Plant Biology Capstone

Course Description

This course covers the biology of plants grown for food, feed, fiber, fuel and fun. Students will learn about plant life cycles in managed and natural ecosystems and their role in global carbon and water cycles. Students will also discover the mechanisms plants use to drive and control their growth, propagate and change to compete with other organisms in their environment. This course is aligned to the course objectives of dual-credit offered AGRO/HORT 131 Plant Biology course at the University of Nebraska-Lincoln.

Course Code:

Program(s) of Study to which This Course Applies

- Plant systems

Course Framework	Reference Standards	Academic Crosswalk
Standard 1.Students will determine the nature and importance of the ecosystem relationship between plants and other living things in natural and managed systems and how the plant's ecosystem niche provides a foundation for global nutrient cycles.	UNL AGRO/HORT 131	[TBD by NDE]
Benchmark 1.1 Explain the plantôs role in C,N,P and H_2O cycles. Sample performance indicators: • Create a wall chart or presentation that shows the connection between living things and the abiotic environment with respect to the C, N,P or water cycles. • Predict how altering one part of a cycle impacts the end result.		[TBD by NDE]
Benchmark 1.2 Identify where photosynthesis, respiration, translocation and transpiration influence nutrient cycles.		[TBD by NDE]

Sample performance indicators: • Identify which plant process is involved in a specific part of a nutrient or water cycle. • Interpreting results of an experiment relating to these plant processes.		
Benchmark 1.3 Identify the types of plant life cycles and justify the anatomy needed to complete that life cycle. Sample performance indicators: • Analyze plant production data and devise a management plan. • Apply the biology of life cycle and plant anatomy to classify a plant.		[TBD by NDE]
Benchmark 1.4 Analyze information to determine if a biological relationship is competition, mutualism, commensalism or parasitism. Sample performance indicators: • Define the types of ecological relationships. • Apply the relationship biology between organisms to solving a plant production problem.		[TBD by NDE]
Benchmark 1.5 Observe the ecosystem and life cycle biology and predict the outcome of a human intervention. Sample performance indicators: • Role play a plant production professional to justify a plant system management plan. • Role research scientist to discover needed information about a plant system.		[TBD by NDE]
Standard 2. Students will describe how plants acquire and manage energy to grow and complete their life cycle.	UNL AGRO/HORT 131	[TBD by NDE]
Benchmark 2.1 Compare and contrast heterotrophic vs. autotrophic life style. Sample performance indicators: • Create a Venn diagram to compare and contrast heterotrophs and autotrophs. • Identify plants that are heterotrophs or identify when plants are heterotrophs in their normal life cycle.		[TBD by NDE]
Benchmark 2.2 Explain how photosynthesis, respiration, translocation and transpiration function to allow the plant to acquire, use and move carbon for building and energy. Sample performance indicators:		[TBD by NDE]

• Diagram the flow of a carbon atom from CO2 in the air to a carbon in a seed or root cell. • Predict how controlling environmental conditions impacts these physiology processes.		
Benchmark 2.3 Interpret the role of cell compartments and enzymes to manage energy to drive photosynthesis and respiration. Sample performance indicators: • Diagram a cell and show where the enzymes needed in photosynthesis and respiration do their work. • Build models that show cell compartments and processes including gene expression.		[TBD by NDE]
Benchmark 2.4 Outline gene expression and identify where genes control cell level processes. Sample performance indicators: • Build models that show cell compartments and processes including gene expression. • Explain how changes in a gene can alter the process of photosynthesis and respiration.		[TBD by NDE]
Benchmark 2.5 Apply an understanding of photosynthesis and respiration to make decisions in plant production problem solving. Sample performance indicators: • Role play a plant production professional to modify a plant system environment to alter plant processes and optimize production. • Role play a research scientist whose objective is to improve a plantôs photosynthesis efficiency.		[TBD by NDE]
Standard 3. Students will demonstrate how plants function at the tissue and cell levels in response to their environment and promote the successful completion of their life cycle.	UNL AGRO/HORT 131	[TBD by NDE]
Benchmark 3.1 Explain the need for the plant to acquire macro and micro nutrients. Justify why they are essential as either macro or micro for biomolecule building. Sample performance indicators: • Diagnose a nutrient deficiency. • Predict what plant processes will be affected by a nutrient deficiency.		[TBD by NDE]
Benchmark 3.2 Describe how plants measure light to control gene expression and		[TBD by NDE]

control their growth. Sample performance indicators: • Describe phytochrome and how this biomolecule interacts with light. • Design an experiment to determine the best method to optimize plant development.		
Benchmark 3.3 Describe how plants make hormones to control gene expression and control their growth. Sample performance indicators: • Predict how growth regulators will provide a plant growth benefit. • Explain apical dominance or goose necking response based on plant hormone effect.		[TBD by NDE]
Benchmark 3.4 Apply an understanding of a plantôs response to nutrients, light or hormones to make decisions in controlling plant growth or productivity. Sample performance indicators: • Role play a plant production professional who wants to control plant growth with growth regulator or hormone application. • Role play a research scientist whose objective is to understand a newly discovered plant hormone.		[TBD by NDE]
Standard 4. Explain how sexual reproduction and changes in genetic information provide the basis for plants to evolve in response to selection pressure imposed by nature or people.	UNL AGRO/HORT 131	[TBD by NDE]
Benchmark 4.1 Evaluate how Flowers are designed for sexual reproduction. Sample performance indicators: • Explain the process the hybrid seed production using flower structure principles. • Rank the difficulty in making controlled crosses given different kinds of plants.		[TBD by NDE]
Benchmark 4.2 Compare and contrast mitosis vs. meiosis based on both the process and end result. Sample performance indicators: • Identify where mitosis and meiosis occur in a flower. • Relate the process of meiosis to the inheritance of specific genes.		[TBD by NDE]

Benchmark 4.3 Describe the relationship between evolution, genetic variation and selection pressure. Sample performance indicators: • Predict which populations will evolve at the fastest rate. • Rank forces that can change a populationôs gene pool.		[TBD by NDE]
Benchmark 4.4 Analyze the evolution of plants and their pests. Sample performance indicators: • Explain why a refuge is used to manage Bt crops. • Diagram the history of pesticide use and the occurrence of resistance in pest populations.		[TBD by NDE]
Benchmark 4.5 Apply an understanding of plant, insect and microbe evolution in pest management problem solving. Sample performance indicators: • Role play a plant production professional who wants to control pest populations most efficiently. • Role play a plant breeder or genetic engineerôs approach to crop improvement.		[TBD by NDE]
Standard 5. Students will design experiments to test hypotheses that explain plant growth and response to environment.	UNL AGRO/HORT 131	[TBD by NDE]
Benchmark 5.1 Applied math skills (graphs and rates) to describing the outcome in a plant biology experiment. Sample performance indicators: • Develop tables and graphs to show the outcome of experiments. • Determine the rate of change based on a graph.		[TBD by NDE]
Benchmark 5.2 Compile and organize written, oral and graphic communication to present a scientific result. Sample performance indicators: • Write the results of an experiment in scientific style. • Give a presentation using multimedia equipment.		[TBD by NDE]
Benchmark 5.3 Appreciate the nature of science through inquiry.		[TBD by NDE]

Sample performance indicators: • Compile information from peer reviewed scientific literature to determine the appropriate starting point for research. • Make the appropriate conclusions based on results of science research. • Contrast science with technology.		

Reference Standards Sources

- UNL AGRO/HORT 131 course objectives, August 2010

Other Information

Suggestions for innovative teaching and learning strategies:	• Apply principles to farming, gardening, greenhouse production
Related assessments:	• Pesticide training or certification
Extended learning opportunities:	• Field trips • Extension events • Career fairs • FFA ï Agriscience Fair