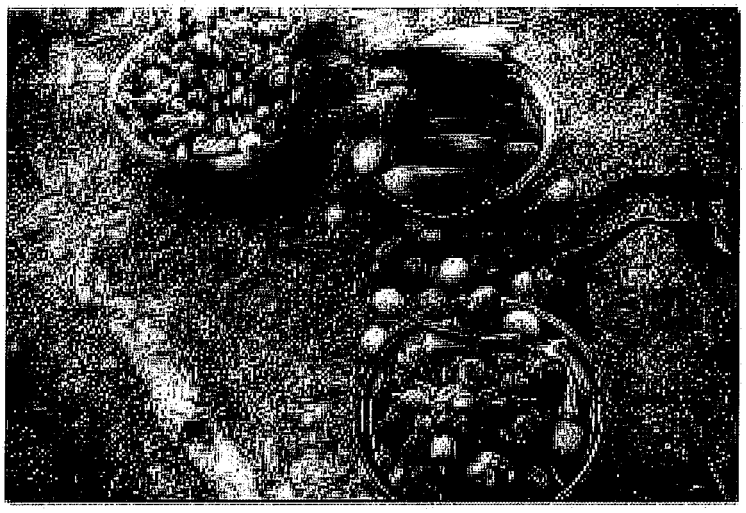
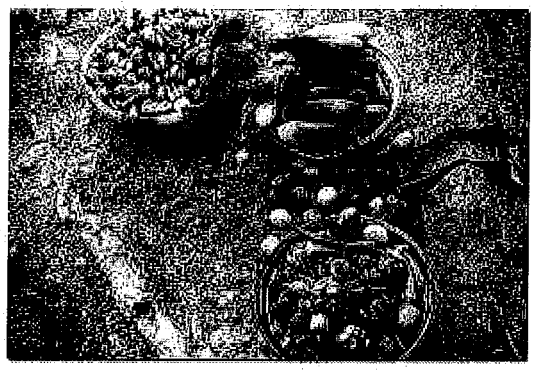
UC
CE

Field Crops and Management





This We Believe:

- The boy and girl are more important than the projects.
- The member should be their own best product.
- No award is worth sacrificing the reputation of a member or leader.
- Competition is a natural human trait and should be recognized as such. It should be given no more emphasis than other fundamentals.
- Learning how to do the project is more important than the project itself.
- Many things are caught rather than taught.
- A blue ribbon member with a red ribbon project is more desirable than a red ribbon member with a blue ribbon project.
- To learn by doing is fundamental in any sound educational program.
- Generally speaking, there is more than one good way of doing most things.
- Every member needs to be noticed, to feel important, to win, and to be praised.
- Our job is to teach members *how* to think, not what to think.

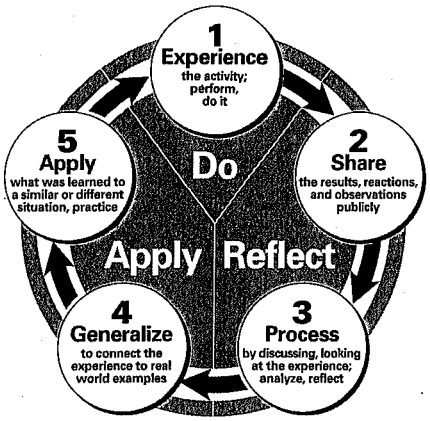
4-H Crop Projects
1
Soybean & Corn

Seedy Business

4H 381A January 2004

IOWA STATE UNIVERSITY
University Extension

IOWA SOYBEAN
PROMOTION BOARD



IOWA SOYBEAN
PROMOTION BOARD

The revision and design of this manual were made possible by a grant from the Iowa Soybean Promotion Board.

Note to the Project Helper

What a wonderful opportunity you have in store for you! A 4-H'er has asked for your help to explore the world of crop production; this includes as many learning experiences for you as for the 4-H'er. As a project helper, you don't need to know all the answers; you only need to know how to help the 4-H'er discover the learning process and find information to help answer the questions. You will be guide, teacher, and mentor as you explore crop production together. You may learn much more about yourself and your 4-H'er while you both learn more about corn and soybeans. Remember that the goal of 4-H is to help youth develop life skills such as leadership, communication, information seeking, and confidence building in themselves; the 4-H crops project is simply the tool to help develop these skills.

As a project helper, you should become familiar with these materials so that you can guide the 4-H'er through the learning experience. You also should help the 4-H'er learn the importance of setting goals and recording the learning experience. Your support and encouragement in following the experiential learning model will both strengthen the member's learning experience and provide the much needed support of a caring adult. The 4-H'er will know you are a trusted friend who offers support through 4-H and other life experiences.

This manual is based on the experiential learning model, in which you do an activity, reflect on what was done and learned (also called sharing), and think about ways to apply what was learned to other real life experiences. By learning experientially, youth have more fun, retain their learning longer, and are better able to apply their learning experiences to new situations. Your role is to help youth share what they learned and guide them in applying what they learned to new situations. The ***4-H Crop Project—Soybean and Corn*** is divided into three levels. Level one is intended for youth in grades 4 to 6, Level two for youth in grades 7 to 8, and Level three for youth in grades 9 to 12. However, youth may work through these levels as fast as they would like. You also may want a computer companion CD that includes more activities and up-to-date crop industry information. The CD will be updated more frequently with new research, new products, and new information.

Thank you for your commitment of time and talent to the 4-H'ers in your life. We hope you enjoy learning with your 4-H'ers, and serving as a mentor for them! What a wonderful opportunity to positively influence the lives of today's youth and tomorrow's leaders!

CONTENTS

Welcome

INTRODUCTION

This 4-H Crop Project Guide is to help you learn the basics about crop production and related careers.

Here are some of the things you will learn.

- About Iowa corn and soybean production
  - Agronomy—the study of crops, soils, and atmospheric sciences.
  - the Iowa State University Agronomy Department homepage, www.agron.iastate.edu
- About plant growth
  - managing those nasty pests
  - making sure the soil has the right combination of nutrients to get plants to grow properly
- About crop production careers that are available to you as an adult
- About setting goals, making good decisions, communicating to others what you have learned, and learning how to go about learning more about crop production

After going through this manual and doing lots of activities, presentations, camps, and helping out others on your farm or a friend's farm, you will become a 4-H Crops Expert!

Getting Started

Let's start by thinking a little about the crops project and what you might like to learn. Don't worry if you can't answer all these questions right away; you'll get more ideas as you work through the project guide and try some of the activities. You probably will change your plans as you grow and that is great! But let's start by getting your thoughts in writing!

1. What do I want to learn in this project? _____

2. What activities, camps, or programs do I need to attend to help me learn more about crops? _____

3. What exhibit would I like to take to the fair? _____

4. What information about crops would I like to share in a 4-H presentation? _____

5. What would I like to include in the record-keeping part of this project? _____

6. What career would I like to learn about that has to do with crops? _____

Fun Fair Exhibit Ideas

- Create a comic book on soybean or corn development.
- Write a story about a day in the life of a soybean or other crop plant.
- Take pictures and create a display of pests you found when scouting a field.
- Demonstrate the effects of light on plant growth.
- Dig several plants and show the difference in root growth.
- Create a display showing various uses of corn or soybeans in your home.
- Videotape or audiotape some farmers to share the differences in how crops were produced when they started farming and how crops are produced today.
- Research what's new in the world of crop production—such as new products, new processes, and new research. Share with others what you have learned through a presentation or creation of your own website.
- Create an original art project using corn or soybeans, using seeds or the whole plant.

Project guides can help 4-H'ers in the crops project by helping them list their goals and plan their project for the upcoming year.

The Importance of Soybeans and Corn

CHAPTER 1

Farmers—What Would We Do Without Them?

Producing food is an important job. Iowa is a grain and livestock producing state; it is our Iowa farmers who make it all happen. Have you ever wondered why farmers produce the crops they do? Have you thought about the jobs in your community that depend on these Iowa crops? In this activity you will think about the importance of farmers to the community and the importance of the two main crops—soybeans and corn—to Iowa.

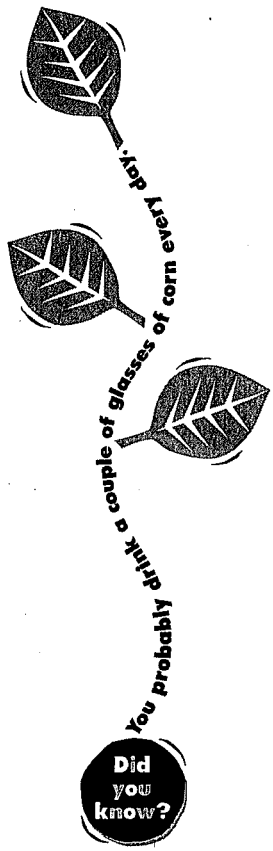
In this activity, try to answer the questions below yourself, then interview a farmer using the questions that follow and any others you can dream up. If you can, use a tape recorder while you do the interview or, better yet, use a video camera. To make this activity really fun, interview several farmers or other people in your community to see how their answers compare with each other. Keep notes of your interviews in your journal.

Materials

Tape recorder and tape or
Video recorder and tape
Pencil and paper

Name of person you interviewed: _____

1. What crops do you grow?
2. Why did you choose to grow these crops?
3. Who in our community does your farm depend on (businesses)?
4. What do these businesses do for you and your farm?
5. What would happen if the businesses weren't in the community?
6. What businesses aren't in the community that would be helpful to you?



7. How are the hybrids or varieties you plant today different from those you planted when you first started farming?
8. How important are your crops to other people, Iowa, and the world?
9. What do you think your grain is used for?

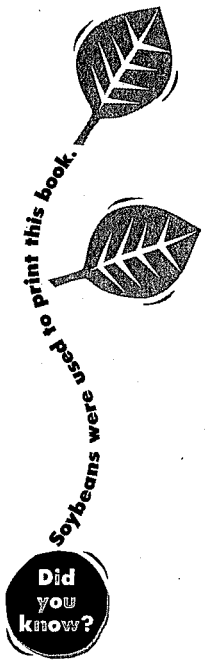
Project or Exhibit Ideas

1. Create a poster on businesses related to the farm.
2. Write a report that includes your taped interviews about the importance of soybeans and corn.
3. Make a diagram below that shows how corn and soybeans get from the farm to your table.

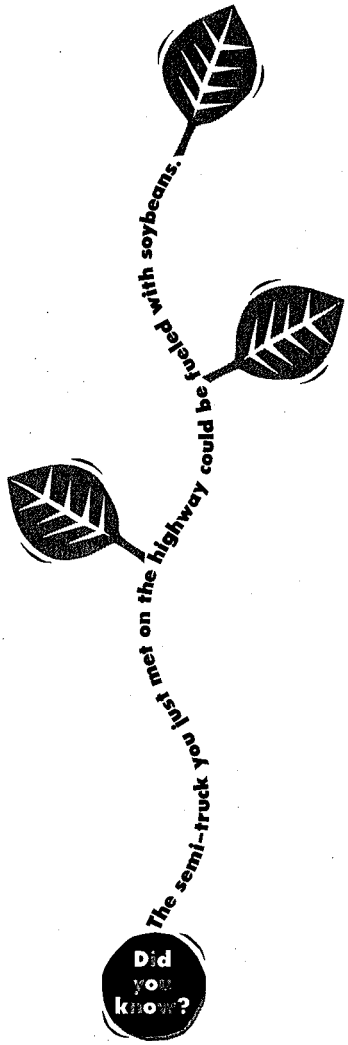
- What did you learn about farming corn and soybeans in Iowa that you did not know before?
- In what ways has Iowa agriculture changed over the years?
- What jobs in your community help support farming?
- If you interviewed more than one farmer, compare their answers. Why do you think some of their answers were different?

Maize from Long Ago

- When humans began producing crops 9,000 years ago, their main concern was to produce food for their family. Since then, farmers have become much more efficient at producing crops. Modern technology has greatly changed the techniques used in producing crops. In addition, many uses for crops besides food have been developed and appear in this chapter. See how many you can find. Hint: Look in the Did You Know facts.



Corn originated in Central America where it was grown by Native Americans, such as the Aztecs.



- People living in central Mexico developed corn or maize (Zea mays) from a wild grass called teosinte around 7,000 years ago. Soybeans (Glycine max) originated in China. The first record of soybeans was found in Chinese books written in 2838 B.C. More information on the history of corn and soybeans can be found at the following Internet sites:
  - The Story of Corn, www.campsilos.org/mod3/students/c_history.shtml
  - NativeTech: Native American History of Corn, www.nativetech.org/cornhusk/cornhusk.html
  - Iowa State University–Soybean History, www.agron.iastate.edu/soybean/history.html
  - Iowa State University–Origin, History, and Uses of Soybean *(Glycine max)*, www.agron.iastate.edu/courses/agron212/Readings/Soy_history.htm
- While many different kinds of crops are grown in the world and in different regions of the United States, corn and soybeans are the two main crops grown in the North Central United States, including Iowa.
- The United States produces about 40 percent of the world's corn crop and 35 percent of the soybean crop. The Midwest produces about 90 percent of all corn and soybeans in the U.S. Iowa is the state that produces the most corn, and Iowa and Illinois are the two top producers of soybeans.
- Crop production is important not only to farmers, but to all Iowans. About 8 out of 10 jobs in Iowa are related directly or indirectly to agriculture. Many jobs are in industries that

support agriculture. Farmers depend on support industries for materials they need to produce a crop, such as seed, fertilizer, chemicals, machinery, and financing. They also depend on people to do research on new varieties, new products, and new uses for our crops. These industries provide many jobs for people in your local community and other communities.

- Crops are used for animal feeds, but they also are processed and made into many products such as foods, plastics, fuel additives, soaps, and paints. Many people are employed to process crops into products we use every day.

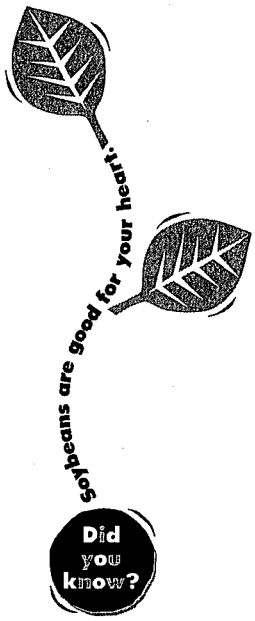
I SPY Soybeans and Corn

OK, farmers are pretty important. So are the businesses that farmers support and that support farmers. Did you know that all this farming wouldn't work unless there were lots of uses for the grains farmers produce?

So let's think about all those uses for soybeans and corn. Look around your home, school, church, or community. Bet you find soybeans and corn there. If you have trouble listing them, have a friend, teacher, or parent help you.

I SPY Soybeans
List all the products that are made of soybeans in some way; example: tofu.

I SPY Corn
List all the products that are made of corn in some way; example: cornstarch.



- How did the number of products you found surprise you?
- How are these products important to the crop industry?
- What are some other ways that corn or soybeans can be used?
- Why is it important for crop producers (farmers) to know what products contain corn or soybeans?

Project or Exhibit Ideas

1. Think of a new way corn or soybeans might be used, and discuss it with others.
2. Create a booklet of all the uses of corn and soybeans.
3. Visit an ethanol or corn syrup plant in Iowa.
4. Talk to a scientist who is creating new products from Iowa-raised grains. Ask how the new products came to be and what effect it will have on Iowa communities in the future.

Corn and soybeans can be processed into many products such as food, beverages, soaps, and paints.

Now pretend to be a crop scientist who is in charge of inventing new uses for soybeans and/or corn. Use your imagination: What would you create to make out of soybeans or corn?

Value-Added Products

In recent years farmers have been seeking ways to add value or extra income to their soybean and corn products. Many agencies and agricultural organizations have been working together to create local networks to produce specialty corn or soybeans. These specialty crops are usually grown and sold for a premium to a processor or to a company set up by farmers. Many value-added agriculture industries are being created in Iowa and range from corn ethanol plants to soybean processing plants that develop soy food products or other soybean products, such as oil.

Want to know what is the newest use for our corn and soybeans? Here are some Internet sites to visit:

- Iowa State University Center for Crops Utilization Research, www.ag.iastate.edu/centers/ccur/
- American Soybean Association, www.soygrowers.com
- Iowa Soybean Association, www.iasoybeans.com
- Iowa Soybean Promotion Board, www.iasoybeans.com/ispb/index.html
- Iowa State University, The Soy Page, www.agron.iastate.edu/soybean/soybean.html
- United Soybean Board, www.talksoy.com/Health/default.htm
- National Corn Growers Association, www.ncga.com
- Iowa Corn Growers Association, www.iowacorn.org/icga.htm
- Iowa Corn Promotion Board, www.iowacorn.org/icpb.htm
- Iowa State University Maize Page, maize.agron.iastate.edu/general.html

Surf the Web

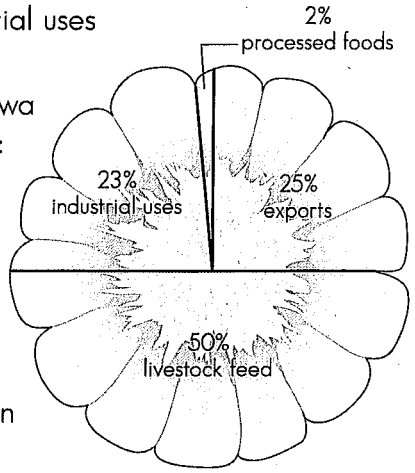
Check out the Iowa Soybean Promotion Board website at
www.iasoybeans.com/ispb/newuses.htm

or the Iowa Corn Promotion Board website at
www.iowacorn.org/newuses.htm

to find out more about new products made from soybeans and corn.

Fun Facts about Corn

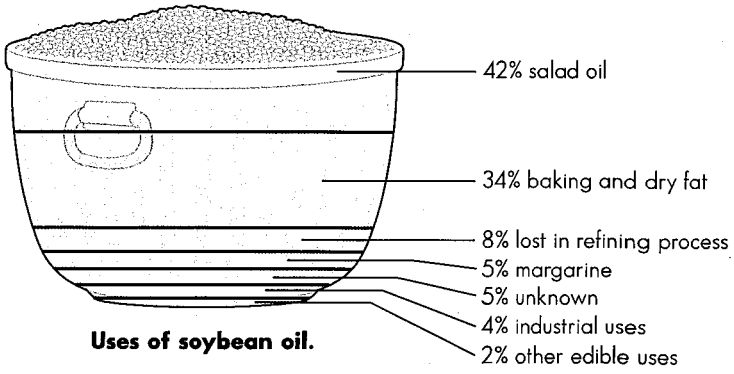
- Corn is made into food products such as breakfast cereals or chips. It also is used as sweetener in many foods including bakery products, catsup, ice cream, canned fruits, frozen desserts, and beverages. Because it is sweeter than table sugar, less of it is needed to sweeten foods. In acidic foods, like lemonade, it tastes sweeter than regular sugar.
- Corn starch is used to make plastic, paper, insulating materials, adhesives, chemicals, paint, paste, dyes, antifreeze, soaps, and many other products.
- Corn starches also can be fermented and used to make ethanol or alcohol products. Ethanol is used as a fuel additive in motor vehicles. To learn more about ethanol, check out the Iowa Corn Growers website. There also are many industrial uses for corn alcohol.
- One 56 pound bushel of Iowa corn can be processed into:
  - 32 pounds of starch or
  - 33 pounds of sweetener or
  - 2.5 gallons of ethanol/ alcohol,
  - 1.6 pounds of corn oil,
  - 11.4 pounds of protein gluten feed, and
  - 3 pounds of gluten meal.



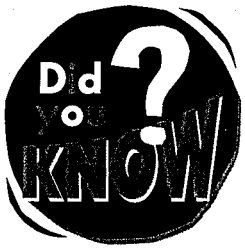
Uses of Iowa corn.

Your grocery store has almost 4,000 products that contain corn ingredients.

Did you know?

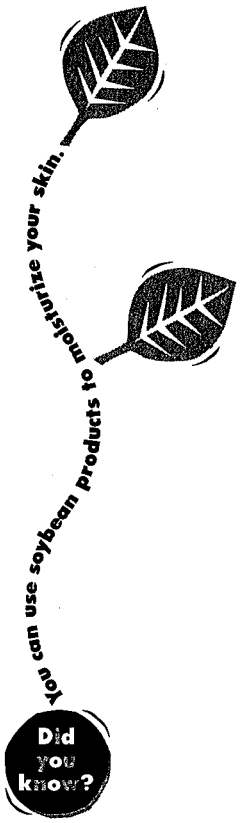


Uses of soybean oil.



Fun Facts about Soybeans

- Because soybeans have a high nutritional value, they can be used for human food. Processed foods or other materials made from soybeans can be found in most American homes.
- Of all the common seeds, soybeans are one of the richest in protein. They are highly prized as a protein feed for livestock. Soybean meal is made by extracting the oil from crushed soybeans, "toasting" the meal, and grinding it or making it into pellets. About 97 percent of all soybean meal returns to the farm as a protein supplement in livestock feeds.
- Soybean flour and related products are used for human food. Processes allow soybean protein to be spun or pressed into rope-like fibers. Then flavoring, coloring, and binders are added to create textured protein foods. Textured protein can be shaped into granules, cubes, or slices and flavored like beef, ham, bacon, or chicken. Nut-like and fruit-like products also can be created from soybeans. Because these foods take little meal preparation time, have a long shelf life, and have health benefits, they may be widely used in the future. If you are interested in learning more about how soybeans can improve your health, check out the United Soybean Board website.
- 50 percent of the soybeans produced in the United States are exported; 50 percent are used to make industrial and food products and to feed livestock.
- One 60 pound bushel of Iowa soybeans can be processed into 11 pounds of soybean oil and 48 pounds of soybean meal. Most soybean meal is used as livestock feed.



The Stages and Ages of Plants

CHAPTER 2

Let's Take a Look at Some Seeds

Seeds are the first stage of plants that we will look at. Without the seed we cannot have a new plant! By looking at the seed, you will find out some cool stuff and be able to recognize the type of plant that will grow from the seed. Farmers also need to know if seeds will grow and how long it will take from seed to harvest. There is a set amount of time in a summer; if the seeds don't grow, yields will be low.

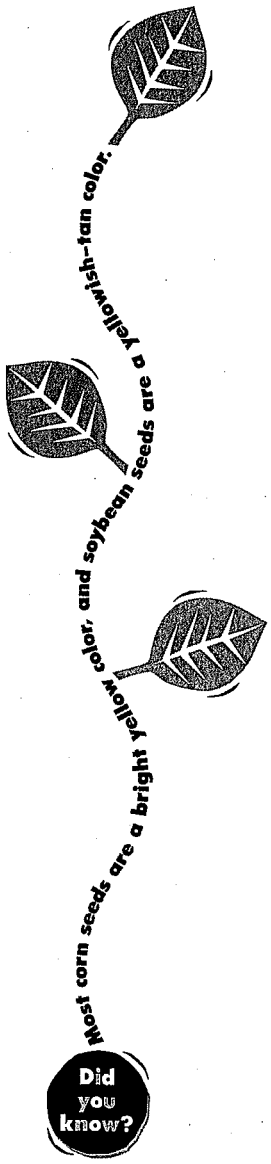
Farmer, Farmer, How Does Your Crop Grow?

If you are going to produce a crop, you will find it useful to know some things about the plants you are going to grow. Handling and the care of seeds is very important since you are depending on them to grow into mature plants that will produce more seed. You will learn how to identify seeds that are grown on Iowa farms and how to do germination (seed growth) tests to make sure the seed you have to plant will produce a good crop. You can even read more about seeds so you can become a corn and soybean seed expert!

By taking a look inside a seed, farmers are able to tell what type of plant will grow, and if the plant will be healthy. In this activity you will dissect some seeds and find out what's inside a seed.

Materials

Different types of seeds: beans, peas, peanuts, corn, wheat, or oats
Paper towels
Dish of water
Magnifying glass
Tweezers



1. Wrap the seeds in a paper towel.
2. Soak the seeds in water for two hours or over night. Soak more seeds than you will need to dissect.
3. After soaking, carefully unwrap the seeds from the towel.
4. Using the tweezers, carefully remove the coats from the beans, peas, or peanuts.
5. Start a chart that describes the differences between the seeds. What do they look like, smell like, feel like as you carefully take them apart?

Seed	Smell	Feel	Looks	Drawing

6. Draw and label the seeds on your chart, the outsides as well as the insides.
7. Find all the parts of a seed by using the information about corn and soybean seeds in the following More Neat Stuff section. Draw and label them here.

- Look at extra seeds that have not been soaked and dissected. What is the name of the plant for each of the seeds?
- With an adult, quiz each other for a review of the types of seeds.
- What are the differences seen between corn and soybeans, peas and oats? Add these to your chart.
- What part of the seed do you think gives the plants its food to grow?
- What part of the seed might become a root, leaf, or other part of the plant?
- What do you think is the function of the hard outer coating?
- What was the purpose of soaking the seeds?

8. Plant the left over seeds in a sunny spot to see what happens next!

Project or Exhibit Ideas

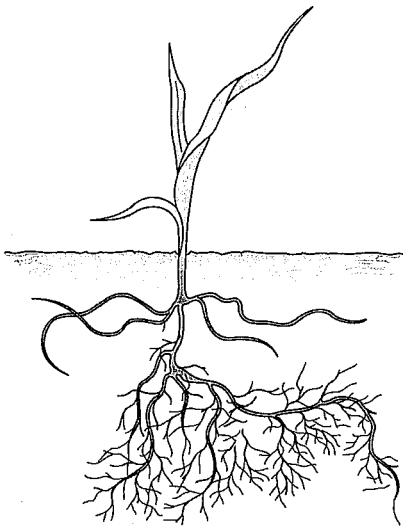
1. Keep a journal about the plants that you grew from your seeds. How do the plants change everyday? Draw or take pictures of your plants for record keeping. Keep track of the time during growth.
2. Make a poster showing the differences between types of seeds and the rate of growth of each.
3. Develop an interactive presentation showing others how seed grow into plants, starting from a tiny seed.
4. Develop an experiment trying to determine if seeds can be planted upside down, and create a comic book showing what you found.

Monocots

There are two different types of plants—monocot and dicot. The first we will look at is the monocot.

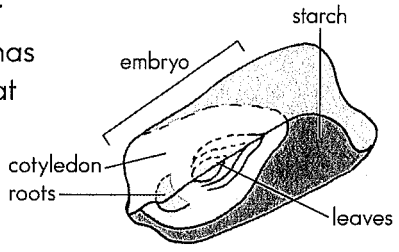
➠ Corn is an example of a **monocotyledonous** plant **(monocot),** which contains only one seed leaf called a cotyledon.

- Grasses are monocots and corn is a member of the grass family.
- Grasses are characterized by long, narrow leaves, with the base of the leaf, or leaf sheath, circling the stem.
- Grasses also have extensive, deep root systems.
- The flowers are small and grow in dense spikes or open, branching clusters called panicles.
- Some other members of the grass family are wheat, oats, sorghum, foxtail, and bluegrass.



Corn is an example of a monocotyledonous plant.

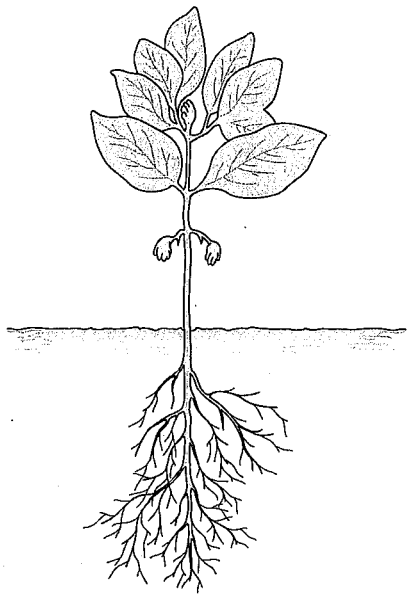
➠ The **corn seed,** or monocot, has three main parts: the seed coat or pericarp, the endosperm, and the embryo. Each of these three parts plays a certain role to produce a new corn plant.



A monocot seed (corn).

- The *pericarp* is a hard, outer coat that protects the seed from damage before and after planting.
- The *endosperm* provides food energy for the young plant until the first leaves appear.

- The *embryo* of the corn kernel contains the new root and five or six tiny leaves. When the seed is planted, it absorbs water, then germinates or starts to grow.



The soybean is an example of a dicotyledonous plant.

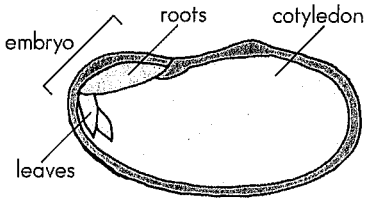
Dicots

The dicot is the second type of plant we will look at.

➠ Soybeans are examples of **dicotyledonous** plants (**dicots** for short) meaning they contain two seed leaves, or cotyledons.

- The soybean plant is a member of the legume family.
- Other common plants in this family include alfalfa, clovers, peanuts, peas, and beans.
- Legume plants are unique because they have nodules on their roots that contain *Bradyrhizobium* bacteria that can take nitrogen from the air and change it into a form of fertilizer for plants to use!
- Legumes also are high in protein, and their seeds always are formed in pods.

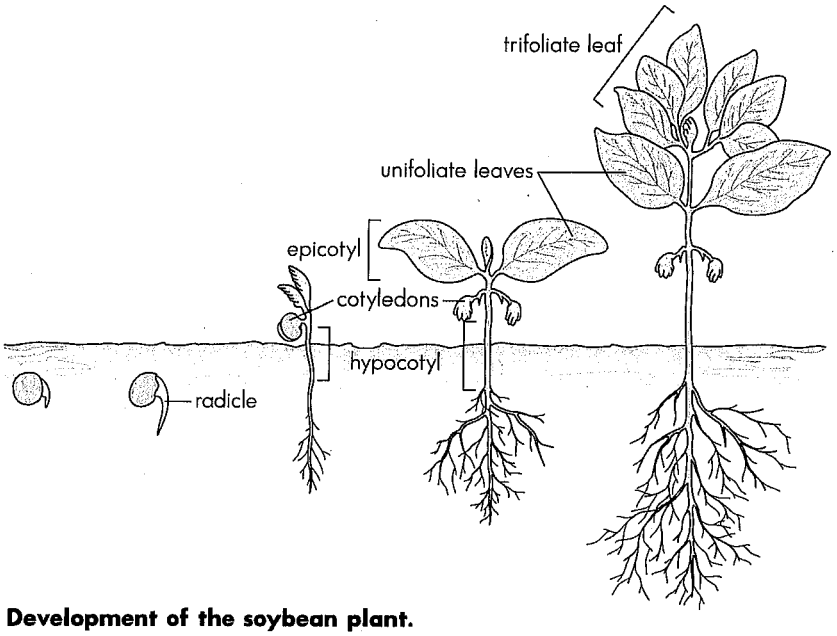
➠ A **soybean seed,** or dicot, has three main parts: the seed coat, the embryo, and two cotyledons.



A dicot seed (soybean).

- The *seed coat* protects the seed from fungi and bacteria that can attack the seed before and after planting. A cracked seed coat lowers the chance for the seed to develop into a healthy seedling.
- The *embryo* of the soybean seed is very important. It contains the first roots and leaves of the plant.
- The two *cotyledons* (each half) make up most of the seed. They provide food energy for the young plant for about two weeks during germination and early growth.

Can you now find other seeds and determine if they are monocots or dicots? As you travel around this summer, create a list of these plants.



Development of the soybean plant.

From Seed to Plant!

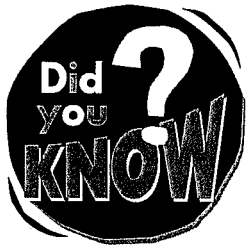
Seeds sprout and grow when they are placed in a warm, moist place. Moisture is absorbed through the seed coat of the soybean and the corn kernel, the seeds swell, and the seedlings begin to develop. It is important to know how well seeds will germinate, since this affects how many plants will grow in the field, after being planted. Not all seeds produce strong seedlings, so how can you tell if a seed will produce a plant or not?

If growing a maximum number of seeds in a field is important, how might you design an experiment to test for how many seeds will grow? This activity will help you do just that!

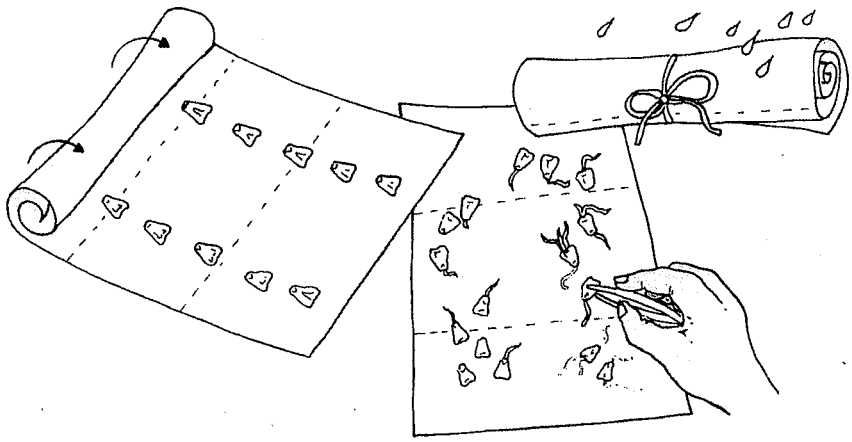
Materials

Paper towels
Water
Rubber bands
Seeds from the last activity that have not been soaked
Journal for recordkeeping

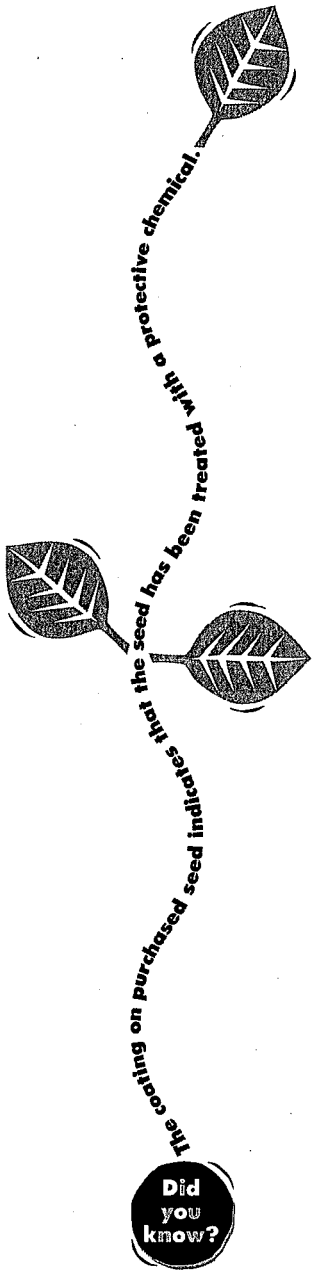
1. First, place two paper towels together.
2. Sprinkle water on them lightly, but do not soak them.



- *Bradyrhizobium* bacteria take nitrogen from the air and change it into a form that the plants can use. A natural fertilizer!
- If soybeans haven't been planted in a field for many years, a farmer should plant seed coated with the generic bacteria *Bradyrhizobium japonicum*.
- Purchased seed for corn may be dyed red, blue, or pink, and soybean seeds may be dyed red, purple, or green. Today's seed may even have multiple colors in the same bag. Often these colored seed coatings are protective chemicals.



A seed germination test.



3. Get a sample of seeds to test. What color are the seeds? Why do you think the seeds are different colors? Remember to wash your hands with soap and water after handling coated seed, because of the protective chemical coating.
4. Put 25 seeds on the moist towels without letting the seeds touch each other.
5. Moisten two more towels, and place them on top of the seeds.
6. Roll the towels and seeds loosely.
7. Put a rubber band around each end of the roll.
8. Stand the roll on end in a small container, and store it in a warm place.
9. Sprinkle the paper towels with water daily to keep them damp.
10. After 5 days, unroll the towels and count the number of seeds that have grown. In your journal describe what the seeds look like. How have they changed?
11. In your journal record the number that have grown.
12. Throw away the seeds that have germinated.
13. Roll the remaining seeds in the paper towels again.
14. Sprinkle water on the towel if necessary. Keep the roll moist.
15. Store it in a warm place for seven more days.
16. Unroll the towels.
17. Count how many seeds grew and record the number in your journal.

- Add the number of seeds that grew after the first five days to the number that grew after another seven days.

  Total: _____

- Divide this total by 25. Then multiply the result by 100 to get the total percentage of seeds that grew. When seeds grow after being in a dark, moist place, it is called *germination*.

  Percent germinated: _____

- **Here is an example:** If 12 seeds germinated in the first five days, and 8 more seeds germinated in the last seven days, then altogether, 20 seeds germinated. Divide 20 by 25, to get 0.80. Multiplying 0.80 by 100 gives a result of 80.

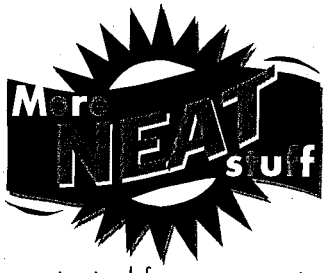
  Answer: In this example, 80 percent of the seeds germinated.

Project or Exhibit Ideas

1. Create a chart or poster comparing the germination rate of several different types of seeds.
2. Make a poster showing the parts of a germinating seed and the function of each part.
3. Write a short story about growing, from a seed's point of view.
4. Create an experiment about seed growth. What other factors might cause seeds to grow? Not grow? Try growing seeds in the sun, cold, or other places. Create a poster showing what happens to the seeds in different conditions.
5. Plant some of the seeds that germinated and some of the seeds that did not germinate. Keep a photo journal of your plants. Create a collage of your photos with descriptions of your procedures.
6. Draw the most unique-looking seed from your germination test.

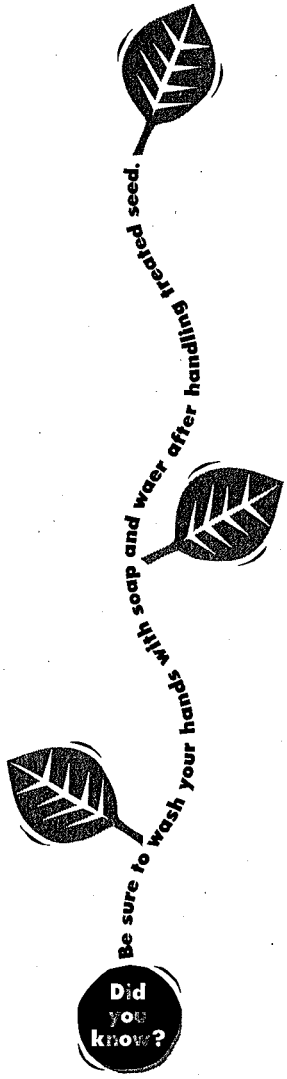
Try this with several kinds of seeds, and keep a record in your journal of what you find.

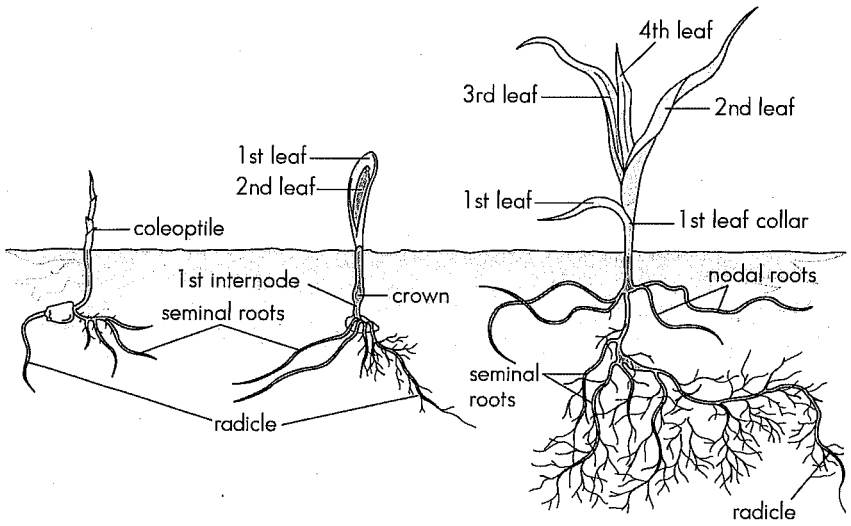
- Why do you think they are different?
- Why do you think it is important to know the germination rate?
- Who might need to know germination rates?
- How else could you determine germination rate?
- Why have the seeds been dyed with a colored material?



Germination and Emergence

- Too many weak seedlings in a field lead to a poor stand of live plants. Fewer live plants result in lower yields. When seeds are tested for germination, the seed analyst also counts the number of weak seedlings. The number of weak seedlings is subtracted from the number of seeds that germinated.
- Once the pericarp on corn absorbs water and swells, chemical changes take place in the embryo. The changes make the radicle (root) and the plumule (leaves) start to grow. The emerging leaves are enclosed in the coleoptile. Growth of the radicle is followed by additional roots called seminal roots. The seminal roots help anchor the plant and supply it with water until the nodal root system is fully developed. Until the nodal root system is developed, the plant lives on food reserves in the seed.
- The root systems on plants start developing at germination. The radicle is the first root. On corn, shortly after the radicle emerges, the seminal roots develop. Soon, both the radicle and seminal roots are replaced by a nodal or secondary root system. When corn reaches about 12 leaves, brace roots may grow above ground and enter the soil. Brace roots provide extra support and nutrients for the corn plant while it is forming ears.
- The radicle on a soybean plant develops into a taproot that grows down about 4 feet into the soil. The soybean also develops a dense, fibrous root system that fills the area between rows.
- It takes a week or two after planting for the corn seedlings to break through the soil surface. New plants then develop very rapidly. About one week after it appears above the soil, the new corn seedling should be well established.
- When the soybean seed germinates, the radicle, or root, grows downward, and the hypocotyl grows upward. The hypocotyl pulls the cotyledons with it toward the soil surface. The hypocotyl stops growing when it emerges through the soil. Then the cotyledons begin to spread apart to expose the epicotyl. The epicotyl produces the stems and leaves of the soybean. Refer back to the illustration on page 15 showing the development of a soybean plant.





Development of the corn plant.

How Do Plants Grow?

What happens when a seedling is damaged from hail or insects? Corn and soybean plants can normally recover from damage that occurs early in the growing season. If seedlings are damaged by insects, hail, or wind, regrowth can occur if the plants are not broken or cut below their growing points.

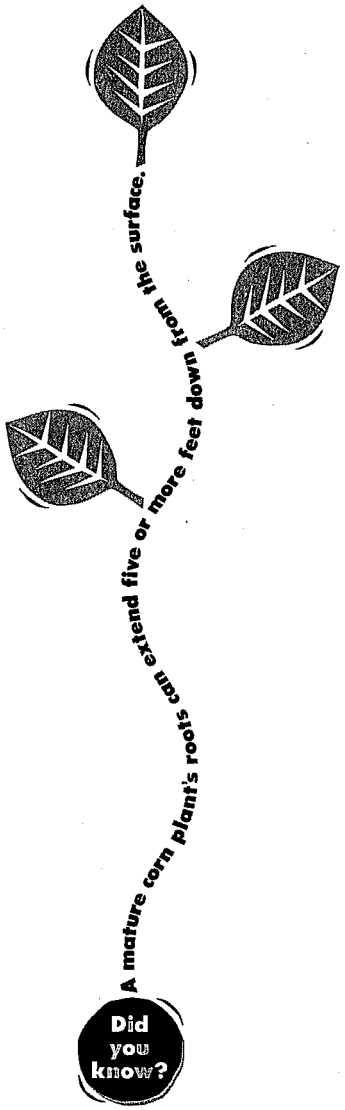
Corn plants have their growing point inside the stalk. This growing point usually is below the soil surface *(until approximately the six-leaf stage).* If the growing point is damaged or if the plant is cut below this point, the plant will die.

Soybean plants have an axillary bud between each cotyledon or leaf, and the stem. The bud will develop into stems if the upper part of the plant is damaged. If the top of the plant is not damaged, these buds may remain dormant and not develop, or may develop into branches or pods. If the plant breaks above the cotyledons, regrowth is likely to occur. However, if the plant breaks below the cotyledons, regrowth cannot occur.

From the activity below you can learn when plants can recover from damage and when they cannot.

Materials

Flowerbed or
Several milk containers
13 corn seeds and 13 soybean seeds



1. In a flowerbed or in several large containers (milk containers will work) plant approximately 13 seeds each of corn and soybeans. You will need 10 seedlings, so plant a few extra in case some don't germinate. Plant the corn seeds 4 to 6 inches apart and the soybeans about 2 inches apart.
2. Wait about 7 to 14 days until the plants emerge. **For the soybeans,** when the cotyledons have spread apart and you can see the epicotyl, cut five plants just below the cotyledons (check drawing on page 15 to find the cotyledon and epicotyl on your plants). Cut the other five just above the cotyledons. **For corn,** cut three plants at the soil surface when two leaf collars are visible. Cut three different plants at the soil surface when four leaf collars are visible. Cut the next three plants at the soil surface when six leaf collars are visible. Each time after you cut a group of three plants, slice the cut-off part of the stalks lengthwise down the center. Check to see if the growing point is present (a hand lens or magnifying glass may be required). Watch the remaining stems for 7 to 10 days to see if any regrowth occurs.
3. Observe how much the two groups of plants grow during the next 7 to 10 days.
4. How much did the plants that were cut below the cotyledons grow?

   _____ inch

   - Describe the regrowth on soybeans that were cut above the cotyledons.

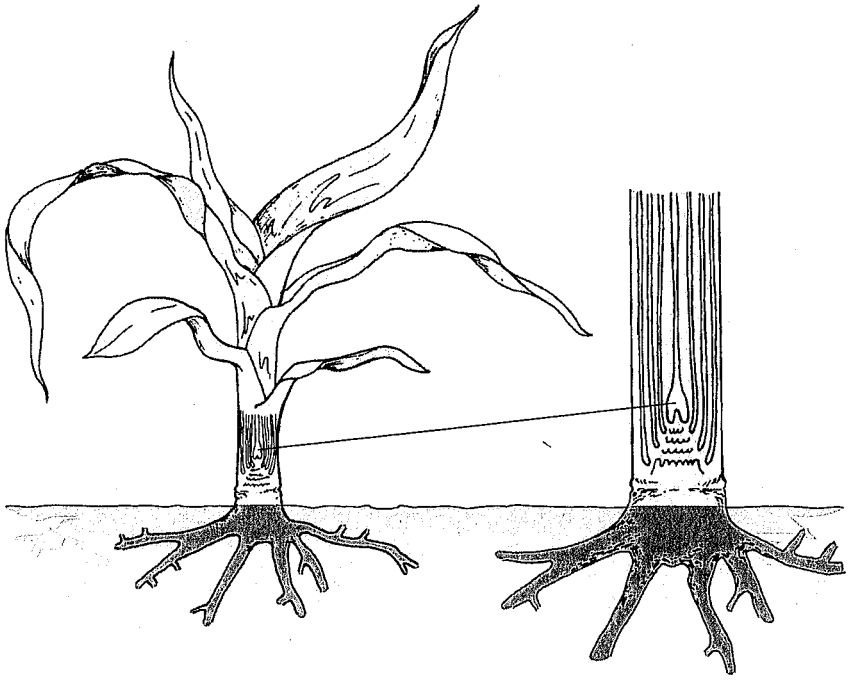
     _____
     _____
     _____
     _____
     _____
     _____

   - How much regrowth did you see in 7 to 10 days in the corn plants that were cut at the two-leaf stage?

     _____ inches or centimeters

   - Was the growing point present in the stalk when it was cut in half?

- Compare growth of the cut plants with the uncut plants. How were they different?
- Why did some plants regrow and others did not?
- Why is it important to know where the growing point is?
- How could a farmer tell if a plant will regrow or not?
- How would you expect other plants to regrow, such as oats or tomatoes? Why?



Location of growing point in a corn plant.

- How much regrowth did you see in 7 to 10 days in the corn plants cut at the four-leaf stage?

  _____ inches or centimeters

- Was the growing point present in the stalk when it was cut in half?

- How much regrowth did you see in 7 to 10 days in the corn plants that were cut in the six-leaf stage?

  _____ inches or centimeters

- Was the growing point present in the stalk when it was cut in half?

Corn Plant Growth

Vegetative Stage

Plant growth is divided into stages that are determined by counting the number of leaves. The first leaf in a corn plant is oval-shaped. Growth stages are counted upward from the first leaf. Look for the highest leaf that has a collar that you can see. Refer back at the illustration on page 19 to review how a corn plant develops. The collar is found at the base of the leaf next to the stem and indicates that the leaf is completely unrolled from the whorl. We don't count a leaf until we see the collar.

Project or Exhibit Ideas

1. Plant some soybeans and demonstrate what happens after a hail storm.
2. Draw a diagram of the cut-off corn stalks and show the growing point. Make this into a poster.

Corn on the Web

For more information on corn growth,
see Special Report 48, *How a Corn Plant Develops*, at

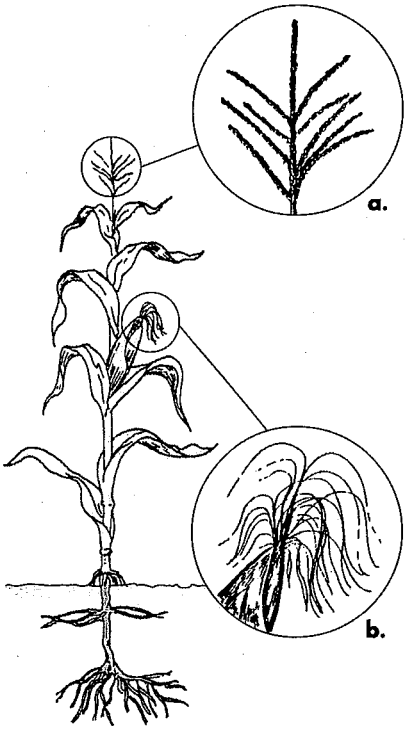
www.maize.agron.iastate.edu/corntitle.html

It also can be obtained from your county Extension office.

- By the time six leaf collars appear on a corn plant, the growing point will be above the soil surface, and the plant will start to develop rapidly. As the corn plant grows, the bottom six leaves will gradually tear away from the plant.

Reproductive Stage

- In mid-July to early August the tassels (male flowers) will appear. After the tassel spreads fully, it sheds pollen for five to eight days. Soon after you can see all of the tassel, silks appear on top of the ears (female flowers). The corn plant's ear is now ready to be pollinated. A plant must be pollinated to produce a crop. Pollination occurs in a corn plant when the pollen grains from the tassel fall on the ear's silks. The pollen grains grow down the silk, fertilize the ovules, and become kernels on the corn ears.



A mature corn plant.
a. Close-up of tassel.
b. Close-up of ear silks.

Mature Stage

- A mature corn plant develops 20 to 22 leaves, but only 14 or 15 leaves will be left on the mature plant. Corn is mature when the kernels develop a black layer at the tip of the kernel.
- Most of the corn grown in the Midwest is dent corn. The dent on the broad end of the kernel is formed when the soft endosperm (inner part of the kernel) dries and shrinks, causing a dent. After the corn plant is mature, the seeds will loose moisture down to about 15.5 percent, when it is ready to harvest.
- Find a corn plant. Can you tell what growth stage it is in?
- Check out an ear of corn. Are the kernels mature?

Beans on the Web

For more information on staging soybeans, get a copy of PM 1945, *Soybean Growth and Development*, from your county office of Iowa State University Extension or from this website,

www.agron.iastate.edu/soybean/beangrows.html

More NEAT stuff

Soybean Growth

Vegetative Stage

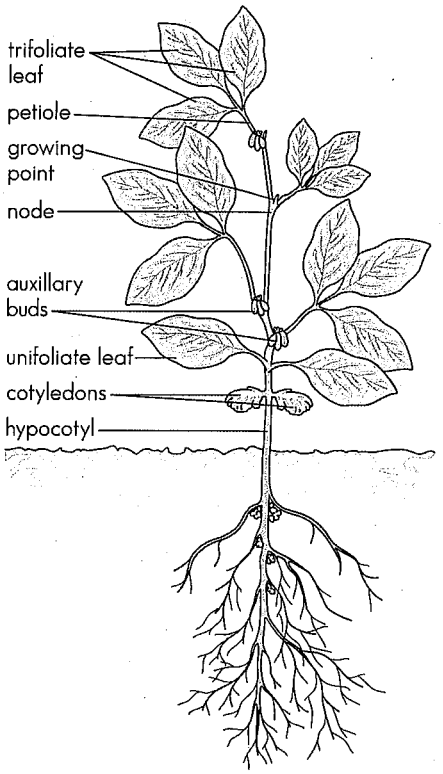
- Vegetative or plant growth of the soybean takes place after the cotyledons (seed leaves) appear above the soil surface and spread apart to expose the top part of the stem or epicotyl. The first true leaves that emerge from the epicotyl are two (single) leaves located opposite each other. All the other leaves that develop will have three leaflets.
- The leaves grow alternately on the stem. They grow out of buds. Buds may do one of three things: develop into a leaf, form a flower cluster, or remain dormant.
- Soybean plants continue to grow and will begin to produce flowers when summer day lengths become shorter.

Reproductive Stage

- After flowers appear, the soybean plant enters the reproductive stage. The flowers will form pods that contain the seeds. The soybean plant will still continue to grow until August, however the plant continues to move food from the leaves to the seed until late September. Before maturity, the seeds and pods lose their green color and turn yellow, and at maturity the plant and pods have turned brown. After maturity, seeds loose moisture to about 13 percent.
- Check out a soybean plant. What growth stage is it in?
- Check out those seeds. Are they mature enough to harvest?

Did you KNOW?

- Soybean plants have one of two different types of growth—indeterminate or determinate.
- Indeterminate varieties continue their vegetative growth until late in the season even while in the reproductive stage.
- The determinate varieties stop vegetative growth when flowering begins. Determinate soybean varieties are raised mostly in states south of Iowa. Any ideas why?



Main parts of the soybean seedling.

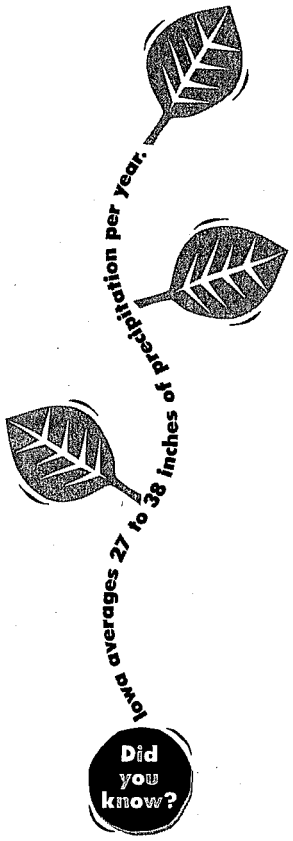
The Plant's World

CHAPTER 3

What Affects Crop Growth?

For crops such as soybeans, corn, and other crops there are many factors that affect how well a crop will do. If there is too much or too little rain or if a tornado passes through, a producer's field can be ruined. A farmer has little control over the weather. But a farmer can help nature by making sure the soil is healthy, by encouraging beneficial insects, and by discouraging damaging insects.

In this series of activities you'll see how you can test the soil so you know what nutrients your crops need, you will get to know some of the weeds and insects that can live in Iowa fields, and you will scout a field for weeds and insects to check how healthy your field is.



Good Soil = Good Crops

Plants are living things, and like you, they need good nutrition and a good growing environment. In this activity you will learn how to take soil samples and where to get your soil checked!

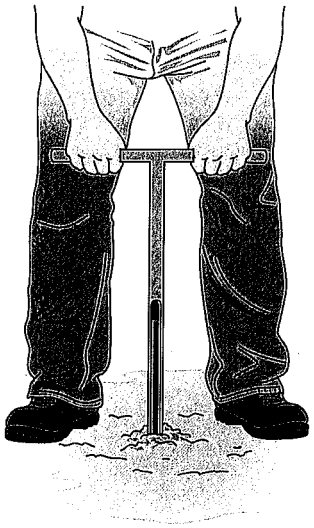
Having your soil tested is the best way to tell how healthy your soil is for growing plants. Based on the results of the test, you many need to add some type of chemical fertilizer, manure, or even limestone to your soil. In this activity, you will sample your farm's soil, and get it tested.

Materials

- Soil sample bags, information sheets, available at your county Extension office
- A soil probe, trowel, or spade
- A clean pail (don't use a galvanized pail if the sample is to be tested for zinc)
- A copy of the soil survey for your county available at Soil and Water Conservation District Office or public library

1. Check out the soil survey map. Find your farm on the soil survey and locate the fields where crops are grown. Write the types of soil found on your farm fields. List them here:

   Make a note of places you think would be good to take soil samples. Remember to sample soils from several areas.



Soil sampling using a soil probe.

2. Each sample should be from a uniform soil area of 10 acres or less. Take 12 to 15 separate 6- or 7-inch deep cores, borings or trowel slices in a zigzag pattern from the sampling area. Avoid sampling odd areas such as old livestock lots and lanes, old fence lines, fertilizer spill areas, and small field depressions. Also, do not sample within 100 feet of lime rock roads.
3. Place the cores, borings, or trowel slices in a clean pail, and mix thoroughly. Fill the plastic lined soil sample bag one-half to two-thirds full with the moist field soil. (If soil cores are taken, it is best if all the cores can be placed in the bag.) Identify and number the bag so you will know which field your sample is from.
4. Fill out the information sheet as completely as possible. Your parents or Extension staff can help you. Be sure to check on the current testing fee to include the correct payment.
5. Send samples soon after they are gathered to a laboratory certified in Iowa, such as the Iowa State University Soil Testing Laboratory, G501 Agronomy, Ames, Iowa 50011-1010. Results from your soil test will be sent to you in a few weeks. Doing this for others could provide a leadership component to your project.

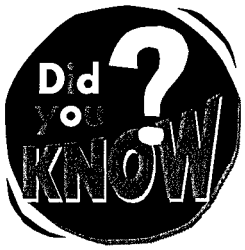
- How large was the field you sampled?
- How many samples did you send in to be tested?
- How many cores did you collect for each sample?
- Why is it important to collect many cores for each sample?
- Why is it important to mix thoroughly?

Project or Exhibit Ideas

1. Do a presentation on how to sample a farm's soil.
2. Volunteer to sample soil for nearby farmers.
3. Talk to your Extension crops specialists or crop consultant to learn about the results that the testing lab provided. Do the recommended applications and see if your crop yields are better or your income is affected.

Soil Testing

- Soil tests will determine the availability of the nutrients in the soil. The availability of nutrients relates to how fertile the soil is. The fertility level of the soil is one factor that determines how well crops will develop.
- You should have your fields soil tested about once every four years, preferably at the same time of year and following the same crop.
- The best time to sample is in the fall after harvest or in the spring before fertilizer or manure is applied.
- A soil test also should be performed on any field being cultivated for the first time.
- At Iowa State University, soil tests are available for phosphorus, potassium, and zinc. Tests also are available for organic matter and pH. Some laboratories test for other nutrients, but those are not calibrated or generally required for Iowa soils.
- A soil specialist uses the results of a soil test to tell what nutrients should be added to the soil to make up for nutrient deficiencies.
- Some other resources for soil testing are publication PM 1688, *General Guide for Crop Nutrient Recommendations in Iowa;* ST 8, *Soil Sample Information Sheet;* NMEP 1, *Soil Testing,* and PM 287, *Taking a Good Soil Sample to Help Make Good Decisions.* These can be ordered at your county Extension office.



- Modern technology like Global Positioning Systems (GPS) and Geographical Information Systems (GIS) allows farmers and fertilizer dealers to use strategies like grid and zone sampling. Grid sampling divides the field into squares or rectangles of equal size (grid cells). Each cell is mapped using GPS technology. Zone sampling divides a field into smaller areas or zones using farming history, aerial photographs, and yield maps. This new technology allows fertilizer and lime to be applied at a variable rate throughout the field, depending on yield maps and fertilizer and lime requirements. Are these new ways of taking soil tests being used by farmers and fertilizer dealers in your area?

- Plants require 17 nutrients to grow and reproduce. They are called the essential elements. These essential nutrients are supplied by soil, air, and water. The essential elements are divided into three groups—primary nutrients, secondary nutrients, and micronutrients. Carbon, hydrogen, and oxygen are supplied to plants by air and water. Fourteen nutrients are supplied by the soil. A shortage of any one of the 17 nutrients will affect crop growth and limit yields. Primary nutrients tend to be lacking more often than secondary nutrients.
- The primary nutrients include nitrogen, phosphorus, and potassium (N, P, and K).

Good Weather = Good Crop

Weather is the most important factor for successful crop production. Of all areas in the world, Iowa has the largest area of favorable soil and weather conditions for growing grain crops like soybeans and corn. The growing season and temperature conditions in Iowa are ideal for crop production. Also, the annual amounts of precipitation (rain and snowfall) and the ability of Iowa soils to hold water are ideal to supply crops, like corn and soybeans, with the water they need for growth throughout the growing season.

How much rain do you receive at your home each year? Is the rainfall uniform throughout your farm? Use the rainfall worksheet at the end of this book to measure how much rain you receive this growing season. Place rain gauges at several locations around your farm. Additional worksheets can be found on the computer companion.

Iowa's Weather

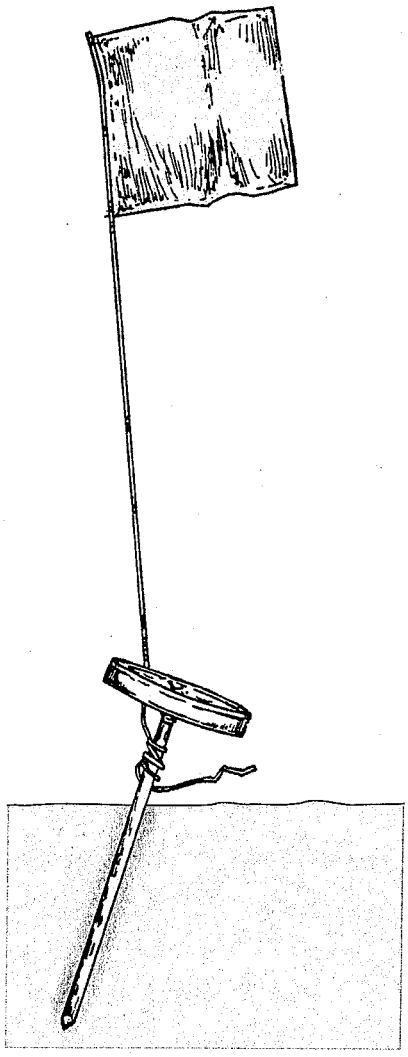
- Three major weather factors that affect crop production are:
  - precipitation,
  - air temperature, and
  - soil temperature.
- Too much or too little rainfall or temperatures too high or too low will cause stressful conditions for crops and may result in reduced yields.

- Was this year dryer than normal, or wetter than normal?
- How did that affect your crops?
- Was the rainfall uniform across your entire farm?

Project or Exhibit Ideas

1. Insert your rainfall worksheet into a notebook and also record other kinds of weather data. Make notes about how well your plants are doing as the weather changes.

The amount of rainfall Iowa receives during the growing season is still not enough to meet the needs of the growing crops. Fortunately, Iowa soils are capable of holding water from rain and snow in the fall, winter, and early spring (soil moisture), which makes the water available to plants throughout the growing season. Iowa soils can hold an average of two inches of water per foot of soil. Sandy soils hold less water, and clay soils may hold more. If soil moisture levels are normal or better at planting time, good crop yields can be expected.



Soil thermometer shown at the 4-inch soil depth. Point must be inserted at least 4 inches into the soil.

Warm Soils = Good Crops

Taking soil temperatures in the spring helps determine when to plant. Soil temperatures should be taken at the 4-inch depth. At this depth the soil temperature should be at least 50° F for both corn and soybean planting.* Soybeans are more sensitive to low temperatures so plant corn first.

Materials

Soil thermometer or steam table thermometer (get at a hardware store)
Piece of bright colored cloth on a wire (wire flag)

1. Begin taking soil temperatures around mid-April for corn and toward the end of April for soybeans.

   You have two options on when to take soil temperatures.

   Option 1: Take the soil temperature once a day between 10:00 a.m. and 11:00 a.m. This temperature will approximate the average daily temperature.

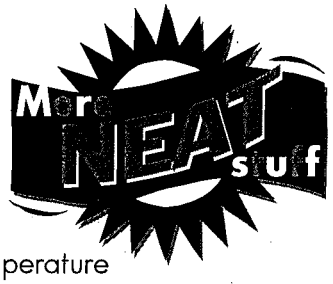
   Option 2: Take both the daily high temperature and the low temperature, then average them together. The daily low temperature should be taken two hours after sunrise and the high temperature between 4:00 p.m. and 5:00 p.m.

2. Walk into your field 50 feet or more from the edge. Place the thermometer into the soil so that the bulb (point) is 4 inches below the soil surface. Leave it there for two minutes until the temperature stabilizes. Read and record the temperatures on the soil temperature worksheet at the end of this book. Additional worksheets can be found on the computer companion.

*50° F = 50 degrees Fahrenheit (F)

- Which option for measuring soil temperature was easier for you to do? Why?
- Where did you test the soil temperature? How might location affect the temperature reading?
- From what other sources can you find the soil temperature?
- Why is soil temperature important?
- How does air temperature affect soil temperature?
- When was it warm enough to plant corn or soybeans in that field?
- What would you do if you had soil temperatures above 50° F in one field and below in another?

Soil Temperature!



- Soil temperatures affect crop growth at germination and during the early stages of development. Corn and soybeans will not germinate until the average soil temperature is above 50° F. Young plants grow faster at warmer soil temperatures. At cooler temperatures, crops grow more slowly and are more susceptible to disease and insect damage.
- Soil temperatures need to be considered in the fall before applying anhydrous ammonium fertilizer. Anhydrous ammonia is the only form of nitrogen (N) fertilizer that should be applied in the fall. The soil temperature at a 4-inch depth should be at least 50° F and getting cooler every day. If soil temperatures are above 50° F, ammonium fertilizer converts to nitrate forms of nitrogen. The nitrate forms can then be lost to the environment. If so, the fertilizer will not be available to plants. Use of a nitrogen "stabilizer" can help reduce the risk of nitrogen loss if soils warm to temperatures above 50° F after the material has been applied. It is preferable both economically and environmentally to apply nitrogen fertilizer in the spring, either before the crop is planted or during the growing season.
- The Late-Spring Nitrogen Test (LSNT) and Cornstalk Nitrogen Test can help a farmer determine how much N to apply.

Project or Exhibit Ideas

1. Check an almanac to see the recommended planting date. How does this date compare to the results of your data?
2. Compare the soil temperatures to the soil types found on your farm (see the activity on testing your soil).
3. Record temperature for all soil types and create a poster showing the differences.
4. Attempt to plant some seed when the temperature is below 50° F. Record the results and present to your club.

Pesky Pests = Poor Crops

Crop plants, whether they are grown in a field or garden, have natural enemies—weeds, insects, and diseases. Crops must be protected from these enemies if you are to produce the best yields.

A modern pest management technique involves first scouting your crops to see if pests are present. If they are present, pests must be identified. Next, you must determine if the pest problem is bad enough that control is necessary.

When there are enough pests present to reduce yields, pests need to be controlled. This amount of pest population is called the economic threshold level. When the economic threshold level has been reached, you must select the best control methods. Economic thresholds are different for each crop, stage of plant growth, and level of pest problem. To learn more about economic thresholds, visit with your Extension crops specialist.

Materials

1 or 2 gallon-size container(s) with soil from each of your fields
Plastic wrap to cover the top(s) of the container(s)

1. Collect soil from different fields, and put each sample into a separate container. Put the container of soil in a place where it is exposed to the sun. Make sure the container is watered thoroughly so the soil stays moist to the touch. Cover the top with plastic wrap. Observe it for several weeks.
2. Record the following information on a weekly basis.

Date	Weather	Drawing of Seedling(s)	Number Found	Seedling Growth

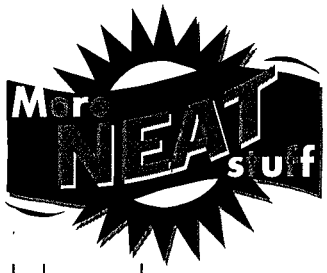
3. After the plants are grown, you can attempt to identify them using the ISU Extension website or a weed identification book from your library. Write the name of the plant. Determine if it is a weed species and if it is an annual, biennial, or perennial (definitions are found on the next page).

4. Find out by asking nearby farmers or your mom or dad if these weeds are usually a problem in your fields. Ask them what they do to control the weeds. Check the website www.weeds.iastate.edu/weed-id/weedid.htm for more information.

Project or Exhibit Ideas

1. Create a display showing the three different types of weed life cycles.
2. Compare the similarities and differences between annual weeds and perennial weeds and in various fields with various soil types.
3. Develop your own weed ID booklet with pictures of the weed as a seedling and mature plant.

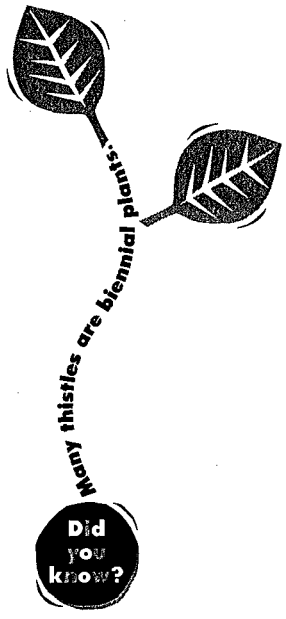
Outsmarting Weeds



Weeds that are the most troublesome in a field generally have a life cycle similar to the crop being grown in the field.

- **Annual plants** complete their life cycle in one year and spread only by seeds.
  - **Summer annual plants** start to grow in the spring, flower in spring or summer, and produce seeds before dying in the fall. Corn and soybeans are both summer annuals, as are most of the weeds that are problems in corn and soybean fields in Iowa.
- **Biennial plants** take two years to complete their life cycle. Because the plant is in the ground for two seasons, a biennial weed will not be a problem in a field that is tilled at least once per year. Herbicides (chemicals that control weeds) are most effective on biennials when applied in spring and early summer of the first year.
- **Perennials** live several years.
  - **Simple perennials** spread only by seed and are killed by tillage. Dandelions are simple perennials.
  - **Creeping perennials** not only spread by seeds; they also spread by means of buds on underground stems or roots. Unlike simple perennials, creeping perennials are able to survive tillage operations. The grass in your lawn is a creeping perennial, as are strawberries. Canada thistle, quackgrass, and wirestem muhly are creeping perennial weeds.

- Where did you find pictures of your weeds?
- Is it easier to identify weeds as seedlings or mature plants?
- Compare the plants found in one field to the others. How were they alike and how were they different?
- In what field do you think you will have the most trouble with weeds?
- Were weeds more of a problem in crops with a similar growth pattern or different growth pattern?



Bug Eye'd

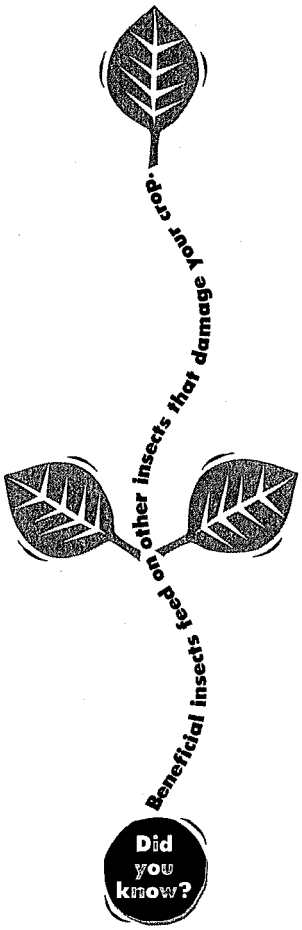
Many insects attack corn and soybean plants throughout the growing season. Several other insect species attack or live off the insects that damage plants; they are considered to be beneficial insects. Many insects found in crops are beneficial.

Before you can tell if a bug is good or bad for your plants, you need to learn some basic identification skills about bugs. In this activity we will check out resources to find out what are some problem insects in our corn and soybean fields. In another activity we will learn the life stages insects go through.

Materials

An insect book, Extension publication, or the Internet to help with this activity

One Internet site to use is www.ipm.iastate.edu/ipm/icm/



❶ Using the books and/or Internet site, list some insects harmful to corn and soybeans and information about them.

Harmful Insect's Name	
Drawing	
Where Damage Is Found	
How to Control Them	

❷ Using the information on page 34 on insect life cycles and one of the books or Internet sites, find the following:

- An insect pest of corn that goes through gradual metamorphosis._____

  What stage of the insect feeds on the crop? _____
- An insect pest of corn that goes through complete metamorphosis._____

  What stage of the insect feeds on the crop? _____
- An insect pest of soybeans that goes through gradual metamorphosis._____

  What stage of the insect feeds on the crop? _____
- An insect pest of soybeans that goes through complete metamorphosis._____

  What stage of the insect feeds on the crop? _____

- What resources can you use to identify insect pests?
- What did your resource tell you about when to control these pests?
- List at least three reasons why it is important to know what stage the insect is in when it feeds on the crop?

Project or Exhibit Ideas

❶ Draw the life cycle of one of your insects.

❷ Make a poster showing insect life cycles.

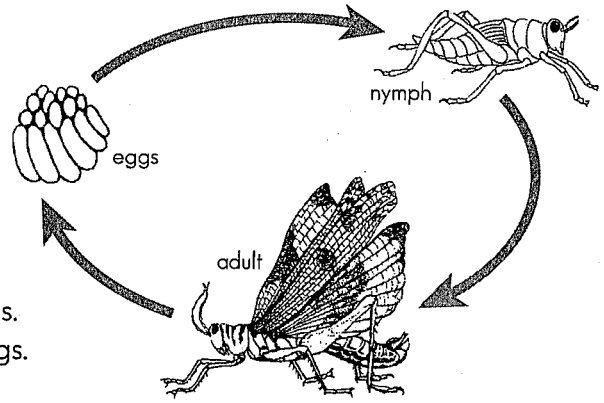
❸ Create your own insect identification booklet.

❹ Scout your own field or garden for insect damage. Find out what insect is causing the damage and how to control that insect.

Insect Life Cycles

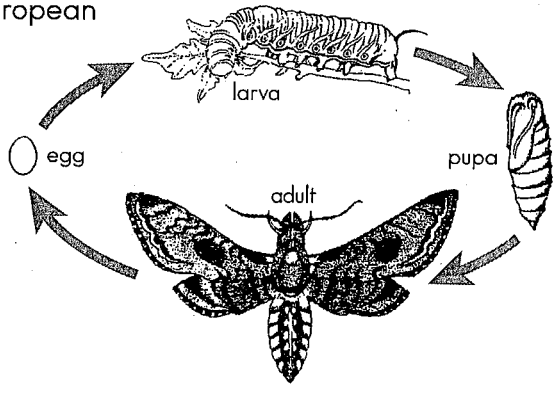
All insects change in shape, form, or size during their life. This change is called metamorphosis. It may be gradual, involving little more than an increase in size, or it may be a very dramatic change in which the adult looks very different from the young.

In gradual or incomplete metamorphosis, the insect that hatches from the egg is essentially a miniature adult. The young insect is called a nymph. The nymphs do not have wings and go through several growth stages (called instars) before becoming an adult with wings. Adults then lay eggs. Grasshoppers are an example of an insect that undergoes gradual metamorphosis.

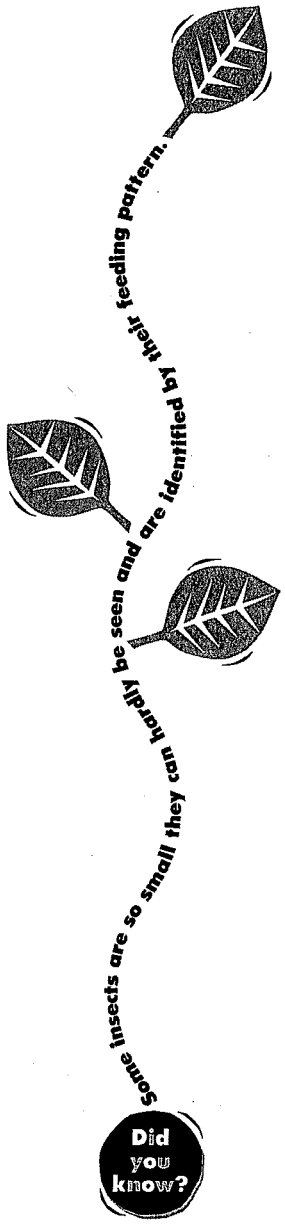


Gradual metamorphosis.
From IC-445 Iowa Core Manual, A Study Guide for Commercial Pesticide Applicators and Handlers, page 145.

In complete metamorphosis, there are four distinct life stages: egg, larva, pupa, and adult. A larva hatches from an egg. The larva may be called a caterpillar, grub, or maggot. People also often call the larva a "worm" and "borer." The larval stage is when many insects do the most damage. When full grown, the larva changes into a pupa, such as a cocoon in the case of a butterfly. During the pupa stage, the insect changes into its adult form. Adults usually have wings. Besides butterflies, other insects that have complete metamorphosis are mosquitoes, houseflies, black cutworms, European corn borers, corn rootworms, and bean leaf beetles.



Complete metamorphosis.
From IC-445 Iowa Core Manual, A Study Guide for Commercial Pesticide Applicators and Handlers, page 146.



Planting Plans

CHAPTER 4

Planning

Before planting corn and soybeans you must determine:

- the type and amount of tillage needed,
- the ideal planting date,
- the best planting depth,
- plant population, and
- row spacing based on the seed variety and weather conditions.

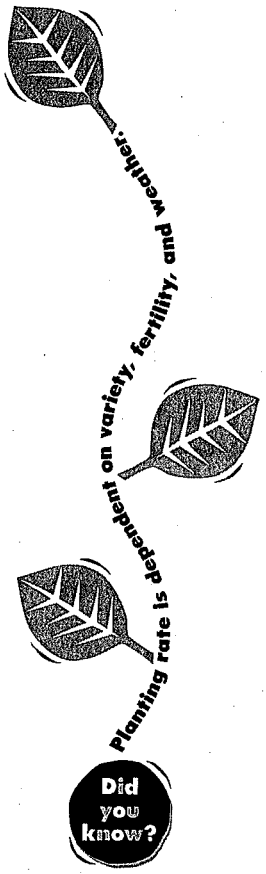
For corn and soybeans to germinate and grow successfully, they must be planted in soil that is warm and moist.

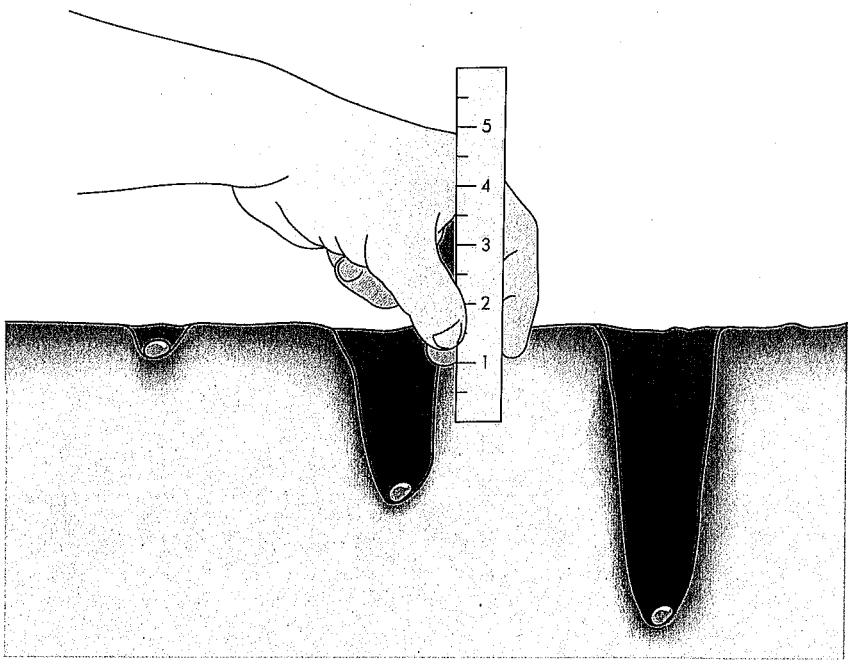
Not Too Deep!

Materials

Select three or four different kinds of seeds. Obtain one or two large kinds (corn and soybeans) and one or two small kinds (tomato or carrot).
Flowerbox, box, or milk cartons
Labels
Paper and pencil to record information

1. Plant 10 seeds at each of three depths—about 1, 3, and 5 inches deep in the soil.
2. Label the containers with the kinds and depths.
3. Record the number of plants that emerged (popped out) for each crop and planting depth in the table on the following page.



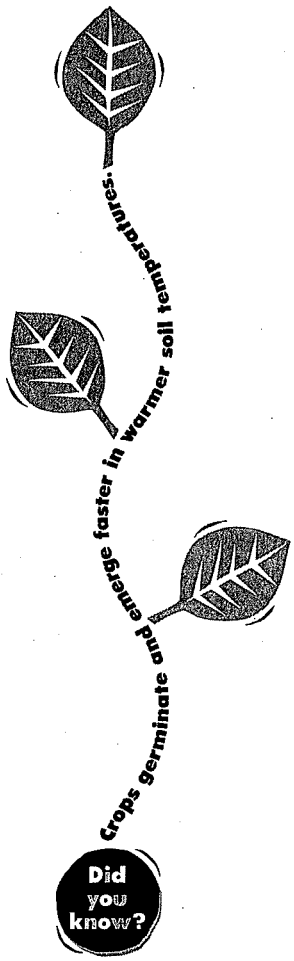


Seeds planted at 1-, 3-, and 5-inch depths.

Comparison of number of plants emerged at each depth:

Depth of Planting	Crop 1 Planted	Crop 2 Planted	Crop 3 Planted	Crop 4 Planted
1" Deep				
3" Deep				
5" Deep				

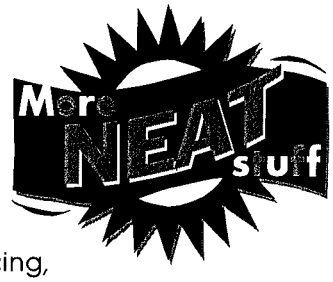
- Which crops emerged best at the shallow planting depths?
- Which crops emerged best at the deeper planting depths?
- Why do you think that happened?
- What do you know about crop growth that helped you estimate which depth was ideal?
- How deep will you plant similar seeds to get the best emergence?



Project or Exhibit Ideas

1. Make a poster comparing planting depths and emergence of various seeds.
2. Create a display showing ideal planting depths for various seeds, and share at the garden center.

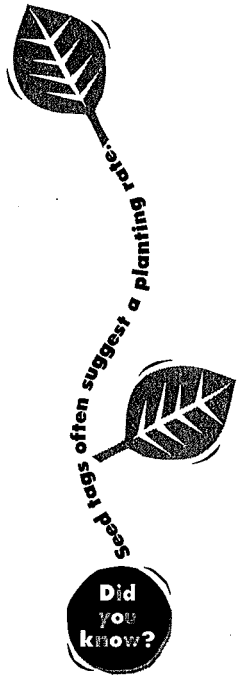
Stand Affects Yields



Plant population (the number of plants per acre) is called a plant stand. This plant population will have an effect on final crop yields. Some of the factors that affect plant population include planting rate, planting depth, row spacing, and uniform seed spacing.

In order to get high yields a farmer must plant enough seeds for a good stand so that when they start to grow they cover or shade the soil beneath them. This is very important so that weeds won't grow and compete with crops for available nutrients and moisture. Corn yield is very dependent on plant population, but soybean plants have the ability to branch out so they are less dependent on plant population.

On the other hand, plant stands with too high a population may result in lower yields because the plants will become tall, weak stemmed, and lodge or bend. Very high corn populations may not pollinate properly and could produce fewer kernels per ear. This also makes harvesting the crop more difficult and more of the crop may be left in the field.



Careers

CHAPTER 5

Opportunities Galore

You'll find plenty of career opportunities related to crop production. In fact, there are so many careers that it is hard to think about or list them all.

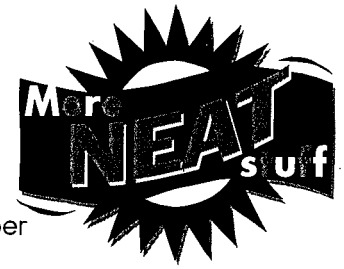
What Can I Do?

Think about someone you know who works with crops, and ask that person if you could visit with him/her about the job. Ask about the following and record in your journal.

1. What are the main duties of this job?
2. How many hours per week do you work? Are they the same all year long?
3. What type of education is needed for this job?
4. How often does this job involve working with people, objects, information, animals, or plants?
5. What advice would you give me about your career choice?

- What would you like most about this job?
- What would you like least?
- If you had this kind of job, what type of friends might you develop through your job?
- How might this job affect your future family?
- What are some similar career ideas that might require the same education or training?
- What are some other career ideas you would like to learn more about?

Cool Crop Careers



It's really cool that people interested in crop production are working to:

- protect natural resources
- help people and communities prosper
- conduct scientific research
- produce and distribute food and fiber
- grow and nurture plants
- help businesses develop
- promote and market products and services
- design and test buildings and machines

Below are a number of careers you might think about doing. Match what you like doing with the category of careers that includes activities that you like.

Careers Working with Buildings and Machines

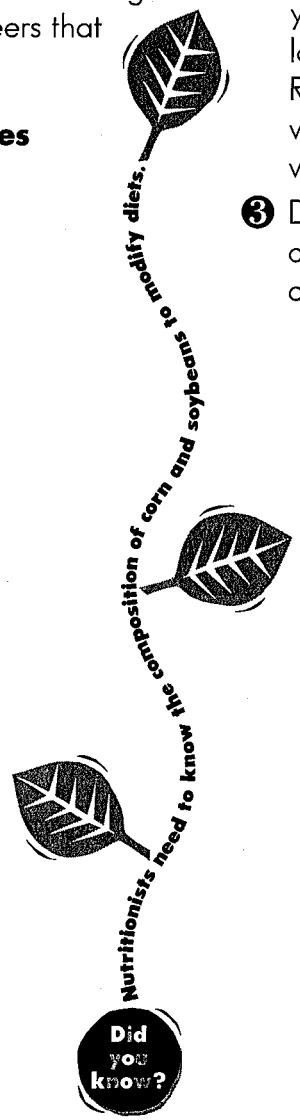
- Agricultural engineers
- Customer support technicians
- Elevator manager
- Experimental mechanic
- GPS technician

Careers Working in Business

- Accountant
- Advertising agent
- Business manager
- Ag loan officer
- Commodity broker
- Computer systems analyst
- Farm management consultant
- Insurance agent
- Technical service representative

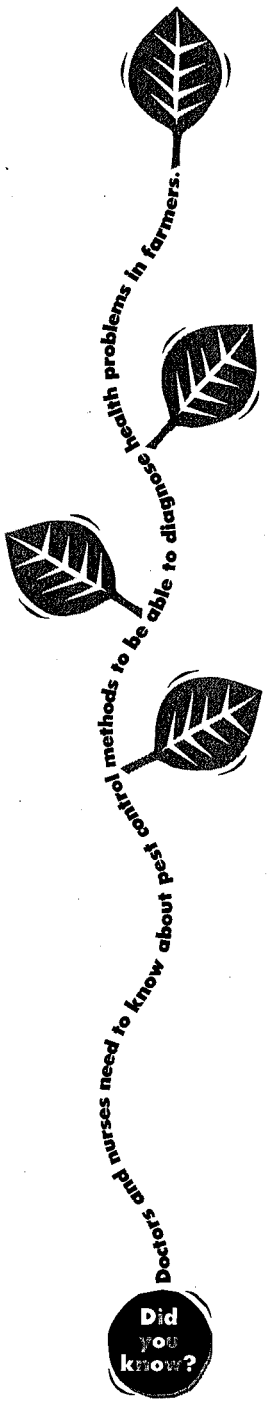
Careers Protecting the Environment

- Conservation officer
- Entomologist
- Environmental engineer
- Horticulturist
- Plant pathologist
- Soil scientist



Project or Exhibit Ideas

1. Write a report about this career option.
2. Draw a picture of what you and your family would look like in this career. Remember to think about where you live, who you work with, etc.
3. Develop a poster to recruit other 4-H'ers to learn about careers in agriculture.



Careers Working with Food

- Nutritionist
- Food technologist
- Grain merchandiser
- Microbiologist
- Recipe modification specialist

Careers Working with Health Professions

- Biochemist
- Doctor
- Geneticist
- Nurse
- Pharmacist

Careers Working with Plants

- Agronomist
- Chemist
- Crop scout
- Crop utilization specialist
- Grain farmer
- Pest management specialist
- Plant pathologist

Careers Working with People

- Advertising executive
- Agricultural educator
- Ag journalist
- Communication specialist
- Extension educator
- Market analyst
- Plant health care provider
- Sales representative

Careers Working in Science

- Agronomist
- Chemist
- Entomologist
- Food scientist
- Natural resources technician
- Plant physiologist
- Soil scientist

If you are interested, find out more about what some of these professions do. You may be surprised how many people with these careers are in your community!

Crop Rainfall Worksheet

Name _____

Address _____

Township and Section Number _____

Rainfall Record

To measure rainfall you will need a properly located standard rain gauge. Record rainfall daily at about 7:00 p.m. If it rains during the night, read your rain gauge early the next morning and add that amount to the previous day's total. Keep up to date with weekly totals and total rainfall to date.

Snow should be recorded as water equivalent. Eight inches of wet snow and twelve inches of dry snow both equal one inch of water.

Do not let water freeze in your gauge or it will be damaged!

IOWA STATE UNIVERSITY
University Extension

Rainfall Record for 20_____

Day	April	May	June	July	August	September	October
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
Total							

Total for 7 months equals _____

Crop Soil Temperature Worksheet

Name _____

Address _____

_____

Township and Section Number _____

_____

Soil Temperature Record

Soil temperatures should be taken at the 4-inch depth. Begin taking soil temperatures in early April to early to mid-May to determine when to plant. They also can be taken in the fall beginning the 10th of October until mid-November for application of ammonium fertilizer.

Date	A.M. Soil Temperature	P.M. Soil Temperature	Average Soil* Temperature

Date	A.M. Soil Temperature	P.M. Soil Temperature	Average Soil* Temperature

* Note: If you are taking soil temperatures once a day between 10 a.m. and 11 a.m., record this in the Average Soil Temperature column. If you are taking temperatures twice a day, list them in the appropriate columns. Then add the a.m. and p.m. temperatures for each day together and divide by 2 to get the Average Soil Temperature.

IOWA STATE UNIVERSITY
University Extension

Authors

Denise L. Schwab, ISU 4-H Youth Development Specialist
Judy Levings, ISU 4-H Youth Development Specialist
John Creswell, Retired ISU Extension Crop Field Specialist

Acknowledgments

Iowa Soybean Promotion Board, Funding to Develop and Design the Curriculum
Chuck Morris, Interim Director, ISU Extension 4-H Youth Development

Advisory Committee

Linda Engelken-Fischer, Benton County Extension Education Director
LuAnn Johansen, ISU Extension 4-H Youth Development Field Specialist
Paul Kassel, ISU Extension Crop Field Specialist
Michael Owen, ISU Extension Weed Management Specialist
Virgil Schmitt, ISU Extension Crop Field Specialist
Denise Schwab, ISU Extension 4-H Youth Development Specialist
David Wright, Director of Production Technologies, Iowa Soybean Association

Reviewers

Michael Owen, ISU Extension Weed Management Specialist
Palle Pedersen, ISU Extension Soybean Specialist
Marlin Rice, ISU Extension Entomologist
Greg Tylka, ISU Extension Plant Pathologist
Wendy Wintersteen, Associate Dean, ISU College of Ag

Creative Team

Cover Photography: Steven Hart, ISU Extension Communication Specialist/Videographer
Illustration: Mike Meyer, Wilderness Graphics
Graphic Design: Mary Sailer, Spring Valley Studio
Editing: Carol Ouverson, ISU Extension Communication Specialist

Adapted from the 1995 edition of 4-H 381, *4-H Crop Project Guide*, published by Iowa State University Extension.

IOWA SOYBEAN PROMOTION BOARD

PRINTED WITH SOY INK

IOWA STATE UNIVERSITY
University Extension

To find out information about careers in this field, please click on this link:

http://admission.wsu.edu/academics/fos/public/field.castle?id=7658

I'm a 4-H Project Leader: Now What Do I Do?

How do I know who is in my project?

- Your club organizational leader will provide you with the names, addresses and phone numbers of the members enrolled in the project for which you are the leader.
- If you are working on the county level, contact the UCCE for the list of project members.
- The organizational leader may indicate to you if any of the youth have special needs. At your first project meeting, note any other youth that may have special needs.
- You may wish to consult with the parent or your 4-H Youth Development Agent as to how to work with a special needs child.

How often should I hold project meetings?

It is recommended you hold 4-6 meetings that each last 1½ to 2 hours in length. Some projects require more meetings or a longer meeting time to accomplish your goals. Some projects, such as leathercraft, may lend themselves to individual project work as members progress on their projects. In this case, you should hold several introductory meetings for all members and then set up a schedule of time for them to sign up for individual help.

When do I start?

Get started as soon as possible! Members' interest in a project is most keen when they are signing up for a project and when they get their project books.

How do I cover the cost of project meetings?

- There is a wide variety of means for covering the cost of project meetings. Some methods used include:
- Each member pays for their share of the expenses or provides a portion of the supplies.
- The club agrees to cover expenses using funds from their treasury. Approval in advance is needed for this.
- Members and leaders can solicit donations/supplies from area businesses.
- Sometimes funds from sources outside your club may be available to cover your project meeting costs.

How do I establish a project meeting schedule?

First, determine when you are available to work with project members. Then determine an initial project meeting date by consulting with your project members.

Thanks to 4-H Youth Development Programs, UW-Extension, Cooperative Extension for use of these materials.

Publicize the date using one of the following means:

- County and/or club newsletter
- Club meeting or leader association meetings
- Postcards or phone calls to project members

You may not be able to schedule an initial meeting that everyone can attend. Establish a time to meet with those unable to attend before you hold your second project meeting.

Where do I hold project meetings?

Typically project meetings are held at project leader homes, schools, or community buildings. For more information on facility adaptability and liability concerns contact your 4-H Youth Development Agent.

What safety precautions do we need to consider?

Consider the type of safety issues your particular project involves. Request and secure necessary safety items such as ear protection, eye protection and head protection.

How do I let others in my club or other clubs know I am a project leader?

Prior to enrollment ask for time on your club's meeting agenda to let families in your club know you're a project leader and to share some things the kids could do in the project if they enrolled in it. When the project materials are handed out, take the opportunity to inform or remind members that you are their project leader and set an initial meeting date with the group. If no one in your club is in your project, you may wish to offer your services to a neighboring club. Talk to your club organizational leader or county 4-H Youth Development agent about this opportunity.

How do I prepare for the first meeting?

You may want to establish a 4-H resource box where you keep your project materials and any additional resources you will be using. Take time to become familiar with your project literature and talk to others who were project leaders for this project to find out what activities the members enjoyed.

What should I do at the initial project meeting?

- At the initial project meeting, here are some ideas of what you might want to cover:
- Find out what the members want to learn and accomplish in the project. The project literature is an excellent source of ideas.
- Review the safety practices that members will need to follow.

Thanks to 4-H Youth Development Programs, UW-Extension, Cooperative Extension for use of these materials.

- Do an introductory activity related to the project so the members get to know one another
- Have a small project the members can complete and take home
- Talk about how the project meeting supplies will be paid for. Experienced leaders have found it easiest to charge a small fee to cover the cost of the expenses.
- Assess when members are available for additional meetings. You may wish to ask the parents or members to bring along their calendars of family activities.
- Encourage parents to participate in project meetings, especially the initial meeting.

What does a typical project meeting look like after the initial orientation?

Use the experiential learning model (found in the introductory pages of your Helper's Guide) to plan your project meeting. The project helper's guide will provide suggestions for designing a project meeting. Here are some suggestions for each section of the model:

Do

- Plan an activity to focus the project members on what they'll be doing today. Work on the project for that meeting.

Reflect

- Review the process completed
- Discuss what worked and didn't work.
- Talk about how any problems that arose were solved.
- Assist members in documenting their project work for inclusion in their record books/portfolios.

Apply

- Ask the project member the following questions:
- What else have you seen that is similar to this?
- How can you apply what you learned today to other situations?

What resources are available to help me?

- 4-H Project Literature – You will receive project literature through your 4-H club or the UW-Extension office. Typically there is a helper's guide and member literature for three to four levels.
- Other People in my Club & County – There are a number of people in your county who would be willing to share project ideas and tips with you.

Thanks to 4-H Youth Development Programs, UW-Extension, Cooperative Extension for use of these materials.

These include:

- Project leaders in other clubs
- County Staff
- Older youth who have been involved in the project

- Media Collection & Public Libraries – Additional resources can be obtained from the Cooperative Extension Media Collection. They have videos, skillathons, displays and resource packages available to support a variety of projects. There is a user fee per item you or your club will be responsible for. You can view their catalog at their website http://www.uwex.edu/ces/media/. Check with your local public library to find out what resources they may have or that you can obtain through inter-library loan.
- 4-H Website – Wisconsin 4-H is continually adding more information and activities to their website. Visit this site at www.uwex.edu/ces/4h/onlinepro/. You may wish to check out websites from other state 4-H programs also.
- Volunteer Leaders Conferences – Review each issue of your county's newsletter to learn about training sessions for project leaders offered by your county, district or at statewide events. Sessions focusing on new project literature are typically offered at the State 4-H Volunteer Leader Conference held every other year. Periodically statewide conferences focusing on specific project areas are offered in addition to sessions at the volunteer conferences. You can also exchange ideas with other leaders at statewide Field Day.
- Field Trips – Youth always enjoy the opportunity to see firsthand how things are done and how they work. Consider taking your project group on a field trip or tour of a local business or company to enhance their project experience. An example would be taking your dairy members to a cheese factory or your foods group to a local bakery.
- Local Experts – Bring in a local "expert" to share their ideas and experiences with your group. One example would be asking a Master Gardener to share information on choosing perennial or trimming shrubs at one of your project meetings.
- Magazines – Many leaders have found creative ideas to supplement those in the project literature in magazines they have or those at the public library.

Thanks to 4-H Youth Development Programs, UW-Extension, Cooperative Extension for use of these materials.

How can I incorporate activities not included in the project guide?

We encourage you to use the ideas in the project literature as they have been successfully used with youth. If you have some additional activities you would like to incorporate, consider the following criteria:

- Of interest to kids
- Developmentally appropriate
- Incorporate the experiential learning model
- Youth and adults are involved in determining what will be done
- Enhances the development of member life and project skills
- Research based source of content utilized

What is the relationship between project work and the county fair?

The County Fair is an opportunity for an independent evaluation of life and project skills a member learned through completing a project. County fair entries typically match the activities included in the project literature and may include other activities that are being emphasized in your county. One of your roles is to help maintain the focus of members and parents on the goal of 4-H, which is to develop blue ribbon kids. Talk with members about what they learned about each of their fair entries from the judging process. Help members celebrate their accomplishments regardless of the color of ribbon each project member received at the fair. This may be done through individual encouragement or at a meeting following the fair. While entering and displaying a project at the County Fair is the traditional method of public affirmation, there may be other means of exhibition such as a club tour, open house, community celebrations or others.

Who can I go to if I need someone to help me during the project meetings?

If you are leading beginning level project meetings, ask older members in the project to help you. This is a great leadership experience for them! Parents are another excellent source of help. Don't hesitate to ask them to stay for the meeting and be actively involved in their child's project work.

Thanks to 4-H Youth Development Programs, UW-Extension, Cooperative Extension for use of these materials.