

# 4-H Breeding Swine Project Reference Guide

## Table of Contents

### Section 1: Getting Started

- Introduction
- How to Use Your Reference Guide
- Purpose of the 4-H Breeding Swine Project
- Project Options
- What Do You Need?

### Section 2: Knowledge and Skills Checklist

- Project Requirements
- Required Swine Activities, years 1 and 2
- Required Life Skill Activities, years 1 and 2
- Additional Swine Activities, years 3 and beyond
- Additional Life Skill Activities, years 3 and beyond

### Section 3: Background Information

- Why Do We Raise Pigs?
- What Names do we use for Pigs?
- The Swine Industry in the United States

### Section 4: Breeds of Swine and Breeding Systems

- Major Breeds
- Your Pig's Pedigree
- Purebred Breeding Systems
- Crossbreeding Breeding Systems

### Section 5: Selecting Project Animals

- Naming External Parts of the Pig
- Selecting Project Gilts
- Performance Data
- Making Genetic Improvement
- Health Considerations (See Quality Assurance in Section 10)
- Selecting a Boar
- Breeding Project Budget

### Section 6: Facilities

- Keeping Pigs Comfortable
- Breeding, Gestation, and Boar Housing Needs
- Farrowing Housing
- Nursery Housing
- Keeping Your Pigs Clean
- Handling Equipment

## Section 7: Swine Reproduction and Breeding

- Sow and Boar Reproductive Systems

- The Estrous Cycle

- Identifying Gilts/Sows in Heat

- Mating Sows: Natural Mating vs Artificial Insemination

- Vaccinations

- Nutrition

## Section 8: Gestation and Farrowing Management

- Gestation

- Gestation Nutrition

- Preparation for Farrowing

- The Farrowing Process

- Problems at Farrowing

- Lactation

- Lactation Problems

- Lactation Nutrition

- Starting Lactating Sows on Feed

- Temperature Regulation

## Section 9: Baby Pig/Nursery Management

- Baby Pig Processing

- Scours

- Creep Feeding

- Weaning

- Nutrition of Weaned Pigs

## Section 10: Marketing Your Feeder Pigs and Sows

- Feeder Pig Marketing

- Sow Marketing

- Quality Assurance

## Section 11: Keeping 4-H Records

- Why Keep Records?

- Kinds of Records

- Financial Records

- Animal Performance Records

- Animal Production Records

- Management Practice Records

- Your 4-H Accomplishment Records

## Section 12: Breeding Swine Management Schedule

# Breeding Swine Reference

## Section 1 Getting Started

### Introduction

Welcome to the 4-H breeding swine project! This project can be an unforgettable learning experience. You will do many things that will help you grow personally and develop skills that will help you become a more responsible person. Skills you learn from breeding and farrowing a gilt or sow will be valuable in the future and will carry over into other aspects of your experience as a 4-H'er. We hope you will have fun, too.

This book will teach you most of the things you need to know to select, breed, and farrow a gilt or sow. There are skills to learn and activities for you to do. You should complete six activities per year. Each year you should select six activities from either the suggested activities list in this book, or from the "4-H Skills for Life", if your county uses that series. Do as many of the activities as you can by yourself, but be willing to call on others for help. As you get older and advance through the swine project, you should select more advanced activities to accomplish. Your parents and project leaders will be happy to teach you all they know about raising swine!

### How to Use Your Reference Guide

Your reference guide is designed to fit into a 3-ring notebook with your project record books. You will receive only one reference guide for your entire 4-H career, so take care of it! It contains a checklist of things you should do and learn to complete your project. The things to do and learn are grouped into lessons about swine. Each lesson includes:

- objectives for that lesson
- information about swine and how to care for them
- words to learn
- ideas for presentations and talks
- suggested activities
- things to talk about with your leaders and other 4-H'ers.

### Purpose of the 4-H Breeding Swine Project

In the Breeding Swine Reference Guide, you will learn the fundamentals of being a good swine producer and build skills that will prepare you for life.

Some of the things you will learn about swine management are:

- why people raise swine
- how to select pigs for your project using performance data
- how to feed and care for breeding swine
- how to keep your sows and litters healthy
- how to breed and farrow a sow

- the parts of a pig
- what happens during gestation
- how to keep records
- how to successfully market feeder pigs and cull sows

Working with your pigs and taking part in 4-H activities will help you to develop personally and build skills for living. These skills include:

- being a leader
- being a citizen
- communicating effectively
- developing personally
- relating to people
- developing values
- preparing for a career

### **Project Options**

Two basic kinds of 4-H swine projects are:

- 1) Market Swine—selection and feeding of one or more feeder pigs to market weight.
- 2) Breeding Swine—care and management of swine raised for breeding purposes. This includes selection and management of one or more gilts from breeding to farrowing, and management of sows and their litters (not recommended for beginning 4-H members).

You will be responsible for caring for your swine. You may choose to take market swine, breeding swine, or both kinds of projects each year. Some things for you to think about when choosing market or breeding projects are:

- do you want a short-term or long-term project?
- how much money can you afford to spend?
- what kinds of buildings, equipment, and feeds do you need?
- how much help can your parents give?

Breeding swine projects are usually continued for more than one year. Market hog projects can be completed in a few months and require fewer facilities and management skills than breeding swine projects.

This book contains information on breeding swine projects only. You will need to get a 4-H Market Swine Project Reference Guide if you elect to take a market swine project.

### **What Do You Need?**

Before purchasing any pigs, make sure you have everything you need to properly manage them and keep them healthy. If you plan to take a swine project, you will need:

- an interest in swine
- a place to keep and farrow your pigs
- equipment for feeding, watering, and handling swine
- money to purchase and care for your pigs
- support from your parents and leaders

## **Section 2**

### **Knowledge and Skills Checklist**

#### **Project Requirements**

Your breeding swine project has three major parts.

1. Breeding and farrowing one or more sows or gilts each year.
2. Completing activities and learning skills needed to complete the breeding swine project. You should complete three swine knowledge skills, and three life skill activities each year. Choose the six activities from either the lists of additional activities in this book or from the “4-H Skills for Life” series. You may do more than six activities if you want to.
3. Keeping records. The records you should keep are:
  - For the first two or three years of a 4-Her’s swine project career (either market or breeding project), members should keep a 4-H Animal Project Record for Beginning Members. Start a new one each year. Older and more experienced 4-H’ers should keep a 4-H Livestock Record for Intermediate and Advanced Projects instead.
  - The Knowledge and Skills Checklist. This can be found in your reference guide.
  - A record of your entire 4-H career. Your leader may ask you for this information if you want to be considered for some 4-H awards.

#### **Do these things each year:**

1. Plan with your parents and leaders what you will do for your project. Identify the skills you would like to learn and the activities you would like to do. Write your goals in your 4-H project record book.
2. Prepare a budget for your 4-H breeding hog project. (See Section 5)
3. Select, breed, and farrow one or more gilts or sows.
4. Keep records of your goals, numbers of pigs, things you do to feed and care for them, money you spend and receive, and your 4-H experiences. Write them in your 4-H project record.
5. Participate in 4-H meetings and activities.
6. Do at least six activities each year. Complete three swine knowledge skills, and three life skill activities each year from the lists of additional activities in this book or from the “4-H Skills for Life” series. Have your leader or parent sign the checklist as you

finish each activity. You may substitute other activities with your leader's permission.

7. Turn in this reference manual and your project record to your leader by the due date for your club or county.

### **Required Swine Activities, years 1 and 2**

Choose three the first year, and three the second year. If you've already completed these activities for a market project, move on to the "Additional Swine Activities" list.

**Date done      Signature**

- Explain the meaning of these sex-related terms for swine: boar, sow, barrow, and gilt.
- Name and locate at least 10 of these body parts on a live hog or diagram of a hog: ham, loin, shoulder, belly, tail, feet, knees, hocks, pasterns, jowl, ears, snout, teats, vulva, testes, and sheath.
- Show and tell the proper way to drive and handle pigs.
- Lead your parent or project leader on a tour of the place where you keep your swine and point out the things you are doing to take care of your pigs.
- Name the three main things that cause pigs to get sick and at least four signs to look for to recognize sick pigs.
- Tell what the normal body temperature of swine is and show or tell the proper way to use a veterinary thermometer.

### **Required Life Skills Activities, years 1 and 2**

Choose three the first year, and three the second year. If you've already completed these activities for a market project, move on to the "Additional Life Skill Activities" list.

- Know and recite the 4-H Pledge, the 4-H Club Motto, and colors.
- Plan what you will do for your project with your parents or leaders each year.
- Select a project gilt using your knowledge of parts and desirable types.
- Keep records of your goals, numbers of swine, things you did and accomplished with them, money spent and earned, and your 4-H activities in your 4-H project record.
- Give a presentation about something you learned about swine at a club meeting or your county presentation contest.

- Prepare an exhibit of your animal or something you made for this project at your county roundup.

### **Additional Swine Activities, years 3 and beyond**

Choose three of these activities each year after the first two years.

- |  | <b>Date done</b> | <b>Signature</b> |
|--|------------------|------------------|
| <ul style="list-style-type: none"> <li>• Tell what to look for when choosing animals for breeding hog projects.</li> <li>• Name at least six breeds of swine raised in Pennsylvania.</li> <li>• Identify at least six breeds of hogs from their photos or from seeing live hogs.</li> <li>• Describe the important characteristics of your breed of swine.</li> <li>• Visit a fair or show and listen to the swine judge give reasons for placing classes of breeding pigs the way he or she did.</li> <li>• List three signs that a gilt or sow is in heat.</li> <li>• Artificially inseminate a sow.</li> <li>• Show a bred gilt at the Pennsylvania Farm Show.</li> <li>• Visit a breeding stock sale to look for pigs that might make suitable project animals.</li> <li>• Visit a large breeding swine facility and learn about its feeding and watering system. Also observe how the owner keeps the pigs comfortable.</li> <li>• Find out what veterinary examinations and documents are needed to show a pig at a state show, such as the Pennsylvania Farm Show.</li> <li>• Describe diseases that can cause reproductive problems in swine.</li> <li>• Prepare a health management plan for properly vaccinating your sow or gilt.</li> <li>• Select a boar from an AI catalog based on performance data. Defend your decision.</li> <li>• Explain to your leader why lactating sows need more feed than do gestating sows.</li> <li>• Describe three signs that a sow is near farrowing.</li> <li>• Start your own library of books, leaflets, and magazines about breeding swine.</li> <li>• Make a kit filled with first-aid supplies and equipment needed to keep your swine healthy.</li> <li>• Demonstrate how to correctly read ear notches.</li> <li>• Castrate boars from a litter of baby pigs.</li> <li>• Collect equipment needed to artificially inseminate a sow</li> <li>• Collect equipment needed to process a litter of baby pigs..</li> </ul> |                  |                  |

- Do a swine skill activity not named on this list.

### **Additional Life Skills Activities, years 3 and beyond**

Choose three of these activities each year after the first two years.

- |  | <b>Date done</b> | <b>Signature</b> |
|--|------------------|------------------|
| <ul style="list-style-type: none"> <li>• Lead the Pledge of Allegiance at a 4-H meeting.</li> <li>• Lead the 4-H Pledge at a 4-H meeting.</li> <li>• Lead a song or game at a 4-H meeting.</li> <li>• Serve as a committee member.</li> <li>• Serve as chair of a committee.</li> <li>• Serve as an officer of your club.</li> <li>• Help plan your club's yearly program.</li> <li>• Help with a fund-raiser for 4-H.</li> <li>• Help with a parents' night or club achievement program.</li> <li>• Help with a 4-H event or activity.</li> <li>• Help with a community service project.</li> <li>• Give a committee or officer's report to your club.</li> <li>• Give a talk to your club about something you learned or did with your swine project.</li> <li>• Give a presentation or talk to a group other than your club.</li> <li>• Act out a skit or pretend you are making a radio or television commercial about 4-H or pork.</li> <li>• Make a poster to tell people about 4-H or something you have learned in this project.</li> <li>• Help prepare a booth or window display to tell about pork, swine, or 4-H.</li> <li>• Help prepare a parade float to tell about pork, swine, or 4-H.</li> <li>• Attend a meeting on farm fire safety.</li> <li>• Help to educate the public about the benefits of raising swine or using pork and pigskin.</li> <li>• Write a thank-you letter to a buyer of your feeder pigs or someone who helped you or your 4-H club.</li> <li>• Write a news story about your club or your project for a local paper or a 4-H newsletter.</li> <li>• Bring a friend who is not a 4-H member to a 4-H meeting or activity to interest him or her in 4-H.</li> <li>• Attend a 4-H camp or overnigher</li> <li>• Attend a livestock or meats judging practice session, workshop, or clinic.</li> <li>• Participate in a quiz bowl contest.</li> <li>• Participate in a skill-a-thon contest.</li> <li>• Help another 4-H'er with his or her project.</li> <li>• Teach a swine skill to another 4-H member.</li> </ul> |                  |                  |

- Start a scrapbook of photos, newspaper clippings, ribbons, and other materials related to your 4-H experiences.
- Graph futures prices for a "lean carcass" contract over an eight week period.
- Find ten websites about selecting, breeding or farrowing sows.
- Develop a marketing plan for your feeder pigs or cull sows.
- Investigate websites on nursery management. Explain how you did the search.
- Develop your own activity with your leader's approval.

### **Section 3**

#### **Background Information**

There are some things you should know about pigs before you get started.

#### **Objectives**

After studying the materials and completing the suggested activities for this section of your project you should be able to:

1. Name the two major products we get from a pig's carcass.
2. Write the scientific name for swine.
3. Explain the differences among the terms swine, pig, hog, feeder pig, and shoat.
4. Name two management practices used in today's swine industry to help keep pigs healthy.

#### **Why Do We Raise Pigs?**

For most of the history of swine production (before about 1950), pigs were raised for both meat and fat. At that time, fat was very important in people's diets. Rendered pig fat is called lard and was used in cooking before vegetable oils became popular.

Today, we raise pigs for meat production. Pork meats you may be familiar with include ham, bacon, pork chops, and sausage. Pig fat, or lard, currently is not very valuable. Therefore, modern market hogs are bred to maximize meat production and minimize body fat.

Before you purchase a gilt for a breeding project, you must realize that at the end of the project, the baby pigs you raise (and eventually the sow) will produce meat for people to eat.

## **What Names do we use for Pigs?**

The scientific name for domestic swine is *Sus scrofa*. “Swine” is a generic word, generally used in reference to any and all *Sus scrofa*. “Pig” is a term that is often interchanged with swine, but can also mean young swine up to market weight. “Hog” is a term usually associated with pigs approaching market weight. “Feeder pig” is a term that refers to young, newly weaned pigs. “Shoat” is sometimes used in place of feeder pig.

Pigs also have different names depending on their gender. “Gilts” are young female pigs before they have farrowed (given birth to) their first litter of pigs. “Barrows” are castrated (have had their testicles removed) male pigs. “Sows” are female pigs after they have farrowed their first litter. “Boars” are uncastrated male pigs.

## **The Swine Industry in the United States**

The swine industry has changed quite a bit since 1970. Before then, many farmers kept a few sows and fed the baby pigs until they reached market weight. Pigs were often a second or third source of income for farmers. At that time, most full-time hog farmers would have owned less than 200 sows.

Today, more hogs are raised on fewer farms. This is called industry “consolidation.” Now, a full-time hog farmer may own many thousands of sows. Of course, one farmer can’t take care of that many pigs, so people who own large numbers of pigs hire other people to manage their pigs for them. There are many jobs available in the swine industry for people who like to work with pigs!

In many instances the same company or individual owns the feed processing facility, the pigs, and perhaps the slaughter plant where the pigs are processed into hams and bacons. The same company or individual may also be involved with retail sales of pork products. A production system where one company or individual controls two or more parts of the pork production chain is said to be “vertically integrated”.

There also have been changes in the way hogs are raised. Instead of raising baby pigs to market weight on the same farm where they were born, sows often are kept at one farm, nursery-sized pigs (12–50 pounds) at another, and finishing pigs at yet a third farm. This management system helps keep pigs healthy and is called “multiple-site production.”

On a large commercial sow farm, sows are moved and fed by groups. Sows mated to farrow their piglets within a few days of each other are housed together all through gestation. As their farrowing date nears, they are moved as a group to a farrowing room. In this system, all sows from the first age group are completely moved out of a room before sows from the next farrowing group are moved in. The room is washed and disinfected between groups of pigs. This is called “all-in, all-out production.” Keeping sows and their litters separated from other pigs on the farm helps keep piglets healthy.

## **Words You Should Know**

Lard

Rendered pig fat

<i>Sus scrofa</i>	The scientific name for domestic swine
Swine	Generic term for all <i>Sus scrofa</i>
Pig	Usually young pigs up to market weight
Hog	Pigs approaching market weight
Feeder pig/Shoat	Newly weaned pig
Gilt	A young female swine that has not yet farrowed a litter of pigs
Sow	A female swine that has farrowed one or more litters
Boar	Uncastrated male pig
Barrow	Castrated male pig
Castration	Removal of a male's testes
Farrow	Give birth
Industry consolidation	Raising more hogs on fewer farms.
Vertical integration	One person or company controlling two or more parts of the pork production chain (feed manufacture, production, packing, processing, retailing)
Multiple-site production	Raising different aged pigs on different farms.
All-in, all-out production	Sows and litters are moved out of a room before another groups of sows is moved in.

### **Suggested Activities**

- Make a chart of the different names used for pigs.
- Have members of your club answer roll call at a meeting with one name used for swine.
- Name the two major products we get from a pig's carcass.
- Explain the difference between multiple-site production and all-in, all-out production.

### **Extra Activities to Try**

- Ask a local swine producer if the names they use for pigs mean the same thing as the names you've learned.
- List all the cuts of pork you can think of.
- Identify two vertically integrated swine production companies in Pennsylvania?

### **Ideas for Presentations and Talks**

- The history of swine domestication
- How uses of pigs have changed
- Changes in the swine industry

### **Things to Talk About**

- How will you react when your project sow is sold for slaughter?
- What are some good and bad things about industry consolidation?
- What are some good and bad things about vertical integration?

## **Section 4**

### **Breeds of Swine and Breeding Systems**

Swine come in many shapes, sizes, and colors. Swine that are alike in color patterns and body structure often belong to the same breed. Breeds can be combined in several planned ways to create market hogs.

### **Objectives**

After studying the materials and completing the suggested activities for this section of your project, you should be able to:

1. Name examples of some of the major breeds of swine raised in Pennsylvania.
2. Identify at least four of the major breeds from looking at photos or from seeing live animals.
3. Identify and describe the important characteristics of your selected breed of swine.
4. Differentiate between purebreeding and crossbreeding.
5. List and describe three crossbreeding systems.

### **Major Breeds**

Many breeds of swine are commonly raised in Pennsylvania. Each breed has characteristics that distinguish it from other breeds of swine.

Swine producers choose to raise a particular breed of swine instead of another breed because that breed has a combination of qualities that producers want to have in their herds. For example, swine from white breeds usually make good mothers, while swine from colored breeds usually make good sires when crossbreeding.

Some of the major breeds of swine raised in Pennsylvania and their characteristics are listed below.

<b>Breed</b>	<b>Description</b>
--------------	--------------------

Berkshire	Black with white on the face, legs, and tail. Erect ears.
Chester White	White with small, partially drooping ears.
Duroc	Red with partially drooping ears. Muscular. Good sires.
Hampshire	Black with a white belt. Muscular. Good sires.
Landrace	White with large, drooping ears. Very long-bodied. Good mothers.
Poland China	Black with white on the face and legs. Partially drooping ears.
Spotted Swine	Black and white spotted. Partially drooping ears.
Yorkshire	White with erect ears. Long-bodied. Good mothers.

### **Your Pig's Pedigree**

A written record of the names of a pig's parents, grandparents, and other ancestors is called its pedigree. Some words you will see used on a pedigree, and their meanings, are listed below.

Sire	The pig's father.
Dam	The pig's mother.
Grandsire	The father of the sire or dam (the pig's grandfather).
Grandam	The mother of the sire or dam (the pig's grandmother).

### **Purebred Breeding Systems**

When both of a pig's parents are registered members of the same breed, the pig is purebred. If its parents are members of different breeds, it is crossbred. A registered pig is a purebred pig whose name, herd and registration numbers, date of birth, pedigree, and name of owner are recorded with a breed registry association. A pig must meet all of the requirements of the breed registry association to be registered.

Breed registry associations issue registration certificates or papers to owners of registered swine. When a registered animal is bought or sold, the seller must send the registration certificate back to the breed association so ownership can be transferred to the new owner. If you buy a registered animal, make sure that the seller transfers the registration papers for you. If you plan to show the animal, make sure that ownership is transferred to you before the show's entry deadline.

If you would like to find out more about a breed, write to the breed registry association for information. Addresses for the various breed associations can be found on the internet at [www.ansi.okstate.edu/breeds/swine/](http://www.ansi.okstate.edu/breeds/swine/).

Producers who raise purebred swine often utilize artificial insemination in order to capture the best genetics available. Semen from purebred boars is available from many commercial boar studs around the country. We will discuss artificial insemination in greater detail later in this guide. Good purebred breeders pay attention to many factors when selecting breeding stock. Performance data, structural correctness, muscling and leanness are the most important.

In the past, when many producers marketed a few pigs, it was relatively easy to sell purebred breeding stock to other producers. Now, markets are fewer, but purebreds can still be sold to other purebred breeders or small commercial producers. Most larger commercial producers buy purebreds from commercial breeding stock companies. If you choose to raise purebreds, buy the best ones you can afford! Purebreds also offer the opportunity to show (and sell) breeding stock at various county, regional, and state shows.

### **Crossbreeding Breeding Systems**

Crossbred pigs have some advantages over purebred pigs because of a genetic phenomenon called heterosis (also known as hybrid vigor). Because of heterosis, most commercial swine producers use crossbred pigs rather than purebreds. What is heterosis? Heterosis usually gives crossbred pigs an improvement over the average of its parent purebreds in a certain trait.

For example, if the average litter size for a herd of Yorkshire purebreds was 11 and the average litter size for a herd of Hampshire purebreds was 9, we would expect the average litter size of Yorkshire x Hampshire crossbred sows to be 10 pigs. In reality, the average litter size might be closer to 11.5 pigs, which is higher than either of the parent breeds. Improvement of the actual litter size over expected litter size is a result of heterosis. You may be able to understand heterosis better by studying the following table.

Yorkshire litter size = 11 pigs per litter

Hampshire litter size = 9 pigs per litter

Expected litter size of Yorkshire x Hampshire crossbred sows = 10 pigs per litter

Actual litter size of Yorkshire x Hampshire crossbred sows = 11.5 pigs per litter

The difference between actual (11.5) and expected (10) = 1.5 pigs per litter is a result of heterosis.

Generally, heterosis affects reproductive traits relatively more than growth and carcass traits. Heterosis affects several important reproductive traits in pigs. In addition to improvements in litter size, crossbred sows usually produce more milk, eat more, and farrow more vigorous pigs than purebred sows.

There are several planned crossbreeding systems that producers commonly use. Pure breeds for crossbreeding systems are selected for their ability to add some trait to the final crossbred market hog. For example, a white breed such as Landrace or Yorkshire is usually included in the crossbreeding system for their maternal traits (number born alive or milking ability). A colored breed such as Duroc or Hampshire is normally included for its growth rate, feed efficiency, or carcass traits. A planned crossbreeding system may include as few as two or as many as four breeds.

The simplest crossbreeding system is called a back-crossing system (or two breed rotational system) and includes only two breeds. In this system a purebred female (Breed A) is mated to a male from another breed (Breed B). The crossbred female progeny (known as an F1 which stands for first filial generation) is mated back to a boar from breed A, and the female progeny from this generation are mated to a boar from breed B, etc.

A third breed (Breed C) may be added to this system. Known as a “three-breed rotational crossbreeding system”, the F1 female is mated to Breed C. The resulting female progeny (known as F2 or second filial generation) is bred to a boar from breed A, etc.

Large scale commercial producers routinely use a terminal crossbreeding system. In this system, F1 females from two maternal breeds are mated to purebred or F1 boars from breeds strong in terminal traits (such as leanness, growth rate and muscling). All pigs from this cross are sold as market hogs. No gilts are retained for breeding purposes.

### **Words You Should Know**

Breed	A group of animals that have unique color patterns or body structure because they share common ancestors that were selected for those characteristics.
Purebred	An animal with parents from the same breed.
Crossbred	An animal with parents from different breeds.
Sire	An animal’s father.
Dam	An animal’s mother.
Heterosis or hybrid vigor	The usual improvement of a crossbred over the average of its parent purebreds in a certain trait.
Back cross or two breed rotational crossbreeding system	Crossbreeding system using only two breeds. Gilts are retained for the next generation.
Three breed rotational crossbreeding system	Crossbreeding system utilizing three breeds. Gilts are retained for the next generation.

Terminal crossbreeding system      Crossbreeding system utilizing 4 or more breeds. All progeny are destined for slaughter.

F1    First filial generation, or first generation crossbred.

F2    Second filial generation, or second generation crossbred.

### **Suggested Activities**

- Answer the roll call at a meeting with the name of a major swine breed.
- Look through swine magazines to find pictures of different breeds. Make a poster or display with pictures of the major breeds of swine. Describe the special uses and features of each breed pictured.
- Visit a fair or show and try to identify the different breeds that are there. For crossbred pigs, try to identify the breeds used in the cross.
- Write to the breed association to find out more about the breed of your project pig. Be able to describe what is special about the breed of pig you have chosen.
- Make a poster to promote or advertise your favorite breed of swine.
- List some advantages crossbreeds have over purebreds.
- Diagram three crossbreeding systems.
- Categorize all breeds of swine into maternal or sire breeds

### **Extra Activities to Try**

- Start a collection of model pigs from different breeds or your favorite breed.
- Discuss with a producer which breed traits are important to a breeding program and why they are important to a herd.
- Ask the manager or owner of a purebred swine farm why he or she raises a particular breed of purebred swine.
- Examine the registration papers of a registered boar or gilt. Be able to name the sire and dam of that animal.
- Ask the manager of a commercial hog farm why certain breeds are used for crossbreeding.

## **Section 5**

### **Selecting Project Animals**

The conformation and quality of the breeding stock you choose will affect the success of your project. Try to choose sound, lean, meaty animals with good performance data. You don't need the most expensive animals to succeed.

### **Objectives**

After studying these materials and completing the suggested activities, you should be able to:

1. Name the external parts of the hog and be able to point them out on a live hog or label them on a diagram.
2. Tell what to look for when choosing gilts and boars for breeding projects.
3. Be able to complete a breeding swine budget.

### **Naming External Parts of the Pig**

It's important to know the words used by swine producers. When you know and use the right words, other people who own swine will be able to understand you.

The parts of a pig's body have special names. Some parts have the same names as the meat products produced from them. For example, the upper hind leg of a pig is called the ham. Of course, this is where the ham we eat comes from.

Learn the terms listed on the diagram on this page. On a sow or gilt, you also should be able to identify the underline (teats) and vulva. On a boar, you also should be able to locate the scrotum, testes, and sheath.

### **Selecting Project Gilts**

Selecting a gilt for a breeding project should be done with care and attention to many factors. Think about how you are going to market the pigs from your gilt. Are you going to raise and show the pigs for a market hog project or sell them as feeder pigs to someone who will raise them for slaughter? The answer to this question could change the emphasis of your selection.

You may purchase project gilts as feeders or at market weight. However, you may be better able to evaluate the quality of gilts if you select them at market weight. Be sure your gilt will be at least 280 pounds and 7 or 8 months old before she is bred. If you are selecting a gilt to farrow pigs for a show, she should be bred about 10 months before your show date. Needless to say, you need to plan ahead!

Always purchase breeding stock from a reputable breeder who can show you records from the gilt's mother and other relatives. You want to select a gilt from a large litter whose dam has consistently produced large, heavy litters at weaning. Gilts should be long bodied, structurally correct, lean, and feminine. Avoid extremely heavily muscled, short or fat gilts. If you plan to show the pigs you produce, pay attention to the balance and style of the gilt from a side view. Often (but not always) large framed, attractive market gilts that are slightly lighter muscled than an ideal market hog make the best sows.

Don't select any gilts with immature vulvas, less than 12 evenly spaced teats, or teats that are too coarse, blunt, or inverted.

### **Performance Data**

Purebred breeders should be able to provide performance data on breeding stock. This information can help you select animals which are more likely to possess the genetic

traits you're looking for based on records from the animal itself, its contemporaries, or its relatives and ancestors.

The first performance data you may encounter are individual data from the gilt herself. Individual data may include the size of litter that gilt was from, her litter's weaning weight, the number of days it took her to reach a certain weight (for example, days to 230 pounds, which gives an indication of growth rate), her average daily gain, or ultrasound data for backfat and loineye area. Ultrasound data is normally taken around market weight of 230 to 250 pounds.

The second type of data that you could see is a comparison of a certain gilt to other gilts from the same farm born about the same time. These data are often given as ratios with 100 as the average. For example, if a gilt had a ratio for days to 230 of 105, she reached 230 pounds 5 percent faster than the other gilts in her contemporary group (group of gilts born about the same time and raised together).

The third type of performance data that may be available are called Expected Progeny Differences (or EPDs). EPDs take into account the records of not only the gilt you are considering, but her dam, sire, and other known relatives. EPDs offer a way to compare the genetic potential of two animals in actual pounds (litter weight EPD), inches (Backfat EPD), pigs (Number Born Live EPD), or whatever the unit of measure of a given trait. For example, if gilt A has an EPD for days to 230 of 0 and gilt B has an EPD for days to 230 of -1, the progeny of Gilt B would be expected to reach 230 pounds one day faster than the progeny of Gilt A. Of all available performance data, EPDs are the most accurate predictor of genetic potential.

### **Making Genetic Improvement**

The swine industry is always striving to improve animal performance and the quality of pork products. Pork producers and breeding stock companies do this by using a technique called genetic selection. By keeping only the best offspring for breeding, animal performance will improve a little bit with each new generation of pigs.

To make progress through genetic selection, it is important that we keep accurate records of the parents and their offspring (progeny). With enough progeny records, we can calculate EPDs for a variety of traits. If you look at a semen catalog, you'll often see EPDs listed for each boar. The EPDs will predict how much we can improve a certain trait like back fat or litter weight. Let's say you are considering a boar with an EPD for backfat of -.10. This means that the boar's progeny would be expected to have .10 less inches of backfat than the offspring from a boar with an EPD for back fat of 0.

In addition to EPDs, we also calculate selection indexes like the Sow Productivity Index (SPI) and the Terminal Sire Index (TSI). If you are buying semen to produce show pigs or market hogs, then you should look for a boar with a high TSI in comparison to other boars of that breed. If you are seeking a boar to generate replacement females, then you should select a boar with a high SPI in relation to other boars of that breed.

## **Health Considerations**

The health status of your project gilt can play a big role in the success of your breeding project. Ask the breeder for information on the health status of the herd, biosecurity practices, and vaccines given. Ask about the most common health problems in the herd. Observe animals for signs of poor health. Coughing (an indication of respiratory disease), scratching (an indication of mange), or crooked noses (sign of atrophic rhinitis) in a herd can be cause for concern.

Every swine farm – especially breeding stock farms - should have a biosecurity system. One of the major parts of a good biosecurity system is not to allow visitors into facilities where diseases may be easily spread. So, if you go to a breeding stock farm to select a gilt for your project, don't be surprised if you are not allowed to visit the farrowing facilities, for example. You could be asked to shower and wear clothes provided for you before you see any pigs at all. These practices are in place not because the producer does not trust you or has something to hide, but are rather an effort to keep his or her pigs from contracting new diseases.

When you get your breeding stock home, you'll want to keep your pigs as healthy as possible. Good biosecurity practices will help you accomplish this goal. Good biosecurity includes the following:

- Isolate new animals to avoid infecting pig you already have on the farm with new diseases.
- Place a foot bath with disinfectant at the entrance to your barn, or wear disposable boots.
- Avoid wearing the same clothes from farm to farm.
- Don't allow people who have recently been around other pigs to be near your pigs.
- Control rats, mice, and birds which can carry diseases to pigs.

## **Selecting a Boar**

Decide early in the project if you will breed your gilt to a live boar or if you will use artificial insemination. Each has advantages and disadvantages.

A live boar requires the least management ability on your part. If you have only one or two gilts, buying a boar - especially a good boar - could be very costly. Boar prices from small seedstock producers may average \$250 to \$450, depending on the breed, quality, and current market conditions. In contrast, boars used for artificial insemination may cost many thousands of dollars. Also, a certain percentage of young boars will not breed without training, if at all. If this is your first breeding project, consider buying a bred gilt, or ask the breeder from whom you purchased the gilt if he or she would consider breeding the gilt for you before you take it home. Perhaps you could borrow a boar, but for biosecurity reasons, few producers will be eager to loan one to you.

If you are buying a boar, use the same selection criteria you would use to purchase a gilt. A good breeding boar should have a tight sheath, and show signs of aggressive breeding behavior at or before six months of age.

Artificial insemination allows you to use some of the top boars in the world - even if you have only one or two sows. However, you must be a dedicated manager if you want to be successful. If you decide to use artificial insemination, order catalogs from semen suppliers as soon as you get your gilt home, if not before. Select the boar you want to use based on the projected market for your feeder pigs. For example, if you plan to sell registered purebreds or retain gilts as replacements, look for boars with superior performance data. If you plan to sell or raise your own club pigs, look for "Show Pig" sires (some of which may not be purebreds). Semen supplies on many top boars are booked months in advance, so you'll want to place an order as soon as possible. You'll learn how to predict semen delivery dates in the section on artificial insemination. Cost of semen (including shipping) to breed a single gilt may be \$75 to \$150. However, semen prices from top show pig sires will be higher during certain months when demand is highest.

### Breeding Project Budget

#### Receipts

Sell feeder pigs	Number _____ x	Dollars per head _____ =	Value _____
Ending sow or gilt value			Value _____
Ending boar value			Value _____

#### Expenses

Sow Feed	Pounds needed _____ x cost per pound _____ =	Feed Cost _____
Nursery/Starter Feed	Pounds needed _____ x cost per pound _____ =	Feed Cost _____
Gilt cost (or sow depreciation)(1.)		_____
Boar cost (or depreciation)(1.) or semen cost		_____
Bedding		_____
Veterinary cost		_____
Supplies (2.)		_____
Transportation		_____
Marketing costs		_____
Entry fees		_____
Interest on borrowed money		_____
Other		_____
Total Expenses		_____

Receipts minus Expenses = Expected Profit (or Loss) \_\_\_\_\_

#### Notes:

1. The cost of a gilt (and boar) can be spread out over three years. For instance, if you paid \$300 for a gilt, her cost on a yearly basis would be \$100 for three years.
2. Similarly, costs for long term assets such as farrowing crates can be spread out over multiple years.

### **Words You Should Know**

Budget	An estimation of the profitability of raising market hogs.
Biosecurity	Practices to reduce the chance of your pigs getting sick.
Individual data	The animal's own performance records
Ratios	A percentage of the average performance of the animal's pen mates or contemporaries.
EPD	Expected Progeny Difference. Expressed in actual units such as pounds, inches, or pigs.
Ultrasound	Using sound waves to measure carcass characteristics of a live animal, including backfat depth and loin eye area.
Selection Index	Index combining multiple traits into a single number. Used to compare animals for multiple traits.
TSI	Terminal Sire Index. Includes such traits as growth rate and backfat.
SPI	Sow Productivity Index. Includes traits such as number born live, as well as growth rate and backfat.

### **Suggested Activities**

- Label the parts of a hog on a diagram or point them out on a live hog.
- Have members of your club answer roll call at a meeting with the name of a swine part.
- Participate in a swine judging practice session, workshop, or contest.
- Select a project gilt using your knowledge of parts and desirable type.
- Visit a breeding hog show and listen to the swine judge give reasons for placing the pigs the way he or she did.
- List some advantages and disadvantages of using live boars vs artificial insemination.
- Identify differences between individual performance data, ratios, and EPDs..
- Compare your budget with real-world feeder pig and feed prices.

### **Extra Activities to Try**

- Visit a breeding stock sale.
- Look up the local feeder pig price each week in a farm newspaper or other source of price information. Make a graph of feeder pig prices each week for several months.
- Check feed prices with a local feed supplier.
- Identify differences in teat spacing, number, and quality on gilts and boars.

### **Ideas for Presentations and Talks**

- Identifying the parts of pigs
- What to look for when selecting breeding gilts

- What it costs to keep a sow for a year

### **Things to Talk About**

- What are the main parts of a pig's body?
- What factors should you look for when choosing feeder pigs for breeding swine projects?
- What is the normal weight and age of feeder pigs when they are sold?
- What is the market value of a gilt or sow?

## **Section 6 Facilities**

Don't buy any pigs until you have a good place to keep them. In some areas, people are not allowed to keep farm animals. Find out if local regulations restrict where you can keep your pigs. Also find out if there are special laws or rules you must follow to care for your swine.

Breeding projects can be raised under a variety of conditions. Facilities for a breeding project need not be elaborate. However, since you will be keeping pigs year-round you must be able to keep pigs warm and dry. Baby pigs farrowed in the winter months require some special facility considerations.

### **Objectives**

After studying the materials and completing the suggested activities for this section of your project, you should be able to:

1. Outline the basics of swine care, including proper bedding and living conditions for the different stages of a breeding project.
2. Lead a parent or project leader on a tour of the place where you keep your swine and point out what you are doing to take care of them.
3. Explain different temperature requirements for different ages of pigs.

### **Keeping Pigs Comfortable**

Pigs don't grow very well when they are too hot or too cold. Comfortable pigs will sleep on their sides with their legs outstretched. Adult hogs are most comfortable and grow best when the temperature is between 55° and 70°F. Baby pigs require temperatures between 85°F and 90°F to keep from chilling. As baby pigs get older and larger, their temperature requirements decrease. Six to seven week old nursery pigs can do well at 70°F.

The best way to tell if a pig is comfortable is to watch the pig when it is sleeping. Pigs that huddle, pile up, or sleep on their stomachs are usually too cold. Cold pigs will use most of their feed to keep warm instead of growing. If the place where you keep your pigs is too cold, provide straw or other bedding so the pigs can lie in it and keep warm. It may help to lay boards over the pen and stack straw bales on the boards to create a warm

spot in the pen for pigs to sleep in. Placing a heat lamp in such as hover will help keep just-weaned pigs warm in cold weather.

During hot weather, pigs may breathe with their mouths open if they are too hot. When pigs are too warm, they will grow slowly because they don't eat enough feed. Provide shade to keep your pigs comfortable in the summer. Exposing your pigs to long periods of sun in the summer could give them sunburns or cause sunstroke. A good, cheap source of shade for pigs kept outdoors in the summertime is a frame of poles covered with straw, cornstalks, or plastic feed bags. Trees will give shade, too. Fans are often necessary in closed indoor facilities to keep pigs cool in the summertime.

Pigs do not have sweat glands, so they do not sweat when they are hot like people do. Instead, to cool off, pigs like to lie in the mud or in water. Some pigs like to play in their water bucket or the automatic waterer. During very high temperatures, you may want to spray water on your pigs to keep them cool.

### **Breeding, Gestation and Boar Housing Needs**

Gilts, sows and boars can be housed in conditions similar to those used for market hogs. As long as they have a warm or well-bedded dry place to lie down, mature pigs can tolerate cold temperatures well.

Commercial swine producers often house gestating sows in gestation crates which are individual pens for each animal. Under this system, each sow or gilt can be fed separately, without competition from other animals. Before the wide-spread use of gestation crates, most producers kept sows grouped in pens. You can use either system.

Gilts and sows penned together will establish a "pecking order". If housed in cramped conditions or with too many gilts and sows to a pen, the pigs at the bottom of the pecking order stand a good chance of not getting enough feed. If you pen several sows or gilts together, watch for pigs that appear to be losing body condition. If you notice a sow getting pushed away from feed, you can do one of several things. First, you can remove the pigs at the bottom of the pecking order, and put them in another pen where there is less competition. Or, you can feed your sows twice as much feed once every two days. In this system, the "boss" sows get full, leaving feed for the bottom ranking sows to clean up. If you are feeding your sows directly on concrete flooring, you could also spread the feed out further so that all pigs get a chance to eat.

If you use pens, it is probably best to house boars and gilts or sows separately, except of course when you are breeding a sow. Boars (especially young boars) will be more apt to breed if kept away from the sows until breeding time. Make sure the flooring of the breeding area is not too slippery. If a boar has poor footing, he may not mount a sow because he is afraid of slipping.

Regardless of the penning system you use, pay attention to ventilation. When pigs breathe smelly, stale air, they may get sick. Provide a good source of fresh air, but keep your pigs out of drafts that could make them sick.

## **Farrowing Housing**

Penning during farrowing time is more critical. It is best to farrow sows in farrowing crates, but farrowing pens will work acceptably well. The most important thing is to have a place where the piglets can get away from the sow and stay warm. Sows are most comfortable at temperatures between 65 and 70 degrees, so try to keep the farrowing area at this temperature. Newborn piglets require temperatures of 85 to 90 degrees.

Farrowing crates have areas on each side of the sow where piglets can get away from the sow. Heat lamps should be hung over these areas to help keep baby pigs warm.

Farrowing pens usually have one corner of the pen closed off to the sow with a heat lamp available for baby pig comfort.

**One note of caution. Broken heat lamp bulbs can cause fires if used with bedding. Always keep heat lamps out of the reach of sows and piglets. In addition, make sure they are secure enough so that they do not fall down and potentially cause a fire.**

Ventilation is critical to farrowing areas as well. In an effort to keep farrowing rooms warm in the winter, producers tend to restrict cold air entering the farrowing room or area. As a result, the air gets stale, and piglets and sows can get sick or not perform as well as they should.

## **Nursery Housing**

Large producers wean pigs at 3 weeks of age or less. Unless you have top quality nursery facilities, you will be better to wait until pigs are at least 4 weeks old before weaning. Older weaned pigs require a less ideal environment to prosper.

Temperature requirements of newly weaned pigs are not as high as that of newborn piglets. By six weeks of age, pigs can do well in temperatures of about 70°F - or less if bedding is available. If you are weaning into an outside pen, make sure it is well bedded. Provide a hover with a heat lamp in cold conditions. Some producers simply remove the sow from the farrowing crate or pen and leave the weaned piglets in the farrowing area until they reach 8 or 10 weeks of age.

## **Keeping Your Pigs Clean**

Pigs usually pick one spot in their pens to use as a bathroom. They will try to leave their urine and manure in the same general place and keep the rest of the pen clean.

Try to keep the pens of your swine clean to reduce the chance of disease. Some swine barns are built with open flooring to keep manure from piling up. If yours is not, you will need to scrape the manure from your pen often to keep it clean. Unless you have slotted flooring in your farrowing crate, you will generally have to clean manure away from the rear of it daily.

Swine manure contains nitrogen, phosphorus, and potassium. All three of these nutrients are necessary to make plants grow. If you have a garden, you can use the manure your pigs produce instead of buying commercial fertilizer. Large swine producers are required to have a certified plan for where their manure will be spread so that the nutrients in the manure match the nutrient needs of plants.

Some places have laws controlling what to do with manure, so find out if there are special rules you must follow in your area.

### **Handling Equipment**

In addition to finding a place to keep your pigs, you also will need equipment to move, transport, feed, and water them.

Have a good loading ramp to move pigs in and out of your facilities. You can get loading chute designs from your extension agent. If you feel a loading chute is too expensive, have an area of the pen or pasture where the pigs can be cornered for easier loading.

Use sorting panels or boards to move sows, boars and piglets from place to place on the farm.

After reaching market weight, replacement gilts, sows and boars are normally fed a limited amount of feed each day. You can present the feed in a trough or pan, or feed them directly on a concrete floor. Sows in farrowing crates or pens should be fed as much as they will eat at least twice daily in a pan or built-in trough in a farrowing crate. Nursery pigs should be self-fed.

Fresh, clean water should be available at all times for all pigs.

### **Words You Should Know**

Hover	Enclosed area to keep baby pigs warm during cold weather.
Farrowing crate	Narrow pen for sows during farrowing and lactation. Has side areas available for piglets to get away from the sow.
Pecking order	Social structure of a group of pigs where a "boss" pig has first access to feed and water.
Ventilation	Air movement and exchange in a barn or room.

### **Suggested Activities**

- Visit a large swine facility and learn about the facilities for breeding, gestation, farrowing, and nursery pigs. Also observe how the owner keeps the pigs comfortable.
- Write down your breeding, gestation, farrowing, and nursery facility plan.
- Lead your parent or project leader on a tour of the place where you keep your swine. Point out the things you are doing to make your pig comfortable. Show that each of the following are taken care of:

\_\_\_\_\_ Is the pig being fed properly?

\_\_\_\_\_ Is the water plentiful and clean?

- \_\_\_\_\_ Is the pig comfortable?
- \_\_\_\_\_ Is the pen clean?
- \_\_\_\_\_ Is there enough fresh air?
- \_\_\_\_\_ Is it too cold or too hot?
- \_\_\_\_\_ What did the feed cost?
- \_\_\_\_\_ Are records being kept?

**Extra Activities to Try**

- Explore advantages and disadvantages of gestation crates vs gestation pens.
- Find information about the social structure of a group of pigs.

**Ideas for Presentations and Speeches**

- How I take care of my sows
- Temperature needs of various ages of pigs
- Swine facilities and equipment

**Things to Talk About**

- What do you need to do to take care of your pig?
- How do you know if your pig is too cold or too warm?
- Why do pigs like to play in the mud?
- Why should boars and gilts or sows be penned separately?

## **Section 7**

### **Swine Reproduction and Breeding**

The goal of a breeding project is to produce feeder pigs to sell or feed. You should have a working knowledge of basic reproduction in order to succeed.

#### **Objectives**

After studying the materials and completing the suggested activities for this section of your project, you should be able to:

1. Identify the important parts of the male and female pig's reproductive system.
2. Explain the estrous cycle.
3. List several signs of heat in a sow or gilt.
4. Demonstrate proper artificial insemination of a sow.

#### **Sow and boar reproductive systems**

The reproductive system of the sow is made of relatively few parts and is diagrammed on page \_\_\_\_\_. The vulva is the only structure you can see from the outside, and is the outside opening of the reproductive tract. The next structure on the inside of the sow is the vagina, or birth canal. At the interior end of the vagina is the cervix, a muscular structure that relaxes when a sow is in heat (able to be bred) and before farrowing. The cervix is about the same diameter as a garden hose with several sets of interlocking rings designed to “grasp” a boar’s penis during mating. Inside the cervix is the uterus, where fertilized embryos develop into baby pigs. The uterus has two sides or “horns”, each of which leads to an ovarian tube. The tube is where sperm and egg meet and fertilization takes place. At the end of each tube is an ovary that produces eggs.

The reproductive system of the boar consists of the testicles, where sperm are produced. Mature sperm are stored in the epididymis until mating. During mating, sperm travel through the penis, mixing with secretions from other glands that serve to make the sperm fertile and allow sperm cells to survive in the female reproductive tract. Sperm is ejaculated in three distinct fractions. The first fraction is rather watery, and contains few sperm cells. The second fraction contains mostly sperm cells, and the third fraction is a gel-like substance that serves to “plug” the cervix, keeping sperm from escaping the sow. See a diagram of a boar’s reproductive system on page \_\_\_\_\_.

#### **The estrous cycle**

A sow’s estrous cycle averages 21 days, but can be as short as 18 days, or as long as 23 days. This means she should be in heat, or receptive to mating roughly every 3 weeks.

During most of the cycle, follicles are developing on the sow’s ovaries. Each follicle will ovulate one egg. Twelve to 15 follicles (or more) develop on each ovary during each estrous cycle! As the time of standing heat approaches, the follicles get larger and larger, releasing estrogen that causes the outward behavioral signs of heat you see. Each

follicle ruptures, releasing an egg into the oviduct where each egg is fertilized by a single sperm. Fertilized embryos then travel to the uterus.

If the sow is successfully mated, the best indication of pregnancy is the absence of another heat period about three weeks later.

### **Identifying gilts/sows in heat**

Heat is often referred to as “standing heat” because the only sure sign that a sow is receptive to mating is if she stands still when pressure is applied to her back. However, other changes in behavior can help you to identify sows or gilts in heat. Examples would be: attempting to ride other pigs, increased nervousness (fence walking), increased vocalization, ear “bobbing” when pressure is applied to her back, and increased swelling and redness of the vulva. Standing heat will normally last about 24-36 hours for gilts, and up to 3 or 4 days for sows, but there is a great deal of variation between animals.

If you have a boar, he can help you determine if a sow is in heat. Simply let him into a pen of females once or (preferably) twice each day, and watch for him to mount and breed any sows that may be in heat. An active boar should nuzzle the sow’s flank, may sniff the vulva, and should attempt to mount. If you are planning to use AI, moving a boar into an adjacent pen will help you identify sows in heat. It is often easier to detect heat if a boar is in the vicinity.

If you plan to use AI and don’t have a boar, you’ll have to rely on behavioral signs and personally apply pressure to your sow’s back daily to determine if your sow or gilt is in heat. You’ll need to spend lots of time with your gilt or sow to know what is normal behavior and what is not. When you observe a gilt or sow in heat and do not breed her, **WRITE THE DATE DOWN**. You can expect her in heat about 21 days later. This is especially important if you will be ordering semen for artificial insemination.

Gilts normally begin estrous cycles at around five to six months of age. Often some period of stress, such as a truck ride or the fighting that occurs after mixing with strange pigs, can trigger a gilt’s first heat. Largest litters are expected if gilts are bred on their second or third heat, but make sure they weigh at least 280 pounds and are 7 to 8 months old.

Sows in good physical condition can normally be expected to be in standing heat four to eight days after weaning. If sows are thin, it may take somewhat longer.

### **Mating sows: Natural mating vs Artificial insemination**

Natural mating is relatively simple if you have a boar that is aggressive, willing, and able to mate. In natural mating, the boar does the heat detection and determines if the sow or gilt is in heat. Some producers simply leave the boar in the pen with sows and allow the boar to mate sows whenever they are in heat. Most better producers practice “hand mating” where they bring the boar into a pen of sows or gilts once or twice each day to allow him to check sows for heat. Once the boar mounts a sow or gilt in standing heat, you can make sure the mating takes place by manually guiding the boar’s penis into the

sow's vulva. An average mating will take five to 10 minutes after which the boar will dismount. The boar should then be removed from the pen until the next heat check or mating.

For best results, gilts or sows should be hand mated at 12-hour intervals at least two services. If you know a sow has just entered standing heat and she has not yet been bred by a boar, you can wait 12 hours before the first mating.

Boars should not be used more than 5 services per week.

Always use a solid hand hurdle when handling a boar. Older boars can be very aggressive and can hurt you with their teeth if you're not careful.

Artificial insemination requires more planning and preparation on your part. Boar semen for AI is usually shipped fresh, not frozen, and is fertile for five to seven days after collection. For maximum conception rate and litter size, fresh semen should ideally be used within 3 days of collection. To complicate matters, you must order semen to arrive when you expect your sow or gilt to be in heat - sometimes months ahead of time. Semen suppliers generally collect semen only two days per week - usually Mondays and Thursdays. Fresh semen is shipped next day air, which means it should arrive at your doorstep on a Tuesday or Friday.

Ordering semen for sows is simpler than for gilts. You'll have control over weaning time, and can expect your sow to cycle 4-8 days after weaning. Thus you should plan to wean sows about four days before you expect your semen to arrive. Order two "doses" or vials of semen for every sow you intend to breed.

Be sure to order insemination rods along with the semen. Rods are disposable, so order one for each service. Rods come in several shapes. One commonly used type is spiral shaped which simulates the corkscrew shape of a boar's penis. The end of another popular type looks like a foam marshmallow with a slight groove around the middle. Both the marshmallow and corkscrew types are connected to a flexible tube approximately 20 inches long through which the semen passes. Several "hybrids" of the two types are currently available. The type you choose is a matter of personal preference; all will work well.

Semen is often packaged in bottles, bags or tubes that resemble toothpaste tubes. The pointed end to the container will be sealed. Store semen in the cooler in which it came. Keep semen in the dark as much as possible since light can damage sperm cells. Semen storage temperature should be at room temperature or slightly below. A basement is a good place to store semen until it is used. Once each day, gently mix the semen, but don't shake it. Mixing distributes the nutrients in the semen container and helps the sperm cells live longer. Shaking or rough handling can damage sperm cells.

When your sow comes in heat, plan to inseminate her twice - 12 and 24 hours after the beginning of standing heat. For instance, if you've ordered semen to arrive on Friday, you should have weaned your sow on the previous Monday. You could expect your sow to begin standing heat sometime Thursday through Sunday. For the sake of this example,

let's say she begins standing heat Saturday morning. You should breed her on Saturday evening and Sunday morning.

If you plan to breed gilts, you must have a record of at least one heat before you order semen. Then you must hope she cycles at nearly 21 day intervals, and order semen for her next expected heat. Gilts should be inseminated 12 and 24 hours after the beginning of standing heat. For example, if you expect your gilt to come into heat on a Thursday, order semen to be delivered the previous Tuesday. If she begins standing heat Wednesday evening, plan to breed her Thursday morning and Thursday evening.

Actual mating of a sow using artificial insemination is not difficult. Collect the following materials you'll need to inseminate a sow: Semen (stored in a small cooler at room temperature and out of the light), scissors (to cut the sealed end of the semen tube or bottle), and an insemination rod. If inseminating outdoors in cold weather, wrap a towel or dishcloth around the semen container to help maintain semen temperature until it enters the reproductive tract.

If a boar is available, move him to an adjacent pen. Straddle the sow's back or lean across her back to make her stand still (a second person could do this). If she doesn't stand still, she may not be in heat. Insert the marshmallow (or corkscrew) tip of the insemination rod into the sow's vulva. Tip the back end of the rod down toward the ground and insert the rod until you meet some resistance. The resistance should be the cervix. If you have the corkscrew type of rod, turn the rod to the left about 2 turns or until you can't pull the rod back out with a slight tug. If you have a marshmallow type rod, push a bit further until the rod springs back when you tug it lightly. The groove around the marshmallow should seat itself into the interlocking rings of the cervix.

While keeping pressure on the back, remove the semen tube or bottle from the cooler, and cut off tip of the sealed pointed end. Insert the opened semen container into the end of the rod and twist 1/2 turn to make sure it is seated properly. Bending the rod, lift the semen container above the level of the sow's back so that, if it wanted to, the semen could drain into the sow.

Now comes the tricky part. If the sow is in a good standing heat and properly stimulated by back pressure, the contractions of her uterus should (and sometimes will) pull the semen into her reproductive tract in a matter of a few minutes. Sometimes however it takes several minutes for these contractions to begin. Be patient. Gently stroking the sow's underline can help to stimulate the process.

If the semen does not seem to be flowing on its own, gently squeeze the semen container and watch for semen flowing back out of the sow past the rod. Ideally, there should be no back flow. If semen is coming back out of the sow, stop the insemination, reposition the rod, and start again. If gently squeezing the semen container does not get semen flowing into the sow, reposition the rod and start again.

It can take as little as 2 minutes for the sow to accept the semen, or as long as 20 minutes. Eight minutes is about average. When the semen container is empty, leave the rod in the sow for another minute or two, then gently remove the rod from the sow. A small

amount of back flow is typical when removing the rod. Discard the rod and semen bottle. Never re-use a disposable insemination rod.

What happens if you are using AI and your sow or gilt comes back in heat 21 days later? Some semen suppliers will allow you to order semen for 3 weeks later on the expected recycle date. If your sow or gilt shows no early signs of coming back into heat, you can cancel the semen order at the last minute. Be sure to ask if you can do this when you are ordering your semen. Of course, if your sow or gilt cycles late, you'll have to order more semen and wait until the next heat period to re-breed your sow.

### **Vaccinations**

All gilts and boars should be vaccinated for some common reproductive diseases before breeding. Leptovirus (causes abortions) and parvovirus (causes mummified fetuses) can be purchased in the same bottle, and should be given twice, 4 and 2 weeks before breeding. Erysipelas vaccine can be given in the same vaccination. Sows and mature boars should be given a booster dose of vaccine at least once per year before breeding.

Other vaccines can be give in response to specific disease problems as they occur.

### **Nutrition**

Sows, gilts, and boars should be on a limit-fed gestation diet at breeding time. Average intake should be about 5 pounds per day - slightly more for gilts, depending on body condition. The diet is commonly corn-soy based and should be around 13 to 14 % crude protein, fortified for swine with vitamins and minerals.

### **Words You Should Know**

Vulva	Structure of the female reproductive tract outside the body.
Vagina	Birth canal
Cervix	Muscular structure between vagina and the uterus.
Uterus	Area where embryos develop and grow into fully formed piglets
Ovary	Produced eggs for fertilization
Testes	Produces sperm cells
Epididymis	Stores sperm cells
Estrous cycle	The reproductive cycle of a sow
Follicle	Structure on an ovary which ruptures, releasing an egg
Standing heat	Part of the estrous cycles when females stand still when pressure is applied to the back

Natural mating    Mating a sow with a live boar

Conception        The fertilization of egg by a sperm cell.

### **Suggested Activities**

- Visit a swine breeding farm and watch them breed a sow using natural mating and artificial insemination.
- Diagram the reproductive tract of a sow and identify the importance of each structure
- List signs that a sow or gilt is in heat.
- Calculate the timing of weaning, semen ordering and breeding so that a sow will farrow pigs the correct age to show at your local roundup.

### **Extra Activities to Try**

- Vaccinate a sow or gilt
- Collect and examine various types of AI rods
- Visit a boar stud and watch semen collection and processing

### **Ideas for Presentations and Speeches**

- Identifying sows in heat
- Artificially inseminating a sow
- Materials needed to inseminate a sow
- Proper semen storage

### **Things to Talk About**

- Differences in timing of breeding between sows as gilts
- Pros and cons of artificial insemination

## **Section 8**

### **Gestation and Farrowing Management**

During gestation, sows and gilts must maintain or increase their own body reserves while providing for the needs of their unborn litters. The farrowing process and lactation place extreme demands on the sow.

### **Objectives**

After studying the materials and completing the suggested activities for this section of your project, you should be able to:

1. Explain the physical and nutritional needs of a gestating sow .
2. Know the steps of the farrowing process.
3. Know when to intervene in farrowing.
4. Explain the nutritional needs of lactating sows.

### **Gestation**

Gestation is the name given to the period of time after breeding and before farrowing. During gestation, fertilized embryos travel to the sow's uterus, where they attach to the uterine lining. These attachments will eventually form umbilical cords through which the developing piglets get nutrients for growth from the sow. During the 114 days between breeding and farrowing, each of the microscopic embryos (up to 15 or more) grows into a piglet weighing 2.5 or 3 pounds!

Sows don't need much special care during most of gestation. However, reducing stress during the first month or two of gestation can help to increase litter size by reducing the number of fertilized embryos that die and are reabsorbed by the sow. Sows and gilts can be housed individually or in pens like market hogs. As long as they have a dry place to lie down (well-bedded if in cold weather), gestating sows are normally comfortable.

### **Gestation nutrition**

Sows and gilts are normally limit-fed during gestation. This means giving each sow a certain amount of feed each day to maintain or slightly increase body condition. You don't want your sow to be too thin or too fat at farrowing time, so pay attention to body condition. If your sow or gilt seems to be getting fat, reduce the amount of feed by one or two pounds. If she seems thin, increase the amount of feed by a pound or two. If housed in gestation crates in climate-controlled facilities, gestating sows can be fed as little as 4 pounds of feed per day. However, gilts housed in pens or any gestating female kept in cold conditions may need 6 or 7 pounds per day. The feed given to gestating sows is normally about 14 percent crude protein and should include some high-fiber feedstuff like oats, barley, or alfalfa hay to keep gestating sows from becoming constipated. Since feed intake is normally limited, the vitamin and mineral content of the feed should be higher than that of finishing feed or lactation feed. Ask your leader or feed supplier for a good gestation diet. Clean fresh water should be available at all times.

### **Preparation for farrowing**

As the farrowing date approaches, you need to make some special preparations to avoid problems for your sow and litter.

First, make sure your farrowing facilities are thoroughly clean and disinfected. You want your new piglets to arrive into a clean environment, as free of disease as possible.

About two weeks before farrowing, worm your sow and treat her for lice and mange. About one week before your sow's expected due date, wash your sow and move her to the clean, dry farrowing facility. Continue feeding her gestation feed until she farrows, but reduce the amount fed for about 2 days before farrowing. Sows experience less problems farrowing and begin eating feed sooner after farrowing if they are hungry when they give birth.

As farrowing time approaches, the piglets send hormonal signals to the sow that farrowing time has come. These signals prompt a sow to exhibit easily seen behaviors just before farrowing. First, you will notice that your sow is extremely restless. She may get up and lie down very frequently. Second, you may notice nest-building behavior. A sow will paw at the floor, root, and chew straw vigorously. In addition, she will begin to

express milk from her udder. These signs of impending farrowing may be seen up to a day or only a few hours before the first piglet arrives. When you see these signals, connect the heat lamps and check your sow frequently.

### **The Farrowing Process**

If at all possible, attend the farrowing. If you are present, you may be able to save a piglet that otherwise would have died. You can also assist the sow if necessary.

Piglets are expelled from the sow because of strong muscular contractions of the sow's uterus. When a sow is farrowing, you can often see her staining during contractions.

Piglets can be born head or rear legs first. When a piglet is born, make sure its nostrils and mouth are free from mucous so it can breathe properly. Often the umbilical cord will remain attached to the sow for several minutes. If it does not loosen on its own, you may gently pull the cord until it breaks loose from the sow. You may cut the umbilical cord about 4 inches from the pig's navel and spray the cut end with .5 percent iodine solution to reduce the chance of navel infections. Dry the piglet off with straw or a towel and place it under the heat lamp. It should eventually find its way to the sow's udder and begin nursing.

After the last piglet is born, the sow will expel the "afterbirth" - or placenta. These are the tissues that surrounded the piglets during gestation. Occasionally, the last piglet is born wrapped in the placenta. If the placenta is wrapped around the piglet's head, the piglet will likely suffocate without immediate help.

After farrowing, the sow should grunt softly and present her udder for the piglets to nurse. If you have kept the litter away from the sow, introduce the piglets and make sure each gets to nurse.

### **Problems at farrowing**

Some mother pigs (especially gilts) will express curiosity at the first piglet and get up to inspect the new arrival. Others will pay no attention to the piglets. A few will act viciously toward piglets - trying to bite them when they get close to her snout. If the piglets seem to be distracting your sow, place them in a bedded basket under a heat lamp until farrowing is completed. If your sow gets up anytime during the farrowing process, make sure all piglets are accounted for when she lies down again. Sows can easily crush newly born piglets.

Farrowing time and the interval between piglets varies considerably among sows. Some will farrow an entire litter in just an hour or two. Others make take four or five hours. If more than an hour passes between piglets, consider assisting the sow. If you arrive part way through farrowing, and find a few dry pigs with full stomachs the sow has not yet expelled the placenta, the sow may also need assistance. If available, a 2 cc injection of oxytocin will re-start uterine contractions in a sow that has gone too long between piglets. If oxytocin does not help, the sow could be finished farrowing or there may be a

piglet stuck in the birth canal. If so, you may need to assist the sow by manually pulling the piglets out. If you don't feel comfortable doing this, call a veterinarian.

If you choose to pull piglets yourself, be sure the sow has not completed farrowing. If she is still straining, and there is no sign of afterbirth, a piglet may be stuck. To check for a stuck piglet, wash and disinfect your hands and arms then place your arm in a thin plastic sleeve. (You can obtain sleeves from a veterinarian.) If you enter a sow without the protection of a plastic sleeve, you could catch an infection through a cut or scratch in your skin. Lubricate the outside of the sleeve with liquid soap before reaching in a sow. Gently reach up the birth canal. You may have to reach two feet or so to encounter the problem. If you feel a piglet, determine which end of the piglet is closest to you. If the pig is presented head first, grasp the piglet by placing your thumb in the piglet's mouth and pull on the lower jaw. If you encounter hind legs, pull both hind legs at the same time. Pull the piglet the whole way out and make sure it is alive and breathing before you reach for the next pig. If you pull one piglet, you may have to pull the remainder of the litter. Generally, if you have to reach into a sow, she should be treated with antibiotics to prevent infection. Consult a veterinarian for proper treatment.

### **Lactation**

Lactation is the process of making milk - in this case for the piglets to eat. Sow's milk provides the best nutrition there is for young pigs. It is high in protein, energy, vitamins, and minerals that baby pigs need to grow and thrive. The first milk from the sow during and after farrowing is called colostrum. This special milk contains antibodies against diseases the sow has encountered and protects piglets from those diseases for about the first three weeks of life. It is very important that each piglet receives one good meal of colostrum to get off to a good start.

Piglets will select a single nipple within the first day or two to which they return during each nursing event. After the first day or so, sows settle into a nursing pattern at about two hour intervals. At nursing time, the sow rolls onto her side, and begins grunting softly. The piglets hustle to their nipple, and begin nuzzling the sow's udder. Soon the sow begins milk let-down for a short time during which the pigs nurse. After nursing, the piglets may nuzzle the udder some more, then wander off until the next nursing time.

As the piglets grow, the nutrient content of the milk is reduced slightly, but the sow produces more of it.

### **Lactation problems**

Sometimes sows experience problems with lactation. Sows with uterine infections, elevated temperature, and hard, red, swollen udders, usually don't produce enough milk for their litters, and the piglets could starve. This syndrome is known as mastitis, metritis, and agalactia or MMA. Sows with MMA should be treated promptly by a veterinarian if their temperature increases to 103.5 degrees F, or if they refuse to eat within 24 hours of farrowing.

### **Lactation Nutrition**

The nutrients needed to produce milk for a litter of baby pigs can come from one of two places: feed eaten by the sow, or the sow's body reserves. Ideally, most of the nutrients needed for producing milk should come from feed. If the sow uses her body reserves, she may be too thin to return to estrous and be re-bred after weaning.

Lactation feed should be high in energy and protein. Fortified corn-soy diets similar to those fed to growing and finishing hogs are generally used. Protein should be kept at about 16%.

In order to produce milk, sows need lots of fresh water. Make sure your sow has access to clean, fresh water at all times, either through an automatic waterer, or in a feed trough mounted in the front of the farrowing crate.

### **Starting lactating sows on feed**

Within 12 hours after farrowing, sows should be offered a pound or two of feed. Sometimes the feed is mixed with a small amount of water. Some sows prefer wet feed to dry feed. Sows should be fed two or three times per day, increasing the amount of feed by 1 pound per feeding until the sow is eating her maximum amount one week after farrowing. Maximum daily feed intake varies among sows, but about 6 pounds of feed plus 1/2 pound per piglet in the litter is about right. Large sows may eat up to 18 pounds per day but some first litter sows will only consume about 8-9 pounds. Unless your sow is nursing a small litter, you want her to eat as much feed as possible.

Sows should have their first bowel movement within two days of farrowing. If no bowel movement is observed and the sow is not eating well, pay attention to her temperature - she could have MMA.

### **Temperature regulation**

Temperature regulation and ventilation of the farrowing quarters is important for sows to be comfortable, eat properly, and remain healthy. The difficulty arises because sows are most comfortable and eat best when the temperature is about 65°F. New-born piglets on the other hand need temperatures in the 90°F range. If we keep the room temperature at a level where the sow is comfortable, the piglets will be chilled. Likewise, if we keep the room at a temperature where the piglets are comfortable, the sow will be too hot.

One answer to this dilemma is to keep the room temperature at about 65 to 70 °F and provide supplemental heat for the piglets with heat lamps. One or two heat lamps should be hung above the side areas of a farrowing crate or in the closed off portion of a farrowing pen. The distance the heat lamp should be suspended above the piglet's sleeping area can be determined three ways. First, place your hand at floor level under the heat lamp. Your hand should be comfortably warm, but not too hot. Second, you could place a thermometer on the floor under the heat lamp. The thermometer should register a temperature of about 90°F. Third, watch the piglets. If piglets are lying in a pile directly under the heat lamp, they are cold and you should adjust the heat lamp downward. If the piglets do not lie directly under the heat lamp at all, it is too close to the floor and should be adjusted upward. If piglets lie scattered around under and near the heat lamp, but are not lying in a pile, heat lamp adjustment is about right. A small

amount of bedding (such as straw) may be used in addition to the heat lamp to help keep piglets warm.

**One note of caution. Broken heat lamp bulbs can cause fires if used with bedding. Always keep heat lamps out of the reach of sows and piglets. In addition, make sure they are secure enough so that they do not fall down and potentially cause a fire.**

Ventilation of the farrowing room is also important to the health and comfort of sow and litter. In cold weather, you may want to keep the room or building closed up to preserve heat and eliminate drafts. This strategy encourages poor ventilation by not allowing enough fresh air into the farrowing area. If you smell ammonia, or if you see condensation on the walls or ceiling, you should increase the amount of air movement in the room. In hot weather, you'll need to allow for some way to move air so that the sows stay cool.

In some farrowing rooms, fans turn on and off when the temperature gets too hot or too cold and automatically keep the room at the correct temperature. If you are farrowing sows in less elaborate facilities, you may have to install a small ventilation fan or manually open and close doors or windows to keep the room at the correct temperature and air quality acceptable.

### **Words You Should Know**

Gestation	Time period between breeding and farrowing during which piglets develop in the uterus.
Lactation	Making milk for baby pigs
MMA	Mastitis, Metritis, and Agalactia. Syndrome in lactating sows resulting in a hard, swollen udder, high temperature, and refusal to eat.

### **Suggested Activities**

- Visit a swine operation and observe their gestation and farrowing facilities. Ask about attention to nutrition, ventilation, and preparation for farrowing.
- Attend a farrowing.
- Watch a nursing event.

### **Extra Activities to Try**

- List the steps you need to take to prepare a sow for farrowing.
- Explain behavioral changes you may observe in the sow just prior to farrowing.
- Design a system to keep sows cool and baby pigs warm at the same time.

### **Ideas for Presentations and Speeches**

- Preparing a sow for farrowing
- Problems at farrowing
- Steps of the farrowing process
- Differences in nutritional needs of gestating vs lactating sows

### **Things to Talk About**

- How do you know if a sow is having problems farrowing?
- How do you identify sows having lactation problems?
- How do you properly adjust a heat lamp?

### **Section 9: Baby Pig/Nursery Management**

Management of baby pigs from birth through weaning and on to feeder pig weight requires some special management on your part.

#### **Objectives**

After studying the materials and completing the suggested activities for this section of your project, you should be able to:

1. Demonstrate the steps of piglet processing.
2. Read ear notches.
3. Explain the nutritional and environmental needs of newly weaned pigs.

#### **Baby pig processing**

Within 24 hours of birth, you'll need to perform some management activities on you piglets, collectively called piglet processing. These activities include clipping teeth, ear notching, administering iron shots and antibiotic shots, docking tails (optional), and castration. We'll briefly discuss each of these.

Materials you will need:

Ear notchers

Small side-cutting pliers

Iodine solution (7 or 10%)

18-20 x 1/2 inch needles

Syringe

Sharp scalpel

Pencil and paper

Injectable iron

Injectable long-lasting antibiotic

Piglets are born with eight sharp teeth, two on each side, top and bottom. These teeth are used by the piglets to fight with each other for a place at the sow's udder. Sometimes the teeth can injure the sow's udder during nursing and cause the sow to avoid nursing altogether. Or, piglets can injure each other when fighting over a nipple, and open a route for infection. If excessive fighting is observed in a litter, the teeth can be removed to reduce the chance for injury to the sow or other pigs in the litter. If you choose to remove these teeth, use a small, sharp pair of side-cutting pliers. Hold the piglet by its head and insert your forefinger in the corner of the pig's mouth, taking care not to get bitten in the process! Insert the pliers over the tips of two teeth at once and snip off the

sharp points. To remove all eight teeth, you'll need to make four cuts per piglet. Pliers should be washed and disinfected between litters.

Ear notching is the preferred means of pig identification. You need to know how to read ear notches before you ear notch your first litter of piglets. The pig's right ear is the litter number ear. A notch in the right ear indicates the litter number for each year or farrowing season. For example, a "2" notch in the right ear would be the second litter. All piglets from the same litter should have identical litter number notches in their right ear.

The left ear is the individual pig number within the litter. For instance, the first pig in a litter will receive a "1" notch, the second pig will receive a "2" notch, and so on. (You do not have to notch pigs in the order they were born, but some producers notch all male piglets - or female piglets - first). Ear notches are read litter number first and pig number second. A pig notched 8-10 would be the tenth pig in the eighth litter. It would be known as "eight dash ten".

Ear notches are given with a special pair of ear notching pliers. Be sure to cut notches deep enough so that they will be easy to see when the piglets grow up. The notches will bleed a little bit, but will scab over and heal very quickly. Ear notching pliers should be cleaned and disinfected between litters to avoid transferring infection. You may spray the new notches with iodine solution. Record the sex of each pig and its ear notch number if you plan to register the litter.

To create specific numbers with ear notches, the ear is divided into four quarters labeled outside bottom, outside top, inside top, and inside bottom. "Inside" refers to the half of the ear closest to the pig's midline. "Outside" is the other half. "Bottom" is the half nearest to the pig's head. "Top" is the half nearest to the tip of the ear. It is important to remember that there should never be more than two notches in any of the four ear quarters. Notches in the quarters are as follows:

Outside bottom = 1

Outside top = 3

Inside top = 9

Inside bottom = 27 (Right ear only)

Tip of ear = 81 (Right ear only)

Notches are added to create whatever number you need. For example, if you need to create an "8" notch, you'll need two "3" notches and two "1" notches ( $3+3+1+1=8$ ). If you need a "9" notch, you only need to place a single notch in the inside top ear quarter. A "10" notch would require the "nine" notch and a single "one" notch ( $9+1=10$ ). Draw pictures of the notches you'll need to use before notching your first litter of piglets.

Baby pigs are often deficient in iron, so they are routinely given iron injections at processing time. Injectable iron can be obtained from a veterinarian and should be injected into the neck muscle, to the side, and about one inch behind the ear. Injections should be given with a clean 18 or 20 gauge, 1/2 inch long needle. Dosage depends on the product used. Iron generally comes in one of two concentrations: 100 mg and 200 mg

per cc. The 100 mg product should be used at 1 cc per piglet, and the 200 mg product at 1/2 cc per piglet. Some producers give a second iron injection when piglets are 7-10 days of age. Iron also can be purchased in an oral powder, but piglets must be old enough to eat it. If you inject the iron, you can make sure the piglet gets the proper dosage, and you can give iron to very young pigs that are not old enough to consume the oral powdered form.

Many producers also inject 1/2 cc of long-lasting antibiotic at processing to help pigs fight infections early in life. Contact a veterinarian for specific products, dosages, and withdrawal period. Use the same size needle you used for administering iron.

Commercial producers routinely dock piglet's tails at birth to reduce the chances of tailbiting during the finishing period. If you choose to dock tails, use the same pliers you used for clipping teeth. Quickly snip half to 3/4 of the tail off and apply iodine to the stub.

Make sure you disinfect the cutter between removing teeth, and docking tails.

Castration involves removing the testicles from male pigs not saved for breeding. The reason for castration is that the hormones produced by the testes in boars after they reach sexual maturity can cause the meat from these pigs to have a strong flavor that is very offensive to some people. Castration is best done when piglets are about 7-10 days of age. If you have never seen a pig castrated, have someone show you how, or at least have someone there to help you. Be sure to check each pig for signs of a hernia (swollen or mis-shaped testicles) before attempting castration. If you suspect the pig has a hernia, do not attempt castration.

Using a sharp scalpel, make a vertical incision over the center of each side of the scrotum, directly above each testicle. Force the testicles out of the scrotum through the incision, and pull them away from the body cavity. Cut the cords that attach the testicles to the body as near to the body cavity as possible. The remainder of the cords should retract back into the pig's body. Spray the open wound with iodine solution. Newly castrated barrows may swell for a few days, then heal.

### **Scours**

Piglets sometimes develop scours when nursing a sow. Several types of scours can occur. Some are serious and can cause piglets to dehydrate and die. Other types of scours are less serious.

Generally, scours during the two weeks of life can be life-threatening because piglets become dehydrated. Scours occurring in the first two weeks can be a result of poor ventilation, drafts, or unclean conditions. Prompt treatment with oral antibiotics is often called for. Consult a veterinarian if young piglets begin to scour.

Scours may also occur about the time pigs begin to eat feed. It is unclear if this mild diarrhea is due to an allergic reaction to plant-based feeds or a change in the bacterial

populations in the pigs' intestines. Normally no treatment is needed for this type of scour.

### **Creep Feeding**

Sometime after piglets reach two weeks of age, they will begin investigating other sources of feed besides sow's milk. Some producers begin creep feeding at this time to help pig's digestive systems become accustomed to the plant products they will be eating the rest of their lives. If you are planning to wean pigs at an age of greater than three weeks, you do not need to purchase expensive creep feed. The feed you are giving the sow will do nicely. Simply place a small amount of feed in a shallow pan or tray in an area where the sow can not reach it. Throw away any left-over feed each day and replace it with fresh feed. Piglets will investigate the feed and begin eating small amounts. By weaning time, they will know how to eat something besides sow's milk.

Pigs to be weaned earlier than three weeks of age may benefit from pelleted, commercially available creep or starter feeds.

Providing an automatic waterer or water in a shallow pan will help pigs learn to drink on their own.

### **Weaning**

Weaning time can be stressful for young piglets. They must quickly make the transition from sow's milk to plant-based feed such as corn and soybean meal, and learn how to drink water on their own. Piglets between 4 and 6 weeks of age make these transitions more easily than piglets weaned earlier than four weeks of age.

Some producers simply remove the sow from the farrowing pen or crate at weaning time, and allow the piglets to live in the area to which they have become accustomed. Other producers move weaned pigs to a special nursery facility. Whichever you choose, make sure the piglets have a draft-free place to stay warm. Bedding and an enclosed box or hover can be used in cold weather. Fresh feed and water (in a pan or from an automatic waterer) should be available at all times. Watch your newly weaned pigs closely for the first few days to make sure they are eating and drinking. If they are too cold, they will sleep in a pile and their hair coat will be shaggy. Optimum temperature of the sleeping area for a four week old pig is 80-82 degrees F.

Weaned pigs may not gain much weight the first week after weaning. However, if you weigh your pigs at weaning and again one week later, they should have gained at least three or four pounds each.

### **Nutrition of weaned pigs**

The nutritional requirements of weaned pigs change rapidly from the time piglets are three weeks old until they reach 45 or 50 pounds. You need to adjust the nutrients in the diet based on the weight and size of your pigs. This is easiest to accomplish in small operations by purchasing commercially available starter feeds. Feeds for newly weaned, young pigs should be about 20-22% crude protein and contain easily digested products

similar to those found in sow's milk. Highly palatable ingredients such as whey and rolled oats are common in high quality starter feeds. Feeds for pigs heavier than 30 pounds normally contain more plant products such as corn and soybeans found in diets of older pigs and sows. Protein concentration for 40-50 pound pigs should be about 18%. Nursery feeds are more expensive than the feeds needed by sows or finishing pigs, but nursery pigs don't eat as much of them. Feed conversion during the nursery period should be about 1.8 pounds of feed per pound of gain, so average feed intake from 15 to 50 pounds will be about 60 pounds per pig.

Nursery and starter diets are often medicated to help pigs cope with the stress and disease challenges associated with weaning.

### **Words You Should Know**

Piglet processing	Management activities performed on baby pigs.
Ear notching	Identification of pigs using v-shaped notches cut out of the ear.
Scours	Loose, watery feces.
Creep feeding	Providing feed to baby pigs before weaning.
Weaning	Separation of the sow and baby pigs so that pigs can not nurse.

### **Suggested Activities**

- Collect the materials you'll need to process a litter of baby pigs.
- Practice ear-notching a litter of paper pig ears.
- Plan where you will house your weaned pigs and how you will keep them comfortable.

### **Extra Activities to Try**

- Watch someone process a litter of baby pigs.
- Investigate commercially available starter and nursery feeds. Check price, ingredients, and choice of medications.

### **Ideas for Presentations and Speeches**

- Processing baby pigs.
- Ear notching for pig identification.
- Castration of baby pigs

### **Things to Talk About**

- Why do piglets sometimes get scours?
- Why do producers perform each of the steps involved with baby pig processing?

## **Section 10: Marketing Your Feeder Pigs and Sows**

The sale of feeder pigs and sows determines if you will make or lose money from your breeding project.

## Objectives

After studying the materials and completing the suggested activities for this section of your project, you should be able to:

1. Identify potential markets for feeder pigs.
2. Explain when and where you should sell a sow.
3. Explain why quality assurance is important when marketing cull sows.

## Feeder pig marketing

Sometime during gestation or lactation you need to give some thought and effort into where you will sell your feeder pigs. Some potential markets are: at a auction barn or graded feeder pig sale, to other individuals or other 4-H members, or selling feeder pigs to yourself for a finishing project.

If you choose to sell pigs at an auction barn or graded feeder pig sale, you'll need to know where and when such sales are held. Local auctions are usually held on the same day every week. Graded feeder pig sales can be held monthly, or less often. At these markets, you receive the highest price bid on your pigs, less sale commissions and trucking costs. If you have a small group of pigs (less than 10), you may not receive as high a price as someone with larger groups of pigs. It usually pays to sort your pigs by size and sell similar sized pigs together. Pigs are sold on a "per hundred weight" basis. Smaller pigs usually bring more per hundred weight than larger pigs, but the total value of larger pigs should be more. Track feeder pig prices from sale reports before you send pigs to an auction to estimate the potential value of your feeders.

Privately selling feeder pigs to individuals or other 4-H members is another marketing option. In this scenario, you'll negotiate a price with the potential buyer and transact the sale privately. You can use reported auction prices as a base from which to start negotiating. A general formula to use for pricing feeder pigs is:

2 times current base market price (per pound) for the first 40 pounds plus  
One time the current market price (per pound) for the next 10 pounds plus  
1/2 times the current market price (per pound) for any weight over 50 pounds.

For example a 55 pound pig with current market price at \$40 per hundredweight (\$.40 per pound) would be worth:

$$40 \text{ pounds} \times (2 \times .40) = \$32$$

$$10 \text{ pounds} \times (1 \times .40) = \$4$$

$$5 \text{ pounds} \times (1/2 \times 40) = \$1$$

$$\text{Total price} = \$37$$

If you are selling feeders to be used for breeding stock or high quality show pigs to other 4-H members, your asking price may be somewhat higher.

If you plan to retain your pigs to feed for your own 4-H finishing project, you should “sell” the pigs to yourself at a reasonable price for record keeping purposes. That way you can evaluate the profitability of your breeding vs your feeding enterprise. Sale reports or the above formula can be used to calculate their value at the time of this “sale”.

Record the number of feeder pigs you sell, their weight and value at the time of sale.

### **Sow marketing**

At some point in the life of your sow, she will fail to breed or become too old or large to make re-breeding an option. Many sows have fewer and fewer pigs as they age past their 6th or 8th litter, and are candidates to be culled. Older, larger sows often will not fit into a conventional farrowing crate, have nipples too large for newborn pigs to place in their mouths, or have rows of nipples are spread too far apart for baby piglets to nurse the top row. All of these are reasons to cull a sow.

Sows can be sold through conventional livestock marketing channels such as a local auction barn. Larger sows are generally worth more per pound than smaller sows. Sows should not be sold until their udders have dried up after weaning. “Wet” (lactating) sows are generally discounted at auctions.

Most cull sows are destined for the production of sausage.

Record the date, weight, and value of cull sow sales.

### **Quality Assurance**

Things you do to a live pig can affect the safety of the pork it produces. While most people associate the quality assurance issue with market hogs, it is also important to realize that cull sows will be slaughtered for food as well. Both injectable and feed-grade antibiotics can help pigs get over being sick. However, if the pig is slaughtered before the antibiotics have had time to clear the pig’s system, the pork from the treated pig could contain antibiotic residues. Antibiotic residues are illegal and can be a public health hazard.

All antibiotics have an approved withdrawal time. Withdrawal time is the minimum time that must pass between when the antibiotic is given to the pig and slaughter. This time period allows the antibiotic to clear the pig’s system. Some antibiotics can be used safely until the pig is slaughtered. Others must be discontinued for several days before slaughter. It is up to you as a pork producer to make sure you observe the proper withdrawal times for any antibiotics given to your pigs.

The withdrawal times for medicated feeds (feeds containing antibiotics) are printed on the feed tag. Check tags of any medicated feeds fed to pigs because some feed-grade medications have withdrawal periods up to 2.5 months! If you give your pigs medicated feed, write down the name of the medication, the level of medication in the feed, and the dates when you started and stopped feeding it.

Injectable antibiotics should be used only when a pig is sick, and then only under the supervision of a veterinarian. If you must treat a sick pig, ask your veterinarian what withdrawal times must be observed. Record any injections given, which pig it was given to, the date, and where you injected the pig. All injections should be given in the neck muscle, in the area between the ear and shoulder blade.

The way you physically treat live pigs also can affect pork quality. If you handle pigs roughly, they could have bruises that will show up on the carcass after slaughter. Bruised meat must be cut off and thrown away, lowering the value of the carcass. To avoid bruised carcasses, be especially careful when loading and unloading pigs. Never hit a pig hard with a solid object. Also check pens, trucks, and alleyways for sharp or protruding objects that could puncture or bruise the pig.

The National Pork Producer's Council offers a program to certify pork producers in proper management techniques to assure pork quality. The program outlines ways that producers can be sure the pork they produce is wholesome and safe. There are three levels to the program. Levels one and two can be completed by reading a book. The third level must include instruction from a veterinarian, extension agent, or agriculture teacher.

### **Words You Should Know**

Graded feeder pig sale	Special sale for feeder pigs where groups of pigs are assigned a grade based on quality.
Cull sow	Sow to be sold for meat for one of a variety of reasons.
Wet sow	Sow still producing milk after lactation.
Quality assurance	Knowledge that the pork you produce is safe and wholesome.

### **Suggested Activities**

- Investigate local auction barns in your area.
- Seek out information on graded feeder pig sales.
- Track current market prices of feeder pigs and sows in a farm newspaper.
- Become Pork Quality Assurance certified.

### **Extra Activities to Try**

- Ask a local swine producer where he or she sells feeder pigs and cull sows.
- Estimate the current value of a 40 and 60 pound feeder pig using the formula on page \_\_\_\_\_.

### **Ideas for Presentations and Speeches**

- When to cull a sow.
- Feeder pig markets.
- National Pork Producers Council Pork Quality Assurance program.

### **Things to Talk About**

- Why are smaller feeder pigs usually worth more per pound than larger feeder pigs?
- Why is it important to establish a price on feeder pigs if you retain them for a market swine project?
- Why is quality assurance important for 4-Hers with breeding projects?

### **Section 11: Keeping 4-H Records**

When you write down something that you did or that happened, you are keeping a record. Records help you remember important information.

Records can prove what was done, who did it, and how much money it cost to do it. When you grow up, you will need records so you can pay taxes, borrow money, buy a house, or apply for a job. Keeping good 4-H records may help you to win an award or college scholarship.

#### **Objectives**

After studying the materials and completing the suggested activities for this section of your project, you should be able to:

1. Explain why people keep records.
2. List the kinds of records 4-H members with swine projects should keep.
3. Set up a record-keeping system for your swine project.
4. Complete your 4-H project record book.

#### **Why Keep Records?**

Records are used to prove what was done and to help make decisions. Good records can tell you if your pigs are costing or earning you money. They can be used to tell you if your sows are producing as many pigs they are supposed to. They can be used to identify health or nutritional problems. Records are an important part of all 4-H swine projects.

#### **Kinds of Records**

Several kinds of records should be kept by 4-H members with breeding projects. These are:

- financial records
- animal performance records
- animal production records
- records of management practices used
- records of participation in training, activities, and events

#### **Financial records**

Financial records tell you about the value of what you own and how much money you spent and received. Your records should include these kinds of financial information:

1. *Inventories of animals and equipment.* These are lists of how many animals or pieces of equipment you owned and what they were worth when your project started and ended.

If you are required to turn in your 4-H record before you have sold some of your animals, you will need to estimate what they are worth on the day your record ends. You should use real-world prices to estimate what your animals are worth. Look in farm newspapers and magazines to find out prices of animals at nearby markets.

2. *Expenses.* These are amounts of money spent to buy animals and the things used to care for them. Include costs of feed, supplies, equipment, animals, and veterinary care. Feed costs should include costs of all feed eaten, not just the feed you buy. Homegrown pastures and feeds cost money to grow and could have been sold to someone else. They are not “free” when your animals eat them. Your parents and leaders can help you estimate what they are worth.

3. *Income.* This is money received from selling animals, animal products, and other things related to your project. It should also include premiums won at shows. If your income is more than your expenses, you have made a profit. If your expenses are more than your income, you have a loss.

### **Animal Performance Records**

Animal performance records track how individual animals grow and use their feed. In order to keep performance records, animals need to be identified with ear notches or ear tags. Write down the identification number, date of birth, and sire and dam of each pig, if these are known. Some examples of performance records are weights, average daily gain, amounts of feed eaten, and efficiency of feed conversion.

*Weights* can be measured using a scale. Good times to weigh pigs are when you wean them and sell them, or when you will be doing other things to your pigs, such as weaning, deworming, or vaccinating them. You should know how much your pigs weigh to calculate the dosage for some dewormers or medicines. Record the weight of your pig at each weighing.

*Average daily gain* can be calculated if you weigh your nursery pigs more than once. Subtract the first weight from the second to calculate pounds gained. Calculate average daily gain by dividing pounds gained by the number of days between the first and second weighing. You should do this every two weeks or so to see if your pigs are gaining as fast as they should.

*Feed intake* can be calculated if you keep track of what kind of feed and how much feed you give to each animal or group of animals. When you buy or mix feed, write down the date, cost, weight, and kind of feed bought. If you mix feed at home, write down the amount of each ingredient mixed.

*Efficiency of feed conversion* can be calculated if you know how many pounds of feed your animals ate between weighings. You can calculate the efficiency of feed conversion by dividing pounds of feed eaten by pounds of weight gained.

Below are some average breeding swine performance traits. Compare the performance of your pigs with the averages.

These guidelines are not based on any particular resource. They are simply a summary of the performance of “average” pigs. Your pigs’ performance will vary depending on genetics, your management ability, and your facilities. Most pigs should fall within the ranges indicated.

Sow and Nursery Performance Traits

	<u>Average</u>	<u>Range</u>
Feed consumed per day (pounds)		
15 pound pig	1.0	.75-1.25
25 pound pig	2.0	1.5-2.5
50 pound pig	3.25	2.5-4.0
400 pounds gestating sow	5	4-7
400 pound lactating sow	12	9-18
Total feed required per sow per year	2400	2000-2800
Total feed required per pig (15 - 50 pounds)	63	50-75
Average daily gain 15-50 pounds	.8	.6-1.0
F/G (15-50 pounds)	1.8	1.5-2.0
Gestation length	114 days	111–117 days
Length of estrus cycle	21 days	18–24 days
Age at first estrus	6 months	4–8 months
Weight at first estrus	240 pounds	200–300 pounds
Length of estrus (heat)		
Gilts	36 hours	8–60 hours
Sows	48 hours	24–72 hours
Weaning age	21 days	10–42 days
Time from weaning until first estrus	5 days	3–21 days
Pre-weaning mortality	15 percent	5–50 percent

**Animal production records**

Animal production records show how many pigs or other products are produced by an animal. They include dates when a sow farrows and her litter is weaned. They also may include the performance of her pigs. Production records kept for animals other than pigs include amounts of milk, wool, or eggs produced. Since market hogs don’t produce any products other than their carcasses at slaughter, you won’t need to keep any production records for market hogs.

Below are some examples of animal production records associated with breeding swine.

	<u>Average</u>	<u>Range</u>
Live pigs born per litter		
Gilts	8.5	4–14
Sows	10.0	4–20
Stillborn pigs per litter	0.5	
Pigs weaned per sow	8.5	

### **Management practice records**

Write down the things that you do to care for your animals. Also write down when, how, and why you do them, and which animals were involved.

Keep records of dates when you buy and sell pigs, or when a pig dies. Other dates to write down are dates when pigs are sick, de-wormed, vaccinated, or blood-tested. If you treat an animal with a medicine or vaccine, write down the name of the product, how much was given, which pig(s) you treated, and why you treated the animal. These records are important for Pork Quality Assurance. You can find a treatment record sheet you can copy and use found in the back of the Pork Quality Assurance book.

### **Your 4-H Accomplishment Records**

In addition to the records you will keep about what you do with your swine, there are some other kinds of records you should keep when you are in 4-H. These include:

- Activities in which you participated, such as camps, contests, and achievement programs
- Special skills and knowledge you learned
- 4-H accomplishments, such as projects completed and things you made
- Offices and other leadership roles you held
- Awards you or your pigs received

### **Words You Should Know**

Financial      Related to money.

Income        Money someone else pays to you.

Expenses     Money you spend for products or services.

Profit         Money you keep when your income is more than your expenses.

Loss          Money you lose when your expenses are more than your income.

### **Suggested Activities**

- Discuss records you should keep and how to keep them with your parent or club leader.
- Keep a diary or barn chart to record things you do with your animals. Be sure to include who was involved, what happened, and when, where, why, and how it happened.

- Complete a 4-H Animal Project Record for Beginners or 4-H Livestock Record for Intermediate and Advanced Projects.

**Extra Activities to Try**

- Weigh your nursery pigs more than once. Calculate how much they gained and their average daily gain. Compare with the listed averages.
- Discuss how to use your records to make decisions about management of your project. Do this with your leaders and members of your club.
- Calculate the efficiency of feed conversion of your nursery pigs. Compare with the listed averages.

**Ideas for Presentations or Talks**

- Kinds of records to keep on your pigs
- How to fill out a swine project record
- How to calculate profit and loss
- Why records are important

**Things to Talk About**

- Why do people keep records?
- What kinds of records should 4-H members keep?
- What kind of information belongs in your 4-H swine record?
- How can you use your 4-H swine records to make decisions about how to manage your animals?

**Section 12: Breeding Swine Management Schedule**

Plan: Breed and farrow a gilt or sow. Wean the piglets at 5 weeks of age and raise them to 10 weeks of age.

Assumptions: Buying 6 month old 250 pound gilt on August 15.

<b>Date</b>	<b>Things to do</b>	<b>Dates for your project</b>
Aug 1-15	<ul style="list-style-type: none"> <li>• Plan project.</li> <li>• Arrange project financing.</li> <li>• Get barn and pens or crates ready.</li> <li>• Make sure feeders and waterers are ready to use.</li> <li>• Arrange to buy feed.</li> </ul>	_____
Aug 16-Sept 1	<ul style="list-style-type: none"> <li>• Gain access to a boar or order AI catalogs.</li> <li>• Observe gilt for signs of standing heat.</li> <li>• Calculate when you want to breed your gilt.</li> <li>• Order semen and inseminating supplies if necessary</li> <li>• Vaccinate gilt</li> </ul>	_____
October	<ul style="list-style-type: none"> <li>• Breed gilt (Assume Oct. 1)</li> </ul>	_____

	<ul style="list-style-type: none"> <li>• Calculate expected recycle date and watch for signs of heat 21 days after breeding</li> <li>• Switch to gestation diet.</li> <li>• Collect materials needed for processing baby pigs</li> </ul>	
Nov-Jan 15	<ul style="list-style-type: none"> <li>• Clean and disinfect farrowing quarters.</li> <li>• Purchase heat lamps if necessary.</li> <li>• Feed and water your gilt daily. Adjust feed intake based on body condition and weather</li> <li>• Watch for visible confirmation of pregnancy.</li> <li>• Prepare nursery facilities</li> <li>• Order semen for next breeding based on expected weaning date, if necessary.</li> </ul>	_____
Jan 10-15	<ul style="list-style-type: none"> <li>• Worm, treat for lice and mange, and wash gilt and move into farrowing facilities.</li> </ul>	_____
Jan 20-30	<ul style="list-style-type: none"> <li>• Watch closely for visible signs of impending farrowing.</li> <li>• Reduce feed offered prior to farrowing.</li> <li>• Attend farrowing.</li> <li>• Process baby pigs.</li> <li>• Switch to lactation feed and increase feed offered to sow</li> <li>• Watch for signs of MMA.</li> <li>• Castrate boars.</li> <li>• Record farrowing date and processing information.</li> <li>• Daily check ventilation and temperatures for sow and baby pig comfort.</li> </ul>	_____
Feb 1	<ul style="list-style-type: none"> <li>• Begin creep feeding piglets.</li> <li>• Gilt should be at or near full feed.</li> </ul>	_____
Feb 20	<ul style="list-style-type: none"> <li>• Purchase starter feed for piglets</li> <li>• Make pans to market piglets</li> <li>• Make final decision if sow will be re-bred</li> </ul>	_____
Feb 26	<ul style="list-style-type: none"> <li>• Weigh pigs and wean into warm, well-ventilated facility.</li> <li>• Check feed disappearance and that piglets have found water.</li> <li>• Switch sow back to gestation diet and begin limit feeding.</li> </ul>	_____
Mar 2-6	<ul style="list-style-type: none"> <li>• Re-breed sow, or check for heat if not to be re-bred on this cycle.</li> <li>• Weigh nursery pigs and calculate first week daily gain.</li> </ul>	_____
April 1	<ul style="list-style-type: none"> <li>• Weigh and market feeder pigs.</li> </ul>	_____

Name

Address

Name of Club

Leader's Name

Name of Project

4-H Club Motto

“To make the best better”

4-H Club Pledge

I pledge

my head to clearer thinking,  
my heart to greater loyalty,  
my hands to larger service, and  
my health to better living, for  
my club,  
my community,  
my country, and  
my world.

4-H Club Colors

Green and White

Prepared by Robert E. Mikesell, senior extension associate; Robin B. Keyser, former assistant professor of agricultural and extension education; Patrick J. Carroll, graduate extension assistant; Ronald J. Knox, graduate extension assistant; and Kenneth P. Kephart, associate professor of animal science, in consultation with the Pennsylvania 4-H Animal Sciences Curriculum Development Committee. Members of the committee during the initial drafting of this manuscript were Robin Keyser, William Henning, Dale Olver, Herbert Jordan, Chester Hughes, Deborah Dietrich, Patricia House, Gere Reed, Bruce Loyd, Patsy Novak, Patricia Comerford, Gary Dean, Denise Pease, Nancy Plushanski, Shannon Davis, Alice Strause, and Penny Farmery.

Committee members during finalization of the document were Keith Bryan, Kenneth Kephart, Norma Lash, Ruth Burns, Sherri Abruzzi, Chester Hughes, Nancy Kadwill, Donna Zang, Missy Whetzel, Patricia Comerford, Marianne Fivek, Bob Lewis, Dale Olver, Bill Weaver, and Christy Kohler.

Acknowledgments:

The authors appreciate suggestions provided by extension agents, 4-H leaders, and members who pilot-tested this reference guide.

Penn State College of Agricultural Sciences research, extension, and resident education programs are funded in part by Pennsylvania counties, the Commonwealth of Pennsylvania, and the U. S. Department of Agriculture.

This publication is available from the Publications Distribution Center, The Pennsylvania State University, 112 Agricultural Administration Building, University Park, PA 16802. For information telephone (814) 865-6713.

Where trade names appear, no discrimination is intended, and no endorsement by Penn State Cooperative Extension is implied.

Issued in furtherance of Cooperative Extension Work, Acts of Congress May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture and the Pennsylvania Legislature. T. R. Alter, Director of Cooperative Extension, The Pennsylvania State University.

This publication is available in alternative media on request.

The Pennsylvania State University is committed to the policy that all persons shall have equal access to programs, facilities, admission, and employment without regard to personal characteristics not related to ability, performance, or qualifications as determined by University policy or by state or federal authorities. The Pennsylvania State University does not discriminate against any person because of age, ancestry, color, disability or handicap, national origin, race, religious creed, sex, sexual orientation, or veteran status. Direct all inquiries regarding the nondiscrimination policy to the Affirmative Action Director, The Pennsylvania State University, 201 Willard Building, University Park, PA 16802-2801: Tel. (814) 865-4700/V, (814) 863-1150/TTY.

© The Pennsylvania State University 1998