KANSAS CORN STEM

Kansas Corn: Corn Field Scouting

qrco.de/cscouting

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KANSAS CORN COMMISSION

kscorn.com

Kansas Corn: Corn Field Scouting
Grade Level: Middle and High School

Overview
Farmers utilize the method of field scouting as a sure-fire way to assess their crops in real-time. Surveying their field allows them to see the development of their crops in order to be sure they are at the predicted growth stage based on the number of accumulated growing degree days. Farmers are also able to observe what types of pests are infesting their crops, what nutrients they are lacking, any diseases spreading throughout, the types of weeds competing for resources and the damage that was done after a severe weather event. From this analysis, farmers are able to immediately intervene and make adjustments to the amount of fertilizer, pesticides and/or herbicides needed in order to ensure the greatest performance of their crop.

The key to scouting is to have a random, yet methodical technique in observing the field. This is important so as to receive the most accurate representation of the conditions found within the corn crop. Students will utilize this surveying technique in order to determine the health of the corn field. This will be done by first learning the five classification types that hinder plant production – pests, disease, weeds, nutrition and weather damage – and the causes of each. There are telltale signs that can be observed with practice and a careful eye. Students will apply that knowledge in the field and finish by creating and presenting a scouting report to their peers.

Kansas College and Career Ready Standards
- **S.ID.2.** Interpret differences in shape, center, and spread in the context of the data sets using dot plots, histograms, and box plots, accounting for possible effects of extreme data points.
- **S.IC.1.** Understand statistics as a process for making inferences to be made about population parameters based on a random sample from that population.
- **S.IC.4.** Use data from a sample survey to estimate a population mean or proportion
- S.MD.6. Use probabilities to make fair decisions.
- **HS-LS2-2.** Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- **HS-LS2-6.** Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.
- **HS-LS4-3.** Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.
- **HS-ETS1-3.** Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

Learning Objectives
- To learn about conditions that affect corn growth and development.
- To learn about proper surveying techniques used by farmers.

- To apply randomization in a real-world setting.
- To perform data analysis on field scouting results.
- To present background information, field results and data to an audience.

Materials

For the Instructor

- Scouting PowerPoint presentation
- Exit ticket case studies for each scouting classification

For Each Group

- Laminated field guide cards to stage in field
- Scouting field guide
- Scouting logbook and grid map
- PowerPoint template for scouting results
- Magnifying glass (optional)
- Whistle (optional)
- Portable shovel, spade or trowel – for digging 8-10 inches
- Camera or phone with camera
- Plastic baggies for samples (if allowed by farmer)
- 5 sets of colored cones (10-12 each color) for grid setup

Safety Considerations

- Wear appropriate clothing for the weather and outdoors.
- Apply bug spray and sunscreen when necessary.
- Use the buddy system to account for all students when in the field.
- Be sure to get permission from owner before entering property.

Procedures for Instruction

Length of Time for Preparation

- 30 minutes for planning lesson
- 30 minutes – 1 hour for planning and organizing field trip

Length of Time for Classroom Teaching

- 50 minutes for introduction to corn field scouting.
- 50 minutes for each group to learn assigned scouting section.
- 1-2 hours for field scouting trip.
- 50 minutes for post-scouting to create presentation.
- 50 minutes for group presentations (about 10 minutes each).

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Preparation Procedure

- Make contact with a local farmer to set a time for students to come out and survey.
  - Be sure to explain the purpose of the lab, what your students are looking for and how they will go about collecting the information.
- Obtain equipment from the Materials List for each group.
- Download the Scouting Lab PowerPoint presentation.
- Print out the five field guide classifications: Weeds, Nutrition Deficiencies, Disease, Pests and Weather Damage.
- Print out a blank Field Logbook and Grid Map for each group.
- Set up the cones for each station before the visit. (The farmer can help pick out a good spot they want you to use.)

Background Information

- Students should complete the Explore Corn and Growing Degree Units activities before this lab.
- See accompanying PowerPoint presentation for an Introduction to Field Scouting.

Classroom Discussion

- Why would a farmer want to scout their field?
- What should a farmer be looking for when scouting their field?
- What are the major parts of a corn plant that should be looked at when scouting?
- How often should a farmer scout their field?
- What stages of corn growth would be the best time to scout?
- Should a farmer scout their field the same way each time or do so in a variety of ways?
- What are some ways that a farmer can randomly survey their field?
- What kind of equipment or technology could be used to scout a field?

Procedure for Lab

Introductory Lesson: 1-2 50 minute class periods

- Present the introductory slides of the PowerPoint presentation to the class.
  - These include a brief introduction to each scouting classification as well as field scouting procedures and techniques.
- Split your students into at least five groups (4 per group is ideal) and assign them one of the following scouting classifications:
  - Pests, Weeds, Diseases, Nutrition Deficiencies and Weather Damage
- Have students read over their assigned scouting classification.
  - Provide additional resources for research – see the Resources Section.
- Have students complete an exit ticket for their assigned scouting classification.

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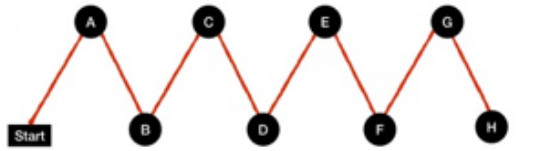
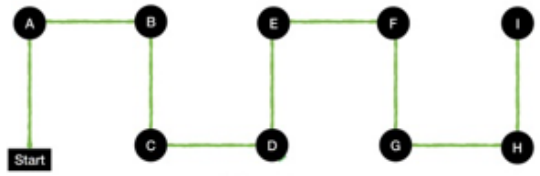
Class Period before Field Visit

- Provide students with the PowerPoint template for their scouting results.
  - Students can cut the cards out within their assigned classification and use these during the field visit.
- Have students determine the type of survey method and pathway they will take onsite:
  - Survey walking pattern - roll the dice: split group into groups. Half will do zigzag, half will do "M" path
    - zigzag pattern
    - "M" pattern
  - Classification Type:
    - 1 – Diseases
    - 2 – Nutrition deficiencies
    - 3 – Roll again
    - 4 – Pests
    - 5 – Weather damage
    - 6 – Weeds

Zigzag



"M"



Field Survey

- Be sure students are appropriately dressed for fieldwork and weather.
- Be sure students apply any needed sunscreen and bug spray.
- Be sure to apply the buddy system for safety.
- Each student group should have a whistle or way to communicate in case they get disoriented or have any issues.
- Have students set an alarm or timer for 10 minutes before having to come back.
- Student groups start at an edge of the corn field.
- When told to do so, the students can then start and apply their chosen scouting pattern.
- At each stopping point, the students will read the laminated card and log the information into their log books. Be consistent in how you choose the corn plants to be scouted.
- Mark down and label the position (A, B, C, etc.) on the Field Grid Map.
- When the last location has been logged in the Field Logbook, students will return to the instructor to get a case study card. Make sure all materials and students are accounted for before leaving.
- Students will use the information gathered in their Logbooks to complete the case study given to them by their teacher.
- If there is time remaining, you can send students back in to find their own conditions and log them in their log book.
- Thank your farmer for letting you scout their field.

Scouting Report

- Students are to research any conditions found in the field that were not included in their Field Guide.
- Students are to calculate the percentages of each condition encountered (see Lab Analysis Section)

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- Students will create a final Scouting Report using the provided PowerPoint template which includes:
  - An introduction to their assigned Scouting Classification with examples.
  - What the students were specifically looking for when scouting a corn plant.
  - The scouting pathway that was taken along with a picture of their completed Field Grid Map.
  - Pictures with accompanying conditions of the corn plants that were observed.
  - Researched corn conditions that were not found in the field guide.
  - Suggestions on what can be done about observed conditions.
  - Mathematical analysis of observed corn plant conditions.
  - Final conclusion.
- Students are to present their findings to the class.

Teachers Resources

- Have students do an image search on their assigned conditions in order to see even more examples.
- Before the field trip, have the students calculate the growing degree days that have been available so far for that region using the "Growing Degree Days" activity from Kansas Corn. This can be an option for the advanced students or if this is an ag based class.
  - Have students calculate the number of growing degree days on the day they scout.
  - Have students predict the corn stage based on the growing degree days.
  - Have students predict the date when the corn plants will reach R6 – the Black Layer.
- Onsite at the cornfield, before scouting:
  - Have students review the parts of an actual corn plant.
  - Have students identify the growth stage the corn plants.
  - Have the farmer give a quick talk on any potential hazards and what to expect (do not give away too many details so as not to influence students' observations).
- Onsite at the cornfield, after scouting:
  - Have students ask the farmer questions about what they observed.
  - If students found any conditions, what would the farmer most likely do to remedy the situation?
  - This is a great time for the farmer to talk about their experiences and what they feel the future of farming will bring.
  - Provide snacks and drinks for the students so they can replenish while listening to the farmer.

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Bonus: Insect Collecting and Display

Learning Objectives

- To discover the diversity of insects found within a specified area.
- To research and identify different insect species.
- To properly collect, preserve, pin and display insect specimens.

Materials

For the Instructor

- Corn Field Scouting PowerPoint presentation
- Field/Work Gloves
- First Aid Kit
- Freezer
- Cooler or Insulated Box with Ice Packs

For Each Group (Outside Materials)

- Insect Net
- Plastic Baggies
- Sharpie

For Each Group (Inside Materials)

- Foam Board (1 per student)
- #2 Dissection Pins (1 per Insect)
- Paper for Labels

Safety Considerations Reiterated

- Wear appropriate clothing for the weather and outdoors.
- Apply bug spray and sunscreen when necessary.
- Use the buddy system to account for all students when in the field.
- Be sure to get permission from owner before entering property.
- Have a first aid kit on hand in case of insect bite or sting.
- Make sure your students are careful when moving rocks or debris when looking for insects.
- Be sure to let your students know if they are allowed to catch stinging insects.

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Procedures for Instruction

Length of Time for Preparation

- 30 minutes for planning lesson
- 30 min for planning and organizing field trip

Length of Time for Classroom Teaching

- 15 minutes for introduction to insect collecting
- 10 minutes for insect collecting instruction
- 10 minutes to go over area and bounds to be collected
- 1 – 2 hours for field scouting trip and insect collecting
- 50 minutes for insect collecting around the school and surrounding area
- 2 – 50 minute periods for identifying, tagging and pinning

Preparation Procedure (Lab Setup)

- Make contact with a local farmer to set a time for students to come out and survey.
    - Be sure to explain the purpose for scouting and collection, what your students are looking for and how they will go about collecting the information and insects.
- Obtain equipment from the Materials List for the instructor and each group.
- Get a cooler or insulated box with a couple of ice packs placed inside.
    - You can use a regular box; just keep it out of the sun.
- Make sure you have room in a freezer for your collected baggies of insects.
- You can buy large pieces of foam board and cut them into smaller pieces around 8" x 11".
- You can stick pins upright into a couple of smaller foam board pieces for students to grab when needed.
- Small pieces of paper or light card stock can be cut out and used for labels/tags.

Background Information

- Students can be shown the Corn Field Scouting PowerPoint presentation.
- Insect collecting is a great way to discover and analyze the diversity of insects found within a specific area.
- Students can research the many different types of insects that are found in their local area.
- Creating a collection is a visual, artistic and scientific way of displaying local biodiversity.

Classroom Discussion

- Why would we want to collect and display insects?
- What type of information is needed on an insect tag?
- What are some ways to humanely collect a living specimen?
- What type of insects can be collected?
- What resources can you use to look up and identify insects?

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Procedure for Lab

Collecting Insects

- In a box or in your cooler (with ice packs), place your baggies and sharpies inside to make it easier to carry.
- Each pair or group of students gets an insect net, multiple baggies and a sharpie to label their names on each baggie.
- Choose and outline the designated area where they are able to collect as well as a spot and a time to meet up at the end of class.
- When students catch and insect, they can wrap the net around the opening ring or they can grab the middle of the net and hold it closed (depending on the type of insect being caught).
- Students can then take the end of the net, where the insect is caught, and can place it inside a baggie to release the insect.
- The student can then blow a puff of air inside the baggie before closing it.
- The student will then label the baggie with their name or their group name.
- It is best to have one insect per baggie.
- When their insects are collected, they can bring them to the instructor and place them in the cooler.
- At the end of class the instructor can place all of the baggies with insects into the freezer.
- Keep the insects in the freezer for at least 48 hours.
- Keep repeating this each day until students collect the necessary number of insects (12 – 15 is a good number).

Tagging and Pinning Insects

- After taking the insects out of the freezer, it is best to pin them right away. They are easier to pin while still cold.
- See the examples and show the videos in the Resources section to your students so they know how to properly pin and tag their insects.
- Decide on the information you want your student to include on each tag:
    - Common name, scientific name, date collected, area collected, etc.
- Have the students explore the internet in order to identify each insect.
- Once you are done grading their collection, the student can take their work home.
    - The insects dry out and keep their form, but they are very delicate.

Teacher Tips

- Be sure there is air in each baggie for the insects to breathe.
- Keep them out of the sun while out in the field.
- It may be best to demonstrate how to catch an insect and place it in a baggie.
- Insects are easier to pin while still cold, right out of the freezer.
- Spiders can be pretty hard to pin and they have a tendency to “leak.”

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- Pin through the cephalothorax and not the abdomen.
- Monarch Watch lets you participate in citizen science by providing tags for monarch butterflies (for a price). The site shows you where and how to tag the butterflies. This is a great and fun opportunity for your students!
- Visit monarchwatch.org.

Reflection and Conclusion

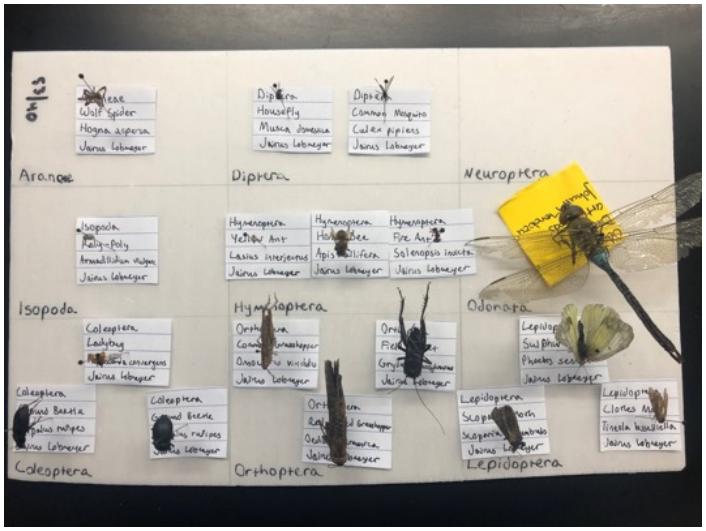
- Students should end up with an insect collection that is properly pinned and tagged.
- The student's collection should be a good representation of the insect diversity found in a specific area.

Assessments

- The completed board with properly tagged and pinned insects should provide the necessary assessment for this activity.
- Students should demonstrate proper collecting techniques and the humane treatment of biological specimens.
- The insect tags should show the relevant information that you requested.
- The student should be able to discuss the different species of insects found on their board.

Resources

- The following links help explain the pinning and tagging and identification process:
  - https://www.youtube.com/watch?v=YhLZKTUeQpc&t=14s
  - https://www.youtube.com/watch?v=MT5VGlSCtg4
  - https://www.insectidentification.org/insects-by-state.php?thisState=Kansas
- Pictures of student insect collections:



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- Certified appraiser
- Crop adjuster
- Data processor
- Extension agent
- Grain buyer
- Geospatial analytics specialist
- Precision agriculture specialist
- Biosecurity manager
- Climate change analyst
- Ecologist
- Environmental engineer
- Environmental scientist
- Nematologist
- Nutrient manager
- Pest control advisor
- Produce inspector
- Irrigation specialist
- Aerial applicator
- Agronomist
- Crop advisor
- Crop scout
- Crop systems specialist
- Entomologist
- Horticulturist
- Microbiologist
- Plant biologist
- Plant breeder
- Plant geneticist
- Plant pathologist
- Field agronomist
- Row crop producer
- Soil scientist
- Weed scientist
- Seed production agronomist

Any educator electing to perform demonstrations is expected to follow *NSTA Minimum Safety Practices and Regulations for Demonstrations, Experiments, and Workshops*, which are available at http://static.nsta.org/pdfs/MinimumSafetyPracticesAndRegulations.pdf, as well as all school policies and rules and all state and federal laws, regulations, codes and professional standards. Educators are under a duty of care to make laboratories and demonstrations in and out of the classroom as safe as possible. If in doubt, do not perform the demonstrations.

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Lab Analysis (Optional activity for advanced classes)

- Calculate the number of Growing Degree Days

$$\frac{((\text{high temperature} - \text{low temperature}))}{2} = 50$$ (high cannot exceed 86°F and Low cannot be below 50°F)

- Students are to calculate the percentage of plants that have specific conditions

$$\frac{(\#\text{ of corn plants affected})}{(=\text{total }\#\text{ of corn plants observed})} \times 100\%$$

- Using that percentage, determine how many corn plants would possibly be affected

(# of acres) x (28,500 corn plants) x (your percentage from above in decimal form)

- Based on your Field Logbook and Grid Notes, what was the distribution of each condition?
  - Even, Clumped or Random

Reflection and Conclusion

- Students are to create a PowerPoint on their results and present it to this class
  - What types of conditions did they observe and at what percentages?
  - What can be done to remedy and prevent these conditions?
  - Was there anything they observed that was unexpected?
- What would be some other methods or equipment to make scouting easier or more efficient?

Assessments

- Students should be able to pass the provided exit ticket quiz before going out in the field.
- Have students identify the parts of the corn plant when out in the field.
- Have students identify the growth stage of the corn plant.
- Students should be graded on the thoroughness of their PowerPoint and their presentation.

Kansas Corn Seed to STEM: Field Scouting Logbook

Student Names: _____ _____ _____ _____

Field Location: _____

Date: _____ Time: _____ Temperature: _____ Weather: _____

Corn Plant Growth Stage: _____

Assigned Classification Type (e.g. Pests): _____

Field Notes (document characteristics of corn plants at each scouting stop):

A

B

C

D

E

F

G

H

I

J

K

L

M

N

O

Field Scouting Grid Map

Walking Pattern _____

Disease Case Study #1

It is August 8th and the weather has been hot and dry. As you wipe the sweat off your brow with your favorite handkerchief, you notice the topsides of your corn leaves have tiny, round spots covering most of the leaf area. The outside of the spots is yellow in color. This is affecting all leaves of the corn plant and is found covering a large area of the field. The stem of the corn plant is sturdy and healthy looking.

Jardine

Disease Case Study #2

You begin your scouting like any other day, except today you feel like taking an "M" patterned approach. About halfway through your route, you notice that some of the corn plants have tan lesions on their leaves. You whip out your favorite pocket ruler and see that the narrow marks measure between half-an-inch to an inch-and-a-half. They tend to get longer and more plentiful as you move down the corn plant. Some of the bottom leaves are dead! In fact, you notice that the most severe ones are bending over due to stalk rot!

Jardine

Pest Case Study #2

It is the end of July, and you decide to take a scouting trip through your fields. You walk through a large, grassy area before coming to the edge of your corn crop. Immediately, you notice that the lower leaves of the corn plants have been stripped away, exposing nothing but their midribs. As you take a closer look with your trusty magnifying glass, you see the culprit. It's a dark, green worm with a white stripe running along its back.

Sloderbeck

Gates

Pest Case Study #2

Today, you decide that it is just too hot of a July day to be meandering about. So, instead you dust off the drone you got for Christmas and send it on a mission. Everything appears fine until you notice a patch of corn stalks bent over. You think to yourself, "It can't be crop circles again. That hasn't happened since the 70s and come to think about it, we haven't seen Uncle Bill since." You drop your drone in for a closer 4K ft. look at the situation. You notice the leaves have holes in them, and there is a bunch of yellow bugs eating away. You run over to the spot, and pick up some of the lodged stalks. The roots are brown and severely stunted. You scoop up some soil and notice larvae that have two heads!

Roozeboom

Nutritional Case Study #1

Driving back to the farm after a good, long day of playing mini-golf in which you beat your high score - the windmill had nothing on you today - you decide to take the backroads and pass by a portion of your field. It's early June and your crop is coming up nicely. Though, looking out at one end you notice that a portion of your field appears yellow and the height of the plants are stunted. Upon closer observation, you see that the leaves have yellow streaks running along the veins of the leaves.

Jardine

Ruiz Diaz

Nutritional Case Study #2

Oh boy, it's been a cold and wet month of May. Today seems nice though, so you decide to pop out and randomly inspect your favorite crop - that would definitely be corn. Soybeans are OK, but they just never seem happy to see you. As you stroll away, you come across an area in which the leaves are yellowing. The pattern is starting at the tips and working their way down the midrib. In fact as you go down the plant to the lower, older leaves, it gets worse! You take a big gulp as you see the the mark of the culprit, the dreaded "V."

Ruiz Diaz

Weather Case Study #1

Your college buddy from the Eastern part of Kansas wants to come out for a visit. He says that he can't handle all of that humidity and just needs some nice dry air for a change of pace. You tell him that the Western side has been pretty hot and dry so, "Come on down!" You take him on a tour of your corn field and decide this would be a great opportunity to show him how cool agriculture is. While discussing the formula for calculating growing degree days of corn and how it relates to growth stages, you notice that your corn leaves have tiny white spots all over! You check underneath the leaves and you start to feel a little better as the spots are not to be seen. You inspect further and see that there are no little bugs or mites crawling around.

Weather Case Study #2

"Good Morning!" You hear your spouse say from downstairs. "Goodness," he says. "You sure slept through that doozy of a storm last night!" He was right, I had been pulling 18 hour days getting the farm in tip-top shape. It felt good to get some much needed rest. I better go check on my corn to see if the storm had affected the crop in any way. As soon as I stepped outside, my heart fell to the floor. The leaves of my corn plants were gone! "Gone," I say! Just the poor midribs jutting out as if to point out the villain. Upon getting closer, I could see that some stalks were broken as well. It looks like most of the damage came from the northeast as that side of the plant is showing the most damage. "Thankfully," I say to myself, "We haven't reached V8. There's still hope!"

Milliman

Weeds Case Study #1

"Ugh," you say to yourself. It has just been a long, hot month of August. It's been really dry and windy as well. You know those dry, hot days where water can't even quench your thirst out in the field or when you wake up and you have to literally peel your eyes open because it's so dry. Driving along the roadway, you smile as you see the tumbleweeds coat the fences as if they were trying to get as far away from Kanas as they could. Oh, the good ol' tumbleweed, also known as the Russian cactus, the prickly rolypoly, or the wind witch. But what weed does it come from?

Weeds Case Study #2

Your friend Billy Einhorn is a crazy horror movie fanatic. One day he calls you up and states that all these scary movies have people running through corn fields while being chased. He says that he wants to try this for himself. You know, to get the whole scary movie experience. So he asks you if he can come over and run through your cornfield at midnight as you chase him with your pitchfork. You politely decline as you sent your pitchfork away to get sharpened for the harvest and offer him a pleasant and equally satisfying alternative. You tell him to come over at 8 in the morning to join you on a scouting mission to find the worst weed of them all. The females of this weed can create up to a million seeds and are extremely hard to stop. You need to apply multiple herbicides over the course of the entire growing season as it will easily compete against your corn plants for food, water and sunlight. Now that is scary!

Anthracnose

Jardine

- Caused by a fungus.
- Starts at the lower leaves. Lesions appear tan in color with reddish-brown or yellowish-orange borders.
- Eventually, the legions cover the whole leaf.

Anthracnose Stalk Rot

Jardine

- The outside of the stalk appears a shiny black color.
- Occurs during hot, very dry weather.

Aspergillus

Jardine

- Greenish-yellow mold on the ear between the kernels.
- Produces aflatoxin.

Bacterial Soft-Rot

Jardine

- Bacteria can be present in deposited soil during high water or flooding events.
- The top of the plant will rot causing a putrid odor.
- The whorl can be easily removed from the plant.

Charcoal Rot

Jardine

Jardine

- The interior of the stalk has a shredded, black, dusty look to it.
- A closer look reveals numerous black fungal structures known as microsclerotia.
- Occurs in hot, dry years.

Common Rust

Jardine

- Elongated lesions with dark brown pustules erupting through the upper and lower surfaces of the leaf.
- Frequent midsummer disease. Occurs anywhere in the canopy.

Common Smut

bugwood.org

- Galls encased in a silvery membrane found commonly on the ear but can occur anywhere on the plant.
- As the galls mature, they will rupture and spill out their black powdery spores.
- Can happen in any field at any time, but most commonly following hail damage or when weather conditions inhibit pollination.

Crazy Top Downy Mildew

Jardine

- Upper leaves are rolled and twisted.
- Tassel or corn ear looks like a mass of leafy structures.
- Infection occurred early in the growing season when the soil was water-saturated for 24-48 hours.

Diplodia Ear Rot

- Plants with husks that are dry while the rest of the plants remain green.
- White mold grows in the kernel channels starting at the base of the ear.
- In some cases, diplodia can mummify the entire ear.

Diplodia Stalk Rot

- The presence of small, dark brown to black pimple-like structures.
- Embedded in the rind of the lower stem.

Fusarium Ear Rot

- A whitish pink to lavender fungal growth found on kernels.
- Often creates a starburst pattern.
- Produces fumonisin toxin.

Fusarium Stalk Rot

- Premature death due to stalks lodging above the soil.
- When the stalks are split, the inside shows complete disintegration with only the vascular bundles remaining intact.

Gibberella Ear Rot

Jardine

- A pink to reddish mold that starts at the tip of the ear.
- Produces vomitoxin.

Gibberella Stalk Rot

Belich

- A reddish discoloration that appears inside the stalk.

Gray Leaf Spot

Jardine

- Leaves have lesions that are tan to gray, narrow and rectangular about 1/4 to 2 in.
- The fungus starts at the lowest leaves and moves upward. Can kill entire leaf.
- Heavily infested plants can develop stalk rot.
- Happens to susceptible hybrids that are grown in continuously cropped, no-till fields.

Gross's Wilt

Harveson

Harveson

- Most common in fields with hail damage. Creates microscopic wounds that allow bacteria to enter the plant tissue.
- Lesions appear as grey to light yellow stripes with wavy or irregular margins.
- Dark green to black water-soaked spots (freckles) appear within the lesions.
- Can be confused with leaf scorch.

Head Smut


Croisant

- The tassel has been partially or fully replaced by a smut sorus.
- The sorus is covered by a thin membrane that eventually ruptures to release dark, dusty spores.
- Plants with a smutted tassel will also have smutted ears.
- Smutted ears do not have silks and the cobs and kernels are completely replaced by the sorus.

Iron Deficiency


Jardine


Ruiz Diaz

- Young corn plants are yellow or pale-green between the veins of the leaves.
- Due to soil being high in pH and calcium and low in organic matter.

Magnesium Deficiency


Ruiz Diaz

- Interveinal striping of leaves.
- Older leaves may become reddish-purple.
- Edges and tips may become necrotic.
- Caused by compacted soils or sandy soils low in organic matter.

Southern Rust

Jardine

- Small, circular lesions often surrounded by a yellow halo found all along the upper leaf surface and normally does not erupt from the underside.
- Usually appears in late July or early August; can result in significant yield loss.

Phosphorus Deficiency

Ruiz Diaz

Ruiz Diaz

- Found mostly in young plants.
- Younger leaves - reddish-purple leaf tips; older leaves - reddish-purple outer edges.
- Some causes include poor soil; cool, wet growing conditions; and sunny days, cold nights. Certain hybrids naturally develop this coloration.

Potassium Deficiency

Roozeboom

- Outer leaf margins become yellow and necrotic; characteristic “V” shape.
- A mobile nutrient. Symptoms appear in the lower, older leaves first
- Appear after emergence - around V5 and V6.
- Can be caused by cold, compacted soil that limits root growth.

Nitrogen Deficiency


Lobum


Ruiz Diaz

- Leaves appear pale green or have yellowish discoloration.
- Yellowing starts at the tips and moves down the midrib. Creates a characteristic "V" shape.
- Nitrogen is mobile. Coloration seen in older, lower leaves first.
- Can be caused by cold, wet conditions

Late Season Nitrogen Deficiency


Ruiz Diaz

- Characteristic V-shaped yellow firing along midrib of lower leaves.
- Stalks are thin and spindly.
- Ears appear pinched, with flinty kernels.

Armyworms


Shelbrock


Gatzi

- Leaf tissue has been removed, leaving the exposed midrib.
- Feeding progressed upward, and damaged plants were near the edge/margin of the field.
- Armyworms moving from the dry neighboring field or from grassy areas.
- Armyworms have a greenish-black body with orange-striped sides and a white stripe on its back.

Cinch Bugs


Wright

- They cluster near the base of the plant.
- Adults have a black body and white wings. Nymphs are red with a white stripe across their body and are wingless.
- Suck juice from the stalk of the plant above the ground and just below, causing wilting of the plant.
- Plants in the first rows of field margins are first to experience cinch bugs back.

Sulfur Deficiency


Ruiz Diaz


Sawyer

- Growth of the plant is stunted with yellow leaves showing interveinal chlorosis
- Similar to nitrogen deficiency except the yellow is in the upper, younger leaves rather than the lower, older ones
- Mainly found in sandy soils with low organic matter

Zinc Deficiency


Ruiz Diaz

- Whitish bands appear on the sides (and move toward the middle) of the leaves and span from base to tip
- The plant's growth becomes stunted as the stalk's internodes shorten
- Occurs in sandy and high pH

Corn Earworms


Shoderbeck

- Corn earworms feed on kernels starting near the tip and open the husks providing entry points for disease and birds.
- Larvae vary in color from brown to green to purple and have yellow lateral stripes along their sides and tiny raised spines.
- Larvae are cannibalistic so only a few are spotted on an infested plant back.

Corn Leaf Aphids


Davis

- The tassels and upper portion of the plant is covered with small, blue-green, soft-bodied insects.
- The plant is also covered in a sticky, sometimes blackened, substance (honeydew) as well as white skin casts on the plant and on the ground.
- The leaves are wilted, curled and have yellow patches.

Corn Rootworms - Larvae

- Larvae can destroy most of the root system; 1/2 in. long, white and slender. They have a brown head and a brown plate at the rear giving them a two-headed appearance.
- Affected roots appear brown and larger roots show tunneling.
- Plants can become lodged or have a gooseneck appearance.

Corn Rootworms - Adults

- Adults feed on leaves, creating scratches and small holes.
- Can also feed on pollen and silks.
- Western (left) and southern (right) corn rootworm.
- The western corn rootworm is the most destructive rootworm in Kansas.

Cutworms

- Young cutworms feed on leaves leaving small transparent areas called window panes.
- Older cutworms cut leaves off near the soil surface.
- Black cutworms feed at night and hide underground during the day.
- Mature larvae are plump, smooth, greasy-looking and dark grey in color.

European Corn Borers

- Young damaged leaves with round shot holes.
- Larvae chew through the unfurled, developing leaves.
- Tunnels inside the stalk at the breaking point of lodged plants weakening the stalk.
- Larvae have a dirty, white body coloring with rows of gray spots along the sides.
- Larvae can also tunnel the ear shanks causing the ears to drop.

Flea Beetles

- Infestation happens during early growing months.
- Vulnerable during slow growth due to low temperatures.
- Corn plants can recover due to the growing point being below ground until emergence of fifth leaf.

Grasshoppers

- Large chunks of tissue are removed from leaf margins leaving a ragged appearance.
- Stalks are not bruised, and few midribs are broken. This is not caused by hail damage.
- Found around field margins; grasshoppers move from the weedy borders to feed on the corn plants.

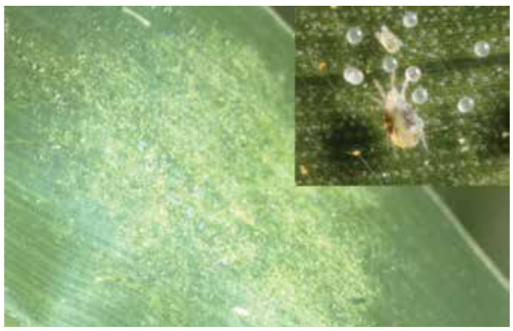
Nematodes

- Nematodes are microscopic, wormlike organisms that live in soil and plant tissue. Can be confirmed by soil tests.
- Create stunted growing patches usually oval or circular in shape.
- These patterns are not characteristic of herbicide damage.
- Roots appear stunted or stubby and are localized on the root system.

Southwestern Corn Borers

- Larvae tunnel inside the stalks and girdle the base causing the plants to lodge.
- Larvae are white with black spots down the sides and an orange head.

Spider Mites



- White or yellow spots covering leaves on surface and underside
- Damage starts at the lower leaves and moves upward.
- Spider mite infestation is heaviest along the leaf midrib.
- Seen crawling specks under a hand lens.

Stalk Borers

- Plants usually found near edges of the field that become stunted and damaged.
- Insects kill the growing point of a plant leads to a condition called deadheart.
- One cause is the common stalk borer.
- They have a recognizable purple band traversing near the legs.

White Grubs

- White, C-shaped grubs.
- Burrow at the base of the plant.
- Feed on the roots causing leaves to wilt after emergence.
- Another indicator, plants being dug up by rodents looking for grubs.

Wireworms

Davis

- Hard-bodied with yellow-brown coloration.
- Burrow at the base of the plant, feeding on the roots causing leaves to wilt.

Western Bean Cutworms

Sloderbeck

- Larvae enter ears through tips or chew through the husks to feed on kernels.
- Causes ear deformation.

Poorly Drained/Compacted Soil

Jardine

- Yellow, wilted plants.
- Stem tissue around ground level will be discolored and water-soaked.
- Indicates seedling blight injury.

High Water/Flooding

Roozeboom

- Soil on the leaves and caked within the whorl.
- New leaves should not be affected.

Water and Freezing Temperatures

Roozeboom

- Leaves are fully white.
- The corn plant first becomes soaked with water.
- It is then exposed to freezing temperatures.

Late Freeze

Roozeboom

- Will kill the leaves above ground
- Corn plants can recover because growing point may still be below ground
- Right - the ground experienced freezing temperatures which killed the growing plant
- Below - plants recovering from frost damage

Cold Weather Crown Stress

Janitine

- Happens during extended periods of cold, wet weather early in the season.
- The crown tissue is soaked with water and appears very dark. The damage can move upwards for several nodes.
- The corn plants on the left and right show this damage and their growth will be stunted.

Windburn

Roozboom

- The older, lower leaves show the worst damage, whereas the younger leaves are relatively unscathed. Not a nutrient problem.
- The bare surface soil allowed strong winds to abrade the leave tissue, drying it out and allowing it to become necrotic.
- This picture was taken a week after a high wind storm.

Drought Stress

Sharp

- Leaves turn a dull gray color instead of deep green.
- Upper leaves will roll upward and inward.

Hail Damage/High Winds

Millman

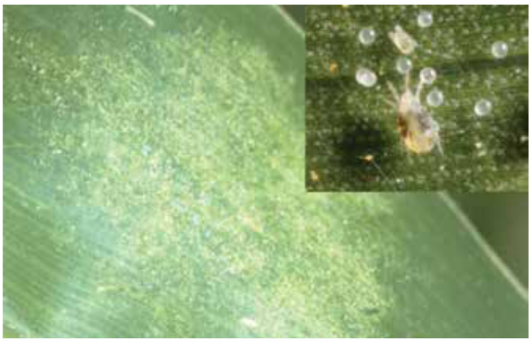
- An entire field with plants that have shredded, bruised and broken leaves, midribs and stalks.
- Dark bruises can be left on the husks.
- Damage is more severe on one side of the plants.
- Plants can recover if hail happens before the V8 growth stage.

Green Snap

Roozeboom

- Two to three weeks before silking corn plants enter the rapid stem elongation phase.
- Stalks are brittle and are susceptible to high winds.
- They can easily snap in two just above the lower nodes.
- When plants tassel and silk, they become less brittle.

Flecking



Stoderbeck

- Tiny yellow or white spots on the upper leaf surface.
- Associated with hot, dry weather, such as in western Kansas.
- Look over entire plant to make sure it's not spider mites.

Barnyard Grass

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

Cheatgrass

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

Excessive Heat

Stryker

- Excessive heat during pollination period can cause sterility and poor seed set.
- Hot, dry winds increase the severity.

Zipper Ear

Mueller

- Parts or entire rows of kernels are missing due to kernel abortion.
- Ears are curved because rows opposite continue to fill and extend the axis of the ear.
- Caused by environmental stressors such as severe drought, nitrogen deficiency and multiple other factors.

Chickweed

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

Common Cocklebur

Pictures courtesy of: Dallas Peterson, Kansas State University
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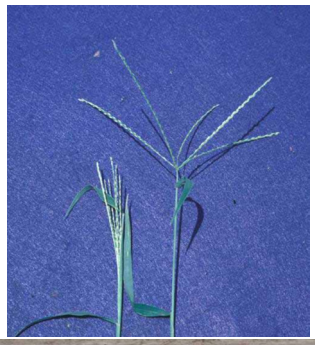
Large Crabgrass



Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

Prairie Cupgrass

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

Green and Yellow Foxtail

Green Foxtail (left)

Yellow Foxtail (right)

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

Giant Foxtail

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

Johnsongrass

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

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Jointed Goatgrass

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

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Horseweed (Marestail)

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

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Kochia

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Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

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Kudzu

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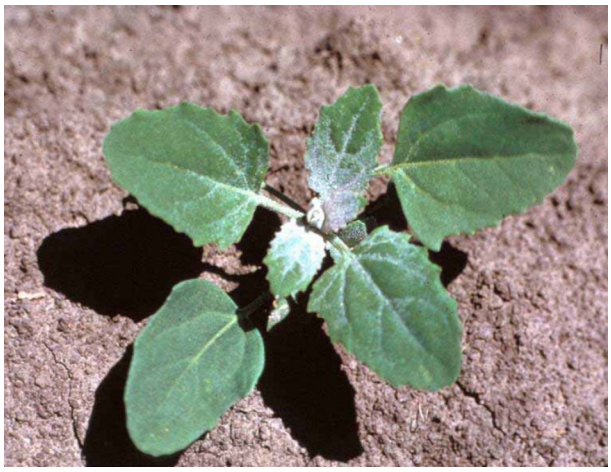
Common Lambsquarters



Pictures courtesy of: Dallas Peterson, Kansas State University

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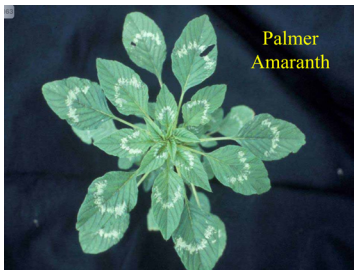
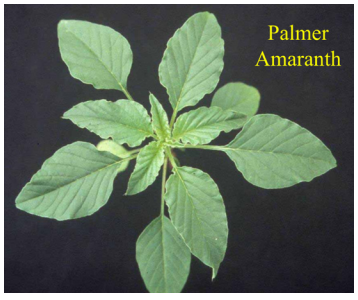
Palmer Amaranth





Pictures courtesy of: Dallas Peterson, Kansas State University

Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

Field Pansy

Pictures courtesy of: Dallas Peterson, Kansas State University

Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

Field Pennycress

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

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Redroot Pigweed

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

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Tumble Pigweed

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

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Prickly Lettuce

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

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Common Ragweed

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

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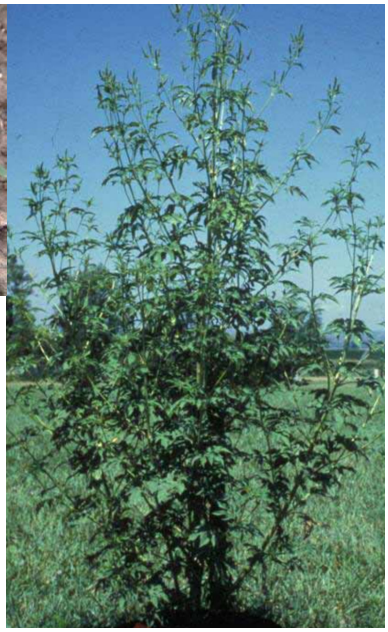
Giant Ragweed



Pictures courtesy of: Dallas Peterson, Kansas State University
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Velvetleaf

Pictures courtesy of: Dallas Peterson, Kansas State University
Weed Identification: https://www.agronomy.kstate.edu/documents/weed-management/pptks-weed-id.pdf

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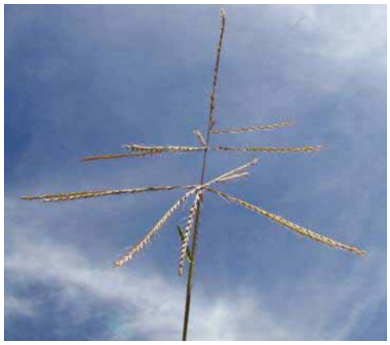
Windmill Grass



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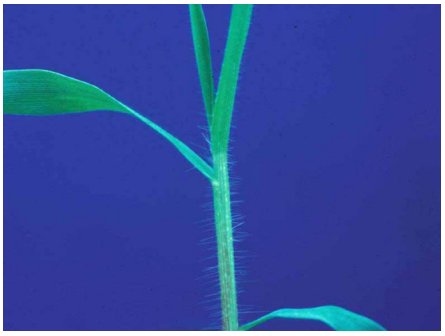
Witchgrass



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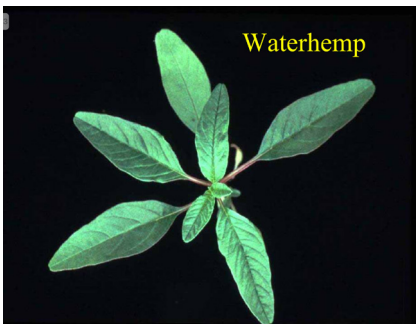
Waterhemp



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