

A SOURCE UNIT ON SWINE PRODUCTION AND MANAGEMENT

by

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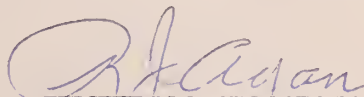
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INTRODUCTION

PHILOSOPHY

The purpose of this study was to provide a source unit that might be used by teachers of vocational agriculture in preparing and teaching lessons on swine to classes in vocational agriculture.

Phipps and Cook in their handbook stated: "A source unit is an extensive collection of teaching materials that may be used in developing a short-time teaching plan. A good source unit contains more ideas than should be used at any one time with a class."(29)

Deyoe in his text pointed out: "When it comes time to teach a unit, or a portion of it, to a given class of students, these materials are a source of suggestions for use in developing short-time teaching plans."(12)

The above authors also indicated that a source unit, besides containing a lot of information, should also be accumulative in nature. New materials should be added as new ideas and information become available. As the teacher gains experience and secures new methods of teaching the source unit should contain an up-to-date condensed source of information for teaching a major unit. Deyoe stated that:

A source unit is accumulative in nature; that is, a teacher will add to it from year to year as new ideas and materials are collected. Under no conditions should all of the materials be used with a given class. Rather, the teacher should utilize these materials as a rich source of ideas which he may review quickly for developing short-time teaching plans and otherwise preparing himself for cooperative planning with the class at hand.(12)

The source unit for this study dealt with swine production and management. It included the production of swine in a farming operation as well as the recommended management practices for attaining high efficiency.

Ensminger in his book Swine Science, analyzed the importance of swine to the American farmer as follows:

The contribution of the humble pig to American agriculture is expressed by his undisputed title as the "mortgage lifter". No other animal has been of such importance to the farmer. Hogs are produced on about two and one-half million American farms; and, upon these farms, twenty per cent of the world's supply of pork is produced.(15)

Bundy and Diggins discussed swine as related to new developments:

Swine production provides an important source of farm income, and the returns per hundred dollars invested are comparatively high. However, hog production in recent years has become increasingly complex. New developments in swine breeding, improved rations, disease control, and marketing have brought about many changes in production and marketing.(6)

Successful development and management of swine enterprises has required that the hog farmer be able to make management decisions that will increase his profits. In their textbook Carroll, Krider, and Andrews summarized this approach to swine management.

Profits in swine production, as in any manufacturing or merchandising venture, are to be found if at all in the difference between the cost of production and the net selling price of the commodity. Most swine producers are extremely sensitive to the selling price of their animals, but seldom know even approximately their cost of production. Under everyday practical conditions, variations in cost of production have greater influence than variations in selling price on the profits of a swine enterprise.(9)

In connection with the materials reviewed for this study it was found that there has been published an abundance of material to instruct the student in swine production and management. However, it was found that most of the material prepared for swine production and management was accurate but lengthy.

Many vocational agricultural teachers have expressed the need for a compact source of information. It was the purpose of this study to develop a source unit from which a teacher of vocational agriculture could readily

make the required preparations that will enable him to have current swine information to meet his local community needs. It was also the purpose to develop the source unit so that the teacher will be encouraged to keep it up-to-date with the constant changes that are occurring in agriculture.

PROCEDURE

Steps were planned to meet the above mentioned purposes as follows:

1. A list of technical publications on the swine enterprise was secured.
2. A selection was made of materials, based on the authors judgment for use of other teachers of Vocational Agriculture in Kansas, pertinent to high school and young farmer classes. Materials were selected on their potential usefulness in helping vocational agriculture teachers obtain one or more of the following objectives.
 - a) To present to boys the possibilities of swine as part of their program.
 - b) To present to boys an up-to-date, authoritative picture of the swine enterprise.
3. A source unit was developed. This was an orderly organization of pertinent materials that would aid high school boys and young farmers in making decisions pertaining to the inclusion of swine in their farming program. Information included would also aid them in putting into operation approved practices in swine production.

4. The tentative source unit was submitted to the advisory committee of two specialists.* One was from the field of agricultural education who reviewed the source unit from the standpoint of its organization and its value in meeting the needs of vocational agriculture teachers; and one was from the field of animal husbandry who reviewed the source unit from the standpoint of technical information.
5. The source unit was revised on the basis of suggestions and criticisms made by the reviewing committee.
6. A pre-examination based on the material in the source unit was developed. An experimental group of students and a control group from the vocational agriculture classes at Goessel Rural High School were selected. The freshmen and seniors were the control group and the sophomores and juniors were the experimental group. All students were given the pre-examination before any lessons on swine production were taught from the source unit. Their scores on this examination were recorded.
7. A selection of lesson plans from the material in the source unit was made. These lessons were taught to the experimental group of vocational agriculture students in Goessel Rural High School.
8. The control group was taught other lessons using the same techniques but on different subject matter.

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9. The same examination on swine production was re-administered. This examination was given again to all the vocational agriculture boys. The results of this examination were recorded.
10. The comparison of results of the pre-examination and the follow-up examination was analyzed. The boys that received instruction and those that did not receive instruction based on the lessons taken from the source unit were compared.

LIMITATIONS

A total of forty-five vocational agricultural boys at Goessel Rural High School participated in the study and were tested on the lessons taught on swine production and management based on the source unit. Twelve freshmen and six seniors, totaling eighteen boys, did not have instruction based on the source unit. Their test scores were compared to the sixteen sophomores and eleven juniors, totaling twenty-seven boys, that received instruction based on the source unit.

Variables which may have affected the accuracy of the data were:

1. It was assumed that all the boys had received no advance notice and did not prepare for the pre-test.
2. It was assumed that all of the boys had an equal interest in learning about swine production and management.
3. It was assumed that there was no outside of class discussion about the pre-test or post-test as it was impossible to test all forty-five boys at the same time.
4. It was assumed that the boys in the control group had the same average mental ability as the boys in the test group.

5. It was assumed that the boys in the control group had the same average experiences and knowledge of swine as the boys in the test group before the pre-test was given.

SWINE PRODUCTION AND MANAGEMENT SOURCE UNIT

HISTORY AND DEVELOPMENT OF THE SWINE INDUSTRY

The swine industry is very old. Hogs were first domesticated in China about 4900 B.C. Biblical writings also referred to swine as early as 1500 B.C.(15)

Hogs are not native to the United States although all of our American breeds were developed in this country. Our American hogs originated from two wild stocks; namely the European wild boar (*Sus scrofa*) and the East Indian pig (*Sus vittatus*).(15) The European wild boar still lives in some of the forests of Europe. This wild hog has coarser hair, a larger head, longer tusks, and a greater ability to run and fight than the domestic pig we know today. These ancestors were extremely courageous and stubborn fighters. The wild boar hunt has been a very noble sport in Europe.

The East Indian pig is native to the East Indies and Southeastern Asia. This pig is smaller, more refined and has finer hair than the European wild boar.

Swine were unknown to the Indians before the white man came to America. Columbus first brought hogs to the West Indies on his second voyage in 1493. The colonists also imported hogs from England as early as 1633.(15) It was very difficult to confine the hogs to pastures like cattle and sheep, so they were allowed to roam the countryside living on nuts, roots, and waste products.

Very few hogs were marked, for these animals were so plentiful nobody minded the theft of a pig. Very little care was given to these hogs, however, sometimes a sow was allowed the privilege of using a shelter if she would be

farrowing in cold weather. When these hogs were ready for market, dogs were used to run them down. Usually dogs held on to each ear of the hog until it could be tied and loaded into a wagon.

One of the early day pork-packing centers was Cincinnati, Ohio.(6) By 1850, it was known as "Porkapolis" because it was the center of the finest hog raising region in the world and it was strategically located so that large quantities of cured pork could be shipped to southern ports via the Ohio and Mississippi rivers.

The growth of hog production has very closely paralleled the production of corn in the North Central States. As early as 1860 the center of pork production and packing was shifting westward and Chicago became the foremost packing center. More recently Omaha, Nebraska; St. Joseph, Missouri; and St. Paul, Minnesota; have consistently ranked in the top ten terminal hog markets in the United States.(15) This indicates that hog production tends to move with the grain producing areas. The production of grain sorghum has also gradually increased southwest of the Corn Belt States.

The hog is the most thoroughly domestic American animal. In no other class of animals have so many truly American breeds been created. The demand for hogs was brought about by the fact that native maize or Indian corn made a very suitable hog feed. Also the easiness of curing and storing pork and the need for high energy foods for laborers in developing a frontier country helped to enlarge the pork industry.

The American hog farmer did not import large herds of purebred hogs like the early beef and dairy stockman. Instead he was content to use the sow that was here from colonial times and cross her to an imported Berkshire, Tamworth, Russian Chinese, or Irish Grazier boar. These importations began

as early as 1825 and out of the various crosses were created the several genuinely American breeds of swine.

In selecting these early crosses breeders stressed large size. This type persisted until about 1890 when breeders turned their attention to the development of refined, early maturing, and extra fat hogs. As a result hogs became so short, thick, and "chuffy" that they were lacking in prolificacy, farrowing sometimes only twins or triplets.

About 1915 swine breeders realized they needed larger, longer and heavier boned hogs. As a result they produced a hog with long legs, weak loins and "cat hams".

Since 1925, however, there has been a move to develop the medium or meat type hog. The best individuals of this type combine size, smoothness, and balance with feeding capacity to gain rapidly and put on meat instead of fat.

This is the goal of most hog feeders and breeders although some difficulties have been encountered due to the lack of uniformity within breeds.

SELECTING TYPES AND BREEDS OF SWINE

For many years swine in the United States have been classified as "lard" type or "bacon" type hogs. Today neither of these classifications has much meaning in terms of consumer demand for pork. In order to produce a market hog that produces a high percentage of lean cuts the hog breeder has been working toward what is commonly called the "meat" type hog.(25)

What is a meat type hog? A meat type hog is one that will produce a high yield of the four lean cuts, the ham, loin, picnic, and Boston butt. It has a carcass that measures twenty-nine to thirty-one inches in length; it

has an average backfat of 1.3 to 1.6 inches and a loin eye containing at least 3.75 square inches.(31) This meat type is pleasing in appearance, firm, and smooth throughout, particularly well muscled in the ham and loin and free from excessive fat. Meat type hogs do not require more feed per hundred pounds of gain than other hogs and they gain just as rapidly as lard type hogs.

All established breeds of swine can claim some meat type hogs. Certain breeds have made more progress in this area than others. It is evident that considerable improvement has been made in our present day swine population over the past several years.(25) Figures show that in 1952 only three to five per cent of all hogs marketed were meat type hogs while in 1962 thirty-five per cent were meat type hogs.(36)

In selecting a herd of swine it is more important to look for and select on the basis of good meat type characteristics rather than on the basis of an individual breed. There are good individuals in every breed as well as in well planned crossbreeding programs.

Some farmers choose a breed because of its market demand. Others select a breed because the stock is most available. According to the number of registrations in the U. S. in 1963 the following are the ten most popular breeds of swine in order:

- | | |
|-----------------|------------------|
| 1. Duroc | 6. Chester White |
| 2. Hampshire | 7. Berkshire |
| 3. Yorkshire | 8. Spotted |
| 4. Poland China | 9. Inbred |
| 5. Landrace | 10. Tamworth |

Each breed has distinctive characteristics which make it different from the others. It is up to the breeder to select the breed of hogs that will best fit his farming operation.

The description and outstanding characteristics of each breed are discussed briefly in the following paragraphs.(6)

Duroc. Until recently this breed was known as the Duroc-Jersey. The breed is now known simply as the Duroc. They were developed in the states of New York and New Jersey. The first breed association was formed in 1883.

The Duroc varies in color from a light golden brown to a deep cherry red. The solid red color is very practical because there is little concern about the fine points of color markings. Durocs are a large breed of medium length. Mature boars weigh from 600 to 1,000 pounds and mature sows from 600 to 700 pounds. The ears should be drooping.

The breed is particularly known for hardiness and prolificacy. They are early maturing and make very rapid gains in the feedlot. This last characteristic is probably the major reason for their great popularity.

Hampshire. The Hampshire breed originated in Southern England in the county of Hampshire. Early development in the United States took place in Pennsylvania, Indiana, and Kentucky. The Hampshire Swine Record Association was organized in 1893.

The most striking characteristic is the white belt entirely encircling the body and including the front legs. This attractive color pattern may have contributed to the popularity of the breed.

The Hampshire is medium in size at maturity with boars weighing from 600 to 850 pounds and sows weighing from 500 to 700 pounds. Hampshires have long straight faces and erect ears. They are most noted for their above average meat qualities and outstanding rustling ability.

American Landrace. One of the newer breeds of hogs is the American Landrace. They are descendants of hogs imported from Denmark in 1934 for experimental purposes. However, in 1948 the purebred Landrace found their way onto American farms and in 1950 the American Landrace Association was formed.

The color of the American Landrace must be white. One of the striking characteristics of the breed is the great body length. This is due to the fact that most Landrace hogs have sixteen to seventeen pairs of ribs as compared to fourteen in other breeds. Their ears are long, pointed, and drooping. Mature boars weigh from 700 to 900 pounds and mature sows from 550 to 750 pounds.

Landrace sows are very prolific and make excellent mothers. Probably more important is the outstanding meat qualities of the breed. They have been used extensively in crossing to increase the meat type qualities of other breeds.

Yorkshire. The Yorkshire breed of hogs originated in England. Yorkshires are white and their ears are held erect. The breed association known as the American Yorkshire Club was established in 1893.

Mature Yorkshire boars weigh from 700 to 1,000 pounds and mature sows from 500 to 800 pounds. Yorkshires are long, smooth, and meaty. They are well known for their excellent meat qualities. They also have the reputation of being the most prolific breed of hogs and they make excellent mothers. Because of their many desirable characteristics Yorkshires have been very popular in commercial crossbreeding programs. Their main disadvantage is that they are a white hog and therefore tend to sunburn under certain conditions.

Poland China. The Poland China is probably the largest modern breed of swine. Mature boars weigh from 850 to 1,050 pounds and mature sows from 500 to 700 pounds.

This breed of hogs originated in Southwestern Ohio. There have been Poland Chinas since 1878. However, it wasn't until 1946 that three associations recording Poland China hogs were able to combine into one association known as the Poland China Record Association.

Polands have a distinctive and attractive color pattern. They are black with white on the four feet, tip of the nose, and tip of the tail. The nose of the Poland is medium length and their ears are drooping.

The breed is known for its quiet disposition and its feedlot gaining ability.

Berkshire. The Berkshire is one of the oldest of the modern breeds of swine. The breed originated in South Central England and was first imported to the United States in 1823. In 1875 the breeders organized under the name of the American Berkshire Association.

Berkshires are black with white feet, a small amount of white in the face and a white tail tip. A very distinctive characteristic of the breed is a short, stubby snout and a dished face. The ears are held erect. Berkshires are of medium size with mature boars weighing from 700 to 900 pounds and mature sows from 600 to 750 pounds.

The Berkshire is a solid hog and is usually free from excessive fat. For this reason the breed has its greatest reputation as a carcass hog. They are tops from the standpoint of cut-out value and quality of meat. They are considered one of the best meat breeds because of this carcass quality.

Spotted. This breed, which in many ways is very similar to the Poland China, was developed in Southern Indiana as a practical strain of hogs because some breeders preferred this color to the black breed of Poland China. The breed organization started in 1914 as the National Spotted Poland China Record Association but changed their name in 1960 to the Spotted Swine Record.

The Spotted hogs are a large breed and are excellent gainers in the feedlot. The ideal color of the breed is fifty per cent white and fifty per cent black with the white and black spots well defined. This comparatively new breed has become quite popular as many of its individuals are trim, high quality, and well muscled animals. Mature boars weigh from 650 to 1,000 pounds and mature sows from 500 to 700 pounds.

Chester White. The Chester White breed had its origin in Chester County, Pennsylvania. The Chester White Swine Record Association was established in 1908. The color of the breed is solid white. They make a very attractive appearance when they are washed and presented in the show ring.

Packer buyers are very pleased with the clean looking white skinned carcasses yielded by the Chester Whites as well as the other white breeds.

The face of the Chester White is medium in length and the ears are drooping. Mature boars weigh from 600 to 900 pounds and mature sows weigh from 500 to 700 pounds. They are an early maturing breed that fatten easily. Sows are good mothers and excellent milkers.

Tamworth. Tamworth, like Berkshire, is one of the oldest breeds of swine. They originated near the town of Tamworth, England, about 140 years ago and were imported to the United States in 1881. The Tamworth Swine Association was organized in 1897.

This breed of hogs is red in color, with shades varying from light to dark. The head is long and narrow, with a long snout and erect ears.

Tamworths are not very large hogs. Mature boars only weigh from 700 to 900 pounds and mature sows weigh from 500 to 700 pounds. In body conformation the Tamworth is very narrow and lean as compared to the other breeds. They have not been popular with the average American farmer mainly because of their lack of thickness and fattening ability.

The breed is outstanding in its rustling ability and has been used quite extensively in commercial crossbreeding and for the development of leaner strains of hogs. Tamworth bloodlines were used in producing the Minnesota No. 1 breed of swine.

Ohio Improved Chesters. The Ohio Improved Chesters were originated in Ohio in 1865 from foundation stock of the Chester White breed. The OIC Swine Breeders Association was organized in 1897. This breed resembles the Chester White breed in color and conformation. Its outstanding characteristics are very similar to the Chester Whites also. At one time this breed of hogs was very superior to the Chester Whites but indications today show that this superiority no longer exists.

A number of new breeds of swine have been developed in the last twenty years. Attempts have been made to produce a breed of hogs that is prolific, will gain rapidly, will make efficient use of feed, and will produce a carcass with a high per cent of lean cuts. This has been done by crossing breeds or strains with some desirable characteristics with breeds or strains that lacked these factors. The Landrace, Yorkshire, and Tamworth have been used in various combinations with the American breeds and the result has

been some promising new breeds. Following is the name and breeding of these new breeds:(6)

Beltsville No. 1 -- 75 per cent Landrace and 25 per cent Poland China

Beltsville No. 2 -- 58 per cent Yorkshire, 32 per cent Duroc, 5 per cent Landrace and 5 per cent Hampshire

Maryland No. 1 ---- 62 per cent Landrace and 38 per cent Berkshire

Minnesota No. 1 --- Completely Inbred--Tamworth-Landrace

Minnesota No. 2 --- 60 per cent Poland China and 40 per cent Yorkshire

Minnesota No. 3 --- Completely Inbred--8 other breeds

Montana No. 1 ----- 55 per cent Landrace and 45 per cent Hampshire

Hybrid hogs are relatively new compared to hybrid corn and hybrid chickens. A hybrid hog is produced by crossing two or more inbred lines usually from different breeds. Hybrid hog production is a complicated procedure and one that involves careful planning and management.

The number of producers of hybrid hogs is still small. Their primary objective is selling tested boars to commercial hog producers. Some of the farms producing hybrid hogs are Farmers Hybrid Company, Hampton, Iowa; Conner Prairie Farms, Noblesville, Indiana; and Lucie Hybrid Hogs, Augusta, Illinois.

SWINE BREEDING

Good breeding stock is essential for profitable hog production. The selection of a good breed of hogs is not enough because of the wide difference among the animals of a particular breed. Careful consideration should be given to type, body conformation, rate of gain, prolificness, and carcass quality. These factors can constantly be improved by using various breeding systems available to the swine breeder.

A general understanding of the different swine breeding systems is important to the swine producer. These systems are commonly referred to as outbreeding, inbreeding, linebreeding, grading-up, and crossbreeding.(16)

Outbreeding is the mating of sows in the herd with boars that are unrelated to them. This system, which is used most commonly in registered herds, tends to improve the outward appearance and performance of the herd.

Inbreeding is the mating of a boar and sow that are closely related such as brother and sister, sire and daughter, and son and dam matings. This type of breeding is used most in producing hybrid hogs. This system should be used only by geneticists or experienced purebred breeders.

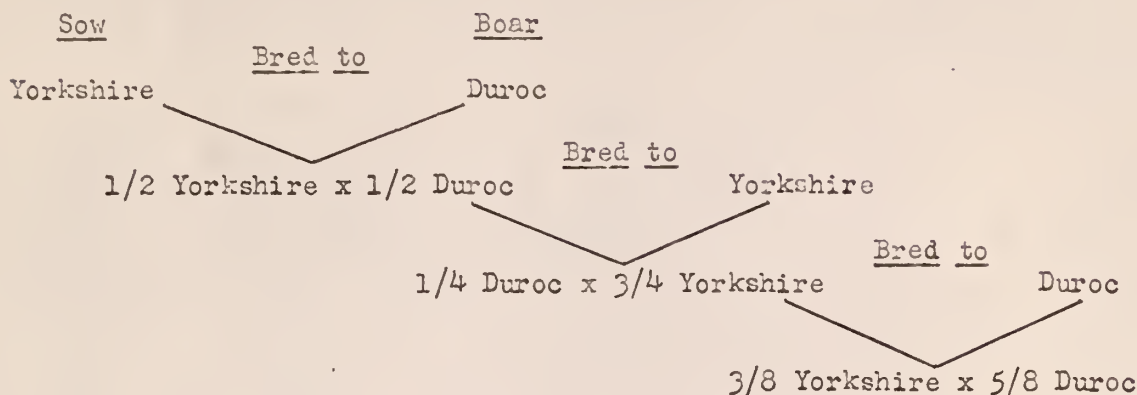
Line breeding is a form of inbreeding where matings are directed toward using the blood line of one outstanding ancestor. These matings are not as closely related as inbreeding. This system can be used to an advantage by many purebred breeders. Good linebred animals stand a much better chance of producing good results in a commercial herd than do outbred animals.

Grading-up and crossbreeding are the two systems of breeding used in commercial herds. Grading-up refers to the use of purebred boars of one breed on grade sows within a herd. This system is used quite commonly by small commercial breeders.

Straight breeding has two advantages over the crossbreeding program, which are simplicity of the breeding program and uniform appearance of animals. Straight breeding's disadvantages are less vigor, higher mortality in pigs, and less desirable mothering ability in sows.

Crossbreeding is a valuable system of breeding to the commercial swine producer. Crossbreeding is the mating of a purebred animal of one

breed with a purebred animal of another breed. A two breed crossing system is illustrated below.(16)



Two breed rotations are referred to as crisscrossing. Males of two breeds are rotated and the best resulting crossbred females from one generation are used as replacements for the next.

If three or more breeds are used the system is called rotation crossing. This system is the most widely used in crossbreeding swine. The breeds of boars used should be carefully chosen to give the greatest amount of hybrid vigor and the general characteristics desired in market animals. At present the most popular program is to put one of the European breeds (Landrace or Yorkshire) in rotation with two American breeds (Duroc, Hampshire, or Poland China).(39)

	<u>Sow</u>	<u>Boar</u>
1st Cross:	Yorkshire	Duroc
2nd Cross:	1/2 Yorkshire 1/2 Duroc	Hampshire
3rd Cross:	1/4 Yorkshire 1/4 Duroc 1/2 Hampshire	Yorkshire
4th Cross:	5/8 Yorkshire 1/8 Duroc 1/4 Hampshire	Duroc

The reasons for crossbreeding are to help make rapid changes in type to meet market demand, to combine the strong points of two or more breeds to give the most profitable hog, and to capitalize on hybrid vigor. Hybrid vigor is noticeable by more rapid growth, improved livability in pigs, and superior mothering ability of crossbred sows. However, it should be remembered that crossbreeding is no substitute for good nutrition and management practices.(39)

In determining which breeds to use in a crossbreeding program it is important to know the outstanding characteristics of each breed. It is also important to know which factors are high heritability factors and which ones are low. Table I shows the heritability per cent of each factor in swine.

TABLE I
HERITABILITY FACTORS IN SWINE(6)

High		Medium		Low	
Length of Leg	64%	Carcass Quality	42%	Weight at 5 Months	20%
Belly Fat	61%	Feed Efficiency	38%	Litter Birth Weight	17%
Carcass Length	61%	Conformation	38%	Litter Size Weaned	12%
Per Cent of Fat Cuts	60%	Per Cent of Lean Cuts	34%	Litter Size Farrowed	10%
Per Cent of Ham	58%	Growth Rate	30%		
Backfat Thickness	50%				
Loin Area	48%				
Per Cent of Shoulder	47%				

Artificial insemination of swine in the United States is still in the experimental stage but there is quite a bit of interest in its application. It is possible to breed sows artificially with freshly collected semen from the boar with satisfactory results. However, before wide use can be made of artificial insemination in swine some problems need to be solved.

First, boar semen is difficult to dilute and store at refrigerated temperatures for a long period of time. Secondly, more sows need to be able to be bred by one boar. For example, it is only possible to breed ten to twelve sows from one collection of boar semen while one collection from a bull can breed as many as five hundred cows. Thirdly, it is sometimes difficult to tell when sows are in heat and ready for breeding.(15) If a sow is not bred at the proper time the litter size and conception rate are likely to be reduced. It should also be emphasized that special equipment is necessary as well as special technical training to do artificial insemination. Even though many problems need to be worked out artificial insemination of swine will be used on farms in the coming years.

SWINE NUTRITION

In order to take advantage of the breeding potentials of good stock an adequate and balanced ration is of prime importance. Feed is also of prime importance in the cost of producing pork because it represents seventy-five to eighty per cent of the total costs of any swine operation.(9) A lack of proper feeding will take the profit out of swine production.

This means that the swine producer needs to know the nutrient requirements of the pig, the characteristics of a good ration, and the nutritional value of the feeds used in swine rations.

In general the nutrients required by swine are classified as carbohydrates, fats, proteins, vitamins, minerals, chemical additives and water. All of these nutrients must be supplied in adequate amounts and proportions to get the fastest and cheapest gains from swine. The common feeds such as corn and milo used in feeding hogs do not contain adequate amounts and

proportions of the nutrients and must be supplemented with feeds that will correct deficiencies in proteins, minerals, and vitamins.(31)

Carbohydrates and fats are used mainly for energy and are supplied in adequate amounts in farm grains. Fats supply 2.25 times the energy of carbohydrates.(31)

Cereal grains such as corn, milo, barley, oats, and wheat provide not only the most adequate but probably the cheapest source of energy. These cereal grains are rich sources of energy but do not contain the quality or quantity of protein required by most swine. Their calcium and salt content is low and they contain only fair amounts of phosphorus. Also, all of the cereal grains are deficient in Vitamin B₁₂, Vitamin D, and only yellow corn has any amount of Vitamin A. Barley and oats are higher in fiber content than most other grains.(25)

Although the composition of cereal grains is similar in many respects their differences are important and should be considered when formulating rations for different periods of the pigs life cycle.

Yellow corn is the most common and basic feed ingredient of swine rations and is used as a standard for comparing the feeding value of other grains.

Oats have sixty to ninety per cent the feeding value of corn and although it is an excellent feed for swine its high fiber content limits its usage. Rations for growing-finishing pigs should not contain over twenty to thirty per cent oats and the maximum for brood sows is about forty per cent of the ration. Oats should be ground fine to medium for hogs.(25)

Milo has about ninety-five per cent of the feeding value of corn. In growing-finishing rations milo can replace corn entirely and also be used as

the only grain in the ration. Milo should be ground for best results with hogs.(33)

Barley has about ninety per cent the feeding value of corn and should be ground or rolled for swine.(25)

The feeding value of wheat is slightly superior (105 per cent) to that of corn.(33) It is more palatable than corn and may safely replace all the corn in swine rations. The high price of wheat and the prestige that it has held as a human food prevents it from being extensively used as a swine feed.

Proteins are made up of amino acids and are needed to repair and build new tissues. The young growing pig requires ten essential amino acids in the ration. An essential amino acid is one which cannot be made in the animal's body fast enough to supply its needs. Thus, if any one essential amino acid is lacking it will limit the use of the other amino acids in the ration. This means that protein needs should be thought of in terms of supplying adequate amounts of each essential amino acid at the right level, in the right proportion, and at the right time in order to give the best results.(25)

Common sources of protein are tankage, meat scraps, bone meal, fish meal, and milk by-products, which are of animal origin. Soybean oil meal, cottonseed oil meal, and linseed oil meal are protein supplements of plant origin. At present two essential amino acids are available in the pure form and others will probably be used in the future.(22) Table II gives the various protein requirements needed by various classes of hogs.

Vitamins are necessary for proper utilization of feeds. Conditions such as unthriftiness, reduced appetite, and poor growth are common with a lack of vitamins. The vitamins most apt to be lacking in swine rations are A, D, B₁₂, riboflavin, niacin and pantothenic acid.(25) Common sources of

vitamins are lush green pasture, animal by-products, alfalfa meal or hay, and commercial vitamin mixes. Any single source will not supply all the different vitamins in adequate amounts. They must be combined for best results.

TABLE II
PROTEIN REQUIREMENTS FOR HOGS(18)

Class of Hogs	Per Cent Protein in Ration	
	Dry Lot	Pasture
20 to 40 Pound Pigs	18	18
40 to 100 Pound Pigs	16	14
100 Pound Market Hogs	14	12
Bred Sows	14	12
Bred Gilts	15	13
Lactating Sows	14	12
Lactating Gilts	15	13
Boars	15	14

Minerals are needed in all body functions as well as in bone and skeletal development. They have a great influence on maximum gain and feed efficiency. The essential mineral elements which are apt to be lacking in swine rations are calcium, phosphorus, salt, iodine, iron, copper, and zinc. These mineral needs of the pig can easily be supplied by using bone meal, ground limestone, and a trace mineral salt. Anemia is a mineral deficiency condition in baby pigs caused by a lack of iron in the blood.

Antibiotics, hormones, enzymes, arsanilic acid and tranquilizers are some of the chemical additives that are used to varying degrees in swine rations. The addition of any of these will increase the cost of ration. If

an additive will not pay for itself its use in a swine ration cannot be justified.(22)

Antibiotics are used more commonly in swine rations than any other additives. Low levels of antibiotics give greatest returns and they are usually used when pigs are under stress conditions.(22) Hormones, enzymes, and tranquilizers are used in experimental swine rations only. Many problems need to be overcome before practical application can be made of these additives. Arsanilic acid has given good results in the control of scours. It also helps to get optimum growth.

Pasture is an excellent source of vitamins, minerals, and proteins for swine. Clean pasture is an asset for growing pigs. However, if pigs are confined to concrete unidentified nutritional problems may result if they are not fed a balanced ration.

Water is the most important nutrient required by hogs because it is needed by all body processes. It is more important to animals than food because an animal can go several days without food. It will be hungry and may lose weight but will suffer very little other bodily injury. On a hot day if an animal is without water it can cause serious damage. Lack of clean fresh water for even short periods of time will cause slower and more expensive gains. Growing pigs need one-half to one and one-half gallons of water daily. A pregnant sow needs one to two gallons and a sow with litter may need four to five gallons of water daily.(15)

A great number of commercially prepared swine feeds are available to the hog producer. They may be purchased as complete feeds, or as supplements to be fed with whole grains free choice, or mixed with ground grains to make a complete ration. Commercial supplements are used more generally than

complete commercial feeds. These supplements usually contain thirty-five to forty per cent protein and also usually contain added vitamins, antibiotics, and minerals.(31)

Commercial supplements supplied by reputable feed manufacturers and dealers are well formulated to furnish a balanced ration when used with farm grains and fed according to the manufacturer's directions. Many feed dealers have facilities for custom grinding grains and mixing complete rations.(15)

Self-feeding pigs generally takes less labor and produces faster, more economical gains than hand feeding. However, the rate of gain and condition of the hog can be controlled more readily by hand feeding. In general hogs being fattened for market should be self-fed and bred gilts and sows hand-fed.

Limited feeding of market hogs is relatively new. This means feeding the pigs on full feed until they weigh about one hundred pounds. From one hundred to two hundred pounds they are fed at seventy per cent of full feed or about five pounds per head daily. The reason for using this method is that hogs have their maximum growth and muscle development up to one hundred pounds and deposit most of their fat during the period from one hundred to two hundred pounds. Limited feeding during this later period reduces calorie intake and fat deposits, yet permits growth or formation of lean tissue. Limited feeding lowers the rate of gain which slightly lengthens the feeding period. It does, however, improve the feed efficiency slightly as well as producing pigs with a higher dressing per cent and carcass value. It is important to sell these hogs on a market that will pay for the increased muscling and meatiness.(3)

Feeds have been prepared for hogs in many different ways. The most common method is grinding. All small grains should be ground for hogs. There is also no indication that feeds are any more efficient when fed wet or as slop than when they are fed dry. Generally no improvement in feed efficiency, except what is not wasted as compared to ground feed, is found when feeding corn or milo in the pelleted form to hogs. However, pelleted barley and oats rations increase the rate of gain and feed efficiency because of the increased palatability of these two high fiber grains. Pelleting feed also has an advantage in reducing bulkiness and excessive waste.

DISEASES AND PARASITES OF SWINE

Efficient hog production depends upon disease and parasite control because there are at least sixty-five known diseases that infect swine.(35) Control of disease is achieved through sanitation, vaccination programs, proper diagnosis and treatment of disease, and adequate nutrition.

Losses due to diseases and parasites are estimated to cost the swine raiser \$15.50 for each \$100 net profit. Twenty per cent of the pigs born each year fail to survive as a result of baby pig diseases.(16)

Recent advances in veterinary medicine have provided more effective treatment for many diseases and parasites but a disease outbreak is still costly. On many farms the profit or loss from the enterprise is determined largely by the extent to which disease and parasite losses have been controlled.

However, in some instances, even on farms with good managers, diseases will occur and correct diagnosis and treatment are the only methods of control. Effective animal health programs call for full cooperation between

the producer and the veterinarian. Even though the veterinarian is an expert on swine diseases and should be consulted, it is also important that the raiser know some of the symptoms, treatment, and causes of the various swine diseases and parasites. If he is familiar with these he is in a position to employ sound preventive measures.

Hog cholera. This is the most serious of all swine diseases. It is an infectious, highly contagious virus disease which affects swine only. It is nearly always fatal and all hogs that have not been vaccinated against cholera are susceptible. The virus that causes hog cholera is present in the blood, urine, and droppings of infected animals.

Symptoms usually appear by the fourth day after exposure. The first symptom is a loss of appetite, followed by a temperature ranging from 104 to 107 degrees. Coughing may be apparent and the eyes may become inflamed. As the disease progresses the pig shows a weakness, depression, and staggering gait.

There is no dependable treatment for a hog visibly sick with hog cholera. This disease can be prevented by vaccination. Regular immunization with modified live virus and serum is the approved means of supplying protection against this disease. Pigs may be vaccinated either before or after weaning. It is not advisable to wean, castrate, or ring pigs at the same time they are vaccinated. It is not worth the risk not to vaccinate for hog cholera because this disease can wipe out a herd practically overnight.

Living with hog cholera is very expensive. In 1962 hog cholera cost United States swine producers over fifty million dollars. Also, over the past fifty years hog cholera has cost the average producer about forty-five cents for each pig he has marketed.(43)

The eradication of hog cholera is probably the best method to control this disease. In September of 1961 Congress passed a law authorizing the United States Department of Agriculture to undertake a broad state-federal effort to eradicate hog cholera from the United States. A nine point program was set up for hog cholera eradication. It includes vaccination, following shipping rules, reporting outbreaks, observing quarantines, disposing of affected hogs safely, cleaning and disinfecting, cooking garbage, outlawing virulent virus, and learning the facts about hog cholera. In March of 1963 twenty-six states, including Kansas, had initiated the eradication program.(43)

A good sanitation program which includes isolating newly purchased animals and keeping visitors out of hog pens will help in keeping hog cholera at a minimum.

Swine erysipelas. Swine erysipelas is an infectious disease caused by bacteria similar to those that cause arthritis in some animals. Hogs may pick up the infection from the urine, feces, contaminated feed and water, or through minor cuts, scratches, or insect bites.

Erysipelas may be seen in either of two forms--acute or chronic. Swine having the acute form will have fever, depression, diarrhea, swollen or painful joints, loss of appetite, red patches on skin, vomiting, and death. The mild or chronic form of the disease is usually seen in the form of a skin disease or lameness. Swine having the chronic form do not die but usually are poor gainers.

No medicines can successfully treat erysipelas. However, the use of penicillin or the injection of antierysipelas serum in the early stages of the disease is helpful. Sick animals should be removed from the herd immediately and the healthy animals moved to clean ground. As a preventive,

to keep the others from getting the disease, the entire herd can be vaccinated with the serum and penicillin.

This disease can be prevented by vaccinating hogs with an erysipelas bacterin. Sanitation and moving pigs to clean ground are also important in preventing this disease.

Leptospirosis. "Lepto" as this disease is commonly called, is a recently recognized infectious disease of hogs. It is of great concern, however, to all livestock farmers because it affects cattle, swine, sheep, horses, and man. The disease is caused by several species of bacteria and may be found in the kidneys or urinary tract. It is spread through the urine. The *L. pomona* species of this disease will infect all species of animals and is very commonly carried by rats.

Leptospirosis is sometimes confused with brucellosis because abortion is one of the symptoms. However, in this disease the abortions occur quite late only, while brucellosis abortions may occur any time during pregnancy. Other symptoms include fever, loss of appetite, depression, diarrhea, bloody urine, and loss of weight.

All animals showing symptoms of leptospirosis should be isolated from the herd and care should be taken not to spread this disease. Animals can be blood-tested for this disease. All pigs should be vaccinated for leptospirosis at eight to ten weeks of age if the disease is prevalent. In all herds, however, breeding stock should be vaccinated one to two weeks before they are bred.

Brucellosis. Brucellosis has been known as contagious abortion of swine or as Bang's disease. Surveys indicate that one to three per cent of

the hogs in the United States are affected.(42) These hogs may serve as the source of infection to humans causing the disease undulant fever.

Brucellosis in swine herds is recognized by the abortion of pigs, pigs born weak, and sterility or infertility in sows and boars.

There are no symptoms other than abortion which can be easily recognized. The only sure way to determine that a swine herd is infected is to have the entire herd blood-tested. Because there is no treatment for the disease the herd should be tested and the reactors marked. A re-test should be made within thirty to ninety days and all infected animals sold. Breeding stock should be selected from brucellosis free herds.(42)

Infectious atrophic rhinitis. This is an infectious swine disease of which the cause is unknown. It has become a very important problem in the last few years. The symptoms of atrophic rhinitis are not easily recognized and the disease may be present without the owner being aware of it. In small pigs, bleeding from the nostrils may be present; in others the pigs may rub their snouts on fences, feed troughs, and other objects. Sneezing is a common sign and a few pigs may show a lateral or upward twisting of the snout. Growth is slow in infested pigs and the utilization of feed is low. Costs are generally much greater to produce a pound of pork than the pork is worth.

No successful treatment or vaccine has been found for rhinitis. However, research has shown that the means for preventing rhinitis is not too far in the future. Infected swine should be isolated from the rest of the herd and marketed as soon as possible. The feeding of high vitamin and antibiotic levels will help improve the rate of gain of affected market animals.

Rhinitis can be prevented by using a good sanitation program, isolating all newly purchased animals, and selecting breeding stock only from herds free of atrophic rhinitis.

Virus pig pneumonia. Virus pig pneumonia (VPP) is a chronic respiratory disease of pigs which is often in combination or associated with atrophic rhinitis of swine. This disease is characterized by a persistent, dry, rough cough and stunted pigs. Diarrhea is another symptom of this disease during its early stages in pigs.

No vaccine is available for this disease. It can be prevented only by good sanitation and careful selection of breeding stock.

Transmissible gastro-enteritis. An infectious diarrhea in baby pigs that is highly contagious is transmissible gastro-enteritis (TGE). It is a sporadic disease of swine characterized by diarrhea, vomiting, dehydration, and high death losses among pigs under two weeks of age. The disease affects all ages of swine, however older hogs are less severely affected.

Pigs with TGE will develop symptoms within twenty-four hours and death often results within forty-eight hours after exposure. Usually an entire litter will develop symptoms and the death rate ranges from thirty to one hundred per cent.(15)

The symptoms of older hogs include diarrhea, some vomiting, going off feed, and loss of weight. Sows that are nursing pigs tend to dry up because of the illness. To date no treatments are known. Pigs from sows infected late in pregnancy appear to have some degree of immunity. Various antibiotics, sulfas, and other drugs have been used unsuccessfully. Thoroughly cleaning and disinfecting all contaminated houses, crates, pens, and equipment is necessary to prevent the disease.

Anemia. This is not a disease but a nutritional condition caused by a lack of iron or copper in the diet of the baby pig. Both of these mineral elements are necessary for the formation of hemoglobin, the red coloring in the blood that serves as the means of transportation for oxygen from the lungs to the rest of the body. It also serves as the means of transportation of carbon dioxide from the body tissues to the lungs so that it can be expelled as waste.

When there is a deficiency in the number of red blood cells or hemoglobin the means of transporting oxygen is lacking and the baby pig slowly suffocates. For this reason anemia usually affects the largest, fastest growing pigs first. Milk is generally deficient in iron and copper.

An anemic pig is dull and listless, the skin is pale and wrinkled, the hair stands on end, and the ears and tail droop. The breathing may become spasmodic and end with respiratory convulsions and death.

The only remedy is prevention by providing the baby pigs with iron and copper. This can be an injection of iron solution into the muscle at four to five days of age. The sows udder can be swabbed with an iron solution or fresh dirt can be given to the pigs at least once a week. Anemia is more common where pigs are raised on concrete.

Swine parasites do not generally cause death losses in hogs but they cost the swine producers millions of dollars annually because they retard the growth of a hog and cause loss of feed efficiency.(13)

Hogs have a number of parasites. Some live on or under the skin and are called external parasites. Others live inside of the animals body and are called internal parasites.

The two most common external parasites found on swine are lice and mange mites. The hog louse is about a quarter inch long and a grayish-brown color. During the winter months it may be found in the ears, in folds of skin around the neck and on the underside of the body. Hog lice suck blood from hogs and are also responsible for the spread of infection.(13)

Mange is a highly contagious skin disease caused by the mange mite. Very few animals die from mange but it is the most serious of the external parasites.

The mange mite, which is very small, feeds on the tissue of the skin, causing a dry, rough and scaly hide. They also cause the hog to do a lot of scratching and rubbing.

Mites and lice can live in infested quarters and can easily move from one hog to another. Complete control measures must include a thorough cleaning of pens and houses as well as spraying the individual hogs.

The chemical lindane is very good for use in controlling lice and mange. It should be mixed at the rate of two pounds of twenty-five per cent wettable powder to twenty-five gallons of water and then sprayed on the infected hogs.(6) When nursing sows are sprayed they should be thoroughly dry before the pigs are allowed to nurse.

The internal parasites are the most injurious to swine and roundworms are the most important because they cause more loss to the swine raiser than any other internal parasite.

Swine roundworms or ascarids, as they are also called, can be found in almost every swine herd in Kansas.(20) The reason for this is that one female roundworm lays more than a million eggs a day. At this rate it is almost impossible to prevent pigs from becoming infected.

The adult roundworm is a large, yellow worm about the size of a lead pencil. It normally lives in the small intestine. Pigs become infected by swallowing the eggs with feed or water. The young worms hatch out in the small intestine and travel in the bloodstream to the liver and on to the lungs. From the lungs they move up to the mouth where they are swallowed. They return to the intestine where they mature, lay eggs, and the cycle starts over again.(6)

Most worming treatments may be mixed and consumed with feed or water. Piperazine compounds or hygromycin are recommended for controlling roundworms. Both are low in toxicity and are easily administered. Piperazine is mixed with water and given over a twenty-four hour period or it may be fed in dry form with the feed. Hygromycin is mixed with the feed and fed continuously until the pigs are at least one hundred pounds. Proper sanitation and rotated pastures help prevent losses caused by roundworms.(20)

One of the most recent advancements in the production of pork and prevention of disease has been the development of the Specific Pathogen Free (SPF) swine program. In this program pigs are obtained and reared under conditions which most nearly assure them of being free of atrophic rhinitis and virus pig pneumonia.

In the SPF program pigs are obtained by either hysterectomy or closed caesarean surgery. The pigs are raised in sterile isolation until four weeks of age. Following this they are allowed to mature on farms and to resume normal reproductive cycles. Pigs from these normally farrowed litters are called secondary SPF pigs. These pigs along with surgically derived pigs, commonly called primary SPF stock, may then be used to restock other farms.(35)

Through these steps it is possible to obtain pigs not only free from virus pig pneumonia and atrophic rhinitis but also practically free from swine dysentery, TGE, scours, external parasites, and other infections. Also, through blood testing and vaccination SPF herds may be kept free of brucellosis, leptospirosis, hog cholera, and erysipelas.

The following steps must be taken if a swine producer is going into a SPF hog program.

1. Market the present herd.
2. Clean and disinfect all buildings and equipment.
3. Remove all manure and establish adequate drainage in the lots surrounding buildings.
4. Let present facilities be idle from four to six weeks.
5. Repopulate from accredited SPF herds or from the approved laboratories.
6. Use hog tight fences and double fence a distance of forty feet or more from any place where neighbor's swine might be a problem.
7. Prevent direct entrance of trucks and other vehicles into hog lots.
8. Provide footwear and antiseptic foot baths for the caretaker or any other person entering the hog lots or buildings.
9. Vaccinate against hog cholera, leptospirosis, and erysipelas regularly.
10. Post your farm to inform visitors of the disease control efforts.(35)

In summarizing, it should be kept in mind that the SPF program is a program to provide hogs known to be free of certain specific diseases. How well these pigs perform and how long they remain free of these diseases depends very much on the managerial abilities of the individual who raises them. Failure of producers to observe sound and proven sanitation recommendations in the past is the only reason we need the SPF swine program today.

HOUSING AND EQUIPMENT FOR SWINE

Adequate housing and equipment can reduce labor, aid in sanitation, protect herd health, and greatly increase the profits from a hog operation. The tremendous changes that have taken place in the methods of producing swine during the last few years have placed considerable emphasis on new swine housing and equipment.

Percentagewise, equipment charges represent only about five to eight per cent of the total cost of producing pork.(9) However, having enough of the right kind of equipment and a convenient layout of lots, buildings, and equipment is much more important than this percentage indicates.

In planning and constructing housing for swine, several functional requirements should be considered. (1) Protection during bad weather. Swine should be protected from snow, cold winds, rain, and extreme temperatures. Summer shade may also be as important as winter warmth. (2) Desirable temperatures within swine buildings depend upon the manner in which the buildings are used. Temperatures between 50° and 60° Fahrenheit are best for farrowing houses. Small areas for the pigs should be warmed to 80° Fahrenheit. Market hogs make the cheapest and most rapid gains at a temperature of 60° Fahrenheit.(4) (3) Ventilation is most important to remove the moisture hogs produce. During warm weather, doors and windows are usually opened and controlled ventilation is not necessary. (4) Insulation reduces the rate at which heat will move through walls, ceiling, and roof. An insulated house is more easily warmed in winter and cooled in summer than an uninsulated house. (5) Adequate floor space is very important because over-crowding can cause serious management problems. Feed and equipment storage should also be given consideration. (6) A plentiful supply of clean drinking water

should be available to the hogs at all times. A pressure water system with pipes extending to the swine houses and lots will greatly reduce the labor required to care for swine. (7) A system of handling and disposal of manure should not be overlooked as a requirement in housing swine. Manure disposal is no problem when hogs are on pasture; however, it may be a serious problem in confinement feeding if no provisions have been made to handle it. (8) The last function of swine buildings and equipment is to provide for the safety of the hogs and the men in handling them. This is sometimes not considered but nevertheless a very important factor.(4)

There are many satisfactory swine raising systems but they are generally classified into pasture or confinement systems. The two general types of housing serving these systems are movable houses for hogs on pasture and permanent houses for hogs in a confinement system. In the pasture program pigs are farrowed or moved to pasture at an early age where they remain until marketed. In the one hundred per cent confinement system, pigs are farrowed, weaned, and fed to market weight in floored, permanent buildings. Maximum use is made of automatic watering, feeding, and cleaning equipment.(38)

Housing and equipment will be discussed for each of the following groups of swine: gestating sows and gilts, boars, farrowing, nursing, and growing-finishing.

Gestating sows can perform satisfactorily under varying conditions. A shelter which furnishes dry quarters in winter and provides shade in summer is satisfactory. During the winter sixteen to eighteen square feet of shed space is needed per sow. An open front shed is excellent. As many as twenty to twenty-five gestating sows can be run together with good results if enough trough space ($1\frac{1}{2}$ linear feet per sow) is provided so that each

sow can eat at feeding time.(38) Replacement gilts should be separated from the market hogs when they are five to six months old and weigh about two hundred pounds. They should be kept separate from older sows during their first gestation period. Their housing and equipment needs are basically the same as gestating sows.

Boars should be penned separately from the sows when not being used. An exercise lot and an open front shed provide adequate housing for a boar. Two or three boars of the same age can be penned together during the off-breeding season if proper care is taken when they are first put together. Boars of different ages should not run together.

There are many different types of farrowing houses. Each type, properly managed, works equally well. In the larger operations in Kansas central type farrowing houses are generally used. One man can observe and care for a larger number of sows at farrowing time in a central type house than he can in individual, portable type houses. Also, the farmer who raises a large number of pigs and follows a multiple farrowing program will find a central type farrowing house a good investment.

There are probably as many different designs for central type farrowing houses as there are swine producers. A large number of central farrowing houses are remodeled barns, machine sheds or cattle feeding sheds. Generally a central type farrowing house is a rectangular building approximately twenty feet wide. It has an alley so the farmer can walk to each pen without climbing through another pen. Either farrowing pens or farrowing crates are used. (5) A farrowing pen has between fifty to sixty square feet and consists of a pen six by eight, seven by seven, or seven by eight feet in size. Guard rails should be provided around the outside of the pen about ten to eleven

inches above the floor. The outer edge of the rail should be eight to ten inches from the wall. A corner of the pen should be partitioned off and a heat lamp hung behind it to keep the pigs warm.

Farrowing stalls or crates can be installed in new or existing buildings, or in any type of shelter suitable for farrowing. They can be made from wood, pipe, scrap iron, aluminum gate material, or purchased at a wide range of prices.(38)

Farrowing stalls should be twenty-four inches wide and seven to eight feet long. Eight feet is preferred for larger sows or if a self-feeder and waterer is used at the front of the stall. The space between the bottom board or pipe and the floor should be approximately twelve to fourteen inches for older sows and ten to eleven inches for gilts.(4) The recommended minimum space allowed on each side of the stall is eighteen inches.

Careful management is important in making farrowing stalls successful. A self-waterer for both the sow and young pigs is a sound investment for each farrowing stall. A self-feeder for the baby pigs should be placed in the stall out of the reach of the sow. Two ways of managing a sow in farrowing stalls are: (1) Turning the sow out twice a day for feeding. The sow usually voids all of the feces and most of the urine during these periods. Additional labor is required to turn the sows out and put them back in the right crate. (2) Another way of managing stalls is to confine the sow to the stall. The farmer must see that the sow has clean, fresh water at all times and has an ample amount of feed. The major problem in confining the sow to her stall is providing a method of handling the manure and urine. Total or partially slotted floors can help with this problem. Sows and their litters can remain in the stalls until the pigs are weaned or they can be

moved to a nursery when the pigs are four to six weeks old. A nursery can be in the same building or in a separate building from the farrowing house. Generally, two litters can be put together if the pigs are of uniform size. The sows are taken back to the gestation facilities when the pigs are weaned and the pigs remain in the nursery pens until they are about eight weeks old.

A general guide for farrowing and nursing facilities is found in Table III.(38)

TABLE III
SPECIFICATIONS FOR FARROWING AND NURSING FACILITIES

Farrowing pen sizes	Gilts: 6 x 8 ft. minimum Sows: 8 x 8 ft. minimum
Farrowing stall space requirement	5 x 7 ft. per sow and litter
Outside feeding and exercise slab area	40 sq. ft. per sow and litter minimum
Nursing pen area	1 to 3 weeks: 4 sq. ft. per animal 4 to 5 weeks: 5 to 6 sq. ft. per animal
Alley width	3 ft. minimum 4 ft. recommended
Ceiling height	7 ft
Partition heights	36 to 40 in.
Pen doors to outside	32 in. wide and 40 in. high
Self-feeder space	1 ft. or 1 self-feeder hole per sow and litter
Creep-feeder space	1 ft. for 5 pigs Maximum of 40 pigs per creep
Automatic waterers	1 cup for 4 sows and litters

During the growing-finishing period hogs need protection from the elements, plenty of water, and adequate feed. These seem rather simple after discussing the detailed housing requirements for farrowing.

Confinement feeding during the growing-finishing period has increased greatly in recent years. One of the most practical growing-finishing arrangements has been when the self-feeder and self-waterer are under a shed area on a concrete floor. A minimum of fifteen square feet of floor space should be provided per hog. The biggest problem in confinement feeding is getting rid of the manure. Manure can be handled in many different ways. No one system seems to suit all farms. Each producer must analyze his particular situation, taking into consideration available labor, equipment, location of facilities, etc.(16)

Manure lagoons are one of the newer methods of solving this problem. A lagoon is a body of water or pond into which liquid manure is discharged and it is digested by bacterial action.(15) The following points seem pertinent to the construction and operation of a lagoon:

1. Size: Provide a minimum of fifteen square feet of water surface area for each hog. In general, the more the manure is diluted, the better; and a lagoon larger than the minimum will allow for later expansion of the hog operation.
2. Location: Most convenient from the standpoint of use thus far has been placing it next to the feeding floor on the south side. The floor can be easily cleaned by hosing or scraping directly into the lagoon. Where conditions prevent this location, lagoons are being placed at a distance from the feeding floor and the manure carried to it by a six to eight inch tile. The usual practice is to build a gutter along the south side of the slab, sloping it to the center where the tile is located. Many units already are constructed this way. Lagoons should be at least three hundred feet downwind from the nearest dwelling.
3. Depth: From three to five feet is deep enough for the lagoon under normal conditions. Storm water and surface runoff should be diverted away from the lagoon. However, surface water may be temporarily diverted into the lagoon to provide initial filling.

4. Construction: Make the bottom as level as possible. Avoid gravel or limestone areas. Artificial sealing may be necessary in porous soils. Build well compacted embankments of impervious soil according to standard practice for pond construction. It also is a good practice to seed embankments above the water level.
5. Water in lagoon: Lagoons should be kept filled with water. Where the soil is impervious, water from washing the feeding floor plus rain water falling on the feeding floor and into the lagoon is usually sufficient.
6. Cleanout of lagoon: It appears that lagoons do not need to be cleaned often, probably only once in five to ten years. Most of the manure will have been decomposed.
7. Bacterial action: Two types of bacteria decompose the wastes. Aerobic and anaerobic bacteria are these two types and it is not necessary to introduce them into the lagoon. The manure is put into the pond and bacterial action follows.(16)

Lagoons are still a new idea. Only several years of on-the-farm use will prove their value. The advantages of a lagoon are:

1. The original cost is low. Most lagoons can be built in two or three hours with a bulldozer.
2. Time and effort in disposing of manure is reduced.
3. The fly problem is reduced.
4. There is no mosquito problem.

Another help to the farmer in manure disposal is the use of slotted floors. Slotted floors can be made of various materials such as wood, concrete, or steel.(32) A slotted floor has regularly spaced openings of sufficient size and number to permit the manure to be trampled through the floor. A pit under the floor collects and holds the waste material until it is emptied or the manure falls directly into a lagoon.

The main advantages of slotted floors as compared to solid floors are improved sanitation and a reduction in the labor necessary for cleaning. Slotted floors eliminate the cost of providing and handling bedding. Apparently,

there is no harm to the pigs' feet or legs. They also reduce the amount of space needed per hog. (Eight square feet is recommended per market hog.) During the winter, slotted floors should be used only in draft-free, insulated buildings with dependable mechanical ventilation.(32)

Additional equipment needed by swine producers would be troughs, automatic waterers, self-feeders, loading chutes, breeding crates, squeeze chutes, scales, trailers, etc.

Automation in the swine industry will increase. Each farm is different, and the type of buildings and labor saving devices will vary accordingly. No one system will fit all farms. A system should be used that is adaptable to a particular farm but flexible enough to incorporate new and better ways of doing a more efficient job. Before building permanent facilities, a farmer should visit several successful modern hog farms.

SWINE MARKETING

Marketing, along with breeding, feeding and management, is a very important part of modern swine production. The efficient hog raiser plans his breeding and feeding operations so that he will have hogs of the weight and conformation desired by the packer and consumer ready for market when the price is most favorable.

It is not always possible to predict the season when the price will be the highest. Supply and demand have a great influence on the price of market hogs. The number of hogs going to market varies seasonably. When hogs are plentiful, the price goes down and when few hogs are being marketed, the price is higher.

In the past, two pig crops have normally been produced each year. One has been farrowed in the spring and has been ready for market in the

fall. The other has been farrowed in the late summer and has been sold in the spring. A large share of the fall farrowed pigs have been marketed in March, April, and May. The bulk of the spring pigs go to market in October, November, and December.(6) Because of the increased supply of hogs the price is lower during these two periods in the year. However, multiple farrowing has tended to even out hog marketings in recent years. As a result there has not been as much seasonal variation in hog prices.

TABLE IV

COMMERCIAL HOG SLAUGHTER UNDER FEDERAL INSPECTION
1954 AND 1960 (MILLIONS)(6)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
1954	5.9	4.9	5.6	4.7	4.2	4.3	4.1	4.7	5.8	6.2	6.9	7.4
1960	7.8	7.0	7.3	6.6	6.5	6.1	5.1	6.2	6.2	6.4	6.8	6.8

Demand for pork has an effect on prices. However, changes in demand are usually slow while changes in supply occur quite rapidly. The rapid changes in supply bring about changes in market prices more rapidly than changes in demand. Even though the changes from demand are slower they reflect to the producer the desires of the consumer.

The consumer wants smaller and leaner cuts of pork and less lard. These requirements are met by meat type hogs that are slaughtered at light weights. Lighter hogs produce less lard, producing a larger proportion of the valuable cuts and consume less feed.

The most profitable weight at which to sell hogs is between two hundred and 220 pounds.(15)

TABLE V
LIGHT HOGS ARE MORE PROFITABLE(31)

No. of Head	Average Wt. Lbs.	Total Wt. Lbs.	Lard Produced Lbs.	Meat Produced Lbs.	Feed Consumed Lbs.
20	225	4,500	560	2,660	18,500
15	300	4,500	720	2,670	20,625

The hog producer also needs to determine where and how to market his animals. Usually, there is a choice of market outlets. The one selected often varies between classes and grades of hogs. Most market hogs are sold through the following channels: (1) Terminal public markets, (2) Auction markets, or (3) Direct selling from the farm to packers, local dealers, and other farmers. In 1956 Kansas farmers sold slaughter hogs and feeder pigs in the proportions shown in Table VI.(26)

TABLE VI
METHODS OF MARKETING SLAUGHTER HOGS IN KANSAS

Class	Terminal Markets	Auctions	Direct to Packers	Local Dealers	Other Farmers	All Others	Total
Slaughter Hogs	49.2	22.8	16.8	10.9	66.0	0.3	100.0
Feeder Pigs	2.0	51.3	66.0	8.6	38.1	0.0	100.0

Terminal public markets are places where large numbers of livestock are assembled to be sold by private treaty and which possess complete facilities for receiving, caring for, handling, and selling livestock. Various numbers of commission firms, depending on the size of the market, sell

livestock at these markets. All buyers and sellers of livestock are privileged to use these facilities. The only terminal market located in South Central Kansas is in Wichita.

Livestock auctions are trading centers where animals are sold by public bidding to the buyer who offers the highest price per hundredweight or per head. Livestock auctions generally serve local areas. Most of the hogs consigned at auctions come from a distance of less than twenty-five miles. Each county in South Central Kansas has, on the average, two livestock auctions.(26)

Direct selling to meat packers is an important outlet for slaughter hogs. Some packers buy hogs direct from producers at the plant while others send their buyers into the country, from farm to farm, where they make bids on the livestock they inspect.

Selling hogs on the basis of carcass grade and yield has been followed to some extent. Selling pork on this basis is bargaining in terms of the price to be paid per hundred pounds dressed weight for carcasses that meet certain grade specifications. It is the most accurate and fair evaluation of the value of a pork carcass. In general, farmers who produce superior hogs benefit from selling on the basis of carcass grade and yield. However, the producers of lower quality animals usually feel that this method unjustly discriminates against them.

The advantages of selling on the basis of carcass grade and yield are summarized as follows:(6)

1. It encourages producers to breed and feed high quality hogs.
2. It provides the most fair evaluation of the product.

3. It eliminates wasteful filling or overfeeding of the animals before marketing.
4. It makes it possible to find losses from bruises, condemnations, soft pork and show them to the responsible producer.
5. It is the most effective approach to swine improvement.

Some disadvantages of selling on a grade and yield basis are:

1. Collecting the information is more time consuming for the packer than the conventional basis of buying.
2. There is less flexibility in operations for the meat packer.
3. Extra equipment and personnel are needed on this basis.
4. There is a delay in returns to the producer.
5. Decreased bargaining power exists on the part of the producer.
6. Grading is done by the buyer in the absence of the seller.

There is a need for a system of marketing which favors payment for a high cut-out value of primal cuts and a quality product. Selling on this basis fulfills this need.

Selling through local dealers can provide a great convenience for the farmer. Hogs are purchased close to the farm or on the farm itself. Price, shrinkage, and transportation can be completed on the farm and cash payment on a per head basis made before the hogs leave the farm. Generally no specific costs are deducted from the price. When selling through dealers, producers need to have an accurate knowledge of the grade and value of their hogs. If a large enough quantity is involved several bids should be obtained.

Market hogs are classified in terms of sex, use, weight, and grade. Classified on the basis of sex there are barrows, gilts, sows, stags, and boars.(31)

1. A barrow is a male swine castrated when young and before reaching sexual maturity.
2. A gilt is a young female swine that has not produced young and has not reached an advanced stage of pregnancy.
3. A sow is a mature female swine that shows evidence of having reproduced or has reached an advanced stage of pregnancy.
4. A boar is an uncastrated male swine.
5. A stag is a male swine that was castrated after it had developed the physical characteristics of a mature boar.

Swine are classified according to use as slaughter hogs, slaughter pigs, stockers, and feeders.

Occasionally, the terms light, medium, and heavy are used to indicate approximate weight, but most generally the actual range in weight is specified both in trading and market reporting.

The market grade for swine is a specific indication of the degree of excellence based upon conformation, finish, and quality.(15) The two primary factors which place a hog in a specific grade are the degree of fatness and amount of muscling. The federal market grades of slaughter barrows and gilts are: U.S. No. 1, U.S. No. 2, U.S. No. 3, Medium, and Cull.

The five grades of slaughter barrows and gilts may be described as follows:

- U.S. No. 1: Slaughter hogs with just enough finish to produce high quality pork cuts. They have good length of body, muscular development, trimness, firmness, good balance and uniform width from front to rear. Their fat is evenly distributed and there is only enough to provide quality to the high priced cuts.
- U.S. No. 2: Hogs which are not too different in conformation from the top grade. They are slightly fatter, usually shorter, and only average in muscle development. Width through the shoulders is

often greater than through the hams. Cuts from this hog would be of high quality after trimming away excess fat.

- U.S. No. 3: Slaughter hogs that are decidedly overfat. They have short bodies, wide flat backs, and are wider through the shoulders than at the hams. The carcass will lack muscling and will have too much interior as well as exterior fat.
- Medium: This grade of hogs is distinguished by lack of finish, narrow body, and light hams. The yield of lean cuts is relatively high but the pork is soft with little or no marbling.
- Cull: Hogs which are decidedly underfinished and produce cuts very inferior in quality. These hogs are narrow over the top; the back is thin and appears peaked at the center, with a decided slope toward the sides. Hips are prominent.

The best single indicator of grade is back fat thickness in relation to either carcass weight or carcass length.

Greater attention to marketing can pay dividends to hog producers today and in the future.

MANAGEMENT PRACTICES FOR SWINE

The size and type of a hog operation will determine the overall management program required for successful hog production. Many Kansas hog producers are now practicing multiple farrowing. The two litter system farrowing in the spring and in the fall, is still a common practice for producers who have small sow herds.

It is not possible to arrive at any over-all formula for success in managing a hog operation. However, those swine producers who have made money have given much attention to the details of management.

Swine management can be defined as the organizing and timing of events and providing conditions which permit the animals to function to the maximum of their capacity.(9) Methods of managing swine vary widely between

areas and individual swine producers. The systems and practices followed are influenced by size of operation, feed supply, labor available, buildings and equipment, markets, and the individual likes and dislikes of the farmer.

Without attempting to cover all management practices, some proven facts and methods of accomplishing them will be discussed about managing a swine operation from the beginning of the gestation period through selling market hogs.

The breeding herd offers greatest reward for good management because the average hog producer manages his breeding herd with less skill than he does his fattening pigs. This is proven by studies of the cost of producing pork which show a much wider variation between farms producing weaning pigs and farms producing pork after weaning. The poorer management given the brood sows appears to be due to a lack of understanding and appreciation on the part of the operator of the needs of brood sows and the nature and requirements of her pigs during the first few weeks of their lives. A brood sow program requires much more management than any other operation. (9)

A good breeding herd is built by starting with high quality gilts and boars. To be kept for breeding purposes a gilt should (1) be from a litter of eight or more pigs, (2) be from a litter whose birth weight was twenty-two pounds or more, (3) have an individual birth weight of three pounds or more, (4) have a thirty-five day litter weight of 128 pounds if from a gilt's litter or 152 pounds if from a sow's litter, (5) weigh at least 225 pounds at seven months, (6) have twelve or more functional teats, and (7) have not more than 1.20 inches of backfat for a two hundred pound gilt. Gilts should also be moderately long, meaty, trim, well balanced, and have strong feet,

legs, and pasterns. Their dams should have good nursing ability and be free from hereditary defects.(6)

Boars should have the same general characteristics as gilts except not more than one inch of backfat for a two hundred pound boar. However, more care should be taken when selecting a boar because he represents half of the breeding herd. A good boar transmits his type, quality and gaining ability to every offspring. Even in a commercial or small hog operation a registered, production tested boar should be used.

Health is another important factor to consider when selecting a boar. Many diseases and parasites can be brought in by a boar. Borrowing boars should be discouraged because it can be a hazard to herd health.

Boars should be eight months old, weigh at least 250 pounds and be well developed for their age before they are used for service. Individual mating is a good management practice. It enables the producer to keep accurate records, breed more sows to one boar and feed the boar the desired ration.

Allowing the boar to run with the sows is practiced by many hog producers. This is not a recommended practice even though considerable time and labor are saved during the breeding season. However, if pasture breeding is used, provide one mature boar for each twenty sows. Younger boars should not be turned in with more than ten sows. If sows are hand bred older boars can breed as many as thirty sows during a breeding season. Younger boars can mate up to fifteen sows during their first breeding season. Older boars can mate as many as two times a day if rested every four to five days.(6) Always bring the sow to the boar for breeding and, if possible, after breeding, keep the sow in a pen by herself until heat passes.

Boars should have plenty of exercise, sunshine, green pasture, and a balanced ration. They should be kept away from the sow herd in a large lot where plenty of fresh water is available at all times. A boar should never be allowed to get too fat or too thin but rather be kept in a lean condition. He should be fed so that he will be gaining in weight about three weeks before the breeding season. Exercise can be forced by placing feed and water away from the sleeping quarters.

Gilts should be at least eight months old and weigh 250 pounds before they are bred. They should be well developed, firm in flesh and not too fat. Breeding gilts too young and too fat will result in small litters, weak pigs, short milk supply, and a sow which will always be small and a poor producer.

Sows farrow 112 to 114 days after breeding. Sows will come in heat four to five days after pigs are weaned and heat will reoccur every nineteen to twenty-one days. Signs of heat are: (1) swelling of the vulva, (2) frequent riding of other sows, and (3) restless activity. The heat period lasts on an average from two to three days. Gilts should be bred on the first day of heat and also the second day. This second mating may improve litter size. Sows remain in heat about twelve to fifteen hours longer than gilts so sows should be bred on the second and third day of heat.

Proper feeding of the unborn pig is important. The ration fed during breeding and up to the time to farrowing affects the number and size of pigs born. It also influences the milking ability of the sow and the number of pigs weaned.

Flushing is the practice of feeding sows so they will gain from three-fourths to one pound daily during the breeding season. The sows feed

should be increased starting about ten days prior to breeding and continuing until all the sows have been bred. Gaining weight during the breeding season stimulates the reproductive organs which will generally result in a higher conception rate. Also, sows are more likely to settle on the first service.

(31)

Less is known about the nutritional requirements for swine during reproduction than in any other stage in their life cycle. During the early stages of gestation a sow will reabsorb unborn fetuses if a properly balanced ration is not fed. Good pasture is one of the best safeguards against nutritional deficiencies during gestation. Clover, alfalfa, rye, wheat, and sudan are excellent pastures for sows. One acre of good legume pasture will carry eight to ten sows or ten to twelve gilts.(34) If pasture is not available green, leafy alfalfa hay should be fed to the sows.

The amount of feed should be controlled so the sows and gilts will not get too fat. Sows should gain sixty to eighty pounds and gilts seventy-five to one hundred pounds from breeding to farrowing.(34) During farrowing and lactation sows will lose about the same amount of weight that they gained during the gestation period. The amount of feed should be increased during the last one-third of the gestation period to meet the increased needs of the unborn litter.

Sows need about two pounds and gilts about three pounds of grain daily when they are on high quality pasture. In addition sows should receive one-half pound and gilts three-fourths pound of a forty per cent protein supplement daily. Sows in a dry lot need four to five pounds and gilts should have five to six pounds of grain daily. In addition sows should receive

around one pound and gilts one and one-fourth pounds of a forty cent protein supplement daily.

Hand-feeding and self-feeding are the two methods of feeding sows during gestation. Hand-feeding sows has the following advantages: (1) Sows are watched more closely and are less likely to get too fat. (2) Hand-feeding also saves feed. One feeding per day is just as satisfactory as two.(18) A new method of hand-feeding sows, to help regulate feed intake, is by the use of stalls. Sows enter these two foot wide stalls and are fed their own amount of ration. The only advantage of self-feeding are saving labor and keeping timid sows from being undernourished. Self-fed rations should include at least one-third oats, one-third ground corn cobs, alfalfa hay, or some other bulky feed.

Corn silage, when properly supplemented, is a cheap and satisfactory ration for pregnant sows and gilts. Corn silage is extremely low in protein and minerals, therefore, it should be supplemented with a mineral mixture and one to one and one-half pounds of a forty per cent protein supplement daily. Sows will need ten to fourteen pounds and gilts eight to twelve pounds per head daily.(18)

About three to four days before a sow farrows bulk should be added to her ration and the quantity of feed should be reduced to prevent constipation while she is penned. It also prevents her from producing a large quantity of milk which is not needed by the baby pigs for the first few days. Oats, bran, or ground alfalfa hay can be added to make the ration more bulky.

There is no substitute for good swine sanitation. Effective sanitation measures start before farrowing. Thoroughly clean the farrowing house. A sprayer that can develop two hundred pounds of pressure will do a

good job of loosening caked dirt. A cold water detergent which includes disinfectant is now available to be used with this high pressure sprayer. The farrowing house can also be scrubbed with hot water and disinfected with a commercial disinfectant or with lye water, (one pound of lye to twenty gallons of water).(6) Steam cleaners are also excellent for cleaning and sterilizing. Allow the farrowing house time to dry and use wood shavings, straw, or ground corn cobs for bedding.

Sows should be removed from the breeding herd two days before they are going to farrow. They should be scrubbed thoroughly with soap and water to remove dirt and manure. Be sure opening of the teat is clean. They should also be sprayed with a mild disinfectant to kill all lice, lice eggs, and mange.

It is important to know when a sow will farrow and to be prepared for the litter. A good hog manager will check the sow frequently to see if she has milk. She will usually farrow within twenty-four hours after milk appears in the udder.(18)

Sows seldom need assistance at farrowing but it is usually a good practice to be on hand while they farrow. A normal sow will finish farrowing within two to three hours.(34) The pigs should be dried off with a sack or cloth to prevent chilling. The navel cord should be cut about two inches long and dipped in tincture of iodine. In cold weather pigs should be placed under a heat lamp. After the sow has finished farrowing, remove the after-birth and replace with clean dry bedding.

Pigs chill at a temperature below fifty degrees Fahrenheit. The heat lamp used should be suspended twenty-four inches above the floor. The heat and light will attract the pigs away from the sow except when nursing.(18)

Immediately after farrowing the pigs should be weighed, ear notched, and have their needle teeth clipped. Weighing pigs is a good management practice because large pigs at birth means heavier pigs at weaning.

TABLE VII
EFFECT OF BIRTH WEIGHT ON FUTURE PERFORMANCE(31)

Birth Wt. Lbs.	Per Cent Born Dead	Per Cent Weaned (6 wks.)	Average Weaning Wt.
1.5	16	13	18
2.0	6	49	21
2.5	4	67	25
3.0	4	77	28
3.5	3	86	30
4.0	1	84	35

Pigs should be ear notched to provide a record of that pig for future reference. The tips of the needle teeth should be removed to prevent the pigs from lacerating the teats of the sow and cutting each other on the mouth when fighting. Care should be taken to prevent crushing the teeth or injuring the gums.

If a number of sows farrow within seventy-two hours of each other adjustments can be made in the size of litters by transferring pigs from sows with extra large litters to smaller litters.(18)

On the day of farrowing a sow should only receive clean fresh water. For the first two days after farrowing a sow should be fed a small amount of the same bulky ration used before farrowing. After two days the feed should

be gradually increased and changed to the grain and protein ration until the sow is on full feed of this ration by the seventh day after farrowing.

Before five days of age pigs that are farrowed on concrete or wood floor should receive an intramuscular injection of iron for preventing anemia. Clean dirt can be put into the pen for the baby pigs to eat as an additional method of preventing anemia.

Baby pigs will start to drink clean fresh water and eat feed at about one week of age. A creep feeder should be provided for them where they can eat and drink away from the sow.

In commercial herds castration may be done at any time but most conditions favor castrating between ten days to two weeks of age.(30) At this age pigs are more easily held, the shock is less, and they heal more rapidly than at an older age. The pigs should be provided with sanitary surroundings until the wounds are healed.

Weaning pigs at six to eight weeks of age is the most practical for most producers. However, weaning at five to six weeks of age may be best for confinement rearing to reduce the amount of housing space needed.(30) To wean pigs at an earlier age will take more skill, special rations, and warm quarters that are dry and free from drafts.

Experiments have shown that pigs weaned at eight weeks are often heavier than eight week old pigs that have been weaned earlier.(34) Early weaning takes less feed per litter since the sows ration is reduced after the pigs are removed, however, the feed cost per pound of gain is sometimes higher for the pigs weaned younger than eight weeks due to a greater consumption of the higher cost creep ration. Early weaning may save labor on

some farms. It will cut down on the housing space needed in a confinement system since the sows are moved out when their litters are weaned.

In most areas the vaccination of pigs for hog cholera and erysipelas is cheap insurance against loss. Vaccination should be done after castration and about two weeks before weaning. The most widely used method of hog cholera vaccination is the use of a modified live virus vaccine and serum. Vaccination can be done any time. However, if done before weaning it is easier on the pig, they are easier to hold, and they have protection for a longer period of time. It is important that the pigs are in good health and have a normal temperature at time of vaccination.

Many hog producers like to move the sows and litters to a clean legume pasture as soon as possible after the pigs are a week or two old. Care should be taken in moving pigs to pasture so that no infections or disease are picked up on route. It is better to haul the sow and litter than to drive them.

However, with multiple farrowing operations pigs are being raised efficiently while confined to pens until they are eight weeks old. Care must be taken to provide dry, sanitary quarters that are well ventilated and a balanced ration which contains the minerals, vitamins, and proteins which are provided by pasture crops.

Baby pigs like pelleted feed better than meals or crumbled feeds. Dusty or finely ground feeds are not eaten readily. Most pig starters and growers on the market are in the pellet form. Each pig will require about twenty pounds of an eighteen per cent protein starter ration and about fifty-five pounds of a sixteen per cent grower ration.(6) An adequate supply of clean, fresh water should be available at all times.

After pigs reach a weight of approximately fifty pounds they have passed the most critical nutritional period in their life cycle. The ones that are thrifty in appearance need comparatively little care when given adequate feed, water, and shelter.

The management involved during the fattening period consists of providing the hogs with adequate feed, water, and shelter and keeping them free from diseases and parasites.

The large roundworm is found on most Kansas hog farms. The best way to handle this parasite is to prevent the pigs from picking up the worm eggs. This can be done by keeping the pigs confined to concrete or by rotation pastures. These methods are not completely effective. Therefore, the only safe way to prevent worms is to treat the pigs with a worming compound.

Hygromycin and piperazine compounds are the best wormers now in use.

(6) Hygromycin is an antibiotic and should be fed continuously from the time the pigs start eating until they are marketed. It should be mixed in the feed according to directions of the manufacturer. It is sold in a premix called Hygromix. It controls these major hogs worms: roundworms, whipworms, and nodular worms.

Piperazine wormers are administered in the water or in feed after the pigs have been fasted for a twelve to eighteen hour period. This drug should be mixed thoroughly with either the feed or the water that will be consumed in a twenty-four hour period. Both of these wormers are not toxic and do not upset the digestion of the animal.

Pigs should be sorted by size and penned in lots of no more than fifty head. The weight variation within the lot should not be more than thirty pounds.(5)

Whether pigs are fattened on pasture or not, an adequate supply of clean, fresh water should be available at all times. Water is the cheapest nutrient that can be supplied to hogs. One automatic watering cup should be provided for each twenty pigs. (An automatic waterer with two openings should be considered two cups.) Pigs, depending upon size, will drink about two and one-half gallons of water per head daily in the summer and one and one-half gallons per head daily in the winter. The drinking water should not fall below a temperature of thirty-five to forty degrees Fahrenheit during the winter.

Recently an increasing number of hog producers are fattening hogs in confinement rather than on pasture. The reasons for this are that it is now possible to formulate a balanced ration that will provide all of the required nutrients for growing pigs without the use of green pasture. Another advantage of drylot feeding is the opportunity the producer has in providing a more comfortable environment. However, a major disadvantage of confinement feeding is manure disposal.

Environment has an important influence on the feed efficiency of growing and finishing swine. Winter quarters should be dry, well-ventilated, and free from drafts and dust. For summer, cooling shade and fogging nozzles are recommended.

Pigs may be hand-fed or self-fed. Self-feeding saves labor and usually produces more rapid and economical gains than those produced by hand-feeding.

(6) If pigs are put on a self-feeder enough space should be provided so there will be one linear foot of self-feeder space for every four pigs.(5)

If pigs are to be hand-fed, feed at one time only the amount of feed that

they will clean up in an hour or two. This is especially important if slop or wet mash is being fed.

Approximately only one-third of the total cost of producing the 220 pound market hog is involved in raising the pig to weaning age. It takes the remaining two-thirds of the total cost to grow the pig from weaning time until it is ready for market.(9) From a financial standpoint, the period from weaning to market is an important one since more than twice as much capital is involved in this period as is involved in producing weaning pigs. The profit from fattening hogs is determined by the cost of production and by the selling price. A producer can usually influence the cost of production by using good management practices more easily than he can the selling price.

FINDINGS

The findings of the study were devoted mainly to the comparison of the pre-test scores and post-test scores earned by high school students. The test scores were recorded on a swine production and management test designed to measure knowledge gained in this area.

The vocational agriculture classes at Goessel Rural High School were used in this study to test the value of the source material. Forty-five students were divided into two groups. Six seniors and twelve freshmen, totaling eighteen students, made up the control group.(Table VIII) Eleven juniors and sixteen sophomores, totaling twenty-seven students, made up the experimental group.(Table IX)

The test used for obtaining the pre-test and post-test scores was developed by selecting ten multiple choice questions from each of the first seven chapters in the source unit and fifteen questions from the eighth chapter. This made a test of eighty-five possible points for each individual. Each question contained a possible four choices of words or statements. The boys were asked to select one of the four answers that did the best job of completing the statement and to put the letter of that answer in the blank at the left of the question.

The test was duplicated so each boy had a copy. It was administered during one fifty minute regular class period. The pre-tests were collected and filed by classes. These pre-tests were not scored or examined by anyone until after the post-test was given.

The results of the study are shown in table and graph form on the following pages.

TABLE VIII
SUMMARY OF TEST RESULTS BY INDIVIDUAL STUDENTS
IN THE CONTROL GROUP

Seniors	Pre-test Score	Post-test Score	Freshmen	Pre-test Score	Post-test Score
Merrill	48	46	Steve	31	33
Richard	55	56	Verne	33	32
Gerald	41	33	Myron	43	29
Leslie	50	51	Gene	40	39
Leroy	44	46	Robert	46	39
Larry	30	38	Darrel	37	28
			Earl	36	44
			Ira Don	27	39
			Clayton	45	60
			Lauren	42	36
			Orville	31	36
			Keith	40	42
Total	268	270	Total	451	457

The data with regard to individual student scores in the control group on the pre-test and post-test was presented in Table VIII. This group of eighteen boys made up the control group. They did not, at any time, receive any instruction from the source unit.

The six senior boys had a total pre-test score of 268 and a post-test score of 270 out of 510 possible points. The highest and lowest score on the pre-test was 55 and 30 respectively and the post-test range was 33 to 56.

The twelve freshmen boys scored 451 on their pre-test and 457 on their post-test out of 1,020 possible points. Their highest and lowest score on the pre-test was 46 and 31 respectively and the post-test range was 28 to 60.

The control group had a score of 719 on the pre-test and 727 on the post-test. They increased their total score by 8 points.

TABLE IX
SUMMARY OF TEST RESULTS BY INDIVIDUAL STUDENTS
IN THE EXPERIMENTAL GROUP

Juniors	Pre-test Score	Post-test Score	Sophomores	Pre-test Score	Post-test Score
Myron	34	41	Dickie	48	45
Fred S.	46	56	Galen	39	56
Larry	60	62	Stanley	40	45
Jerry V.	55	61	Henry	51	60
Jerry S.	47	64	Alan	40	54
Fred W.	63	73	Ivan	43	56
Clayton	47	64	Richard	51	60
Nelson	34	43	Harlan	46	49
Duane	43	53	Larry	46	51
Norman	39	54	Ray S.	39	36
Gerald	45	67	Bruce	43	57
			Alvin	39	46
			Delbert	53	58
			David	50	62
			Clifford	29	41
			Floyd	52	60
Total	513	638	Total	709	836

The data with regard to individual student scores in the experimental group on the pre-test and post-test were presented in Table IX. This group of twenty-seven boys made up the experimental group. They received instruction based on the source unit between the pre-test and post-test.

There were eleven junior boys that had a total pre-test score of 513 and a post-test score of 638 out of 935 possible points.

The sixteen sophomore boys scored 709 on their pre-test and 836 on their post-test out of 1,360 possible points.

The experimental group had a score of 1,222 on the pre-test and 1,474 on the post-test. They increased their total score by 252 points.

TABLE X
SUMMARY OF TEST RESULTS ON THE PRE-TEST

Group	No. Boys	Total Score	Class Score	Per Cent of Perfect	Average Score per Boy
Control Group:					
Seniors	6	510	268	52.54	44.66
Freshmen	12	1,020	451	44.21	37.58
Total	18	1,530	719	46.90	39.94
Test Group:					
Juniors	11	935	513	54.87	46.64
Sophomores	16	1,360	709	52.31	44.31
Total	27	2,295	1,222	53.24	45.26

The data showing average class and group scores on the pre-test was presented in Table X. The number of boys in each class and group, the total points possible, and total scores for each class and group were shown. These scores were presented and discussed in connection with Tables VIII and IX.

The eleven junior boys had the highest average score on the pre-test with 46.64 points. The six seniors were next with a score of 44.66 followed closely by the sixteen sophomores with a score of 44.31. The twelve freshmen had an average score of 37.58 points. This same data presented in percentage form and showing average per cent for each class is as follows: juniors, 54.87 per cent; seniors, 52.54 per cent; sophomores, 52.31 per cent; and freshmen, 44.21 per cent.

A summary of the scores on the pre-test by groups showed that the control group (seniors and freshmen) had an average score of 39.94 and the test group (juniors and sophomores) had an average score of 45.26. This represents a total difference between average group scores of 5.32 points.

TABLE XI
SUMMARY OF TEST RESULTS ON THE POST-TEST

Group	No. Boys	Total Score	Class Score	Per Cent of Perfect	Average Score per Boy
Control Group:					
Seniors	6	510	270	52.94	45.00
Freshmen	12	1,020	457	44.71	38.08
Total	18	1,530	727	47.51	40.38
Test Group:					
Juniors	11	935	638	68.23	58.00
Sophomores	16	1,360	836	61.46	52.25
Total	27	2,295	1,474	64.22	54.59

The data showing average class and group scores on the post-test was presented in Table XI. The number of boys in each class and group, the total points possible, and total scores for each class and group were shown. These scores were presented and discussed in connection with Tables VIII and IX.

The eleven junior boys had the highest average score on the post-test with 58.00 points. The sixteen sophomores were next with a score of 52.25 followed by the six seniors with a score of 45.00 and the twelve freshmen with a score of 38.08. This same data presented in percentage form and showing average per cent for each class is as follows: juniors, 68.23 per cent; sophomores, 61.46 per cent; seniors 52.94 per cent; and freshmen 44.71 per cent.

A summary of the scores on the post-test by groups showed that the control group (seniors and freshmen) had an average score of 40.38 and the test group (juniors and sophomores) had an average score of 54.59. This represents a total difference of 14.21 points between average group scores.



FIGURE 1

AVERAGE CLASS SCORES ON THE PRE-TEST AND POST-TEST

The average class scores on the pre-test and the post-test were presented in graph form in Figure 1. A total of 85 points was possible on this test. All of the classes increased their scores on the post-test over the pre-test. The increases were as follows: (a) In the control group the seniors increased their average score 0.34 points and the freshmen increased their average score 0.50 points. (b) In the test group the juniors increased their average score 12.64 points and the sophomores increased their average score 7.94 points. The junior class had the highest average class score with 58.0 points on their post-test and the freshmen had the lowest class score with 37.58 points on their pre-test.

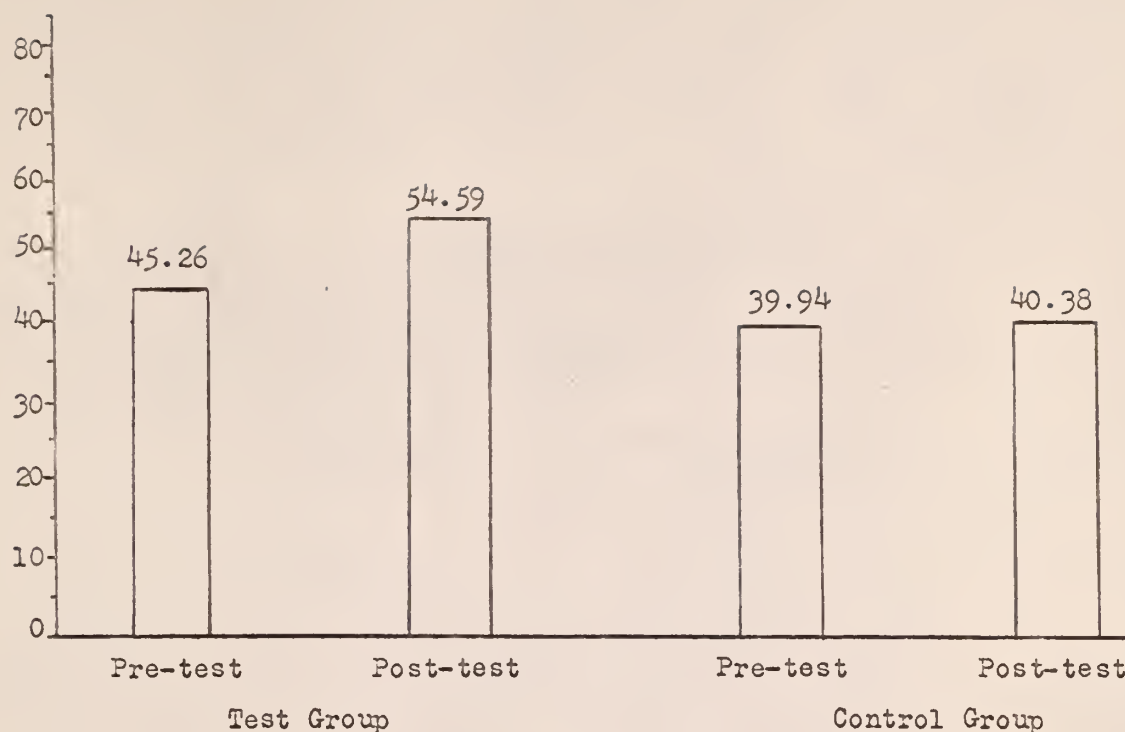


FIGURE 2

AVERAGE GROUP SCORES ON THE PRE-TEST AND POST-TEST

The average group scores on the pre-test and the post-test were presented in graph form in Figure 2. The average scores of those boys having access to lessons from the source material (test group) were contrasted with the average scores of those boys not having access to lessons from the source material (control group).

It was found that those boys that did not have lessons from the source material scored an average of 39.94 points on the pre-test and 40.48 points on the post-test out of a possible 85 points. It was also found that those boys that had received instruction from the source material scored an average of 45.26 points on the pre-test and 54.59 on the post-test out of a possible 85 points.

The results of the comparison showed that those students receiving instruction from the source unit increased their score by 9.33 points and that those students that did not receive instruction from the source unit increased their score by 0.44 points.

This same data presented in percentage form comparing the two groups showed that the test group increased their average score by 10.98 per cent and the control group increased their average score by 0.61 per cent.

The group of boys having access to the source material had a total difference of 10.37 per cent over the group that did not have the material.

SUMMARY AND IMPLICATIONS

The purpose of this study was to evaluate source material and develop a source unit that might be used by teachers of vocational agriculture in preparing and teaching lessons on swine production and management. It included the production of swine in a farming operation as well as the recommended management practices for attaining high efficiency.

A source unit was interpreted as a collection of instructional materials and technical information for teaching a major unit. It was also considered for the purposes of the study as a collection of accurate information that might be used in developing selected lessons and that it would contain more information than should be taught at one time to a class. The source unit was also designed to be accumulative in nature, with new materials being added as new ideas and information became available.

Many vocational agriculture teachers have expressed the need for a compact source of information. It was the purpose of this study to develop a source unit from which a teacher of vocational agriculture could readily make the required preparations that will enable him to have current swine information to meet his local community needs. It was also the purpose to develop the source unit so that the teacher will be encouraged to keep it up-to-date with the constant changes that are occurring in agriculture. The following procedures were used:

1. A list of technical publications on swine production and management was made.
2. The above material was reviewed. Selections were made on the basis of their potential usefulness in helping Kansas vocational

agriculture teachers teach lessons on swine production and management.

3. A tentative source unit was developed. It contained information in the following areas:

- a) History and Development of the Swine Industry. Hogs are not native to the United States although all of our American breeds were developed in this country. Our American hogs originated from two wild stocks; namely the European wild boar and the East Indian pig. Columbus first brought hogs to the West Indies on his second voyage in 1493. The hog is the most thoroughly domestic American animal. In no other class of animals have so many truly American breeds been created. The demand for hogs was brought about by the fact that Indian corn made a good hog feed. Therefore, the growth of hog production has very closely paralleled the production of corn in the North-Central states. Since 1925 there has been a move to develop the meat type hog.
- b) Types and Breeds of Swine. In selecting a herd of swine it is more important to look for and select on the basis of good meat type characteristics rather than on the basis of an individual breed. There are good individuals in every breed as well as in well-planned crossbreeding programs. Some farmers choose a breed because of its market demand. Others select a breed because of personal preference while still others select one because the breeding stock is most available. Each breed has distinctive characteristics which

make it different from the others. It is up to the breeder to select the breed of hogs that will best fit his farming operation.

- c) Swine Breeding. A general understanding of the different swine breeding systems is important to the swine producer. These systems are commonly referred to as outbreeding, inbreeding, linebreeding, grading-up, and crossbreeding. Crossbreeding is a valuable system of breeding to the commercial swine producer. The reasons for crossbreeding are to help make rapid changes in type to meet market demand, to combine the strong points of two or more breeds to give the most profitable hog, and to capitalize on hybrid vigor. Artificial insemination of swine in the United States is still in the experimental stage but there is quite a bit of interest in its application.
- d) Swine Nutrition. In order to take advantage of the breeding potentials of good stock an adequate and balanced ration is of prime importance. Feed is also of prime importance in the cost of producing pork because it represents 75 to 80 per cent of the total costs of any swine operation. A lack of proper feeding will take the profit out of swine production. In general the nutrients required by swine are classified as carbohydrates, fats, proteins, vitamins, minerals, chemical additives, and water.
- e) Diseases and Parasites of Swine. Efficient hog production depends upon disease and parasite control because there are

at least sixty-five known diseases that infect swine. Control of disease is achieved through sanitation, vaccination programs, proper diagnosis, and treatment of disease, and adequate nutrition. Losses due to diseases and parasites are estimated to cost the swine raiser \$15.50 for each \$100 of net profit. Approximately twenty per cent of the pigs born each year fail to survive as a result of baby pig diseases. On many farms the profit and loss from the enterprise is determined largely by the extent to which disease and parasite losses have been controlled.

- f) Housing and Equipment for Swine. Adequate housing and equipment can reduce labor, aid in sanitation, protect herd health, and greatly increase the profits from a hog operation. Equipment charges represent only about 5 to 8 per cent of the total cost of producing pork. However, having enough of the right kind of equipment is much more important than this percentage indicates. Some functional requirements for swine housing that should be considered are protection during bad weather, desirable temperatures, ventilation, insulation, adequate floor space, clean water supply, manure disposal, and safety.
- g) Swine Marketing. Supply and demand have the greatest influence on the price of market hogs. Multiple farrowing has tended to even out hog marketings in recent years. As a result there has not been as much seasonal variation in hog prices. The most profitable weight to sell hogs is between 200 and 220 pounds. Most market hogs are sold through terminal public

markets. The federal market grades of slaughter barrows and gilts are: U.S. No. 1, U.S. No. 2, U.S. No. 3, Medium, and Cull.

- h) Management Practices for Swine. The size and type of a hog operation will determine the overall management program required for successful hog production. Swine management can be defined as the organizing and timing of events and providing conditions which permit the hogs to function to the maximum of their capacity. A producer can usually influence the cost of production by using good management practices more easily than he can influence the selling price.
4. The tentative source unit was submitted to an advisory committee of two specialists: one from the field of agricultural education who reviewed the source unit from the standpoint of its organization and its value in meeting the needs of vocational agriculture teachers; and one from the field of animal husbandry who reviewed the source unit from the standpoint of technical information.
5. The source unit was revised on the basis of suggestions made by the reviewing committee.

The usefulness of the material in the source unit was evaluated by a comparison of pre-test and post-test scores taken in connection with the teaching of lessons from the unit to Goessel Rural High School vocational agriculture students. These students were divided into two groups. The freshmen and seniors were the control group and the sophomores and juniors the experimental group.

The test was developed based on the material in the source unit. All of the students took this examination before any lessons on swine production and management were taught. Their scores were recorded on this pre-test.

The selection of lesson plans was made from the material in the source unit. The lessons were taught to the sophomore and junior vocational agriculture students.

After these lessons were taught the test was re-administered to all of the vocational agriculture students. The results of the pre-test and the post-test were analyzed.

The findings showed that those students which received instruction from the source unit increased their scores from the pre-test to the post-test by 10.98 per cent. Those students not having access to the material increased their scores by 0.61 per cent. There was a total difference of 10.37 per cent between the experimental group and the control group.

The source unit on swine production and management covered a broad area of problems dealing with swine. However, persons teaching agriculture should realize that there is a lot of material on swine not included in this source unit. They should also realize that as new developments take place in the swine industry these new ideas will need to be placed in proper perspective and used in addition to this source unit.

New developments in swine breeding, improved rations, disease control, and marketing have brought about many changes. A knowledge of the material in the source unit would be helpful to a person considering swine as an enterprise to include in his farming program.

The results of the practical application of the source unit supported its usefulness as a supplemental teaching device. This will not, however,

solve all of the problems of teaching swine production and management.

Field trips, demonstrations, discussion groups, and additional reference material should be used by vocational agriculture teachers in addition to lessons from this source unit for most effective teaching.

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APPENDIX

SWINE PRODUCTION AND MANAGEMENT QUIZ

Name _____

Class _____

INSTRUCTIONS: Select one of the four answers that does the best job of completing the statements. Put the letter of that answer in the blank at the left of the question.

- _____ 1. The growth of hog production has very closely paralleled the production of (a) alfalfa (b) corn (c) wheat (d) barley in the North Central States.
- _____ 2. In 1860 the center of pork production and processing in the United States was (a) Chicago (b) Kansas City (c) Wichita (d) St. Louis.
- _____ 3. In early selecting and crossbreeding of swine, breeders stressed (a) size of litter (b) carcass quality (c) gaining ability (d) large size.
- _____ 4. The modern hog producer of today is working to produce a (a) lard (b) meat (c) bacon (d) grazing type hog.
- _____ 5. In selecting a breed it is more important to select on a basis of (a) good meat type characteristics (b) color markings (c) size of litter (d) what the neighbors have so you can borrow their boar.
- _____ 6. The (a) Duroc (b) Hampshire (c) Yorkshire (d) Berkshire breed of hogs is the most numerous in the United States.
- _____ 7. In 1962 (a) 10 (b) 35 (c) 50 (d) 65 per cent of all hogs marketed were meat type hogs.
- _____ 8. The (a) Duroc (b) Hampshire (c) Yorkshire (d) Berkshire breed of hogs originated in the states of New York and New Jersey.
- _____ 9. The most striking characteristic of the (a) Berkshire (b) Poland China (c) Chester White (d) Hampshire is the white belt entirely encircling the black body.
- _____ 10. (a) Tamworth (b) Poland China (c) Landrace (d) Hampshire breed is noted for its outstanding grazing ability.
- _____ 11. The Landrace breed of hogs was imported from (a) England (b) West Indies (c) Denmark (d) Scotland.
- _____ 12. (a) Yorkshires (b) Chester Whites (c) Tamworths (d) Durocs are white in color and their ears are held erect.

- _____ 13. The Poland Chinas are probably the (a) smallest (b) largest (c) best (d) poorest breed of swine.
- _____ 14. A very distinctive characteristic of the (a) Poland China (b) Berkshire (c) Spotted Poland China (d) Tamworth breed is a short stubby snout, with a dished face and erect ears.
- _____ 15. The (a) Tamworth (b) Duroc (c) OIC (d) Landrace is one of our oldest breeds of swine.
- _____ 16. It is possible to artificially breed (a) 2-3 (b) 10-12 (c) 100 (d) 500 sows from one collection of boar semen.
- _____ 17. Hogs from one particular breed are alike only in (a) body type (b) rate of gain (c) color markings (d) carcass quality.
- _____ 18. (a) Outbreeding (b) inbreeding (c) crossbreeding (d) linebreeding is the mating of an unrelated sow and boar.
- _____ 19. (a) Outbreeding (b) grading-up (c) crossbreeding (d) none of these is the method used in mating a sow and boar that are closely related.
- _____ 20. When the crisscrossing method of breeding sows is used only (a) one (b) two (c) three (d) four boars are needed in the herd.
- _____ 21. Which one of the following factors does heredity affect very little? (a) backfat thickness (b) loin area (c) quality (d) litter size farrowed.
- _____ 22. (a) Crossbreeding (b) grading-up (c) line breeding (d) outbreeding is the system used when a purebred boar is bred to grade sows.
- _____ 23. Artificial insemination in swine is not as common as in cattle because (a) boar semen loses potency when diluted and stored at refrigerated temperatures for a long period of time (b) boars are generally not as expensive to buy as a bull (c) no one knows how to breed sows artificially (d) sows will not conceive when bred artificially.
- _____ 24. The (a) Tamworth (b) Chester White (c) Yorkshire (d) Spotted Poland China breed of hogs is the most popular breed to cross with other breeds in a crossbreeding program.
- _____ 25. If a Yorkshire sow was crossed to a Duroc boar the pigs would be (a) $1/4$ Duroc and $3/4$ Yorkshire (b) $3/8$ Yorkshire and $5/8$ Duroc (c) $1/2$ Yorkshire and $1/4$ Duroc (d) $1/2$ Duroc and $1/2$ Yorkshire.
- _____ 26. Feed represents (a) 25 to 30 (b) 40 to 50 (c) 60 to 70 (d) 75 to 80 per cent of the total costs of any swine operation.

- _____ 27. Cereal grains, such as corn, milo, barley and oats do not contain enough (a) energy (b) carbohydrates (c) fats (d) protein required by most swine.
- _____ 28. (a) Yellow corn (b) oats (c) milo (d) wheat is used as a standard for comparing the feeding value of other grains.
- _____ 29. In growing-finishing rations (a) milo (b) oats (c) barley (d) wheat can replace corn entirely and also be used as the only grain in the ration.
- _____ 30. The feeding value of wheat is (a) equal to (b) slightly better than (c) slightly poorer than (d) only half as good as corn.
- _____ 31. The young growing pig requires (a) 2 (b) 5 (c) 10 (d) 25 essential amino acids.
- _____ 32. (a) Bran (b) tankage (c) soybean oil meal (d) linseed oil meal is not an example of a protein supplement.
- _____ 33. A feed for hogs that is high in vitamins is (a) milo (b) green pasture (c) molasses (d) white corn.
- _____ 34. Minerals are used primarily in (a) bone development (b) tissue development (c) reproduction (d) digestion of food.
- _____ 35. Limited feeding of market hogs means (a) feeding only once a day (b) providing only one half enough feeder space (c) feeding the sows less feed so they won't get too fat (d) feeding the pigs on full feed until they weigh about 100 pounds and then feed at 70 per cent of full feed until they weigh 200 pounds.
- _____ 36. There are at least (a) 10 (b) 25 (c) 50 (d) 65 known diseases that infect swine.
- _____ 37. (a) Five (b) ten (c) fifteen (d) twenty per cent of the pigs born fail to survive as a result of baby pig diseases.
- _____ 38. The most serious of all swine diseases is (a) hog cholera (b) scours (c) erysipelas (d) leptospirosis.
- _____ 39. Market hogs should be vaccinated for (a) leptospirosis (b) hog cholera and erysipelas (c) rhinitis and erysipelas (d) hog cholera.
- _____ 40. (a) Virus pig pneumonia (b) TGE (c) anemia (d) hog cholera is an infectious scours in baby pigs that is highly contagious.
- _____ 41. A swine breeding herd should be blood tested to determine if the disease (a) TGE (b) brucellosis (c) hog cholera (d) virus pig pneumonia is present.

- _____ 42. Anemia is a nutritional condition caused by a lack of (a) protein (b) minerals (c) iron (d) vitamins in the blood.
- _____ 43. Hog lice (a) suck blood from hogs (b) live in the intestines (c) can be controlled by vaccination (d) are internal parasites of swine.
- _____ 44. The Specific Pathogen Free (SPF) program is a program to provide hogs (a) that will produce a high quality carcass (b) that will gain very fast (c) that are known to be free of certain specific diseases (d) that will never have any worms, lice, or mange.
- _____ 45. A gilt that is kept for the breeding herd should have at least (a) 8 (b) 10 (c) 12 (d) 15 functional teats.
- _____ 46. A boar should be (a) 5 (b) 6 (c) 7 (d) 8 months old before he is used for service.
- _____ 47. If sows are pasture bred one mature boar can be used for breeding every (a) 10 (b) 20 (c) 30 (d) 50 sows.
- _____ 48. Sows will farrow (a) 112 to 114 (b) 148 to 150 (c) 283 to 285 (d) 30 to 32 days after breeding.
- _____ 49. Flushing sows means (a) washing them before farrowing (b) treating them for roundworms (c) cleaning out their pens (d) feeding them so they will be gaining in weight during the breeding season.
- _____ 50. If hand breeding is used sows should be bred on the (a) first (b) first and second (c) second (d) second and third day of their heat period.
- _____ 51. If pasture is not available for sows during the gestation period (a) alfalfa hay (b) silage (c) prairie hay (d) oats should be fed.
- _____ 52. During the gestation period sows should gain about (a) 10 to 20 (b) 60 to 70 (c) 125 to 150 (d) 200 to 225 pounds.
- _____ 53. The amount of feed should be increased during the last one-third of the gestation period to (a) meet the increased needs of the unborn litter (b) fatten the sow so she won't lose so much weight when she farrows (c) produce milk (d) give her energy to walk with a litter of unborn pigs.
- _____ 54. (a) Watching sows more closely (b) not getting sows too fat (c) saving feed (d) saving labor is the only advantage of self-feeding sows during the gestation period.
- _____ 55. Corn silage can be fed to sows during the gestation period if

(a) it contains lots of corn (b) it is properly supplemented
(c) it is too rotten for cattle to eat (d) sows are not on
pasture.

- _____ 56. Bred sows in a dry lot need (a) 4 to 5 (b) 6 to 7 (c) 9 to 10
(d) 10 to 12 pounds of grain and one pound of 40 per cent
protein supplement per head daily.
- _____ 57. About three to four days before a sow farrows she should be fed
a bulky ration to (a) act as a laxative and reduce milk supply
(b) make her farrow (c) increase milk supply and prevent disease
(d) make her drink more water.
- _____ 58. A sow will usually farrow within (a) 3 (b) 6 (c) 12 (d) 24 hours
after milk appears in the udder.
- _____ 59. The (a) navel cord (b) needle teeth (c) ear notches (d) anemia
on baby pigs should be removed shortly after farrowing to pre-
vent the pigs from cutting each other on the mouth when fighting.
- _____ 60. The average birthweight of a baby pig is approximately (a) 1
(b) 2 1/2 (c) 6 (d) 8 1/2 pounds.
- _____ 61. Baby pigs should be castrated at (a) 10 to 14 days (b) 4 weeks
(c) 6 weeks (d) 8 weeks of age.
- _____ 62. (a) Phenothiozine (b) BHC (c) flushing (d) piperazine is an
excellent compound to add to the drinking water to prevent
worms in swine.
- _____ 63. Drinking water for hogs should not fall below a temperature of
(a) 20 to 25 (b) 30 to 35 (c) 35 to 40 (d) 60 to 70 degrees for
hogs.
- _____ 64. Only (a) one-fourth (b) one-third (c) one-half (d) three-fourths
of the total cost of producing a 220 pound market hog is involved
in raising the pig to weaning age.
- _____ 65. Equipment costs represent only (a) 5 to 8 (b) 75 to 80 (c) 20 to
30 (d) 10 to 15 per cent of the cost of producing pork.
- _____ 66. The most desirable temperatures for farrowing houses are (a) 40
to 50 (b) 50 to 60 (c) 60 to 70 (d) 70 to 80 degrees Fahrenheit.
- _____ 67. The major problem with fattening hogs in confinement is (a) pro-
viding a balanced ration (b) protecting them from diseases
(c) keeping them cool in summer (d) removing the manure.
- _____ 68. As many as (a) 10 to 12 (b) 20 to 25 (c) 50 (d) 100 sows can be
put in the same pen together during gestation.
- _____ 69. A farrowing pen should contain at a minimum (a) 24 (b) 36 (c) 48
(d) 64 square feet.

- _____ 70. Manure is decomposed in a manure lagoon by (a) aerobic and anaerobic bacteria (b) minerals in the water (c) antibiotics (d) germs.
- _____ 71. (a) Increased rate of gain and feed efficiency (b) improved sanitation and less labor for cleaning (c) cheaper and faster construction (d) longer life and warmer environment are the main advantages of using slotted floors as compared to concrete for swine.
- _____ 72. Farrowing stalls for sows should have an overall minimum width of five feet with about (a) 2 (b) 3 (c) 4 (d) 5 feet width for the sow.
- _____ 73. When feeding market hogs on slotted floors approximately (a) 6 (b) 10 (c) 12 (d) 15 feet of floor space should be provided for each hog.
- _____ 74. When feeding market hogs in confinement on concrete approximately (a) 6 (b) 10 (c) 12 (d) 15 feet of floor space should be provided for each hog.
- _____ 75. (a) The commission man (b) supply and demand (c) the age of the hog (d) the packer buyer has the greatest influence on the selling price per pound of market hogs.
- _____ 76. Spring pigs are generally marketed during the months of (a) July, August, and September (b) January, February and March (c) October, November, and December (d) April, May, and June.
- _____ 77. The modern day housewife or consumer is demanding to buy (a) smaller cuts of pork (b) leaner cuts of pork (c) pork with less lard (d) all of these.
- _____ 78. The most profitable weight at which to sell hogs is (a) 180 to 200 pounds (b) 200 to 220 pounds (c) 220 to 240 pounds (d) 240 to 260 pounds.
- _____ 79. Most slaughter hogs are sold (a) through terminal markets (b) through livestock auctions (c) direct to packers (d) to local dealers.
- _____ 80. Yield of a hog means its (a) live weight (b) dressing per cent (c) carcass weight (d) backfat thickness.
- _____ 81. Selling hogs by (a) live weight (b) the head (c) the grade and yield (d) the age is fairest to both the buyer and seller.
- _____ 82. (a) U. S. No. 1 (b) Cull (c) Choice (d) Medium is not a U.S.D.A. grade of slaughter hogs.
- _____ 83. The best single indication of grade of market hogs is (a) backfat

thickness (b) live weight (c) litter size (d) loin area.

- _____ 84. A (a) stag (b) barrow (c) sow (d) boar is an uncastrated male swine.
- _____ 85. One of the symptoms of (a) erysipelas (b) rhinitis (c) leptospirosis (d) hog cholera is the abortion of unborn pigs during pregnancy.

A SOURCE UNIT ON SWINE PRODUCTION AND MANAGEMENT

by

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ABSTRACT

The purpose of this study was to evaluate source materials and to develop a source unit that might be used by teachers of vocational agriculture in preparing and teaching lessons on swine production and management.

A source unit was interpreted as a collection of instructional materials and technical information for teaching a major unit. It was also considered for the purposes of the study as a collection of accurate information that might be used in developing selected lessons and that it would contain more information than should be taught at one time to a class. The source unit was also designed to be accumulative in nature, with new materials being added as new ideas and information became available. The following procedures were used:

1. A list of technical publications on swine production and management was made.
2. The above material was reviewed. Selections were made on the basis of their potential usefulness in helping Kansas vocational agriculture teachers teach lessons on swine production and management.
3. A tentative source unit was developed. It contained information in the following areas:
 - a) History and Development of the Swine Industry
 - b) Types and Breeds of Swine
 - c) Swine Breeding
 - d) Swine Nutrition
 - e) Diseases and Parasites of Swine
 - f) Housing and Equipment for Swine
 - g) Swine Marketing
 - h) Management Practices for Swine
4. The tentative source unit was submitted to an advisory committee of two specialists: one from the field of agricultural education

who reviewed the source unit from the standpoint of its organization and its value in meeting the needs of vocational agriculture teachers; and one from the field of animal husbandry who reviewed the source unit from the standpoint of technical information.

5. The source unit was revised on the basis of suggestions made by the reviewing committee.

The usefulness of the material in the source unit was evaluated by a comparison of pre-test and post-test scores taken in connection with the teaching of lessons from the unit to Goessel Rural High School vocational agriculture students. These students were divided into two groups. The freshmen and seniors were the control group and the sophomores and juniors the experimental group.

The test was developed based on the material in the source unit. All of the students took this examination before any lessons on swine production and management were taught. Their scores were recorded on this pre-test.

The selection of lesson plans was made from the material in the source unit. The lessons were taught to the sophomore and junior vocational agriculture students.

After these lessons were taught the test was re-administered to all of the vocational agriculture students. The results of the pre-test and the post-test were analyzed.

The findings showed that those students which received instruction from the source unit increased their scores from the pre-test to the post-test by 10.98 percent. Those students not having access to the material increased their scores by 0.61 per cent. There was a total difference of 10.37 per cent between the experimental group and the control group.

