What's happening here? Teacher notes

Slide 2: **Ag cycle poster**: Farmers are busy all year long making decisions based on data they have collected throughout the previous year and looking at predictions for what might come during the next growing season. This cycle is pictured here. This lesson will show some of the challenges that growers face as they plant, scout, and harvest a crop.

Slide 3: **Pre-planting**: This is a field that has been harvested. Decisions will be made about what to plant next year and whether to till the field (plow or turn over the soil) or not. There are many types of tillage, from conventional to no-till. Soil tests may be completed to determine the soil type, range of nutrients, and organic matter in the soil. These tests inform the grower about how to proceed with planting decisions, fertilizer needs, and choices (manure or synthetic fertilizers). Different plants have different nutrient requirements. Farmers generally rotate different crops in fields each year so the nutrients taken by one can be replenished and so that microbes and insects in the soil will be more diverse.

Slide 4: **Planting**: Seed selection is a critical decision for a farming operation. What crop and kind of seed, whether it will be organically or conventionally raised, and what inputs will be needed throughout the growing season, are just a few of the things farmers must consider.
Also, how might it be planted? There are several different types of planters: drills, traditional planters, and air seeders. Different planters are used for different purposes and different crops. Pictured here is a drill.

Slide 5: Planter with seed boxes

Slide 6: Which field do you think was planted with a drill? The one on the left was planted with a drill. Notice that there are no defined rows like there are in the field on the right.

Slide 7: Sometimes, the weather prevents fields from being planted. In 2019, the northwest portion of the state was so wet that many acres looked like this and were not planted with a crop at all.

Slide 8: Emergence: seeds are bred to sprout from the ground within 24 hours of each other 3-5 days after planting.

Slide 9: What do you think happened here? Emergence in a low spot after water covered this part of the field.

Slide 10: These soybeans have been damaged by excess water and pythium, a species of oomycetes or water mold.

What do farmers do about low spots in fields? Tile drainage is a solution. Long sections of perforated pipe are installed in a field 3 to 6 feet below the surface and 3 to 10 feet apart. Determining depth and spacing depends upon the soil type, the hydraulic conductivity of the soil, the outlet for the drainage, and the economics of the cost-benefit from installing the tile. See this presentation for the

technical information about determining tile drainage:
https://fyi.extension.wisc.edu/drainage/files/2015/09/Basic_Eng_-Princ-2_2017.pdf

Slide 11: What happened to these growing soybeans?
These beans were planted on different dates and exposed to a hail event. While plant damage occurred regardless of growth stage, the damage appeared to be most severe on the latest-planted soybeans, with stems of some plants broken over and many of the primary growing points severely damaged.

Slide 12: **Growth**: This is a field full of healthy soybean plants.

Slide 13: **Pre-harvest:** What happened to this plant? Growers must pay attention to what is happening in their fields throughout the growing season. This plant was preyed upon by several pest species.

Slide 14: Soybeans respond to drought stress by flipping their leaves over so the underside of the soybean leaf is turned up. A less obvious sign of drought stress in soybeans is diminished vegetative growth, which normally occurs prior to leaf flipping. In severe drought conditions, the leaf trifoliates will close or clamp together, with the center leaflet being sandwiched between the outside leaflets.

Drought-stressed soybeans are often shorter with smaller leaves due to a lack of water, nutrient availability, and nutrient uptake. Soybean root growth increases during drought conditions because plant carbohydrates are shifted to root growth. When adequate rainfall or soil moisture returns, vegetative growth will resume. Under severe drought stress, soybean flowering may occur earlier than normal in an effort to produce seed before premature death.

Slide 15: What's the difference between these two fields?
Weeds! Some soybeans are genetically modified to resist glyphosate, a common herbicide. These plants can be planted, then sprayed with the herbicide and they will survive, while the weeds do not. All farmers are required to be certified in order to apply pesticides and fertilizers.

Slide 16: These are soybeans when they are ready to be harvested. They must be at a certain moisture level in order to be successfully stored or marketed.

Slide 17: **Harvest**: This is a harvester or a combine. Harvesters or combines can have different heads (attachments to the front) to harvest soybeans, corn, and wheat.

Slide 18: The seed that is harvested is off-loaded into the grain cart shown here behind the tractor.

Slide 19: What are these structures?
Post-harvest: These are grain bins where farmers store their harvested crops. The bins have fans in them to help reduce the moisture in the crop. Why does moisture need to be reduced? Moisture allows for fungus and microbes to grow and they will spoil the crop, or cause it to rot before it gets

sold.

Slide 20: What happened to them? What effect will this have on the people who use them? These bins were destroyed by a derecho, a straight-line wind storm that can cause heavy rain, flash flooding, hurricane-force winds and tornadoes. This one blew through Iowa in August of 2020.

Slide 21: Normal soybeans on the right: Yield is a measure of how many bushels of soybeans (or other crops) are harvested. A bushel of soybeans weighs about 60 lbs. That is a lot of soybeans! How many beans are shown here in each of these pods? If there are 7 pods each with 3 beans, there would be 21 beans.

Beans are transported to a grain elevator, processing plant (The Anderson's or Cargill), or a farmer's cooperative for sale. Many farmers have semis to help them get the grains to the buyer. The grain may then be turned into animal feed, fuel, and/or other products to be sold to consumers or food producers. About half of all the soybeans in Ohio are exported to other countries.

Look at these soybean pods on the left. What is going on here?
STINKBUGS! What effect will stinkbugs have on the amount of yield? How many pods are here? How many beans? If the five pods here only result in 2 beans, that is a significant decrease. Hopefully, a farmer would not have stinkbugs throughout the entire field, but overall, there would be a lot fewer beans! Farmers need to investigate pest management programs to help them combat pest species or diseases.
See: http://www.ohiofieldleader.com/research/are-stink-bugs-in-your-soybeans/

Slide 22: soybeans

Slide 23: How were these soybeans bred? You can see differences in the color of the beans and the spots (each is called a hilum). These beans were bred conventionally, crossing beans with others with different color hila to create these variations. Some cultures want the beans to be a certain color and the hilum to be transparent as in image E.

Additional note: Soybeans are genetically modified for a variety of traits, but hilum color is not one of those. Soybeans are bred and modified in combination to protect the plant from competitors: i.e. to resist glyphosate or to resist various diseases caused by pathogens in the soil. A GMO is researched and tested for over 10 years before it passes all the regulations set up by the FDA, EPA, and USDA. Only at that point can it be sold commercially for use.

If you have questions about any of the information included here, please contact Jane Hunt, jane@educationprojects.org.