



Be'an All You Can Be

4H 381C January 2004

## 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!



IOWA SOYBEAN  
PROMOTION BOARD

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# Welcome

## INTRODUCTION

**W**elcome to the senior level of the 4-H Crop Project Guide. This guide will help you learn more technical information about crop production and careers in agriculture. In this unit you will learn:

- ▣▣▣▣ Management skills needed to produce corn and soybeans profitably
- ▣▣▣▣ How plants and pests can be managed together
- ▣▣▣▣ Record keeping needed for crop production and how it is used for successful marketing
- ▣▣▣▣ More career opportunities related to crop production
- ▣▣▣▣ The important role decision making plays in crop production.  
You also will improve your skills in communication and information seeking.

### Putting It All Together

You've already learned a lot of the basics of plant growth and nutrition, and soil and environmental management. Now is the time to challenge yourself to learn more about how to put it all together for a profitable operation.

- 1 What are your senior goals for the crop project? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 2 What activities do you plan to participate in to further your knowledge about crops? \_\_\_\_\_  
\_\_\_\_\_
- 3 What exhibits would you like to share with others or take to the fair? \_\_\_\_\_  
\_\_\_\_\_

4 What information would you like to share with others through a presentation or working exhibit? \_\_\_\_\_

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5 What new information do you need to include in your crops record keeping system? \_\_\_\_\_

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6 What careers would you like to explore and learn more about? \_\_\_\_\_

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### **Fun Fair Exhibit Ideas**

- ▮▮▮▮ Create a comparison of specialty crops versus traditional commodity crops.
- ▮▮▮▮ Compare the economic benefits of alternative types of crop production.
- ▮▮▮▮ Plant your own crop plot doing most of the work yourself.
- ▮▮▮▮ Enter a grain quality contest with grain you raised and stored.
- ▮▮▮▮ Participate in the crops track of the State 4-H Conference.
- ▮▮▮▮ Cross pollinate your own corn hybrid.
- ▮▮▮▮ Assist in a seed or herbicide test plot.
- ▮▮▮▮ Help your seed dealer host a demonstration field day.
- ▮▮▮▮ Spend a day with someone who earns a living in research and development of crop products. Explore what educational training and career planning that person needed.
- ▮▮▮▮ Organize a tour for younger members.

# ICM Concepts

## CHAPTER 1

### Integrated Crop Management

As you completed Levels one and two of this project, you saw that farmers need a lot of inputs to produce a crop, and that crop production can affect the environment in a lot of ways. The goal of the farmer is to produce a crop with the least amount of inputs, optimum yields, and minimum impact on the environment. Not an easy task!

Integrated Crop Management (ICM) is one management tool farmers can use to meet their goal. But what does Integrated Crop Management really mean?



### What Is ICM?

Identify a farmer, an agronomist (or crop consultant), and a conservation worker you would like to interview. Ask them what Integrated Crop Management means to them. Also ask what ICM techniques or tools they use in

their role. How do their efforts at ICM help the environment? Write your findings in your journal, in a table similar to the following.

- ▶▶▶▶ How were their ideas of ICM the same?
- ▶▶▶▶ How were they different? Why do you think they were different?
- ▶▶▶▶ How many different ICM techniques did they identify?
- ▶▶▶▶ How many techniques were identified by more than one person?
- ▶▶▶▶ Which of these techniques do you implement on your farm?
- ▶▶▶▶ Which one or two techniques do you think you might like to learn more about, or implement in the future? Why?
- ▶▶▶▶ What impact are they having on our environment?

Position	What ICM Means to Them	Techniques They Use	How It Helps the Environment



## Project or Exhibit Ideas

- 1 Create a poster showing some of the different ICM concepts or techniques.
- 2 Do an Internet search on ICM concepts and report on your findings at a club meeting.
- 3 Do a presentation for a farmers group or your club about ICM concepts.
- 4 Share what you learned with a neighboring farmer. Discuss what ICM techniques he/she uses.
- 5 Create a display showing some of the ICM concepts you use on your farm.
- 6 Develop a plan to incorporate new ICM concepts on your farm.

## ICM

- ▮ Integrated Crop Management has different meanings for different sectors of agriculture.
  - To the producer, ICM means an intensified program that requires more information and planning than conventional crop management. It takes environmental impacts into account, and improves efficiency and economic profitability. Planning is the essential activity of ICM.
  - To the crop consultant or agribusiness agronomist, ICM means an opportunity to help meet a producer's increased information and planning needs with more individualized services. This includes current technical information (current research, soil testing, combine yield monitor data, on-farm plotwork, record keeping, etc.); nutrient, pest, and tillage management planning; crop scouting; crop enterprise record analysis; and assistance with new equipment and computer software applications. ICM can be profitable for both producers and service providers.
- ▮ Be sure to use the ICM process as you develop your crop project. Visit with an Extension crop field specialist or crop consultant for more ideas on how to incorporate ICM into your project this year.



## Starting Your Own ICM Program

Integrated Crop Management plans follow the 4-H philosophy of seeking out sound, proven information, and making wise decisions based on that information. But how do you get started on an ICM plan? Much information is needed on each field to design your plan.

- 1 Start by collecting a history of one of your fields or each field on your farm. Draw a map of the fields of your farm in the box below or in your journal, and number or name each field.

2 Collect the following information for each field for the last 3 to 5 years. Record this in your journal, in a table similar to the one below.

- crop grown and yield
- soil tests, cornstalk N tests, late spring nitrogen tests
- fertilizer applied, when and how much
- common weed pests and level of the problem
- weed management used and its success
- common insect pests and level of the problem
- insect management used and its success
- common plant disease pests and level of the problem
- plant disease management used and its success
- other pests

Field	Year	Crop	Soil Test	Fertilizer	Common Weeds	Weeds Management	Common Insects	Insect Management	Diseases	Other Pests

3 Develop your own ICM plan. Record the details of your plan in the table below or in your journal.

<b>Year</b>	
<b>Crop</b>	
<b>Soil Fertility Plans</b>	
<b>Weed Management Plans</b>	
<b>Insect Management Plans</b>	
<b>Disease Management Plans</b>	
<b>Conservation Practices Plans</b>	
<b>Who Needs a Copy of the Maps</b>	

4 Discuss your field history with your crop input providers. What information would they use in assisting you in ICM decisions? What additional information would they suggest you record?



- ▶▶▶▶ When was the last time each field was soil tested? What were the results and what fertilizer was applied?
- ▶▶▶▶ How does the fertility program impact crop management decisions?
- ▶▶▶▶ Why are nitrogen tests, either the cornstalk N test or the late spring N test, important to ICM?
- ▶▶▶▶ How do common pest problems impact ICM decisions?
- ▶▶▶▶ Who else needs to know the field history of your farm?
- ▶▶▶▶ In what other ways might you use these maps?
- ▶▶▶▶ How might a yield monitor in your combine aid in ICM decisions?

## Project or Exhibit Ideas

- 1 Create a crops notebook with maps, history, plans, etc.
- 2 Create a display showing your field maps and history.
- 3 Create a poster showing the decision making process you go through.



## ICM Programs

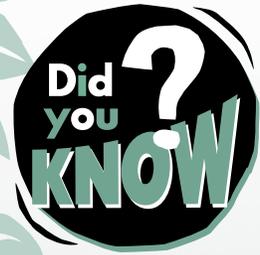
- ▶▶▶▶ Integrated Crop Management is an intensive crop management program that begins with a field-by-field evaluation of the soil resource. Integrated Crop Management uses best available technology, management strategies, and equipment improvements in an interrelated manner. An ICM program is broader than just pest management and nutrient management—it includes all crop production decisions and balances them against available capital, labor, soil and machinery resources, and environmental concerns. Economic information about management options and field-by-field comparisons are critical to the ICM decision-making process.



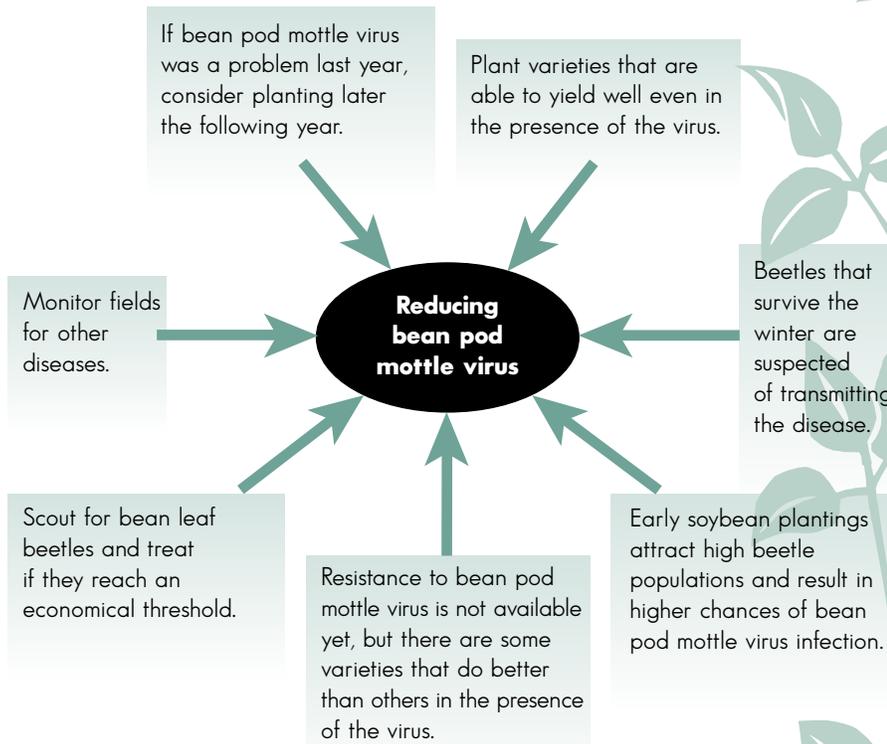
**Crop scouting requires close inspection of plants.**

## An Example of an Integrated Pest Management Plan for Bean Pod Mottle Virus

- ▶▶▶▶ Bean pod mottle virus is a virus disease of soybeans. Bean leaf beetles transmit the virus from plant to plant when they feed on the plant.
- ▶▶▶▶ The effect on yield of bean pod mottle virus depends on when the plants are infected, but typical yield losses can be 10 to 40 percent.
- ▶▶▶▶ Soybeans can be infected by more than one virus at a time, but bean pod mottle virus can be transmitted only by bean leaf beetles. Plants infected with other soybean viruses along with bean pod mottle virus have even higher yield losses.
- ▶▶▶▶ Seeds infected with bean pod mottle virus can be identified by a dark color around the seed hilum. The pigments around the hilum of a soybean seed will diffuse, or spread out, when infected with bean pod mottle virus. Mottled seeds are discounted at the market place, especially when intended for the food industry. Infected seeds also may have reduced germination or seedling vigor (strength) and lower seed quality.
- ▶▶▶▶ Many factors need to be considered to reduce the spread and impact of bean pod mottle virus.



- ▶▶▶▶ ICM looks for the least-cost options that are also efficient, resource conserving, environmentally sound, and practical.
- ▶▶▶▶ ICM seeks to maximize profitability while taking environmental impacts into account.
- ▶▶▶▶ Critical resources for ICM include the soil, equipment and capital resources, records, and management.



ICM is a site-specific strategy tailored for a producer or single farm operation.



## Disease Management

In earlier levels of the crop project you learned about weeds and insects. Diseases are another crop enemy that can reduce yields.

### Be a Disease Scout

In this activity you will explore a crop disease in depth, and create a plan to manage that disease.



**1** Identify a disease of corn or soybeans that you have experienced on your farm (or a neighbor's farm).

**2** Research that disease.

- What disease are you researching? \_\_\_\_\_
- What type of disease is it? \_\_\_\_\_
- How is it spread? \_\_\_\_\_
- What conditions promote the spread of this disease? \_\_\_\_\_
- What are the symptoms of this disease? \_\_\_\_\_
- Draw an illustration of an affected plant in the box below.

- What are the economic impacts of this disease? \_\_\_\_\_
- What are some control measures (prevention or management)? \_\_\_\_\_
- What are the costs of the control measures? \_\_\_\_\_
- How prevalent is this disease (how often do you expect to have a problem with it)? \_\_\_\_\_

Information on diseases can be found at the ISU Department of Plant Pathology website, [www.ent.iastate.edu/imagegal/plantpath/](http://www.ent.iastate.edu/imagegal/plantpath/).

Diseases very rarely can be managed mechanically.

**Did you know?**

- ▮ How do you plan to manage or control this or other diseases?
- ▮ What is the difference between management and elimination of the disease?
- ▮ How might you balance the economic costs to manage the disease?
- ▮ How does disease management differ from weed or insect management?



### Project or Exhibit Ideas

- 1 Create a poster showing the symptoms of this disease and suggested management tools.
- 2 Develop a journal of common crop diseases that you can use when scouting fields. Include photos if possible.
- 3 Assist neighbors in scouting fields for diseases.
- 4 Develop a biosecurity plan to prevent potential disease spread from field to field or from other farms.

### Plant Diseases

- ▮ For a disease to occur,
  - a disease-causing organism, or pathogen, must be present in the field;
  - the environment, including the temperature and humidity, must favor growth and development of the pathogen; and
  - the crop plant must lack resistance to the pathogen.
- ▮ Four types of pathogens cause most plant diseases. They are fungi, bacteria, nematodes, and viruses.
  - 1 Fungi usually are multi-celled organisms that reproduce by spores.
  - 2 Bacteria are single-celled organisms that reproduce by cell division.
  - 3 Nematodes are microscopic worms that reproduce by laying eggs.
  - 4 Viruses consist of genetic material surrounded by a protein coat; they reproduce and cause disease by entering living cells and using the cellular mechanisms to make copies of the virus genes and protein coat.
- ▮ If you want to know more about plant health go to the Plant Health Initiative website at [www.planthealth.info](http://www.planthealth.info).



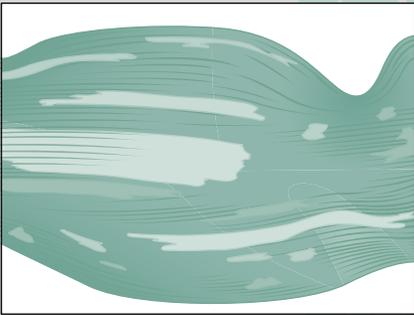
Disease-resistant varieties, disease-free seed, crop rotation, tillage, and planting date help manage diseases.



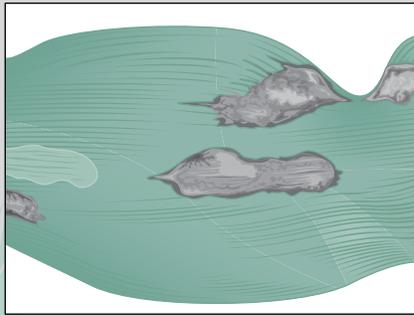
## Common Corn Diseases

### 1 Leaf blights

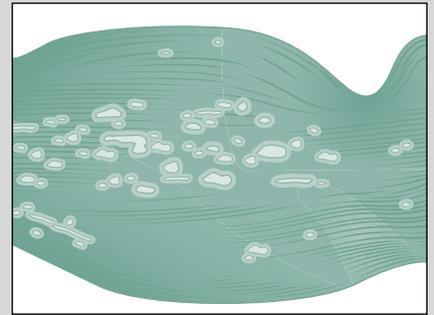
There are several different types of leaf blights, but all of them cause lesions (injured areas) on the leaves. Common leaf blights are gray leaf spot, anthracnose leaf blight, and eyespot. Planting disease-resistant hybrids is the best strategy for management, but other strategies include extended crop rotations and conventional tillage to reduce residue on the soil surface. Use of fungicides is possible, but it is difficult to make the treatment pay for itself through increased yield.



Gray leaf spot on corn leaf.



Anthracnose on corn leaf.



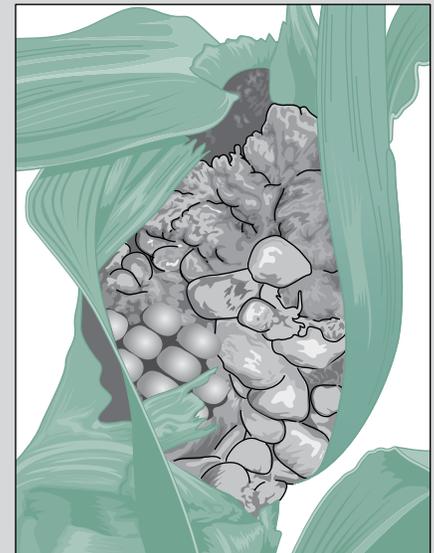
Eyespot on corn leaf.

### 2 Smut

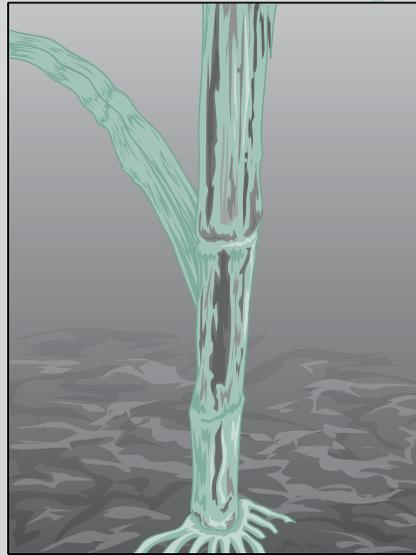
This fungus is a gray lump, or gall that attacks all above-ground parts of the plant, but it is most obvious on the ear. Smuts most often occur when plants have been physically damaged, such as by hail. There is no practical management strategy.

### 3 Stalk and root rots

Several fungi can infect and rot the roots and stalks of corn plants or enter through insect injuries. The disease can cause plants to die early, or lodge easily, reducing yield and making them difficult to harvest. Common stalk rots are *Fusarium*, *Gibberella*, anthracnose, and *Diplodia*. There are no fungicides available to manage stalk rots. Some hybrids are partially, or somewhat, resistant to stalk and root rots. Hybrids with excellent stalk strength often tolerate stalk rots better than other hybrids. Hybrids with the *Bacillus thuringiensis*



Ruptured smut galls and black spores on corn ear.

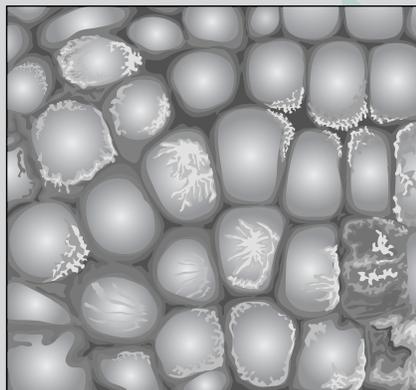
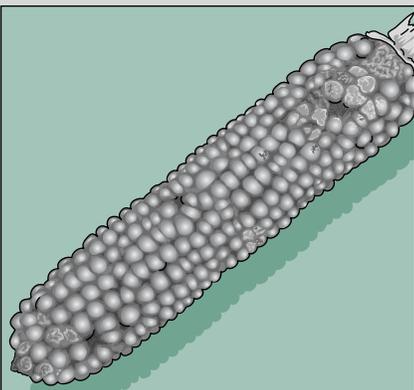


**Stalk rot symptoms on corn.**

(Bt) gene also may have less stalk and root rots, since they reduce the tunneling caused by European corn borer and corn rootworm larvae.

**4 Ear rots**

Some of the same fungi that cause stalk rot also can cause ear rots of corn. They enter through the silk channel, through insect injuries, or through the stalk, causing mold development on the kernels before harvest. Common ear rots include *Fusarium*, *Gibberella*, and *Diplodia*. Currently there is no highly effective hybrid resistance available nor are fungicides available to manage ear rots. Bt hybrids may have less ear rot because of the reduced damage caused by European corn borer larvae.



**Close up of corn ear and kernels showing ear rot.**

Producers usually rely on cultural and chemical management strategies for diseases.

**Did you know?**

## Common Soybean Diseases



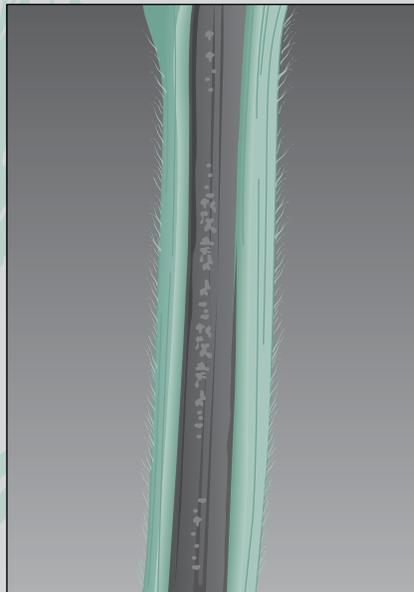
**Phytophthora stem rot.**

### 1 Phytophthora root and stem rot

This fungus is favored by wet soils and is more common in low spots in the fields. It kills seedlings before or after emergence from the soil, or can rot the roots and base of the stem on bigger plants. The stem will be brown and rotted, while the leaves turn yellow, wilt, and fall off. The best management strategy is to select resistant varieties. Fungicide (chemicals to kill fungi) seed treatments and improved drainage of a field may be helpful.

### 2 Brown stem rot

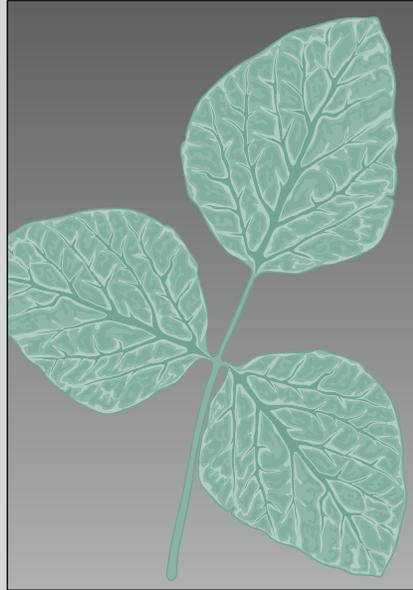
This is another fungus disease that infects the soybean stems. It causes a reddish-brown discoloration in the center part of the stem, and the leaves sometimes develop stripes of necrotic or dead tissue and live, green tissue. The infection occurs early in the growing season but symptoms are not noticed until August. The best management strategy is to select resistant varieties, tillage, and crop rotation.



**Internal stem and leaf symptoms of brown stem rot in soybeans.**

### 3 Sudden death syndrome

This is caused by another soil-borne fungus. It rots the roots and causes the leaves to develop stripes of dead tissue and live tissue, like brown stem rot, but the symptoms usually occur earlier in the season, and cause no discoloration of the pith. With sudden death syndrome, the leaves fall off, leaving the petioles (leaf stems) still attached to the

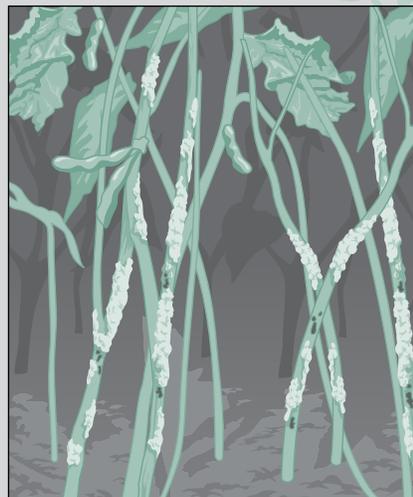


**Stem and leaf symptoms of sudden death syndrome of soybean.**

plant, so they look like green sticks in the field. No fungicides are available. Some varieties of soybeans are less susceptible to sudden death syndrome. Later planting also reduces the susceptibility.

**4 White mold**

This fungus infects through the flowers and kills the plants by rotting the stems. A white cottony growth of fungus can be seen on the outside of the stems. If a field does not have white mold, it is important to not bring it into the field. This fungus can be spread by soil from infected fields or by planting bin run seed from infected fields. Some varieties are less susceptible than others. Wide row spacing and low plant populations also reduce the risk of white mold.



**Signs of white mold on soybean stems.**

(continued)

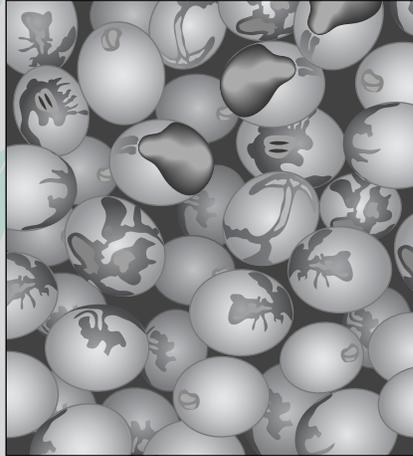
Fungicides can be used to control some diseases. Fungicides can be used to control some diseases.

**Did you know?**

## Common Soybean Diseases (continued)



Leaf foliar symptoms and seed discoloration from soybean mosaic virus.



### 5 Virus diseases

Soybean mosaic virus and bean pod mottle virus are the two most common soybean diseases caused by viruses. Both diseases are transmitted by insects and cause the leaves to be crinkled and mottled in color. The seeds are discolored with a brown or black hilum. Early-season bean leaf beetle management, soybean aphid control, and the use of certified (virus free) seed help to manage bean pod mottle virus.

### 6 Soybean cyst nematode

This is probably the most damaging disease of soybeans. These microscopic worms feed on plant roots and reduce the yield of the plants, often without causing any symptoms above-ground. The female worms stay attached to the roots and swell up into round "cysts," which are about the size of a pin-head. They are white at first but turn yellow to brown. The best management includes resistant varieties in conjunction with crop rotation.



Soybean cyst nematode females on roots.

### ISU Resources

- PM 879, *Soybean Cyst Nematode*
- PM 1649, *Soybean Cyst Nematode—Resistant Soybean Varieties for Iowa*



## Conservation Planning

Integrated crop management focuses not only on inputs and profitability, but also on the impact to the environment. An old Indian proverb says, "Treat the earth well: it was not given to you by your parents; it was loaned to you by your children. We do not inherit the earth from our ancestors; we borrow it from our children." Conservation of our natural resources is a very important part of farming, and was discussed in Level 2.

All farms are required to have a conservation plan on file with the county Farm Service Agency. Some typical conservation practices were listed in Level 2, Green and Growing.

- 1 Work with your parents or county FSA office to study your conservation plan.
- 2 What conservation practices do you incorporate into your plan?  


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- 3 What are the benefits to each practice?  


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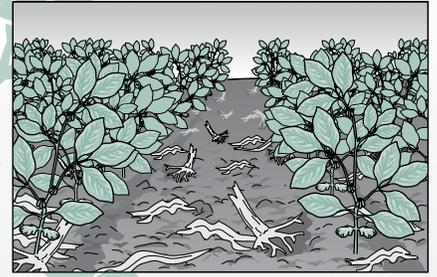
  


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- 4 What are (were) the costs to install and maintain these practices?  


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**Residue on the soil surface is one way to reduce soil erosion.**

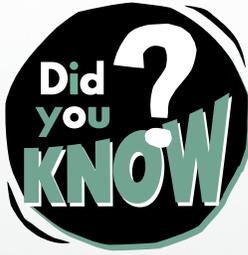


- ▶ How are the conservation practices different for every field?
- ▶ Why is it important to have different practices for different fields?
- ▶ What are the benefits other than profit for some of the practices?
- ▶ What are some conservation practices you might do to improve your plan?
- ▶ How would these improvements help?
- ▶ Who will benefit from these conservation practices?

## Project or Exhibit Ideas

- 1 Discuss your ideas for improvements with the FSA conservation staff. What are the costs involved with these changes?
- 2 Create a poster showing the costs and benefits to a conservation practice.
- 3 Create a display showing the conservation plan for your farm. Remember to include the costs and benefits of these practices.
- 4 Give an educational presentation on your farm's conservation management plan at a club meeting or at the county fair.
- 5 Give an educational presentation on resources that are available to help in conservation planning. Be sure to include resources available on the Internet.
- 6 Explore how water quality regulations may affect your crop management plans.





- ▶▶▶▶ Reduced tillage can improve soil structure and drainage, and reduce soil compaction.
- ▶▶▶▶ Crop residue contributes to increased organic matter and biological activity.
- ▶▶▶▶ Higher organic matter improves soil structure, water holding capacity, and nutrient availability.
- ▶▶▶▶ Extended crop rotations using three or more crops improves soil structure.
- ▶▶▶▶ Limiting tillage trips conserves fuel.

## Conservation

- ▶▶▶▶ Conservation management practices improve water quality and farm profitability. Conservation tillage, buffer and filter strips, and other conservation practices reduce soil and nutrient runoff. Adopting conservation management practices improves Iowa's surface water quality and increases your crop yields.
- ▶▶▶▶ Conservation tillage practices reduce nutrient runoff, reduce soil erosion, reduce fuel costs, and improve soil tilth. These practices include no-till, ridge till, strip till, and minimum tillage systems that reduce the number of tillage trips in a field, which leaves a significant percentage of crop residue on the soil surface. Uniform and maximum crop residue cover on the soil surface lowers the impact of rain drops on bare soil. This reduces the detachment and transport of soil particles to nearby surface waters.
- ▶▶▶▶ The Conservation Reserve Program (CRP) is voluntary and is administered by the United States Department of Agriculture's Farm Services Agency (FSA). The FSA offers annual rental payments and cost-share assistance to establish a long-term plant cover on eligible land.



## Additional Conservation Resources

- ▶▶▶▶ Your county FSA office or District Soil and Water Conservation District Office.
- ▶▶▶▶ Your Iowa State University county Extension office also can provide you with educational material on conservation planning. Ask for copies of the following pamphlets:
  - AE 2049, *Planning—Conservation Tillage*
  - AE 3050, *Effects on Soil Erosion—Conservation Tillage*
  - AE 3051, *Effects on Water Quality—Conservation Tillage*
  - PM 1507, *Vegetative Filter Strips—For Improved Surface Water Quality*
  - NMEP 4, *Residue Management*
  - NMEP 10, *Conservation Reserve Program*
  - NMEP 11, *Conservation Practices*

# Planning

## CHAPTER 2

### Finances

The first two levels of the 4-H Crop Project guide covered many aspects of crop production. One last and very important aspect of crop production is financial assessment. A financial assessment includes record keeping, setting up a financial agreement, and examines the costs to produce the crop.

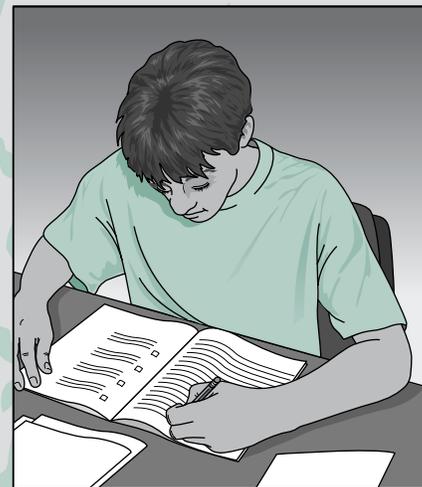
Several months before you begin planting your crop project it's a good idea to estimate what you expect your costs of production and returns will be. This part of the project should be done with your parent(s) the winter before you produce your crop. Extension publication FM-1712, *Estimated Costs of Crop Production in Iowa*, will help you estimate your costs. You can get this publication from your county Extension office, or it can be downloaded at [www.extension.iastate.edu/Publications/FM1712.pdf](http://www.extension.iastate.edu/Publications/FM1712.pdf).



### Profitability

Use your past crop project records along with the *Estimated Costs of Crop Production in Iowa* to estimate your costs for producing a crop this year. This will be your budget to plan for your financial needs and to use in forward marketing your grain crop.

Use the form on the following page to record your estimated and actual returns and costs for crop production. After filling in this form, try some different yields and prices for your crops and see how much your net returns change. A spreadsheet to help calculate estimates can be found on the CD computer companion.



**Record keeping is a critical part of profitable crop production.**

Estimated and actual returns and costs for crop production:

Income	Estimated (To Be Completed Prior to Planting)	Actual (To Be Completed at End of Project)
<b>a.</b> Yield/acre	_____	_____
<b>b.</b> Price/bushel	\$ _____	\$ _____
<b>c.</b> Expected government payments	\$ _____	\$ _____
<b>d. Total income</b> (yield times price/bushel plus line c)	\$ _____	\$ _____
<b>Expenses</b>		
<b>e.</b> Machine costs/acre	\$ _____	\$ _____
<b>f.</b> Seed costs/acre	\$ _____	\$ _____
<b>g.</b> Fertilizer costs/acre	\$ _____	\$ _____
<b>h.</b> Lime costs/acre	\$ _____	\$ _____
<b>i.</b> Herbicide costs/acre	\$ _____	\$ _____
<b>j.</b> Insecticide costs/acre	\$ _____	\$ _____
<b>k.</b> Drying costs/bushel	\$ _____	\$ _____
<b>l.</b> Land charge or rent/acre	\$ _____	\$ _____
<b>m.</b> Other expenses/acre	\$ _____	\$ _____
<b>n. Total expenses</b> (add lines e-m)	\$ _____	\$ _____
<b>o.</b> Net return (line d minus n)	\$ _____	\$ _____
<b>p. Total return for project</b> (line o times number of acres in project)	\$ _____	\$ _____

Machine costs should be figured using the *Farm Custom Rate Survey, FM-1698*.

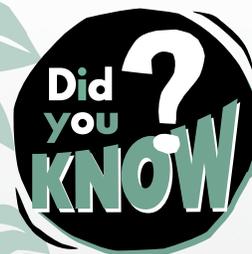


- ▣▣▣▣▶ What variable costs do you think will be different from last year?
- ▣▣▣▣▶ Why do you expect this?
- ▣▣▣▣▶ What costs remain fairly constant from year to year?
- ▣▣▣▣▶ What is the lowest price you could market your grain for and still break even?
- ▣▣▣▣▶ What happens if you have a dry summer and yields are lower than expected?
- ▣▣▣▣▶ What is your new break even in that case?



## Project or Exhibit Ideas

- 1 Create a report on your expected profitability. Include all the variables that might affect profit.
- 2 Discuss your estimates with your ag lender. Does the lender feel your estimates are reasonable?
- 3 Compare your estimates before the crop season to the final profits at the end of the season.



- Expected income depends upon yield per acre and price received from the market place.
- When estimating yields, base them on historical yields for your soil type and area.
- Following grain prices throughout the year will help estimate a price for your grain crop.
- There may be government program payments available, so include them along with market prices.
- You can learn about government payments at your local Farm Service Agency (FSA) office.

## Crop Production Costs



- Direct (variable) costs are those items that are purchased and used in one crop season. These costs will vary from farm to farm and from field to field, depending upon the production practices you and your parent(s) decide to use. They include such items as fertilizer, pesticides, seed, fuel, and supplies. You need to decide how much of these items you will use and what seed variety, fertilizer analysis, etc., you will need. Use your *4-H Crop Production Project Worksheet, 4H-382WS*, to figure the individual costs you should include in your crop project.
- Once you have figured your income and direct costs, you can determine your return over direct costs, or gross margin. If your gross margin is a positive number, you are better off to produce a crop than to let land and machinery set idle.
- Besides direct costs, fixed costs are also a part of crop production. Fixed costs are costs that must be paid whether you do or do not grow a crop. They include property taxes, interest on machinery and land debts, machinery depreciation, family living expenses, labor, and any cash rent you may pay. These resources can change through time. For example, machinery wears out over time. For now, though, these costs already are fixed or locked in. Gross margin minus fixed costs equals your net profit per acre.
- Crop producers will adjust their management practices (tillage practices, type of fertilizer or pesticides used, etc.) to make optimum profit. They also may grow more than one kind of crop to lessen their risks from such things as weeds, insects, diseases, and weather and to use their labor more efficiently.

## Need Some Cash?

You most likely will not have many fixed costs with your project unless you own land or machinery. If you rent land or machinery from your parents, then most of your costs will be direct costs. You may need to borrow money from a lending institution or from your parents to pay for your share of the expenses that occur before the crop is sold.

If you do borrow money, or rent land or machinery from your parents, make a financial agreement with them. This will give you experience in preparing business agreements and budgeting costs. The type of agreement you work out will depend upon the ownership or tenancy situation that your parents have. Your parents may own and operate all of the land, own part and rent part, or rent all land under a crop-share or a cash rent lease.

Write your own financial agreement for your crops project. Be sure to include the following information:

- ❶ How many acres of land are included?
- ❷ How much will you pay, and when? Or how will you divide the expenses and income with the landlord?
- ❸ Whose machinery will you use, and how will you reimburse them?
- ❹ How will the crop be stored and when might it be marketed?



- ▮▮▮▮ Which arrangement might work best for you?
- ▮▮▮▮ What additional information did you include in your arrangement?
- ▮▮▮▮ What factors influenced your decision about financial arrangements?

## Project or Exhibit Ideas

- ❶ Discuss your financial arrangement with a farm manager. What additional information should you include?
- ❷ Create a display or poster showing the decisions involved in establishing a financial arrangement.
- ❸ Create a display comparing the financial risk associated with two different financial agreements.



In cash rent agreements the tenant pays all inputs and stands all risks.

**Did you know?**

## Alternative Financial Arrangements



### EXAMPLE ARRANGEMENT 1

4-H'er cash rents from parent:

- ① 4-H'er pays cash rent for land. A good guide is seven percent of the present land value, or one-third of the value of the crop.
- ② 4-H'er pays for all fertilizer, seed, herbicides, insecticides, crop insurance, etc.
- ③ 4-H'er pays all machine expenses at the rate agreed upon.
- ④ 4-H'er furnishes or pays for all labor.
- ⑤ If the crop is dried, the 4-H'er would pay this expense.

### EXAMPLE ARRANGEMENT 2

4-H'er crop-share rents from parent:

- ① 4-H'er gives parent share of crop produced as land rent, generally one-half of the corn and soybeans and one-half or two-thirds of oats.
- ② When the crop is split 50-50, the 4-H'er pays one-half the costs for fertilizer, seed, insecticides, crop insurance, etc. A decision should be made on how herbicide costs are to be handled if they are used. An alternative arrangement is for the 4-H'er to pay none of the costs of seed, fertilizer, or pesticides, and to receive one-third of the crop.
- ③ 4-H'er pays all machine expenses at the rate agreed upon.
- ④ 4-H'er furnishes or pays for all labor.
- ⑤ Crop drying costs are shared.

### EXAMPLE ARRANGEMENT 3

4-H'er has joint enterprise with parent:

- ① No charge to 4-H'er for land rent.
- ② Fertilizer, seed, insecticides, and hail insurance costs are shared jointly.
- ③ Machine expense shared jointly.
- ④ Labor costs shared jointly.
- ⑤ Storage cost shared jointly if there is any charge.
- ⑥ Parent maintains control of crop.
- ⑦ Profits are shared as per agreement.

Older 4-H'ers may be able to rent land directly from a land owner. Examples of written agreements are included in the Computer companion CD.

*In a crop share agreement the landlord and tenant share input costs and risks.*

**Did you know?**

Let's  
**DO**  
something!

## Selecting a Soybean Variety

Putting it all together requires a great deal of planning long before you head to the field in the springtime. One of those winter tasks is to select the best hybrids or varieties for your farm.

While there is no one best soybean variety, you need to concentrate on finding two or three that are best for your cropping program, tillage, field conditions, soil types, and management.

Many tools are available to assist you in selecting the best soybean variety for your fields. One of these tools is the *Iowa Crop Performance Test—Soybeans*, AG 18. It is available in printed form from your county Extension office, or is also available on the web at [www.agron.iastate.edu/icia/YieldTesting3.html](http://www.agron.iastate.edu/icia/YieldTesting3.html)

**1** Go to this website and select the soybean test. Read through the Progress Report to learn more about how the test is conducted and what traits are measured.

- What district do you live in? \_\_\_\_\_
- What are two of the traits tested in the performance test?  
\_\_\_\_\_
- What information is provided by the seed entrant? \_\_\_\_\_  
\_\_\_\_\_

**2** Next go to the General Information section.

- What was the planting date for the three plots in your district?  
\_\_\_\_\_
- What was the average yield of the three plots in your district?  
\_\_\_\_\_

**3** What crop traits are most important to your farm? For example, does your farm have soybean cyst nematode, or are you marketing your seed for high oil or high protein content?  
\_\_\_\_\_  
\_\_\_\_\_

**4** Identify those varieties that meet your selection criteria for the traits other than yield. Make a list of them or highlight them with a marker. Don't accept varieties that don't meet your selection criteria! How many did you have? \_\_\_\_\_  
\_\_\_\_\_

Soybeans growing near a lighted area such as a shopping district or street light may never flower and set seed.

**Did you know?**

- Now rank these varieties based on their yield for this year. How many have two years of performance data? \_\_\_\_\_

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- Should you be influenced by varieties that have two years of performance data? \_\_\_\_\_

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- 5** Now look to the very bottom of the table, and find the average yield for all entries. Cross off those varieties that were less than average. How many varieties are left now? \_\_\_\_\_

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- Look to the bottom of the table again for the "LSD." The "LSD" is the Least Significant Difference. That tells you the margin of difference allowed within ratings. If the LSD for yield is 2.5, that means two varieties that are less than 2.5 bushels difference would be considered the same potential yield. If there is more than 2.5 bushels difference between two varieties, they would be considered as having different potential yield. Now that you know the LSD for this year's test, which two or three varieties would you select for your fields? \_\_\_\_\_

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- 6** If you want to plant some Roundup Ready soybeans, go through the same process using the table for Roundup Ready beans. If you have some fields infested with soybean cyst nematode, go through the same process using the table for soybean cyst nematode tests.



- ▶▶▶ How do the varieties compare for yield?
- ▶▶▶ How do they compare for the other traits you selected on?
- ▶▶▶ Would you plant these same two or three varieties in every field, or would you select some different varieties for some of your fields? Why?



### Project or Exhibit Ideas

- 1** Create a display or poster comparing the varieties you selected.
- 2** Plant a comparison plot using these varieties and share the results with your 4-H club.
- 3** Create a poster showing how you selected these varieties and what factors influenced your decisions.
- 4** Share how to use the variety tests with other 4-H'ers.

## Soybean Variety Selection



- ▶▶▶ Seed companies, Iowa farmers, and the Iowa Crop Improvement Association may include entries in the *Iowa Crop Performance Test—Soybeans*, AG 18.
- ▶▶▶ Soybean cultivars are evaluated and scored in the Iowa Crop Performance Test—Soybeans for yield, maturity, height, lodging, emergence score, chlorosis score, selected disease tolerance and herbicide resistance, protein and oil content, hilum, flower, and pubescence colors. The seed type and availability is also published.
- ▶▶▶ Most soybean varieties grown in the Midwest are indeterminate cultivars that have a flowering period ranging from three to four or more weeks. Determinate soybeans are raised in the southern United States, and bloom in a relatively short period of time.



## Corn Hybrid Selection

Each different corn plant type is called a hybrid. More than 500 corn hybrids are listed in the *Iowa Crop Performance Test—Corn* report, PM 660, available from the county Extension office or on the web at [www.agron.iastate.edu/icia/YieldTesting3.html](http://www.agron.iastate.edu/icia/YieldTesting3.html).

- 1 Go to this website and select the corn test. Go to the map showing the corn districts.
  - What district do you live in? \_\_\_\_\_
  - Read through the report for your district to learn more about how the test is conducted and what traits are measured. What are two of the traits tested in the performance test? \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - How many times is each hybrid replicated (repeated) in each plot? \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - What was the planting date for the three plots in your district? \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_
  - What was the average yield of the three plots in your district? \_\_\_\_\_
  - \_\_\_\_\_
  - \_\_\_\_\_

Corn plants tend to be shorter with earlier planting



2 Now go to Table 1 for your district. This is a very large table with important information in it. The first step is to select the crop traits that are most important to you. If drying the corn in the field is important to you, pay special attention to the column on moisture percent. If you have had problems in the past with root lodging, then you should pay special attention to that column. If you are selling your corn for a specific value-added market, you might want the protein, oil, or starch content to be one of your selection criteria also. Of course, yield is a very important selection criteria for everyone.

- What are the top three selection criteria to consider for your farm?

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3 Identify those hybrids that meet your selection criteria for the traits other than yield. Make a list of them or highlight them with a marker. Don't accept varieties that don't meet your selection criteria!

- How many did you have? \_\_\_\_\_
- Now rank these hybrids based on their yield for this year. How many have two years of performance data? \_\_\_\_\_

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- Should you be influenced by hybrids that have two years of performance data? \_\_\_\_\_

---

4 Now look to the very bottom of the table, and find the average yield for all entries. Cross off those hybrids that were less than average. How many hybrids are left now? \_\_\_\_\_

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- Look to the top of the table for the "LSD." The "LSD" is the Least Significant Difference. That tells you the margin of difference allowed within ratings. If the LSD for yield is 8, that means two hybrids that have less than 8 bushels difference would be considered the same potential yield. If there is more than 8 bushels difference between two hybrids, they would be considered as having different potential yield. Now that you know the LSD for this year's test, which two or three hybrids would you select for your fields? \_\_\_\_\_

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5 Now go to Table 2 for your district. This has the two- or three-year averages for those hybrids tested more than one year. Find your hybrids on this list. Based on more than one year's information, would you select the same hybrids? Why? \_\_\_\_\_

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- Would you plant these same two or three hybrids in every field, or would you select some different hybrids for some of your fields? Why? \_\_\_\_\_

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- In what other ag areas could you use selection criteria? \_\_\_\_\_

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### Project or Exhibit Ideas

- 1 Create a display or poster comparing the hybrids you selected.
- 2 Plant a comparison plot using these hybrids and share the results with your 4-H club.
- 3 Create a poster showing how you selected these hybrids and what factors influenced your decisions.
- 4 Share how to use the yield tests with other 4-H'ers.



### Corn Hybrids

- How do the varieties compare for yield?
- How do they compare for the other traits you selected on?
- Corn hybrid maturity is determined genetically. But maturity is also influenced by environmental factors such as soil type, soil moisture, crop nutrition, and especially air temperature.
- Since you cannot judge the performance of a hybrid by looking at the seed, yearly yield tests are conducted by Iowa State University and the seed companies.
- Since 1988, data for protein, oil, and starch percentages have been included in the *Iowa Crop Performance Test—Corn, PM 660* report.
- There are seven districts in the *Iowa Crop Performance Test—Corn* report.



# Farm Safety

## CHAPTER 3

### A Hazardous Occupation

Do you know someone who has been seriously injured in a farm accident? You probably do, since farming is the nation's most hazardous occupation.

### Safety Surfing

1 Research farm accidents, either on the Internet or at your local library. Here are a few websites to help get you started.

- [www.abe.iastate.edu/Safety/index.asp](http://www.abe.iastate.edu/Safety/index.asp)
- [www.abe.iastate.edu/Safety/ifsc.htm](http://www.abe.iastate.edu/Safety/ifsc.htm)
- [www.fs4jk.org/](http://www.fs4jk.org/)
- [research.marshfieldclinic.org/children/](http://research.marshfieldclinic.org/children/)

• How many farm accidents could you find reported in Iowa in the last two years? \_\_\_\_\_

• What kind of accidents were they? \_\_\_\_\_

• How many resulted in a human death? \_\_\_\_\_

• What were the most common injuries on the farm? \_\_\_\_\_

• What age group reported the most injuries? \_\_\_\_\_

• What were your sources of information? \_\_\_\_\_



Over 100 children younger than 20 years of age die of agricultural injuries annually.

**Did you know?**

2 Talk to other family members, neighbors, members of the health community, and EMT workers about farm accidents.

- Can they identify some local farm accidents? \_\_\_\_\_
- What advice would they share with you or other youth about farm safety? \_\_\_\_\_



- ▮▮▮▮ What could the individuals involved have done to prevent the accident?
- ▮▮▮▮ Was there anything in common among all the accidents?
- ▮▮▮▮ Which could possibly happen on your farm?



## Project or Exhibit Ideas

- 1 Do an educational presentation on farm safety at a club meeting or county fair.
- 2 Prepare a poster on farm safety for exhibit at your county fair.
- 3 Attend an ISU Extension Farm Safety Day Camp or help teach a session there. (contact your county Extension office)
- 4 Attend a Tractor and Machinery Certification training program offered by ISU Extension (contact your county Extension office).

## Farm Safety

### Tractor Rollovers

- ▮▮▮▮ The most serious on-farm injuries and fatalities involve machinery and equipment. Tractors are the number one killer of farmers. In 1998, the National Safety Council estimated that more than 317 people were killed while operating a tractor, and over half of those deaths were the result of a tractor rollover. A rollover protective structure (ROPS) is a cab or frame that provides a safe environment for the tractor operator in the event of a rollover. Seat belts must be worn at all times by operators of tractors with a ROPS. To reduce your rollover risks:
  - Avoid sharp turns and reduce the tractor speed when turning.
  - Avoid driving on steep embankments, near ditches, and around holes.
  - Hitch loads only to a drawbar.
- ▮▮▮▮ Older tractors can be retrofitted with factory approved and tested ROPS. Farmers should not add their own homemade ROPS to a tractor.

### Pesticides

- ▮▮▮▮ Most farmers use pesticides to manage weeds, insects, and plant diseases, or to manage household pests. Because pesticides are



toxic, they must be used, stored, and disposed of with caution. Remember to always read the pesticide label! The pesticide label will tell you how to use and store the product, how to dispose of it, and what to do in case of accidental poisoning.

- Half of the pesticide-related deaths each year in the United States involve children under the age of 10. The main factor in these deaths is the improper disposal or storage of pesticides. Improper use, storage, and disposal of pesticides also can contaminate surface and groundwater. To be safe and not sorry with pesticides:
  - Always store pesticides in a locked storage area.
  - Always keep pesticides in their original, labeled container.
  - Never keep pesticides that have been banned, such as DDT, chlordane, or Silvex.
- Take banned, unwanted, or unlabeled pesticides to the nearest Iowa Department of Natural Resources Regional Collection Center. Contact the Department of Natural Resources or the regional U.S. Environmental Protection Agency office for information on how to dispose of large amounts of hazardous waste.

### Grain Harvest Safety

- We all know that water can drown or suffocate a swimmer. That's why we should never swim alone. But did you know that grain could also quickly trap and suffocate you? All too often, farm workers or family members suffocate beneath the surface of grain. This tragedy is repeated in Iowa several times a year.
- Grain handling entrapments happen very quickly. Flowing grain is like a fluid. Objects on the surface sink, and heavy objects sink faster than light ones. Flowing grain can entrap a person within five seconds. For example, a high capacity conveyor can move 5,000 bushels of grain an hour. At that rate, a 6-foot tall person would become submerged in only 15 seconds. The force required to remove someone buried below the surface of grain easily can exceed 2,000 pounds, which is about the same as lifting a small car.
- To prevent entrapment, always lock all access doors to grain storage structures. Never allow children to play or ride on grain wagons, or be in the work area. To reduce risk:
  - Lock out power to all types of grain-handling equipment. Disconnect power and place locks over operating switches.
  - Always use the buddy system when you are unloading or loading grain. Notify a second person where you are at all times.
  - Never enter a bin when grain is caked or spoiled. Moldy, wet grain clumps, so as it is unloaded, a large air pocket may form just below the surface. This creates a grain bridge that can collapse at any time.

In 1991, approximately 32,800 agricultural-related injuries occurred to farm children under the age of 20.

**Did you know?**



## Hazard Hunt

These are just some of the major farm hazards we need to consider. Each farm is different and has different hazards, so you need to look at your own farm to identify potential hazards.

- 1** Conduct a hazard hunt on your farm. Start with the machine shed, looking for any potential hazards.

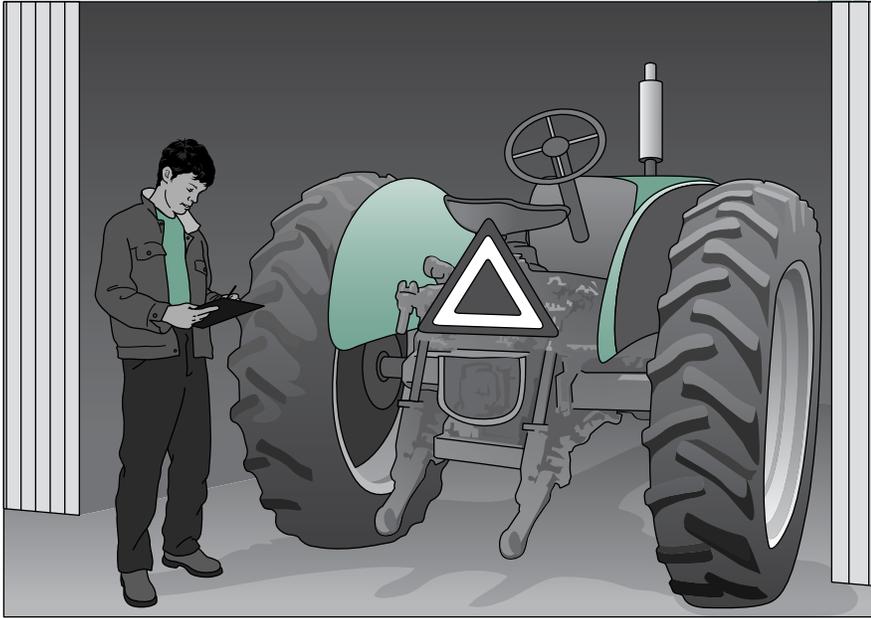
  - Are there any stacks or piles waiting to tip over? \_\_\_\_\_
  - \_\_\_\_\_
  - How about the tractor dual tires? Are they leaning against something and could be bumped and knocked over, or are they securely fastened? \_\_\_\_\_
  - \_\_\_\_\_
  - Where are there potential accidents waiting to happen in your machine shed? \_\_\_\_\_
  - \_\_\_\_\_
- 2** Next look over all your machinery.

  - Are all safety guards in place on all PTO's and over augers, belts, and pulleys? \_\_\_\_\_
  - Do you have Slow Moving Vehicle signs on all equipment? \_\_\_\_\_
  - \_\_\_\_\_
  - Are all the tractors equipped with a ROPS and safety belts? \_\_\_\_\_
  - \_\_\_\_\_
  - Are extra riders not allowed on tractors? \_\_\_\_\_
  - Do all flasher lights work correctly? \_\_\_\_\_
  - What safety steps need to take place to ensure safety around your machinery? \_\_\_\_\_
  - \_\_\_\_\_
- 3** Where do you store your extra chemicals and pesticides? \_\_\_\_\_

  - Are all chemicals stored in their original containers, not pop bottles? \_\_\_\_\_
  - Are chemicals stored safely out of reach of youngsters? \_\_\_\_\_
  - Are procedures in place to handle chemical spills? \_\_\_\_\_
  - Are chemical storage areas locked to prevent children and animals from entering? \_\_\_\_\_

Two out of every 100 farm youth 13 years old or less report a farm-related injury.

**Did you know?**



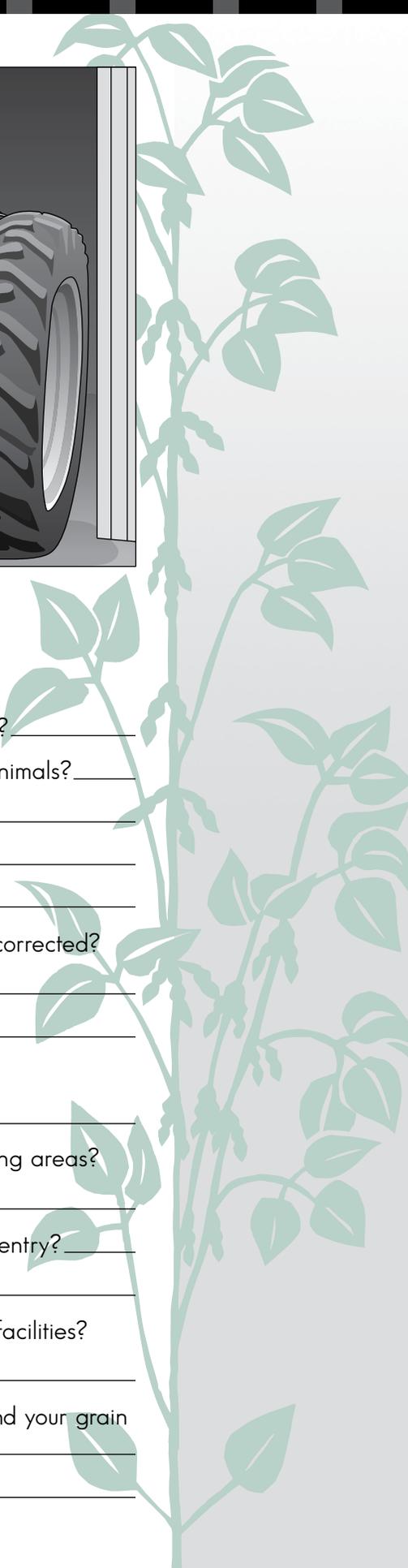
**Are Slow Moving Vehicle signs on all equipment?**

**4** Now check out any livestock buildings you have.

- Are animals handled in a safe and humane manner? \_\_\_\_\_
- Are the facilities safe for the humans handling the animals? \_\_\_\_\_  
\_\_\_\_\_
- Are pit gases a concern in your buildings? \_\_\_\_\_
- Are gates safely hinged and tied? \_\_\_\_\_
- What animal hazards did you find that need to be corrected?  
\_\_\_\_\_  
\_\_\_\_\_

**5** Check all your grain handling facilities.

- Are safety guards in place? \_\_\_\_\_
- What prevents children from playing in grain handling areas?  
\_\_\_\_\_
- Are access ladders and hatches secured to prevent entry? \_\_\_\_\_  
\_\_\_\_\_
- Could children accidentally get into grain handling facilities?  
\_\_\_\_\_
- What do you need to do to prevent accidents around your grain handling facilities? \_\_\_\_\_  
\_\_\_\_\_



6 Finally, look over your farm and house yard.

- Where can you find potential hazards in this area? \_\_\_\_\_

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- If very young children live on your farm, do you have a fenced-in area that is their safe play area? \_\_\_\_\_

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- How do you prevent youngsters from getting in the farm work area? \_\_\_\_\_

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- What modification do you need to make? \_\_\_\_\_

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Fifty-two percent of all work-related fatalities to children occur during crop production.



- ▮▮▮ How many potential hazards did you find?
- ▮▮▮ Were more related to farm equipment, livestock, grain handling, or home?
- ▮▮▮ How did you correct them?

### Project or Exhibit Ideas

- 1 Create a display showing the potential safety hazards on your farm. Educate others on ways to prevent these hazards.
- 2 Create safety rules for your family and share them with extended family as well as your own immediate family.
- 3 Demonstrate the "Tug-of-War with GRAIN" display at a club meeting. Contact your county Extension office to get this display.
- 4 Organize a Hazard Hunt club project to inspect neighboring farms for potential hazards.
- 5 Plan a farm safety workshop for your school.



**Did you know?**

## Children's Safety Rules

▶ To help keep children safe on the farm:

- Designate safe play areas.
- Determine hazardous areas that might attract children.
- Identify farm safety dangers with children.
- Practice and pass on safe practices to children.
- Enforce family farm safety rules with children.

▶ A relatively new program, Iowa's Center for Agricultural Safety and Health (I-CASH), is now working to help keep Iowa farmers safe. The mission of I-CASH is to enhance the health and safety of Iowa's agricultural community by establishing and coordinating prevention and education programs. I-CASH is headquartered at the University of Iowa College of Public Health in Iowa City, Iowa. It is a joint venture of The University of Iowa, Iowa State University, Iowa Department of Public Health, and the Iowa Department of Agriculture and Land Stewardship. They have several programs including training doctors and nurses to be better prepared to treat farm related illnesses and injuries, and funding local activities to reduce youth farm accidents.



### Resources

- Farm and home safety, [www.extension.iastate.edu/pubs/](http://www.extension.iastate.edu/pubs/)
- ISU Agricultural and Biosystems Engineering Department's safety web page, [www.abe.iastate.edu/Safety/](http://www.abe.iastate.edu/Safety/)
- Iowa's Center for Agricultural Safety and Health, [www.public-health.uiowa.edu/ICASH/](http://www.public-health.uiowa.edu/ICASH/)

# Grain Handling during Harvest and Storage

## CHAPTER 4

### Harvest Time

Once grain is harvested, a race begins to see who will consume it—insects and molds, or humans and livestock. Because mold, insects, and germination all require moisture, low moisture conditions are necessary for storage.

Some crops will dry to a safe moisture content in the field. Small grains and soybeans are usually field-dried. However, field-drying corn can result in high grain losses from stalk lodging (falling over) or ear droppage. Larger grain losses from harvesting equipment can also occur when the corn becomes too dry. To reduce harvest time losses, make sure that the combine is adjusted and operating properly.

### Determining Corn Harvest Losses

Not all the corn produced is harvested; some is lost during the harvesting process, and some falls off prior to harvest. European corn borers, poor hybrid characteristics, high winds, and late harvesting are the main reasons that ears drop before harvest.

- 1 Length of row (feet) for  $\frac{1}{100}$  acre (435.6 square feet) for measuring corn ear losses:

Row Width (Inches)	2 Rows (Feet)	3 Rows (Feet)	4 Rows (Feet)
20	130.7	87.1	65.3
28	93.3	62.2	46.7
30	87.1	58.1	43.6
32	81.7	54.4	40.8
36	72.6	48.4	36.3
38	68.8	45.9	34.4
40	65.3	43.6	32.7

Note: Be sure to collect fallen ears from all rows for the indicated distance.

Corn should be dried to 15.5 percent moisture if you plan to store it until the following spring.

Did you know?

Just before harvest, mark off  $\frac{1}{100}$  of an acre using the table on page 36. Pick up all ears that have fallen from this row and count them. Each good size ear (about  $\frac{3}{4}$  pound) represents an estimated loss of 1 bushel per acre. Count small ears as somewhat less than 1 bushel. How many bushels per acre loss did you estimate?

**EXAMPLE USING 4 ROWS**

30 inch row width = 2.5 feet x 43.6 feet x 4 rows = 436 square feet

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- 2 Now harvest this area and check for dropped ears and shelled kernels along the same row as before. First, count the ears dropped during harvest. Then calculate the shelled corn loss. To calculate this, consider that two kernels per square foot equals approximately 1 bushel per acre. Walk your row, and estimate what your average shelled-corn loss will be. Mark off square foot sections and count how many kernels of corn are inside that area. Add the ear loss during harvest to the shelled-corn loss to determine harvest losses. How many bushels per acre were lost during harvesting, according to your estimate?

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- 3 Harvesting loss plus loss prior to harvesting equals total loss. How many bushels per acre total loss did you have? \_\_\_\_\_

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- 4 For more accurate estimate of losses, make at least three checks at random places in your field. Record your findings below.

Estimated yield loss:

Sample	Estimated Bushels/Acre Loss Before Harvest	Estimated Bushels/Acre Loss After Harvest	Total Losses
1			
2			
3			
<b>Average Loss (Total Losses Divided by 3)</b>			

- 5 Multiply your average total bushels lost by the market price per bushel of corn to determine the value of corn lost. How many dollars loss did you determine? \_\_\_\_\_

---

Harvesting corn late causes high field losses but too early results in high drying and excessive kernel damage.

**Did you know?**



- ▶ Why is it important to determine harvest losses and total grain losses?
- ▶ What can you learn from walking the fields before or at harvest, besides determining yield loss?
- ▶ What could you do to decrease yield losses in the future?

- 6 For more information on determining corn preharvest and harvest loss, call your county Extension office and ask for a copy of PM 574, *Profitable Corn Harvesting*.



### Project or Exhibit Ideas

- 1 Create a poster showing how to calculate yield losses in corn.
- 2 Offer to help check yield losses in a neighbor's field.
- 3 Create an exhibit showing the economic impact of yield losses.
- 4 Develop a plan to minimize yield losses.

### Corn Harvesting Losses

- ▶ Harvesting losses can be separated into four types.
  - Gathering losses occur at the front of the combine, and consist of ears missed or dropped by the machine and loose kernels shelled by the stalk rolls in the cornhead.
  - Cylinder and separating losses will be found on the ground behind the combine. Cylinder losses are kernels attached to pieces of cob that were not shelled by the combine cylinder.
  - Separating losses are loose kernels that were not shaken out of the cobs and husks and were lost over the back of the combine.
- ▶ Every bushel of corn you save by careful operation of your combine adds to your profit per acre. Harvesting losses cannot be completely eliminated, but they can be reduced to 1 to 2 bushels per acre if you take time to check the performance of your combine.
- ▶ The optimum corn harvest moistures are 20 to 25 percent for combines. Corn harvested at these moistures should be dried to the values listed in the table on page 42. Corn should be dried to 15.5 percent moisture if you plan to store it until the following spring. However, corn can be held through winter at 18 percent moisture if you have a low-temperature dryer and don't finish drying it in the fall, or if you have a livestock feeding system that



corn can be held through winter at 18 percent moisture if you sell or feed it by spring.

Did you know?

allows use of wet grain. You must dry, sell, or feed 18 percent moisture corn by spring, though, or it will spoil.

- ▶ Be sure to check corn at regular intervals during the winter, to make sure it doesn't spoil. To be safe, this should be done by two adults. One turns on the bin fan while the other smells the fan air for a spoiled grain smell. This has to be done fast, because the air moving through the grain will quickly dilute the spoiled or sour smell. One person should check the grain surface for crusting while the other stays on the ground. Beware of grain entrapment and suffocation hazards while checking for crusted grain.



## Estimating Soybean Harvest Losses

Soybean yield losses can happen before or during harvesting. Before harvest, losses are caused by lodged plants and burst pods.

During harvest, losses occur from dropped plants, shattered pods, low pods that stay attached to stubble, and grain lost from the combine head. Harvesting losses cannot be completely eliminated, but they can be reduced to only 1 to 2 bushels per acre if you take the time to check the performance of your combine.

- 1 A very simple procedure will allow you to check the total soybean crop loss. Make a rectangular frame to enclose an area of 25 square feet. Make it as wide as the combine header and long enough so that when length and width are multiplied they equal 25 square feet. Such a frame could be made of heavy string or plastic clothesline taped to four wire or wooden stakes placed to give the correct dimensions. Make the pins of No. 9 wire, 3 to 4 inches long, so they can be pushed into the ground to hold the frame tight. The dimensions needed for various header widths are given in the following table.

Frame dimensions based on header width:

Header Size	Frame Width in Feet	Frame Length in Inches
	15	20
	16	19
	18	17
	20	15
	25	12
	30	10

Harvesting soybeans below 12 percent moisture increases harvest loss due to seed cracking.

**Did you know?**



**A rectangular frame used to check soybean losses in a field after harvest.**



- ▮▮▮▮ Why is it important to know harvest loss?
- ▮▮▮▮ What decisions would you make for next year based on this year's yield loss?

- 2 Place the rectangular frame across the machine swath after the combine has passed. Then count all soybeans found in this area. Don't forget those still in pods. Four beans per square foot equals about 1 bushel per acre loss. Thus, 100 beans in your 25 square foot area equals about 1 bushel. Make at least three such measurements at random places in the field, but stay away from the ends of the field. Divide soybeans found at each site by 100 to get bushels of soybean loss per acre.

Soybean loss per acre:

Sample	Number of Beans Found	Soybean Loss/Acre (Column B/100)
1		
2		
3		
<b>Average</b>		

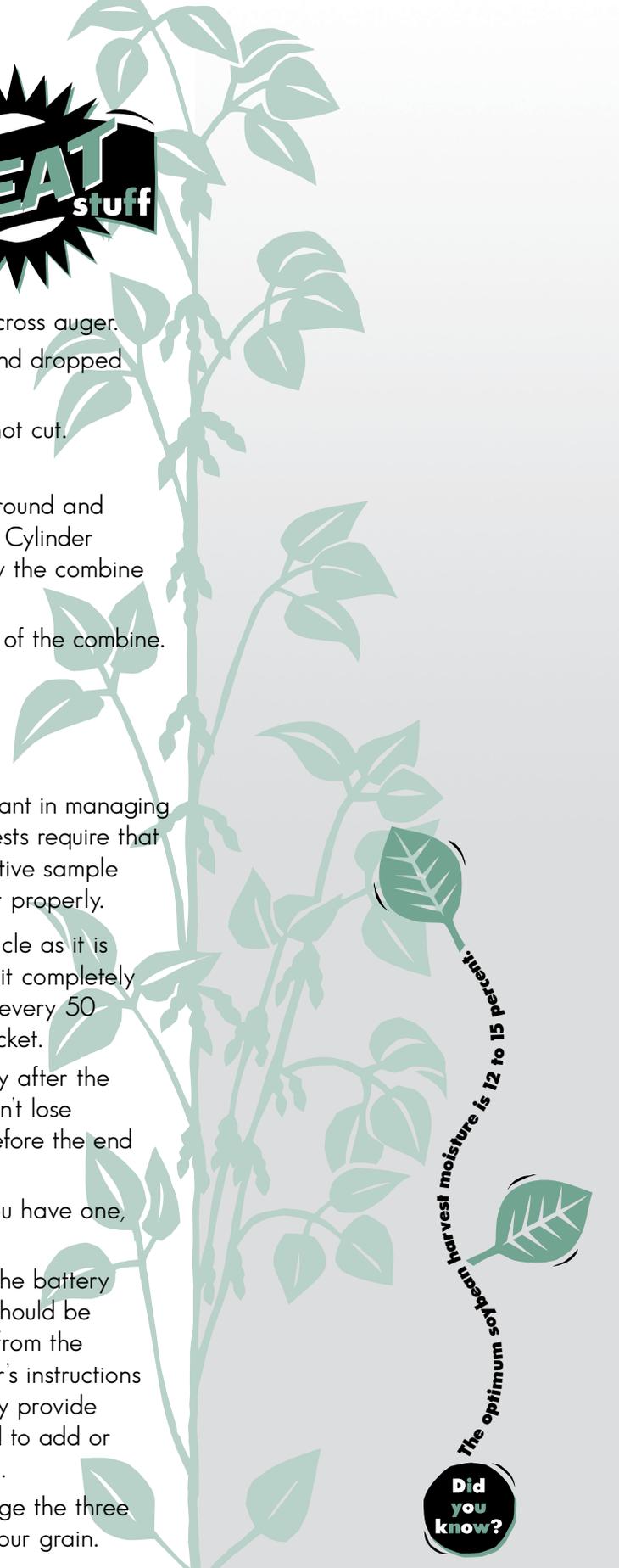
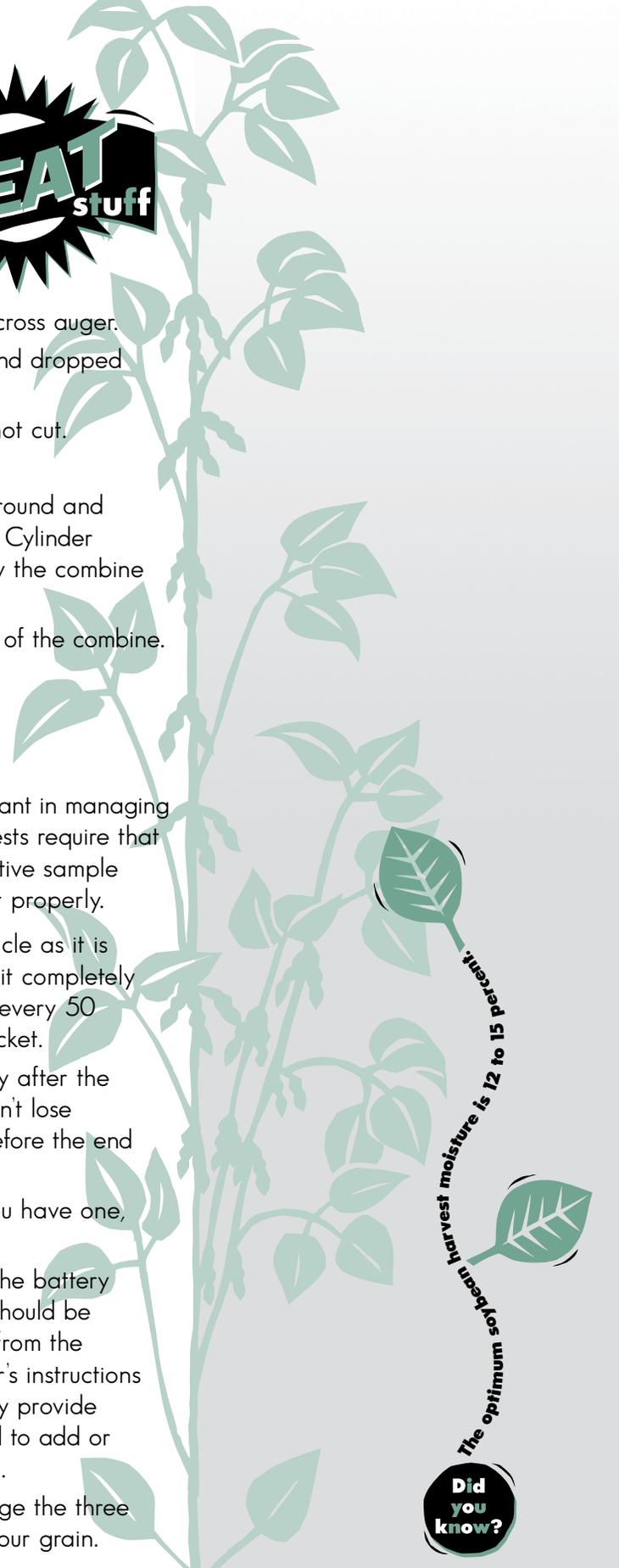
- 3 Multiply the bushels lost per acre by the current market price per bushel of soybeans to determine the value of soybean loss. What value did you determine?

### Project or Exhibit Ideas

- 1 Create a display showing where soybean harvest losses can happen, and how they can be prevented or minimized.
- 2 Do an educational presentation about soybean harvest losses and their economic value.
- 3 Develop a "harvest loss frame" and market it to neighbors to calculate harvest losses.
- 4 Offer to help some neighbors by measuring their harvest losses.



## Soybean Harvest Losses

- 
 Harvesting losses can be separated into several types of losses according to their location. Gathering losses occur at the front of the combine:
  - Loose beans and beans in pods that are shattered from the stalks by the cutterbar, reel, or cross auger.
  - Beans in pods attached to stalks that are cut off and dropped before entering the combine.
  - Beans in pods attached to lodged stalks that are not cut.
  - Beans in pods attached to uncut stubble.
- 
 Cylinder and separating losses are found on the ground and in pods attached to the straw behind the combine. Cylinder losses are beans in pods that were not threshed by the combine cylinder.
- 
 Separating losses are loose beans lost out the back of the combine.



### Using a Grain Moisture Tester

Accurate moisture tests are important in managing and marketing grain. Accurate tests require that the grain tested be a representative sample and that you use your moisture tester properly.

- 1 It is easiest to sample the grain from a loaded vehicle as it is being unloaded. Use an open container, and pass it completely across the flowing grain during unloading. Do this every 50 bushels or so, and pour the collected grain in a bucket.
- 2 If you don't take your moisture readings immediately after the grain is unloaded, cover the bucket so the grain won't lose moisture from air drying. Test the grain sometime before the end of the day.
- 3 Test your grain with a portable moisture tester if you have one, or take it to your elevator to have it tested.
- 4 When using a portable moisture tester, make sure the battery is good so you get accurate readings. The battery should be replaced once each year and should be removed from the tester when it is not in use. Follow the manufacturer's instructions for operating your tester. Some testers automatically provide temperature compensation, but for others you need to add or subtract a correction factor to the moisture reading.
- 5 Test at least three samples from your bucket. Average the three moisture readings to get the moisture percent for your grain.

The optimum soybean harvest moisture is 12 to 15 percent.

Did you know?



**Sample grain for a moisture test by passing an open container completely across the flow of grain as it is unloaded. This is done every 50 bushels or more and emptied into a bucket. The test sample is then taken from the bucket.**



**Testing grain with a moisture tester.**

Record your readings on the table below. How does the moisture percentage you measured compare with the safe storage moisture?

Moisture sampling:

Sample	Moisture Test Reading
1	
2	
3	
<b>Average</b>	

Safe storage moisture for aerated good quality grain:

<b>Shelled Corn Sold by Spring</b>	15.5%
<b>Shelled Corn Stored Up to One Year</b>	14%
<b>Shelled Corn Stored More than One Year</b>	13%
<b>Soybeans Sold by Spring</b>	14%
<b>Soybeans Stored Up to One Year</b>	12%



- ▮▮▮▮ Why is it important to get a representative sample from each load?
- ▮▮▮▮ Why is it important to measure the moisture of grain?
- ▮▮▮▮ What management decisions require you to know the moisture level?
- ▮▮▮▮ Why is it important to compare your portable moisture tester to an elevator's tester?

## Grain Drying

- ▮▮▮▮ Drying grain involves blowing dry air past a seed to remove moisture. Heating the air increases the moisture holding capacity and speeds up the drying rate. The two basic types of drying are low-temperature and high-temperature.
- ▮▮▮▮ Low-temperature drying uses unheated air (natural air) or air that has been heated just a few degrees. It takes about 4 to 6 weeks to dry a bin of grain using natural air. If the grain is too wet, it should not be dried with low temperatures because the grain will mold before it dries. The moisture content of grain and the airflow of the fan determines if grain can be low-temperature dried. For more information, get a copy of PM 1016 *Low-Temperature Drying Systems in Iowa*, from your county Extension office.
- ▮▮▮▮ High-temperature drying involves heating the air to 100 to 300 degrees F by natural gas, L.P. gas, or a biomass burner. The temperature used depends on the specific type of dryer. With high temperatures, the grain will dry more quickly in only a few hours to a few days. This method has two disadvantages—the high temperatures can stress the kernels, which leads to cracking and breaking, and it requires more energy units than low temperatures. Low-temperature drying will use more electricity than high-temperature drying, but uses no LP or natural gas, and less total energy units than high temperatures. Which method is cheaper will depend on the relative costs of electricity and LP or natural gas.
- ▮▮▮▮ Drying is not the only method that can be used to prepare grain for storage. Grain can be safely stored by using high moisture storage (silos) or by treating high moisture corn with acid preservatives. However, high moisture grain can be used only for livestock feed.
- ▮▮▮▮ The same conditions that allow mold growth on grain (high moisture and warm temperatures) also allow insect infestations. Keep stored grain dry and cool to avoid insect problems. If insects invade a bin, you probably will have to treat the grain for insects. If dry grain is to be stored for more than 6 months, you may want to treat it with an insecticide as it is placed in storage.

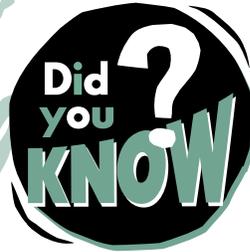


## Project or Exhibit Ideas

- 1 Create a display or poster showing proper procedures to sample harvested grain for moisture content.
- 2 Create a display comparing on-farm moisture testers to commercial moisture testers (found at the local elevator) and showing how to properly calibrate an on-farm tester.
- 3 Offer to help calibrate a neighbor's on-farm moisture testers.

### ISU Resources

- *Using Farm Moisture Testers*, PM 1633



- ▶▶▶▶ Check grain every day during low-temperature drying, every week during summer storage, and every two weeks during winter storage.
- ▶▶▶▶ For stored grain, start the aeration fan, and measure the temperature of air blowing out of the grain and smell it, checking for musty or sour odors.
- ▶▶▶▶ Your parent or other adult should walk on the grain surface and probe the grain looking for moldy, sticky, or warm kernels. **Walking on the grain surface can be dangerous and should not be done by 4-H'ers.**
- ▶▶▶▶ Grain temperatures should be 30 to 40° F in winter and 50 to 60° F in summer to reduce chances of mold growth.

# Marketing

## CHAPTER 5

### Marketing for Profit

Marketing the grain crop you produce can be an important part of the crop production process. The price buyers will pay for your grain changes constantly. You will need to pay close attention to market conditions if you are to sell your grain at a price that will cover the costs of producing it and make a profit.

### Who's Going to Market?

One little piggy went to market,  
one little piggy stayed home,  
One little piggy had roast beef,  
one little piggy had none,  
And one little piggy went whee, whee, whee  
all the way home.



A good grain producer knows when to market the product, and when to hold the product. Selling when the market is high, however, isn't as easy as it sounds. In this activity you will identify sources of information to use in making your marketing decisions.

Identify three to five sources of marketing information, what information is provided, and how you might use that information in decision making. One example is included in the table. Remember to use a variety of sources. Record your information in the following table or in your journal.

Source of Information	Information Provided	How to Use in Decision Making
<a href="http://www.nass.usda.gov/ia/">www.nass.usda.gov/ia/</a>	Monthly crop production reports and planting intention reports.	Predicting how much grain crop will be available this fall (supply), and to determine how well the current crop is growing to aid in predicting market upswings.

(continued)



- ▮ Did you include several different sources, such as radio, newspaper, Internet, local elevators, etc? Why is it important to have a variety of information sources?
- ▮ Are some of your sources more biased than others? How can you tell if a source is biased or unbiased?
- ▮ Supply and demand are two key components of marketing, but what are some others?
- ▮ How does weather impact supply and demand? Did you include a weather information source?
- ▮ What are some international factors that affect market prices?

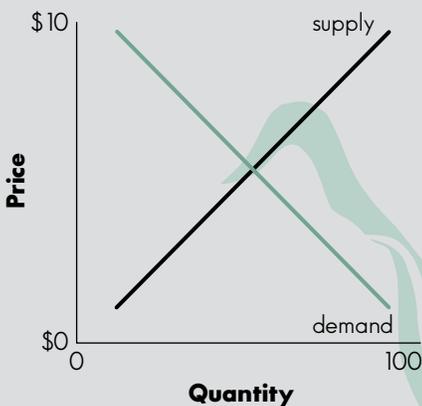
(continued)

Source of Information	Information Provided	How to Use in Decision Making



### Project or Exhibit Ideas

- 1 Create a journal tracking grain supply and demand, and market prices.
- 2 Identify a longer list of information sources. Create your own "checklist" to evaluate each site to determine the two or three that best meet your needs for information and marketing.
- 3 Create marketing charts for your local grain prices.
- 4 Learn more about other methods of marketing grain, such as hedging, contracting, and forward pricing. Compare and contrast the advantages and disadvantages of each.



**Understanding how supply and demand affect market price will help in determining when to market your grain.**

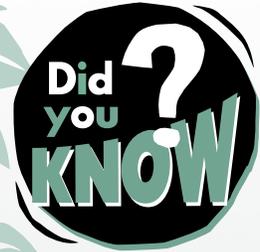
### Grain Marketing

- ▮ The price of grain depends on the supply and the demand. Supply is the amount of grain available for sale. Demand is the amount of grain that people want to buy. As the demand goes up, sellers can ask higher prices for their grain. When demand for a grain crop goes down, it is harder to sell, so sellers usually lower their prices to make it more attractive to buyers.
- ▮ The supply of a grain has just the opposite effect from demand. When the supply of grain for sale is small, the buyers compete more strongly to obtain the grain, and so they are willing to pay



higher prices. On the other hand, when the supply is large, sellers usually lower their prices to encourage people to buy more of a particular grain.

- Generally a one percent change in the total supply of corn will push the price of corn two percent in the opposite direction. As an example, if the price of corn is \$2.75 per bushel and the supply increases by three percent, the price will be lowered six percent, bringing the price of corn down to \$2.59 per bushel. For soybeans, the price change is 2.5 percent in the opposite direction of a 1 percent change in the supply.



- The supply of a grain crop depends on the amount that is produced each year, plus the amount left over in storage from other years.
- The national yield depends on the weather and on disease and insect conditions.
- The demand for a grain crop depends on how much is needed in our own country and how much is wanted by other nations.



### What's It Worth?

Once you have decided when to sell your grain, you must decide how to price it. You have several alternatives. You can forward price the crop before harvest, sell it at harvest, store the crop and sell it later, or store the crop and forward price it for delivery at some

later time. Your goal is to choose an alternative that will cover your production costs and allow you to make a profit.

- 1 Create your own pricing chart for soybeans or corn. Each Wednesday record the nearby futures price and the cash price at your local elevator on a table similar to the one below. You can obtain this information from newspapers, radio, television, a local elevator, or a brokerage firm. Keep track of prices for at least one year in order to see trends.

Date	Nearby Futures Price	Cash Price	Basis (Futures—Cash Price)	Other Market Factors

- 2 Other market factors, such as weather, grain exports, and acreage can cause prices to change from one week to the next. Include these in your price record report also.
- 3 Plot the prices on a graph and observe for any seasonal fluctuations in prices.



- The difference between the cash price and the futures price is called the basis. What happened to the basis at harvest time?
- How did the basis at harvest time compare to the basis in December, February, and June?
- Did other market factors have a major impact on cash or futures prices this year?
- When was the best time of year to sell grain on a cash basis? Was the highest cash market at the same time last year?

## Project or Exhibit Ideas

- ➊ Keep your journal of prices and charts for two to three years and compare them. Are there common trends or seasonalities?
- ➋ Create a display showing the comparisons between prices and market factors.
- ➌ Develop a poster showing a grain marketing decision-making model.
- ➍ Share your graphs with other producers in your area. Do they have similar graphs over more years to aid in long-term market analysis?

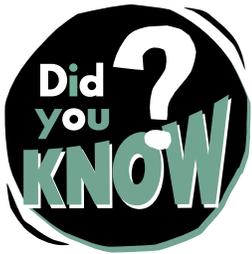


## Pricing

- Forward pricing is simply making arrangements to sell a crop before it is actually delivered to the buyer. It can be accomplished through a cash contract with the local elevator or through the futures market.

- In a cash contract, the farmer agrees in advance to sell the crop to the elevator for a price set with a formula with set delivery requirements. The advantage of this arrangement is that the farmer is given a guarantee of a certain price or range of prices, for the grain. The disadvantage is that if variables in the price formula move in unexpected directions after the contract is made, the farmer still must accept the resulting price agreed to with the elevator. Another disadvantage could occur if the yield is less than expected; the farmer still would need to deliver the quantity agreed to and may need to buy grain to deliver all the grain. The price of the grain that the farmer buys may be more than the forward price.
- Futures contracts are somewhat similar to cash contracts. They too are made when the producer agrees to sell the crop for a certain price and deliver it later at a certain time. Such an agreement is called selling futures.
- An important difference between the two types of contracts is that a futures contract can be offset easily. Farmers and other users of the futures markets generally offset their futures positions by purchasing contracts in the crop and month that they would have sold the contract. In fact, it is extremely rare for Iowa farmers to deliver grain to fulfill a futures contract. Farmers generally use the futures market as a means of gaining some certainty about the expected price of their crop. We call this price risk management.

- Suppose, for example, that at harvest a farmer sells a futures contract for delivery in March. Typically, the farmer would buy back the futures contract in March and sell the grain crop to the local elevator. By trading in futures, the farmer can avoid the risk of losses that would occur if the cash price were to drop sharply. Price risk is exchanged for basis risk. This process is call hedging.
  - To decide whether a cash contract or a futures contract that allows hedging is better, a producer must be able to estimate basis. The basis is the difference between the local cash price and the futures price. In the example described above, suppose that a March futures contract for soybeans is priced at \$7.00 per bushel and that the local elevator is offering \$6.50 per bushel. The basis in this case is \$0.50. If the basis in March is normally \$0.30, the farmer is better off hedging, or selling the March futures contract, than accepting the cash contract.
- ISU Extension Ag Economists track basis for the crop reporting districts and major grain markets. Several sources of basis information are listed below.



- Current ag market news can be found on the ISU Extension website, [www.extension.iastate.edu/Information/market.html](http://www.extension.iastate.edu/Information/market.html).
- Ag market news includes weekly average price comparisons, commodity market reports, Extension radio programs, and links to the Chicago Board of Trade and Chicago Mercantile Exchange.

# Biotechnology. The New Frontier

## CHAPTER 6

### Plant Breeding

Humans have been selecting plants and animals with improved genetics and desirable traits like increased yield and better taste since 5000 BC. Corn and wheat were two of the first crops to be genetically modified by early agriculturalists through selective seed gathering and planting.

The work of Austrian monk, Gregor Johann Mendel, with garden peas in the 1800s taught us the principles of heredity of physical characteristics. These principles (Mendel's laws) became the basis for modern genetics and heredity, and are still used by plant breeders and geneticists. Heredity is the process of transmitting biological characteristics from parent to offspring through genes. Genes are the basic units of heredity. Did you know that one-half of your biological characteristics came from your mother and one-half from your father?

Biotechnology, the manipulation of biological organisms to make products that benefit human beings through hybridization or selective cross breeding of plants and animals, has been around since the dawn of civilization. The modern era of biotechnology, however, started in 1953 when two scientists, American biochemist James Watson and British biophysicist Francis Crick, discovered the double-helix model of deoxyribonucleic acid (DNA). DNA, an organic acid and polymer composed of four nitrogenous bases—adenine, thymine, cytosine, and guanine, is the genetic material of most organisms. Other words used to describe this exciting area of study include gene cloning, genetic engineering, genetically modified organisms (GMOs), gene splicing, and recombinant DNA. Biotechnology compliments or assists the traditional plant breeder's work in improving crops through selective breeding.

The *Bacillus thuringiensis* gene has been inserted into corn, cotton, and potato varieties.

**Did you know?**



### Friend or Foe?

New advances in biotechnology have not been without controversy. Some advances such as development of Bt corn and Roundup Ready soybeans have proven beneficial for producers, but have been questioned by consumers. In this activity you will explore both sides of the biotechnology issue.

- 1 Use the Internet, newspapers, magazines, or library to find three articles or resources related to the advantages and benefits of a genetically engineered crop. Also find three articles or resources that oppose or question this crop. Some examples of genetically engineered crops include Bt corn, Roundup Ready soybeans, Roundup resistant corn, the FlavorSaver tomato, and many more new products that will continue to come on the market over time.
- 2 Record all the advantages and disadvantages to the producer of your crop.
- 3 Record all the advantages and disadvantages to the consumer of your crop.
- 4 Discuss with other producers, parents, or members why this genetically modified crop should be produced.



### Project or Exhibit Ideas

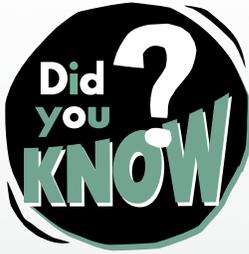
- 1 Lead a discussion in your club on the pros and cons of genetically modified crops. Remember to invite some experts on the topic, and to include both sides of the issue.
- 2 Write a news release showing the differences among opinions of producers and consumers.
- 3 Develop a poster showing the opposing views on genetically modified crops.
- 4 Research this topic, then prepare an exhibit or give a presentation on the various methods researchers have used—past and present, in genetic engineering.

### Biotechnology

- Biotechnology is rapidly expanding into many different areas, including law, waste management, mining, and medicine. For example, corn and other plants are now being genetically engineered to produce cheaper and better medicines. These crops are called biopharmaceuticals, or "pharma-crops." This industry has significant economic potential. However, critics are concerned about the potential contamination of the Nation's food and feed supply. They argue that this bio-corn should not be grown near crops for human or animal food since windborne pollen may contaminate nearby "regular" fields. Currently there are more than 400 products being developed by about 20 companies and universities. These products include vaccines, anti-HIV drugs, oral treatment for traveler's diarrhea, anti-clotting agents, and industrial enzymes. For more information, go to the ISU Plant Sciences Institute web page, [www.plantsciences.iastate.edu/](http://www.plantsciences.iastate.edu/).



- Why should we consider the opinions of the consumer as we develop new products?
- What factors influence consumer attitudes toward this issue?
- How many of your sources were based on research? How many were based on public opinion? How can you tell the difference?
- How do you weigh the advantages to producers versus the disadvantages in the view of consumers?
- Who else would be affected by the adoption of these crops?
- How have these new technologies impacted crop production?
- What are some other uses of biotechnology in crop production?
- Will the advantages and disadvantages of this modified crop provide some benefit to all, or will some profit at the expense of others?
- Should consumers have the right to know if their food is produced from genetically altered methods?



-  Genetic engineering is the addition of the DNA of a gene into the chromosomes of another organism by use of laboratory methods.
-  The soybean and corn growers fund research on production and new uses of these crops through organizations such as the Iowa Soybean Promotion Board and the Iowa Corn Promotion Board.
-  For more information about the history of biotech, check out this website—[www.iowabiotech.com/](http://www.iowabiotech.com/)

 Using biotechnological principles, a gene from one species can be incorporated into a host species. This process is called transgenic (between species) engineering. This process of improving an organism is controversial and has many critics as well as supporters. Some object to a procedure that changes the genetic composition of an organism. Another concern is that a genetically altered form may cause the extinction of an existing species of plant or animal.

 This is an exciting time to be in agriculture. Dramatic change is occurring due to market and consumer demand, new products, technological developments like biotechnology, and new manufacturing processes.

### Additional Resources

-  The following ISU biotechnology publications can be ordered at the county Extension office:
  - NCR No. 483, *Careers in Biotechnology*
  - NCR No. 487, *Principles of Biotechnology*
-  The following web pages contain additional information on advances in biotechnology.
  - [www.unitedsoybean.org/](http://www.unitedsoybean.org/)
  - [www.iasoybeans.com/](http://www.iasoybeans.com/)
  - [www.ncga.com/](http://www.ncga.com/)
  - [www.iowacorn.org/](http://www.iowacorn.org/)
  - Iowa Grain Quality Initiative, [www.extension.iastate.edu/Pages/grain/news/biotechnews.html](http://www.extension.iastate.edu/Pages/grain/news/biotechnews.html)
  - ISU Extension Science, Engineering and Technology (E-SET), [www.extension.iastate.edu/e-set/](http://www.extension.iastate.edu/e-set/)
  - ISU Office of Biotechnology, [www.biotech.iastate.edu](http://www.biotech.iastate.edu)
  - Biotechnology Outreach Education Center, [www.biotech.iastate.edu/publications/BOEC/default.html](http://www.biotech.iastate.edu/publications/BOEC/default.html)
  - National Center for Biotechnology Information, [www.ncbi.nlm.nih.gov/](http://www.ncbi.nlm.nih.gov/)

# Precision Agriculture

## CHAPTER 7

### New Technologies

Production agriculture changed dramatically during the late 1900s. Larger farms and expensive labor and equipment motivated farmers to move to mechanized agriculture and adopt larger field sizes to benefit from economy of scale. Cost and technology restraints caused farmers to treat these large fields in a uniform way. However, this is not necessary anymore. Precision agriculture, sometimes called site-specific farming, allows a farmer to identify the variability within a field and manage that variability to increase crop production and profits. The use of precision agriculture techniques offers the opportunity to use new and emerging technologies to better manage crop production.

Precision agriculture is made possible through the merging of several technologies including: personal computers, global positioning systems (GPS), geographic information systems (GIS), variable rate controllers (sometimes called variable rate technology or VRT), in-field and remote sensing, and telecommunications. GPS technology uses satellite transmissions to determine the precise latitude and longitude of any location on earth. GIS technology uses software to coordinate the data gathered to help form detailed maps of a given point in a field. VRT uses these new methods to apply precise amounts of nutrients, lime, pesticides, etc. on that area of the field. The end result is the generation of layers of information including yield (combine yield monitors), soil characteristics, nutrient levels, pest levels, etc. to help determine the best management practices within a particular field. This, in turn, should help a farmer maximize profit.



### Finding Precision

Explore your farming operation to find what precision farming technologies you are using. Complete the table with the help of your parents or crop advisors. What technologies are you currently using? How do you use the information or the power of that precision farming technology?

How could you better use that information, or better take advantage of the power of that tool?



- ▣ Do you feel you are fully utilizing the abilities of the technologies you identified?
- ▣ What is preventing you from utilizing the technologies better?
- ▣ Who do you need to cooperate with in order to better use the abilities of these technologies?

Precision Farming Technology	How We Use It Now	How Could We Improve



### Project or Exhibit Ideas

- 1 Visit with farmers, agronomists, or Certified Crop Advisers and fertilizer dealers who are using precision agriculture, then share your findings at a club meeting.
- 2 Develop a poster on precision agriculture or give a presentation at the fair.
- 3 Demonstrate to your club how one of the technologies you are using helps your farming operation.

### Precision Farming

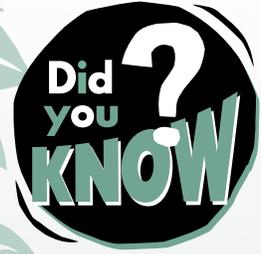
▣ Not all parts of a field will yield the same because of the variability in soil texture, soil structure, pests, and pathogens. By using the newest technologies, such as satellites and computers, you will be able to match your inputs and practices to localized conditions within a field—also called precision farming. Precision farming will help to maximize yield by minimizing the necessary inputs for a specific part of the field. An example might be a low-lying area in a field. Standing water could inhibit growth and yield even though the maximum input was used for that specific crop. Those inputs could be minimized and costs saved with no or minimal yield loss. Another more technical term for precision farming is site-specific management. Regardless of the name, the goal is to maximize crop returns using better management decisions with a minimum amount of inputs while protecting the environment. The environment is protected because only the precise quantity of inputs is applied when and where needed.



- ▶▶▶▶ GPS (Global Positioning System) is a valuable tool for precision farming since it helps to find specific locations. When GPS data is combined with other numerous types of data from specific locations, data are given a geographic address on a map using Geographical Information Systems (GIS). In agricultural applications GPS data can be connected with numerous information such as precipitation, soil types, yield, and seed type planted. Using GIS will then help to manage the data in a simple and easy way. A certain location within a field can be analyzed for rainfall, fertilizer and pesticide application, and soil type in relation to yield. GIS allows this type of data analysis. The data is usually in a map format with graphical data representation overlaid on the map.
- ▶▶▶▶ Another important part of precision farming is yield maps. Yield maps are created using GPS coordinates and GIS-based software and serve as a report card of a given year's crop yield. Low-yield areas on the map should be identified to determine if causes are related to obvious factors such as soil type, drainage, or a pest infestation. Where causes of low yield are not known, additional scouting and monitoring may be justified in future years.

### Additional Resources—Web Pages to Visit

- *Introduction to Precision Agriculture*, PM-1703, [www.extension.iastate.edu/Publications/PM1703.pdf](http://www.extension.iastate.edu/Publications/PM1703.pdf)
- ISU Extension—Iowa Soil and Land Use, [extension.agron.iastate.edu/soils/](http://extension.agron.iastate.edu/soils/)
- Federal and Educational Institutions Precision Agriculture web sites, [nutcracker.ae.iastate.edu/precision-ag-links.html](http://nutcracker.ae.iastate.edu/precision-ag-links.html)
- United Soybean Board, [www.unitedsoybean.org/](http://www.unitedsoybean.org/)
- Iowa Soybean Association and Iowa Soybean Promotion Board, [www.iasoybeans.com/](http://www.iasoybeans.com/)



- ▶▶▶▶ Precision agriculture may:
  - improve crop yields and profits
  - provide better information for making management decisions
  - provide more detailed and useful farm records
  - reduce fertilizer and pesticide costs
  - reduce fertilizer loss
- ▶▶▶▶ The Iowa Soybean Promotion Board is funding research on remote sensing of fields to identify potential problems early in the growing season.

# Careers

## CHAPTER 8

### Career Planning

Career opportunities in the field of crop production and all its related areas keeps broadening. Throughout this guide we have included a section on careers related to each topic area.



- 1 Identify five career tracks you might be interested in pursuing. They don't have to be directly related to crop production. \_\_\_\_\_  
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\_\_\_\_\_  
\_\_\_\_\_
- 2 What education or training is needed for each of these? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 3 What aspects of these careers are most interesting to you? \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_
- 4 How might a general knowledge of crop production be helpful in each of these careers? Remember to think broadly. \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



5 Identify someone you know in one of these areas to interview. Some questions to consider include:

- How often does this job involve working with people, objects, information, animals, or plants? \_\_\_\_\_

\_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

- What is the average income for a person in this type of job?

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 \_\_\_\_\_

- In what kind of surroundings would a person in this job work?

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 \_\_\_\_\_  
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- If you had this kind of job, what type of friends might you develop through your job? \_\_\_\_\_

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- How might this job affect your future family? \_\_\_\_\_

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- ▶ Why is it important to identify several career tracks that are interesting?
- ▶ How can you use your knowledge of crop production to benefit others in these career choices?
- ▶ Who can help you narrow your choices of careers? How might they help?
- ▶ What aspects of your crop project have influenced your career choices?

Career	Salary Range	Locations	Education Needed	Training Needed



## Project or Exhibit Ideas

- ① Create a poster showing two or three career choices and why you are interested in them.
- ② Lead a discussion with others in your club about career interests.
- ③ Invite someone to share his or her career with others in your club.
- ④ Create your own journal listing the advantages and disadvantages to several career choices of interest to you. Include information from the discussion above. Use this in selecting advanced training beyond high school.

## Ag Careers

▮ Iowa State University College of Agriculture student services office reports that the starting salaries for graduates in field crop careers averages about \$32,500 and ranges from \$25,000-\$42,000.

- ▮ Some of the most common types of field crop careers include
- Crop consultant
  - GPS technician
  - Grain elevator manager
  - Seed geneticist
  - Seed sales and marketing manager
  - Chemical sales and marketing manager
  - Chemical research and development
  - Seed research and development
  - Journalist/editor



## Be a Shadow

Several career options appear throughout the 4-H crops project materials. You are encouraged to start thinking about your interests and what you might like to do. Now is the time to put this in action to really discover the world of crop production!

- ① Select one of the careers you have studied and have an interest in, and identify an individual in that career. Contact that person and ask if you can spend a day or two with the individual. Be considerate of his or her time and workload in trying to schedule a day working together. Be sure to do your homework so you are prepared to make good use of this shared time.



2 Observe the person's work style and work time. Record your observations in your journal. Some questions to consider include:

- What were the education or experience requirements for the position? \_\_\_\_\_

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- Who does the person work with? \_\_\_\_\_

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- What were the working conditions? \_\_\_\_\_

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- Did the person spend most of the time inside or outside? \_\_\_\_\_

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- ▮▮▮▮ What did you observe about the training needed to advance in this career?
- ▮▮▮▮ Did the job shadow experience change your interest in this career?
- ▮▮▮▮ After your job shadowing, are there other jobs that might be of interest to you or that you would like to learn more about?

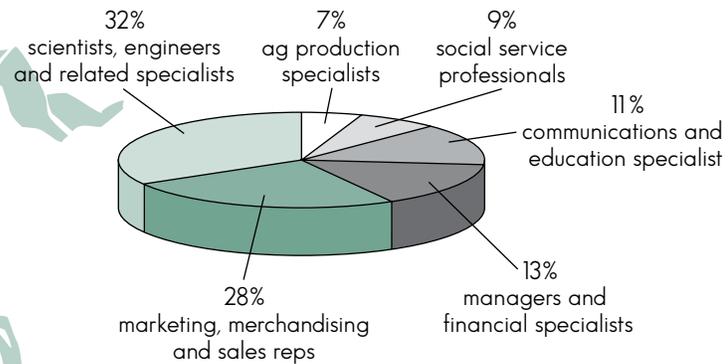
### Project or Exhibit Ideas

- 1 Record your thoughts and interests in careers in your journal. Create a list of interesting careers and develop a list of education needed for each.
- 2 Create your own education planning chart including the education and experience training needed for each of the careers you have identified. Focus on how you might start your education without limiting your career options.



## Career Opportunities

According to a Purdue University study on ag careers, job openings for U.S. food and agricultural science graduates will exceed the number of students graduating in agriculture. They break down the career possibilities according to these categories:



Other career possibilities

- Commodity trader
- Purchasing manager
- Financial manager
- Advertising manager
- Reporter
- Editor
- Real estate appraiser
- Land developer
- Field engineer
- Human resource director
- Environmental planner
- Water resource specialist
- Packaging engineer
- Quality control coordinator
- Landscape designer
- Food chemist



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