve soil structure.
- Basic principles of soil fertility.
- Soil pH and plant growth.
- The materials used to raise or lower soil pH and their specific effect.
- Importance of soil testing.
- Procedure for collecting a representative soil sample.
- Soil test kit use.
- Pre-planting site preparation.

Practices

- Planning and carrying out an investigation to determine the quality of a variety of soils.
- Analyzing and interpreting soil quality data.
- Constructing an explanation describing how a lack of nutrients/poor pH affect turfgrass health.

Crosscutting Concepts

- Energy and matter.
- Cause and effect.

Essential Questions

- Why do turfgrass producers need to modify/amend naturally existing soil?

AFNR Standards

- NRS.01.02. Performance Indicator: Classify natural resources.
 - NRS.01.02.05.a. Demonstrate techniques used to identify rock, mineral and soil types.
 - NRS.01.02.05.b. Identify rock, mineral and soil types. NRS.01.02.05.c. Conduct a field inventory of rock, mineral and soil types, and record and document findings.
- PS.02.03. Performance Indicator: Develop and implement a fertilization plan for specific plants or crops.
 - PS.02.03.01.a. Identify the essential nutrients for plant growth and development and their major functions.
 - PS.02.03.01.b. Describe nutrient deficiency symptoms and recognize environmental causes of nutrient deficiencies.
 - PS.02.03.02.a. Discuss the influence of pH and cation exchange capacity on the availability of nutrients.
 - PS.02.03.02.b. Contrast pH and cation exchange capacity between mineral soil and soilless growing media.
 - PS.02.03.03.a. Collect soil and plant tissue samples for testing and interpret the test results.
 - PS.02.03.03.b. Determine the nutrient content of soil using appropriate laboratory procedures and prescribe fertilization based on results.
 - PS.02.03.04.a. Identify fertilizer sources of essential plant nutrients, explain fertilizer formulations and describe different methods of fertilizer application.
 - PS.02.03.04.b. Calculate the amount of fertilizer to be applied and calibrate equipment to apply the prescribed amount of fertilizer.

Unit 5: Establishing and Fertilizing Turfgrass

OVERVIEW

Summary

As with all plants, there are a variety of ways to establish turfgrasses. Students will outline the four common methods of turfgrass establishment. Students will also identify and utilize seed packet information to determine the best method of seeding. As fertilizing at all life stages of turfgrasses is important, students will revisit soil fertility and fertilizer and make decisions about the best types of fertilizer to use in different situations taking into consideration rate and frequency of fertilization.

Content to Be Learned

- Seed labels and identify what information is present.
- The four methods of turf grass establishment: (1) seeding, (2) sodding, (3) sprigging, and (4) plugging.
- The nutrients required by turf grass plants.
- The different types of fertilizer.
- The factors that influence the selection of an appropriate fertility program.
- Importance of nitrogen in a fertility program.
- Differences between fast-release and slow-release nitrogen carriers.
- The rate and frequency of fertilizer application.
- Methods of fertilizer application.

Practices

- Analyzing and interpreting data to determine the best methods of turfgrass establishment in different regions of the United States.
- Obtaining, evaluating, and communicating the importance of nitrogen in a fertility plan specific to turfgrasses.
- Constructing an explanation that prescribes a fertility plan for a specific turfgrass scenario.

Crosscutting Concepts

- Cause and effect.
- Structure and function.

Essential Questions

- How does ensuring that turfgrasses have the proper nutrients and care relate to this same idea for all living things?

AFNR Standards

- PS.02.03. Performance Indicator: Develop and implement a fertilization plan for specific plants or crops.
 - PS.02.03.01.a. Identify the essential nutrients for plant growth and development and their major functions.
 - PS.02.03.01.b. Describe nutrient deficiency symptoms and recognize environmental causes of nutrient deficiencies.
 - PS.02.03.03.b. Determine the nutrient content of soil using appropriate laboratory procedures

- and prescribe fertilization based on results.
- PS.02.03.04.a. Identify fertilizer sources of essential plant nutrients, explain fertilizer formulations and describe different methods of fertilizer application.
- PS.02.03.04.b. Calculate the amount of fertilizer to be applied and calibrate equipment to apply the prescribed amount of fertilizer.

Unit 6: Common Turfgrass Maintenance Practices

OVERVIEW

Summary

Since the technique used to mow turfgrass significantly impacts the plant, students will explore different methods that can be employed to maintain healthy turfgrass. Student will determine optimal mowing heights for a variety of species of turfgrasses. Students will learn and describe safe and unsafe mowing practices.

Content to Be Learned

- Importance of correct mowing practices and the quality of turf.
- Effects of mowing on turf grass plants.
- Factors that influence the selection of the correct cutting height.
- Factors that determine how often turf grass should be cut.
- Different types of mowers.
- Advantages and disadvantages of collecting grass clippings.
- Safe and unsafe mowing practices.

Practices

- Obtaining, evaluating, and communicating information regarding the impact of mowing on turfgrass plants.
- Constructing explanations that describes the advantages and disadvantages of collecting grass clippings.
- Engaging in an argument from evidence to convince classmates of the safe way to operate mowing equipment.

Crosscutting Concepts

- Cause and effect.
- Structure and function.

AFNR

- PS.03.02. Performance Indicator: Develop and implement a plant management plan for crop production.
 - PS.03.02.05.a. Explain the reasons for controlling plant growth.
- PS.03.05. Performance Indicator: Harvest, handle and store crops.
 - PS.03.05.01.a. Identify harvesting methods and harvesting equipment.
 - PS.03.05.01.b. Assess the stage of growth to determine crop maturity or salability and demonstrate proper harvesting techniques.

Essential Questions

- How can the life cycle of a plant be manipulated by humans?

Unit 7: Turfgrass Pests and Pest Management

OVERVIEW

Summary

Pests (weed and insects) can have a detrimental effect on the production and maintenance of turfgrasses. In this unit, students will describe how proper care of turfgrass can prevent both weed and insect pest problems. They will begin by learning to identify impactful weeds and insects and describing the lifecycles of each. Students will also research and describe how different types of herbicides and pesticides work. With this information, students will be able to select different types of herbicides and pesticides to best interrupt the life cycle of weeds and insects and therefore stop and/or prevent damage to turfgrass. Lastly, students will examine how a variety of chemical and nonchemical methods can be employed in tandem (integrated pest management) to interrupt and prevent pest damage.

Content to Be Learned

- A correct turfgrass maintenance program results in less weed competition.
- Important and locally impactful weed species.
- Types of herbicides.
- Methods of controlling annual grasses, perennial grassy weeds, and broad-leaf weeds.
- Diagnosis of turfgrass injury caused by insects.
- Type of damage caused by insect pests.
- Insect species that are serious pests to turf grass.
- The life cycles and characteristics of major injurious pests.
- Control of insect pests including pesticides and IMPs (integrated pest management).

Practices

- Engaging in arguments from evidence to determine the best course of action when treating particular weed and pest species.
- Analyzing and interpreting data and observation regarding signs of pest damage.
- Obtaining, evaluating, and communicating information regarding signs of pest damage and how best to treat them.

Crosscutting Concepts

- Structure and Function.
- Cause and Effect.

Essential Questions

- How can the lifecycle of weeds and insects be manipulated in order to prevent damage to plant species?

AFNR Standards

- PS.03.03. Performance Indicator: Develop and implement a plan for integrated pest management.
 - PS.03.03.01.a. Identify types of plant pests and disorders.
 - PS.03.03.01.b. Identify major local weeds, insect pests and infectious and noninfectious plant diseases.
 - PS.03.03.02.a. Describe damage caused by plant pests and diseases.
 - PS.03.03.02.b. Diagram the life cycles of major plant pests and diseases.
 - PS.03.03.02.c. Predict pest and disease problems based on environmental conditions and life cycles.
 - PS.03.03.03.a. Describe pest control strategies associated with integrated pest management.
 - PS.03.03.03.b. Describe types of pesticide controls and formulations.