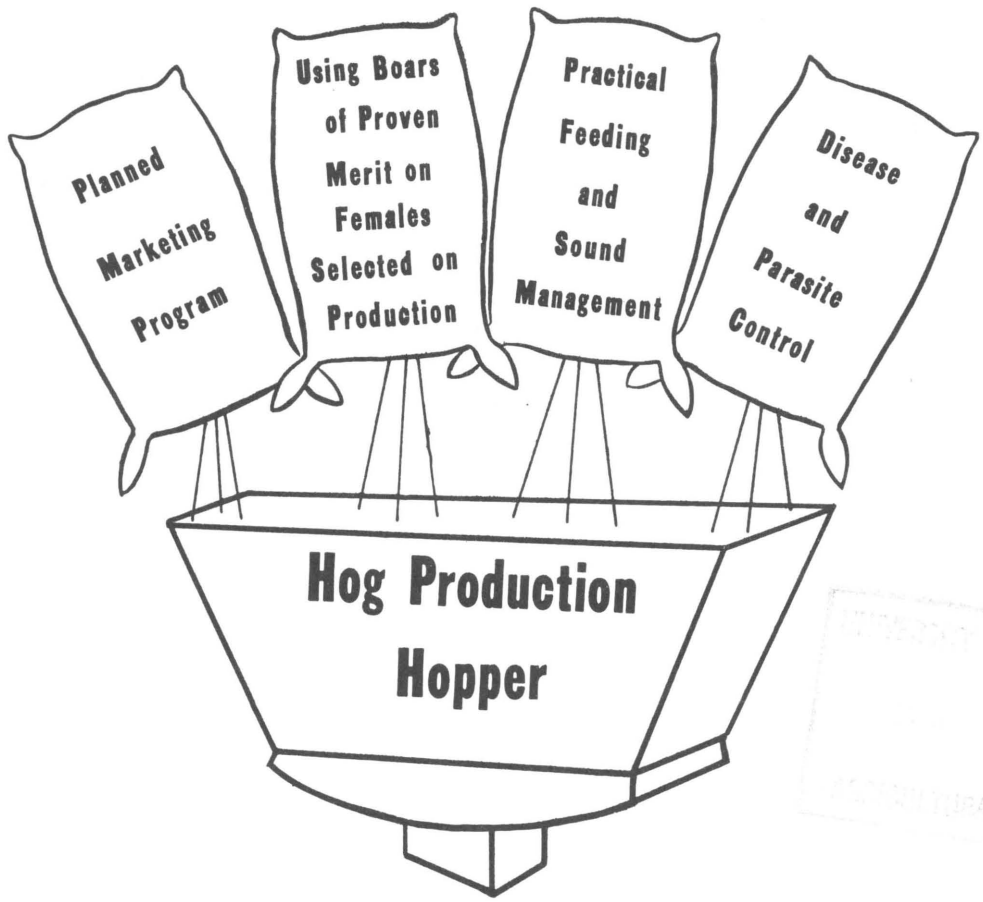
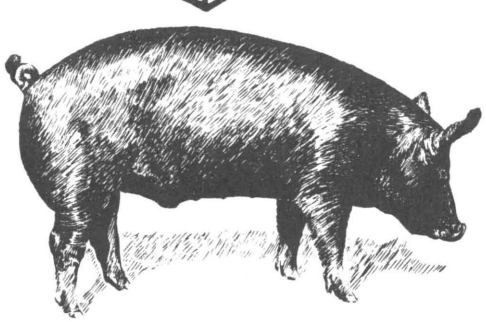
Proceedings of the

NINTH ANNUAL SWINE SHORT COURSE

April 4–5, 1960, College Station, Texas



Maximum Pounds of Desirable Pork



Produced Economically to Bring Top Market Price

DEPARTMENT OF ANIMAL HUSBANDRY

TEXAS AGRICULTURAL EXPERIMENT STATION

R. D. LEWIS, DIRECTOR, COLLEGE STATION, TEXAS

TABIE OF CONTENTS

A FORWARD LOOK AT THE SWINE INDUSTRY

Bernard W. Ebbing
Livestock Service Department
Rath Packing Company
Waterloo, Iowa

Let us recognize that this industry is divided into five distinct groups. 1) Producer, 2) Marketing Agencies, 3) Processor, 4) Retailer, 5) Consumer. This was not always the case. Some years ago, the producer, processor and consumer were one and the same. The farmer raised his hog, slaughtered, processed and consumed it. It was a rather crude operation....eating most of it fresh and preserving the balance. The weather was a big factor....with most processing done in the winter time and if there was any surplus, the producer became a distributor.

The development of transportation, refrigeration, and packaging over the years has resulted in our present-day complex system. Don't lose sight of the fact that the future of this pork business will be determined by group five.... the consumer. In this group, we are all critical -- critical of the producer, the processor, and the retailer. Why don't they raise better hogs, process them better, and merchandise them better? We, as consumers, want leaner, heavier muscled, more palatable pork at a somewhat uniform price throughout the years.

Prior to World War II, the industry was working on less lard and lighter hogs, but because of the war which stimulated demand for both meat and fat, quality disappeared. As we came out of the war, the attitude that prevailed was "a hog was a hog" throughout the industry. That is to say....there wasn't much difference, not enough to sort him out from the 80 million other hogs that had to be slaughtered, other than by the traditional weight groups. This is where we were 13 years ago.

Since 1946, there have been numerous developments which represent departures from this old attitude. I am happy to say that my Company did research on the dollar and cents values of different kinds of hogs. They worked with the U. S. Department of Agriculture in the development of the U.S. No. 1, U.S. No. 2, and U.S. No. 3 hogs. Along with this, my Company saw fit to buy hogs on a new method....carcass grade. Our Company, as well as many others, recognize this declining consumer acceptance of pork and trained buyers to recognize this new quality value in live hogs. They paid producers more for the meatier type and discounted the over-fat, meatless hogs. The packing industry, some three years ago, announced through the American Meat Institute, that it was adopting a national policy on a new look in pork called the "close trim".

I want to remind you that these significant developments have taken place in the last 10 years in a free-enterprise system. I want to say that you cannot legislate a consumer's acceptance to meat-type hogs.

We,in the packing industry, must work toward identifying this superior meat-type product. It may be called select, meaty, or some other name, because today, heavy cuts from 200-225 pound well-muscled hogs are not being priced properly. As an example...the trade prefers a 10-12 pound pork loin. The pork loin from a 210 pound hog, that has 30 inches of carcass length and 4 inches of eye muscle, is going to weigh 14 pounds. I have no doubt that this will be corrected in the near future.

I might say that our pork quality has improved greatly because we have eliminated a large percentage of the short U.S. No. 3 hogs. We are not receiving the complaints from retailers on pork loins that we were 5 years ago. The job isn't complete....but we have come a long way.

Each of us here is vitally interested in profitable pork sales -- which boils down to having a good demand at the consumer level.

I would like to take each of you into a modern self-service food market this afternoon -- not to look at the food, but at the shoppers. Quickly you would notice that the pork items in which each of us are so vitally interested are in stiff competition with thousands of other items....not only other meat items, but other products on display and all competing for her spendable dollars.

You would notice too that this shopper, the famous American homemaker, is pushing her cart through a colorful and musical atmosphere. She's doing something in which she has confidence....at least in her own mind she's buying more food and better meals for her family per dollar than anyone could possibly do.

Though this happy little homemaker may be a sweetheart to Dad and a loving Mom to her children, she's a tough shopper. She buys your product because she hasn't found a better one. Given the opportunity, she will grab something better or newer....something tastier or easier....something quicker....a handier package ....a better color....a better buy!

How does this relate to pigs and pork? Just this way -- it means that pork must be promoted better to the consumers than any other competing item. She spends just so much, and eats just so much....only part of the meal and money budget goes for pork. The challenge then is to make pork appealing, exciting and vital in all meals. There has been considerable activity by packers along these lines.

For years consumers balked on pre-sliced bacon, but since it has caught on sliced bacon is as common a household food as bottled milk or sliced bread. She didn't want sliced bread until it was invented....she never asked for instant coffee, and was slow to buy, although blind taste tests proved its excellence ....she was satisfied with "spray" deodorants until "roll-on" came along. The life blood of advertising and modern merchandising is change. Over 80 percent of the items in a super market did not exist in their present state at the end of World War II. Also keep in mind that 20 percent of the food stores do 80 percent of the food business.

You know what happened in soap? Well, white was swell....until colored came along. For example, Camay was a leading brand for years....but their share of the market dropped from 12 percent to 8.3 percent in three years. Then they made a product change that sent their share of the market back to 12.5 percent and one year later to 13.1 percent, showing continual growth. They added color and told consumers this new soap with the expensive French perfume was more fragrant and washed better than ever before. Sales showed consumers liked the change.

Now, I would like to talk about a product in which I am more aware of the actual details....you might call it a two-minute live commercial....and of which you will be more interested in results and some of the mechanics which go into a product change. The product is the well-known Rath Black Hawk Hickory Smoked Ham-in-a-Can.

I might add that months of product research and development, followed by much premarketing, went into this new type product. Basically, the change was that we smoked our canned hams, when normally canned hams were not smoked.

From surveys, we found that four out of five consumers definitely preferred the flavor of a smoked ham, and only one preferred the bland flavor of the old conventional canned ham. However, they did prefer the ease and convenience of a canned ham.

Now that we knew this to be true and had the right product, we had to tell people about the change. The basic advertising media was "Life Magazine", read by 32 million people each issue. The first ad was a double page, full color ad. Incidentally, it is interesting to note that a single page colored ad in "Life" costs approximately $40,000.00....in itself a big figure, but broken down to a cost per impression it is a different story.

Then we followed with an ad that featured the Smoke House atmosphere built right into the ad.

Of course the big problem before the ads appeared, creating a demand at the consumer level, was creating a desire on the part of buyers to squeeze the product into his precious store space with from 5,000 to 7,000 already established food products in his retail store.

Our Sales people had to carry the story to retailers all over the country. To complete the task, there are many complex sales tools such as brochures and in-store display pieces.

The most interesting of these items was a giant Smoke House. It was colorful, dimensional and electrically-lighted....mighty hard to pass by in the market....and certainly made a bigger impression on impulse buyers than the average of 5,000 other competing items in the store. Needless to say, Hickory Smoked Hams-in-a-Can received excellent reception.

There are constantly new ideas....product improvement and conveniences being built into pork products....to help homemakers decide that pork can be served more often and in many different and exciting ways.

Although there is much being done, there is much more to do....pork processors are trimming closer, boning more cuts, and making more fully-cooked items. There are many new approaches for making pork products more appealing in the research and development state right now. You will see more in the future....push-button foods for push-button living.

I am sure there is no push-button pig in the near future....but, thanks to interested universities for their research that has given producers the tools to produce better pork. Thanks to the breeders with their certification and swine evaluation station data -- they have given producers the best breeding stock we have ever had. And, thanks to the producer who is producing the leaner, meatier-type pig....plus farrowing on a more uniform basis to get away from peaks and valleys in supply.

All these activities, better hogs....more even supplies....research.... advertising....improved products, add up to terrific expenditures; but demand

for pork must be constantly maintained and increased. Remember, there are many countries that eat little or no meat. Some eat more than the United States per capita consumption.

Let's all work to produce a better product on the farms and in the packing plants. Let's all work to promote and advertise pork at the packing plant and retail level. Let's present pork in a favorable light whether we are producers, processors, or retailers. Let's use it in our home and tell our friends. We need to encourage additional research in breeding and quality improvement, nutrition, disease, equipment and buildings, management, processing, and merchandising. The swine industry has some real opportunities in years to come.

TOOLS FOR SWINE IMPROVEMENT

Bernard W. Ebbing
Livestock Service Department
Rath Packing Company
Waterloo, Iowa

What We Know

Genetic improvement in swine is accomplished by permitting superior individuals to produce more offspring than the less desirable ones. This process is called selection. In effect, when one chooses a replacement animal for the herd, he is selecting a combination of genes which he accepts or rejects as a unit. In the reproductive process, new combinations of genes are formed in the new individual, with each parent contributing equally to this genetic make-up of this new individual. Some of these new individuals are superior to, some are equal to, and some are inferior to their parents. Those possessing the most desirable characteristics are selected as breeding animals and the process repeated.

Through this process, breeders have "inched" their way toward their chosen goal with the gains made each generation resting on the progress made by the previous generation. Through this process, we have come a long way in developing our meat-type hog. Today, the swine breeder has more tools that he can use than ever before. To name a few: certification based on litter size, rate of gain, and carcass characteristics; on-farm testing based on litter size, feed conversion, backfat probe, and slaughter data; and boar testing stations which are using daily gain, feed efficiency, and carcass characteristics in their evaluation.

Our ability to change swine type depends on three basic principles: (1) variations within a breed, (2) the amount of pressure applied by the breeder, and (3) the heritability of the specific traits.

Variation among pigs is great. I believe if one wanted to find variation in two-hundred pound hogs, he could find hogs that varied from 26 to 33 inches long and from .8 to more than 3.0 inches in average backfat thickness. In area of loin eye muscle at the tenth rib, variations from 1.75 to more than 6 inches could be found. Variation in lean cut percentage based on live weight from 30 to 40 percent. Variations in rate of gain, from 1.0 to 2.0 per day from weaning to market weight would not be too difficult. Figures on feed conversion vary from 260 to 400 pounds of feed per 100 pounds of gain. Litter weight at 56 days vary from less than 180 pounds to over 500 pounds. Variations such as these give real opportunities for selection.

The swine industry is fortunate in the fact that length, muscling, backfat thickness, litter size, and milking ability all seem compatable.

Heritability traits of swine as reported by the Regional Swine Breeding Laboratory state that swine characteristics are heritable as follows:

Length - 60%	Rate of Gain - 20%
Backfat Thickness - 50%	Feed Efficiency - 25%
Loin Area-Lean Cuts - 30%	Litter Size - 5%

To illustrate, if the 1959 spring crop of pigs in a herd averaged 28.5 inches in length and if the needed number of replacement gilts selected from this herd averaged 29.5 inches, the selection differential is one inch so far as the gilts are concerned. That is, the selected gilts average one inch longer than the average length of the crop of pigs from which they are selected. Since fewer boars than gilts are needed, the selection differential on boars is usually greater than that obtainable on gilts. In this case, let us say that a 30.0 inch boar is obtained ...selection differential 1.5 inches. Since the influence of the sire and dam is equal, the average selection differential is 1 + 1.5 = 2.5 ÷ 2 = 1.25. If the heritability of this characteristic is 60 percent, as indicated above, the expected genetic improvement in length would be .75 (1.25 x .60 = .75).

You will note that the factors influencing carcass merit have a relatively high rate of heritability while litter size improvement comes rather slow. In any swine improvement program, it is most important that the swine breeder has as many records available on his animals as possible such as weaning and 180-day weight, backfat probes, and carcass information. The words "swine breeder" refer to the commercial producers raising crossbred hogs as well as the purebred breeder supplying the herd sires.

Certification

1. 8 pigs raised

   A. Minimum weight at 21, 35 or 56 days

	21 days	35 days	56 days
Gilts	95#	140#	275#
Sows	105#	165#	320#

2. 2 pigs submitted for slaughter that weigh 200 pounds or more at 180 days. Pigs must be submitted between 180 and 230 pounds.

Weight	Loin Area	Length	Backfat
180-200	3.50	28.5-32.0"	1.0-1.6"
201-215	3.75	29.0-32.5"	1.1-1.65"
216-230	4.00	29.5-33.0"	1.2-1.7"

3. Pigs are weighed off truck, ear notches checked, and each pig tattooed individually. Loin area is calculated with a planimeter from tracing taken at 10th rib.

4. If litter makes pig raised and weight requirements, weight for age, and carcass minimum requirements, it is called a certified litter.

5. A boar that sires five litters which qualify as certified litters is called a certified meat sire. Not over two litters can be from full sisters or daughter dam combinations.

Boar Testing Stations - Iowa System

Minimum Standards

Index	over 100
Feed Efficiency	3.25 lbs. feed/lbs. gain or less
Rate of Gain	over 1.6 lbs./day
Backfat Thickness	1.4 maximum

A sample index is given for the following boar:

Rate of Gain	2 lbs./day
Feed Efficiency	3 lbs. feed/lb. gain
Backfat Thickness	1 inch

They multiply rate of gain by 50 (2 x 50); feed efficiency by 50 (3 x 50); and backfat thickness by 50 (1 x 50). To make the index average around 100, they add the figure 240 plus the rate of gain figure (2 x 50) and subtract the efficiency figure (3 x 50) and the backfat figure (1 x 50). Thus the index is:

240 + (2 x 50) - (1 x 50) - (3 x 50) = Index
240 + 100 - 50 - 150 = Index
340 - 200 = Index
140 = Index

The carcass cutout figures are given on barrows that are full or half brothers to the sale boars. The cutout figures are not used in the index.

Encourage farmers to buy boars that have daily gains of 1.8 or more and probe less than 1.1 inches of backfat. The barrow should have over 4.0 inches of loin area and over 36.0 percent ham and loin when carcasses are chilled which will mean better than 51.0 percent lean cut.

On-The-Farm Testing

Encourage producers to ear-mark pigs, and weigh and probe their gilts. County Extension Agents or Vocational Agriculture Teachers can help them.

Gilt Requirements

1. 8 pigs raised
2. 230 pounds at 180 days
3. Probe - 1.35 or less

Goals

In checking back through our recorded swine history in this country, it becomes obvious that our goals have changed from time to time and possibly at times there are no well-defined goals.

As I interpret our present goals, we are seeking to produce a hog that is prolific, has good mothering ability and one that produces a desirable product on a minimum amount of feed. I consider a pig that is self-fed a high-energy ration will weigh 200-215 pounds at 165 days of age and will produce a pork carcass 29 to 32 inches in length, with an average backfat thickness 1.1 to 1.6 and a minimum of 3.75 square inches of loin. The yield of lean cuts should amount to 50 percent or more of the chilled carcass of 35 percent of the live weight.

These goals are the first definite set of measurable standards that have been proposed in the history of the swine industry in this country. They were established by a committee meeting with the swine secretaries some six years ago, and were incorporated in the certification program.

Goals of the Future

In all the retail pork studies with consumers, the American housewife has definitely told us she wants heavy-muscled, lean, and close-trimmed pork cuts.

We can breed hogs in 1975 that, at 200 pounds, will have 7 square inches of loin eye with 43% lean cuts based on live weight. Obviously, improved muscling in the ham and loin are the greatest importance because these cuts carry a high dollar value. As the ham and loin are improved, the shoulder will follow with this superior muscling as well as the bellies which will produce leaner bacon.

As the muscling improves, we can reduce backfat thickness to .75 of an inch. This will mean no defatting on picnics and hams as we know today. Some will say that this lean meat will lack "quality" ....that is, intermuscular fat thought to be necessary for flavor and juiciness. I'm not sure that we have to lose this intermuscular fat as we reduce backfat thickness. Then, too, we might ask how important is this characteristic?....do you know of any meat drier than cooked breast of turkey or any meat softer or more watery with less finish than an 8 or 9 week broiler?

Some of you will say that this heavy-muscled pig will present a problem with heavier cuts, and I say slaughter him at 180 pounds. Increase litter size by one pig, or market 8 pigs per litter instead of 7. Eight 180-pound pigs produce 1440 pounds per litter. Seven 200-pound pigs produce 1400 pounds. This will increase feed efficiency just as it has done in the broiler business. Some of you will say packers discount 180-pound hogs today, and I'll agree because this light hog today is the cull of the herd and not the heavy-muscled pig I'm thinking about.

There has never been a time when a young swine breeder could start with superior stock, follow a constructive program and provide a customer with production records. This breeder must do testing on his farm to improve his foundation herd as well as supply his customers with records. Carcass data should be an integral part of the information. Breeding animals found to be superior should be kept in the breeding herd as long as possible. Many good boars have been discarded before their value was evident. Year around breeding or multiple farrowing will be practiced more in the years to come. Purebred herds need to be large enough so that young boars can be used sparingly until their breeding worth as a herd sire can be determined, with the major portion of the pig crop being sired by proven boars.

You may see a top-notch breeder develop and he may have several good hog men in the locality join him as associate breeders. Cooperatively, they can do a better job and spread the overhead on a larger number of animals sold.

Artificial insemination may have a bearing on how fast we make improvement. Dr. H. L. Self of Iowa State University tells me we are about in the same place as A. I. was with dairy cattle back in 1941.

At present we can hold boar semen for about 24 hours. We cannot dilute boar semen more than about 10-12 to 1.

A field trial has been held in Wisconsin under the direction of Dr. Self on several hundred sows, and Eastern Iowa Breeders will be holding field trials this spring under Dr. Self's direction. When the results from these tests are reported more will be known about the practical application.

I believe this will mean that our top-notch boars will be used to cover a larger number of sows. Also, the small commercial man with 6 to 10 sows can have the service of a top boar. About half of the hogs produced in Iowa are on farms that farrow less than 10 sows a year.

A SOUND HEALTH PROGRAM FOR TEXAS SWINE PRODUCERS

H. E. Redmond, Professor
Veterinary Medicine & Surgery

Disease prevention methods are usually effective if certain facts about diseases of swine are known and understood. In the first place, diseases are almost always brought into a herd from some outside source. That is to say, you bring your diseases into your herd by going out and buying hogs that are either diseased or are carriers of a disease as the result of having had a disease and then being a carrier for some time after recovery. Diseases just don't develop in the thin air and in order to develop, diseases must have something in which to grow. In the case of hogs, if exposed to diseases, you may have a disease problem in many cases that will be with you as long as you are in the hog business.

From a practical standpoint, it is extremely difficult if not impossible under present methods to go into a herd of swine and select certain individuals with any assurance that you have purchased hogs that will not bring diseases into your herd. The reason that it is impossible to select hogs free of diseases is that a recovered animal often will appear normal even though he is a carrier of the disease and is capable of spreading the disease when introduced into your herd. It doesn't take a very smart man to realize the dangers involved in the simple process of making additions of breeding stock to the average herd. Any sanitation program that doesn't first take into consideration this fact is doomed to failure. All the disinfectants and drugs in the world will not help you in your disease prevention program if you do not understand this one point and make up your mind to do something about it. It is therefore, essential that the hog raiser develop a program that will fit his own individual situation and one that will at the same time prevent the introduction of diseases into the swine herd.

We will discuss some of the requirements that we think are necessary for you to consider in a disease prevention program.

Addition of Breeding Animals to the Herd

The addition of breeding stock to the herd is the most critical point to consider in any disease control program. In order to prevent disease, we must start out with animals that are free of disease. You must realize that other hog breeders are subject to the same disease problems that you are subjected to, therefore when you are out trying to buy breeders, you must be aware that it is necessary for you to use every method you can to select hogs from a herd that is healthy and as disease free as possible. I would pay particular attention to the following points:

1. Purchase breeding stock from an individual known to you to be entirely reliable and has had a good herd health record. It will take a great deal of effort on your part to seek out these individuals. Often you can contact the local veterinarian and determine whether there has been any serious disease outbreak on the farm in question. The county agent can also be of service in this connection.

2. Several states have Swine Health Certification programs in which breeding herds are given periodic examinations and certified to be free of certain diseases. These programs are generally well controlled and offer the purchaser some definite assurance of being able to purchase healthy swine.

3. A period of isolation is absolutely essential no matter from what source you purchase your breeding stock. A period of 30 to 60 days isolation for newly purchased breeding swine will likely prevent the spread of any disease that may be in the incubation stage when you purchased your hogs. It is essential to observe the isolated animals closely for any sign of sickness and great care should be exercised that you do not carry any possibly infected material from isolated pigs to your herd. Some breeders make it a practice to import only breeding boars and to keep them in isolation and hand breed sows to as to reduce to a minimum any chance of outside contact.

4. Test all breeding stock for brucellosis and leptospirosis before you complete your purchase and then retest these animals at the end of the isolation period. This procedure will prevent the introduction of an animal that may have been in the incubation stages of a disease that would not be detected by the first test. There is at present no test that will detect carrier animals that may be spreaders of virus pig pneumonia, transmissible gastroenteritis, or atrophic rhinitis. The recovered animal can transmit these diseases. It will probably be best for you to contact the local veterinarian to determine whether the herd from which you plan to make your purchase has had evidence of these diseases. In some instances it may be desirable that you have your own veterinarian look the herd over for evidence of these diseases.

5. It is also essential that you determine whether or not the animals that you purchase have been vaccinated for hog cholera and swine erysipelas. If the hogs have not been vaccinated for hog cholera, then I would vaccinate the pigs before placing them in the herd. I think it would be best to give the pigs hog cholera serum, then transport them to the farm and then if at the end of the first two weeks isolation the pigs are still normal then vaccinate using the attenuated virus vaccine and serum. My suggestion that you use serum along with your vaccine is the safe method of immunizing your pigs against hog chlera. We have seen a number of instances where the attenuated virus vaccines have been used alone when pigs were suffering from a sub-clinical disease or a disease that was mild in its effect and severe losses resulted.

If you do not vaccinate your pigs for cholera, then I would give all purchased hogs a large dose of hog cholera serum before bringing them to the farm in addition to giving them the usual period of 30 to 60 days isolation.

If the pigs you purchase are from an area where swine erysipelas is known to be present, by all means vaccinate the pigs before brining them to your farm. Bacterins or attenuated vaccines or serum should be used as the disease is not widespread in this state. The use of live culture vaccines are controlled by state officials and permission must be obtained to use this product.

Equipment

The type of equipment that you have has a great deal to do with your ability to keep your place clean and also has a great deal to do with your ability to handle a disease out-break should one occur on your hog farm. From a disease standpoint, the more concentrated set-up that you have the greater will be the chances that once a disease becomes established it will in all probability, spread unchecked through the entire herd. We know that the greater the numbers that we concentrate on a small area the greater also will be the chances that our disease problems will become acute and the greater will be the necessity for

very strict sanitary measures. Certain types of equipment are easier to clean and to keep clean, therefore, your equipment contributes to your overall sanitary program.

The type of equipment and the use you make of the equipment will largely determine whether you will be able to follow a program of sanitation. It is almost impossible to sanitize some of the dirt floors and lots that are used in hog raising in a number of places. Pasture is an excellent method of preventing concentration and the filth that so often goes along with it. This is especially true of cultivated areas. We usually think of hog lots or concentration areas as concrete slabs that are easily cleaned and can be sanitized with a minimum of cost and effort. Wooden floored hog houses lend themselves to easy cleaning and can be disinfected thoroughly when necessary.

Space is one of the greatest factors that we have when it comes to disease control. I have often seen hog raising operations concentrated on a very small area on farms where there was available plenty of good pasture land. Pasture not only furnishes a lot of the necessary nutrients that are essential for the hog but pasture furnishes them in a cheap form in addition of furnishing space that is a real factor in disease control. Where any animal operation is concentrated into a small area we find that our disease problems are greatly multiplied. There is simply a greater chance for the spread of disease from one animal to another where they are confined to a small area.

There are many types of farrowing houses that are designed to adequately care for the brood sow. Some of these farrowing houses are superior to others from a disease prevention standpoint. The ideal farrowing house as far as we are concerned, is the single type house that can be easily moved to new ground where hogs have never been. Your chances of spreading disease are greatly reduced with this system if you are careful with the traffic between the houses and particularly careful that there is adequate fencing to prevent mixing of groups of hogs.

Good adequate fencing is just as important as good housing and equipment. In fact, as far as I am concerned, I would rather skimp on housing and have good fences. These are important for several reasons. In the first place it is highly important to prevent mixing of your own hogs so that you can contain any outbreak that may occur and it is of extreme necessity that you exclude your neighbors hogs because you may be responsible for a disease outbreak at your neighbors as well as your own. This is an important source of disease.

Let us discuss the two basic systems of farrowing houses that are in use today with regard to their use in disease prevention. We think the ideal is the single house that can be moved frequently, can be cleaned adequately, and should a disease break out in one of these single units, it can be contained much easier than it can be contained in a central farrowing house. The central house can be maintained just as clean and sanitary as can the single house and in some instances can be maintained in a sanitary condition with a minimum of labor, but when it comes to the factor of disease prevention or spread, the central house is an ideal place for a highly infectious disease to spread from one litter of pigs to another in a matter of just a few hours in spite of the best efforts that you can put forth. It should be obvious to you that the greater concentration in the central farrowing house where you have a number of developing litters affords an excellent

chance for a disease to spread to all of your new crop of pigs. In the single farrowing house system it is possible, with extreme care, to prevent the disease from spreading if you use the simple safeguards that are known today. In fact, it is possible to hook on to the house and move it on the other side of the farm. This can be done with a minimum of time and effort and without too much chance of spreading the disease.

I know that some of you are concerned about the early weaning-complete confinement rearing setups that you hear a great deal about. We hear a lot less about this system at the present time and it is my opinion that we probably will hear less about it as time goes on. There is no doubt that there will be a few instances where this system can be made to work but in the majority of the cases this system has some very obvious weaknesses from a disease prevention standpoint. In the first place, when we remove any small animal from its mother before the normal weaning time and try to substitute artificial means of raising this animal, we usually wind up with a great deal of trouble in the form of nutritional difficulties and disease problems due to the fact that the small pig is highly subject to a great many infectious diseases and under the concentration methods these diseases spread to the entire group in a very short time. We think that the methods of artificially raising pigs except in a few instances is not practical. In other words, I don't think we have reached the point in our usual methods of swine husbandry where we can concentrate pigs in extremely small areas as we are doing with broilers and make a profitable business. It may be that this will be possible in the future. It was only possible with the chicken after we learned to solve our disease problems and I think that is the important limiting factor in this complete confinement system at the present time.

The point I am trying to make with regard to equipment and housing is this: use equipment and housing that makes it possible for you to effectively clean and disinfect before reuse and in planning your operation, it is greatly to your advantage to stay away from concentrating your pigs on a very small area. The old adage that "there is safety in numbers" certainly does not apply to the swine raising business and is particularly with disease control measures.

I don't mean to imply that distance and space is the answer to your disease problems at the exclusion of all others. I do say that distance and space works in your favor in a disease control program provided you are aware of the fact that diseases are almost always brought into herds by the importation of other swine that are either carriers of disease or are in clinical phases of some disease. It is much easier for you to handle an outbreak where you have semi-isolation and a considerable space to contain a disease. If your operation is crowded, your chances of working out of a disease outbreak without heavy losses are small indeed.

Workers and Visitors

You, your workers and your visitors can be a big factor in the spread of infectious agents from one place to another. The feed agent or delivery man that drives from one farm to another is capable of spreading infectious agents from one farm to another and sometimes the veterinarian may be the factor in the spread of disease if he is careless in his disposal of some of his material and is not careful about tracking material from one place to another.

You would do well to have your place well fenced and locked to prevent people from trailing through your entire operation without regard to the necessary sanitary precautions. Good fences and locks prevent man and animals from carrying infectious agents into your operation.

Your help can be a big factor in the spreading of diseases. Most help doesn't come to you trained to be aware of the hazards of diseases and are not aware of the damage that can be done by being careless about the sanitary measures that are necessary to prevent diseases. It is essential that you make your help aware of diseases and the necessary steps to prevent the spread of disease agents. It is well to provide your help with some type of footwear that can be thoroughly scrubbed with a disinfectant. It may even be wise to provide your help with coveralls so that they can be exchanged daily and be cleaned in a good antiseptic solution. These suggestions may at first appear expensive and time consuming to you but they are really not. Two or three pairs of coveralls are sufficient and a simple solution of antiseptic placed at proper places afford the help plenty of oprortunity to prevent the spread of contamination from one place to another. A good antiseptic is Roccal. This is used at the rate of one ounce to four gallons of water. This solution is very mild even to the hands and is a very effective antiseptic for scrubbing the hands, overshoes, and sterilizing the clothing. Use it liberally and along with plenty of scrubbing.

It is an especially good idea to wash your hands and boots in an antiseptic before entering each farrowing pen or feeding pen. It is a simple matter to maintain a brush and a bucket of antiseptic for this purpose.

Each pen should be thoroughly scrubbed and cleaned and disinfected after use. For this purpose you can use Kreso dip at the rate of one ounce to a gallon of water or you can scrub the place down with hot lye solution using one pound can of lye to 50 gallons of water. It is necessary to thoroughly clean and then wet the entire surface of the building with the disinfectant in order to do a satisfactory job of killing all types of disease agents.

Most disease agents do not spread very far unless taken by the infected animal or are transported by human beings on their feet. Sunlight and drying will kill most disease agents within a fairly short period of time, so if you are even across the road from your neighbor it is still possible for you to prevent infection from another farm if you can prevent animal contact and limit traffic into your hog farm. There is some danger that birds and other animals are capable of transporting disease agents but it is our thought that this method of spread is probably very minor. Recent experiments wherein disease free pigs have been maintained on farms adjacent to those with the usual diseases indicate that with the reasonable safeguards and the exclusion of outside animals makes it possible to maintain a disease free herd. This is encouraging information and offers great hope to those who make the effort to eliminate disease with the hope of maintaining a herd free of diseases.

Let me list for you some of the points that I consider to be essential to prevent the spread of diseases to your herd:

1. Most diseases are brought in in the form of a sick pig or one that is a carrier of a disease.

2. Add as few new animals to your herd as possible. Some breeders make it a practice to add only breeding males and even then keep them in isolation, hand breeding the females to prevent contact as nearly as possible.

3. When pigs are added to the herd, these animals should be subjected to a period of at least 30 to 60 days isolation.

4. Check on the herd health of the herd from which you plan to purchase your breeding stock.

5. Be sure your pigs have been immunized against the usual diseases and if possible make your purchases from a herd that has been certified to be free of certain diseases.

6. Do not concentrate your operation if it is at all possible to do otherwise. There is a certain safety factor in space if you are careful in your operation.

7. Construct and use equipment that is easily cleaned and disinfected.

8. Fence your place to prevent outside animals from bringing in infection.

9. Instruct and carry your workers through the routine of using antiseptics and make them realize the necessity of doing so. A better informed worker will go a long way in helping you solve your disease prevention problems.

I think it would be well to give you a short discussion of a program that is in the experimental stage at the present time that seems to offer considerable promise for the development of herds of swine free of certain common diseases that are responsible for the greatest losses that we suffer in the swine industry.

This program involves the removal of a litter of pigs from a sow at least two or three days before the pigs are due to be born. These pigs are removed along with the entire uterus of the sow and placed in individual sterile incubators and are never handled and even the air is filtered into and out of the incubator. These pigs do not have the usual diseases as they are removed from their mother before they can become contaminated at birth. This is possible because in the sow these disease agents are not capable of infecting the pig so long as he is in the uterus and before birth has taken place, however, as soon as he is born normally the sow transmits diseases to the pig within a very short time. The removal of the pig from the sow within the uterus makes it possible to get the pig before he becomes contaminated and then raise him in a disease free environment. After a period of development in the incubator and a brooder, the pigs can then be placed on farms where hogs have never been and maintained in a disease free state. This system of producing disease free pigs undoubtedly will develop to a point within a few years so that it will be possible for you to purchase breeding stock that is free of the usual diseases.

SWINE PARASITE PREVENTION AND CONTROL

R. D. Turk, Head
Department of Veterinary Parasitology

It must be emphasized that all parasites come from pre-existing parasites. Most disease problems are purchased. Almost without exception, every parasite that exists in swine in the United States today was introduced when the particular group were imported to their present area.

Before parasitism can build up on a place, two things are necessary. First, the parasite must be introduced and second, conditions must be such that it can be transferred to new hosts. With those two things in mind, we will get down to specific examples.

Flukes and adult tapeworms are not a problem in Texas swine. Three immature tapeworms occur in the muscles or viscera of swine. Two are immature stages of dog tapeworms. The third is the larval form of a tapeworm of man. Control is simple and effective. Do not feed raw pork or offal to dogs and keep dogs out of hog lots. In case of the human tapeworm, do not eat raw pork nor allow humans to use hog lots for latrines. Fortunately, the pork tapeworm of man is rarely found in Texas swine or people.

The roundworms are serious pests. Some eighteen species have been reported, but only four are really matters of concern.

The first, Trichinella spiralis, is transmitted to pigs through raw garbage usually, and is primarily important because of public health since it is also a parasite of man. It is rare in Texas, but a minor outbreak near Austin was recently reported to the Health Department. As with the pork tapeworm, control is simple and effective. Cook all pork well; do not feed raw garbage to swine.

Lungworms are prevalent in Texas swine. The worms produce a certain amount of mechanical irritation, but they are primarily important because they carry the virus of swine influenza. All use earthworms as intermediate hosts. Eggs are coughed up, swallowed and pass out with the droppings. They are ingested by the earthworm where they develop to the infective stage. The pig eats the earthworm, the lungworm is released and migrates to the lungs where it matures and starts another cycle. Control is difficult if pigs are allowed to range. Infected earthworms live from several months to years. However, if clean pigs are placed on clean pastures and given sufficient high quality concentrate to satisfy their protein and mineral requirements, they will be less likely to "plow the north forty" looking for earthworms, dung beetles and similar animals. There is no medicinal treatment of proven value.

Kidney worms are common in the more humid areas of the state. The adults live in the fat around the kidneys and form tunnels which connect with the kidney pelvis or ureter. Eggs pass down to the bladder and out with the urine. Eggs hatch within a few hours and develop to an infective larvae within a few days. Infection may be through the skin or by mouth. After ingestion, the larvae migrate to the liver, then across the peritoneal cavity to the kidneys. About six months is required to become adult. In other words, if a pig were infected the day it was born, it would be six months old before it would be a source of infection for other swine. Eggs and larvae are quite susceptible to sunlight, drying and freezing. They are not resistant but will live several weeks in damp, well-shaded areas.

There is no effective treatment. Control consists of introducing clean pigs and keeping them clean. When areas do become infected, removing all pigs before they are six months of age will allow the infection to die out. They can be kept within reasonable bounds by using the McLean County System as devised for Ascarid control. If care is taken in introducing clean stock, they can be prevented. They are primarily wet weather, muddy lot, mud hole infections.

Last but not least are the ascarids or common roundworms of swine. Ascarids probably are the most important parasites of swine in that they are:

1. Prevalent in every area where swine are raised.
2. Are the largest of the nematodes.
3. Dwell in the intestinal tract.
4. Lay around 200,000 eggs daily.
5. Produce an extremely thick-shelled egg that develops to the infective stage without hatching.
6. Embryonated egg is extremely resistant and may live for years.
7. Can be removed by treatment.

There are many treatments available including sodium fluoride, piperazine salts, hygromycin, cadmium salts and possibly others. There are certain advantages and disadvantages to all treatment procedures, but we feel that the piperazine salts when given in the feed work very well.

Control is much more important than treatment. Have clean sows farrow in clean houses; move to clean ground. In other words, the McLean County System or some modification of it.

BREEDING OF PIGS. PROGRESS OF PIG PROGENY TESTING IN SWEDEN AND DENMARK

Olle Dahl
Scan's Centrallaboratorium
M A L M O , Sweden

You are all familiar with the fact that the heredity properties of pigs may vary considerably. From a consumers point of view a large proportion of lean meat and a small proportion of fat is desirable. But, of course, also other properties are of importance as, for instance, rate of growth, gain in weight per feeding unit, etc.

The usual way of selecting individuals of desirable properties is the pig progeny test, in which the parents intended for breeding are tested by their offspring. Pig progeny testing started in Denmark and Sweden about 40 years ago and it has resulted in considerable improvements of carcass quality as well as rate of growth and gain of weight per feeding unit.

In the pig progeny test, as it is performed in Denmark and Sweden, the offspring from a boar and three different sows is examined. Four piglets (2 males, 2 females) from each litter are fed on a standard ration I from 15 to 50 kg (= 33 to 110 lbs.) live weight and on another ration (II) from 50 to 90 kg (110 to 199 lbs.) live weight. The compositions of these rations or concentrates are given in Table I.

Table I

Compositions of the concentrates used in pig progeny testing trials.

	Ration I for pigs from 33 to 110 lbs. live weight (Lbs.)	Ration II for pigs from 110 to 199 lbs. live weight (Lbs.)
Barley	73.0	70.0
White oats, first rate	10.0	20.0
Wheat bran	5.0	5.0
Fodder yeast	3.0	0.5
Fish meal	3.0	1.0
Soybean meal (solvent extracted)	1.5	0.5
Coconut meal	1.5	0.5
Lucerne hay meal, artificial dried	1.0	1.0
Ground limestone	1.5	0.8
Dicalciumphosphate	0.5	0.4
Common salt	-	0.3
Total	100.0	100.0

In addition, the pigs are fed skim milk. The amounts of concentrate and skim milk fed during the rearing period are evident from Table II.

Table II

Amounts of concentrate and skim milk fed during the rearing period per pig and day.

Live weight, lbs.	Concentrate, lbs.	Skim milk, lbs.
	Ration I	
33	1.41	2.2
44	1.67	3.3
55	2.20	3.3
66	2.73	3.3
77	3.37	3.3
88	4.08	3.3
99	4.50	3.3
110	4.87	3.3
	Ration II	
121	5.37	3.3
132	5.75	3.3
143	6.10	3.3
154	6.38	3.3
165	6.75	2.2
176	6.98	2.2
187	7.13	2.2
199	7.40	2.2

The pigs are slaughtered and the length of carcass, average thickness of back fat and belly, distribution of fat in the back line, and meatiness are measured. For approval of a boar for breeding purposes the maximum or minimum requirements contained in Table III must be fulfilled. The figures are averages for the three groups of offspring. For approval of a sow for breeding purposes testing of one group is sufficient. The requirements are the same as those given in Table III. In this table the average results attained in Sweden during the year 1958 are also indicated both for the Landrace, which is predominating, and for the Large White breed.

Table III

Max. or min. requirements in pig progeny testing along with results for the year 1958 for the average group results of boars.
For all classifications an ascending scale from 9 to 15 points has been applied.

Characteristics	Require-ments	Results 1958	
		Swedish Landrace	Large White
Age at slaughter (=199 lbs), days	max. 190	171	172
Length of carcass, cm	min. 93 (=3 feet, 0.5 in.)	95.1	94.8
Average thickness of back fat	max. 32 mm (= 1.26 in.)	31.5	31.7
Distribution of fat in the back line, points	min. 12	12.5	12.9
Meatiness, points	min. 12	12.5	12.5

In practice each pig to be tested is weighed every week during the rearing period and the results are plotted on a diagram with a normal weight curve printed on it just for comparison.

After killing at a live weight of 90 kg (= 199 lbs) the thickness of the back fat is measured at the shoulder, at the middle of the back and at the lumbar region. In addition, the thickness of the belly is measured at three locations. In fact, when measuring the back fat, three measurements are made at the lumbar region and from these the average is calculated. Finally, an average is calculated from the measurements at the shoulder, the middle of the back fat and the lumbar region. Other measurements refer to "slight of lean", "inside fat", area of the eye muscle and thickness and length of the belly muscles. These measurements are combined to give a figure for points of meatiness. In doing so all the characteristics mentioned are attributed equal importance. All these measurements are made on a cut across the body close to the last rib. "Slight of lean" is the measure for three different carcass qualities. This characteristic is inversely related to the area of the eye muscle. "Inside fat" means the fat between the eye muscle and the adjoining ends of the belly muscles. Also an estimation of the distribution of the fat is made. The length of the carcass is measured from the aitch bone to the atlas joint. The short length measurement determined by measuring from the aitch bone to the bottom of the first rib is no longer in use.

Now let us see some practical results of selection of parents according to the pig progeny test. During the years 1926 through 1958 the thickness of the back fat has progressively decreased from 41 mm (= 1.6 inches) to 30 mm (= 1.2 inches). The thickness of the belly has, however, been practically constant. During the same period the length of the carcass has increased from 88 cm (2 feet and 10.5 inches) to 94½ cm (3 feet and 1 inch). Thus, there is an inverse relationship between thickness of back fat and length of carcass. This is one of the most outstanding results. On the other hand, it has been shown that meatiness increases with the length of the carcass. Because of these facts the length of the carcass is evidently a very important measurement. Moreover, during the 32-year period the average daily gain in weight increased 10%, from 623 grams (1.38 lbs.) to 685 grams (1.51 lbs.), while the feeding units required per lb. gain of weight decreased 14%. All these data clearly demonstrate the usefulness of the pig progeny testing.

We must not forget, however, that in the progeny testing the animals are fed standard ration. In practice that should be done, too, but as you know it is not always the case. If you feed pigs on an excess of cereals (corn, barley, oats, sorghum) they will grow fat even if their parents have a heredity for thin back fat and good meatiness. It has been told me that feeding is responsible for 3/4 of the result and heredity for just 1/4. I think there is much of truth in these figures. Therefore, it is very important not to overfeed the pigs with cereals. As a rule a total of about 250 kg (550 lbs) of cereals to each pig should not be exceeded when raising 40-45 lbs. piglets to a live weight of 200 lbs. It is, however, very important that the pigs get a sufficient amount of supplementary high quality protein. Table IV shows the results with regard to growth and carcass quality when pigs are fed on various amounts of protein.

Table IV

Influence of various amounts of high quality protein on growth and carcass characteristics.

Supplementary protein per day per pig, grams	32	64	96
" " " " " ", ounces	1.13	2.25	3.40
Corresponding amounts of skim milk, kg.	1	2	3
" " " " ", lbs.	2.2	4.4	6.6
Feeding units per day per pig	1.99	2.01	2.01
Average daily gain in weight, lbs.	1.16	1.27	1.31
Feeding units per lb. of growth	1.71	1.58	1.54
Weight of leaf fat, lbs.	4.10	3.76	3.45
Thickness of back fat, inches	1.41	1.31	1.28
Points for hams	12.1	12.3	12.5
Points for meatiness	11.9	12.6	12.7

According to Table IV an average quantity of 80 grams (ca. 3 ounces) of supplementary high quality protein, corresponding to 2.5 kg (= 5.5 lbs.) skim milk, is adequate. The high quality protein is preferably supplied by skim milk, but also meat meal or fish meal could be used. It should be remembered, however, that fish meal ought to be low in fat (max. 5%); otherwise the pig fat will get a fishy taste, soft consistency and reduced keeping qualities. Also garbage, fed in large quantities, will yield a similar, low quality pig fat.

Finally, Table V shows an example of the prices in ore per kg dressed weight paid in Sweden for pigs of different grades. For instance, the best grade ("expr", thickness of back fat max. 24.9 mm = 0.98 inch) is paid 405 ore per kg and the lowest grade ("III", back fat thicker than 34.9 mm = 1.37 inches) is paid 310 ore per kg within the weight group 60 to 63½ kg. As also seen from Table V about 88% of the carcasses are graded "expr" and "I", i.e. this percentage of the carcasses has a thickness of back fat equal to or below 28.9 mm (= 1.13 inches) in the middle of the back.

Table V

Prices in öre per kg dressed weight for pigs. January 18-23, 1960.

Grade	35-49½ kg	50-54½ kg	55-59½ kg	60-63½ kg	64-67½ kg	68-72½ kg	73-79½ kg	80-89½ kg	90 kg
Expr	-	-	400	405	395	380	365	340	335
I	320	360	385	390	380	365	350	330	320
II	295	340	345	345	335	325	320	310	305
III	265	300	310	310	305	300	300	290	285

Grade	Max. thickness of back fat, mm (middle)	Per cent of carcasses of diff. grades, 1957 60 kg	60-67½ kg	68-72½ kg	73-79½ kg	79½ kg	Total
Expr	24.9	18	54.5	19.5	6.5	1.5	48
I	28.9	30.5	23.5	19	16.5	10.5	39.5
II	34.9	3.5	30.5	30.5	23.5	12	9
III	34.9	2	14.5	22.5	28	33	3.5

REPRODUCTION IN SWINE

A. M. Sorensen, Jr.
Associate Professor
Department of Animal Husbandry

Do you realize that 56 percent of the eggs produced by the female are lost due to non-fertilization or embryonic death between the time of ovulation and the time young pigs are born? Also, 36 percent of the matings are infertile and 22 percent of the animals that are mated fail to conceive. On the average therefore, about one-fifth of our gilts and sows fail to produce litters.

I would like to discuss some of these sources of infertility. First, I would like to discuss the age at puberty or the age at which the gilt reaches sexual maturity and will accept the boar. This age falls usually between 201 and 230 days or 6 1/2 to 8 months. In order to farrow pigs at one year of age, gilts should be bred at approximately 250 days of age. Therefore, we see that most of our gilts do reach puberty prior to the time at which they would be bred for farrowing at one year of age. We do find some deviations from this, however, and one of the reasons for that deviation is the period during the year in which the pigs are born. Pigs that are born in the winter and early spring months tend to be older at puberty by approximately one heat period or 21 days. This may have economic value to the swine producer in his breeding program although it is not too critical because if we grow our pigs out on a good ration and put weight on them rapidly we usually find they will reach maturity at an earlier age than normal.

The greater the weight of the pig the earlier the animal will reach puberty in most instances. This is usually associated with the level of nutrition that the animal receives and the higher the level of nutrition the earlier the animal will reach puberty. If the animals are grown out on a normal level of nutrition and then put on a higher level of nutrition for a short period of time puberty will probably not be advanced any. Along with this increased level of nutrition is another factor that should be considered and this is laying on of fat. Animals that tend to become fat also tend to postpone the initial onset of estrous or heat. Animals that are in a growing condition, that is, they are growing muscle and bone as well as laying on some fat are in better condition than those animals that mature early and begin laying on fat. Animal proteins or milk tend to hasten puberty over strictly vegetable diets.

Ovulation rate and embryo survival increase with age and this may be set up on the basis of each additional ten days of age will equal about one-half more pig. This is only true for a limited number of estrous periods, but the increase is due to more ova being shed and due to increased livability of embryos. As the animal becomes older through three or four estrous periods we can expect gains such as this although it will not be maintained over a longer period of time. Animals that are kept for prolonged cycles will usually give fewer pigs at the first farrowing time. The ovulation rate generally increases from the first to the second heat period from one to two more eggs. This means that there is a possibility of getting one or two more pigs from animals bred at the second heat period compared to those bred at the first heat period.

Our research has shown that the best method of feeding the breeding herd is to carry them on a limited ration, that is about two-thirds of what they would eat if they were on free choice rations, until they reach puberty. Then the animal should be put on a self-feeder and about a 14 percent protein ration until they

are bred at the second heat period. Then the pig should be returned to the limited ration after the breeding and as a result of this three weeks of flushing from first heat period until the second heat period one should expect an additional one or two pigs per litter. This management practice will pay off in most of our herds as a result of increase nutritive level at the time in the gilt's life when she will be growing and producing more eggs. It has definitely been proven that the animals on a higher level of nutrition will produce more eggs to be fertilized. However, we have also found that there is greater livability of these fertilized eggs in the pigs that are on limited rations. Therein lies the reasoning behind holding the animals on a limited ration and then flushing just before breeding and following breeding with a limited ration.

Ovulation, or the shedding of eggs, occurs approximately one and one-half days after the onset of heat and heat generally lasts from one to five days. We have found in our experimental animals here at the College that in the warm summer months we can expect a gilt to stay in heat only one day. Ovulation does occur during that time and we have found our best results come through the breeding of the animals when we notice them in heat. Sperm live in the sow's reproductive tract twenty-four to forty-eight hours and it only takes a few minutes for them to get up to the oviduct to fertilize the eggs. The boar deposits the semen partially in the cervix of the sow and partially in the vagina and seals this with a gelatinous plug so that very little sperm is lost to the outside. Generally, fertilization is high. It ranges somewhere between 82 and 96 percent. This means that if we could expect all of the eggs that are fertilized to yield us live pigs we would certainly be knee deep in pigs at the time of farrowing. However, this is not true and we find that of these fertilized eggs approximately 20 percent of them are not present as living embryos 25 days after the animal is bred and an additional 15 percent are lost in the next 15 days up to 40 days of age. From here on we find that there is very little if any decrease in the number of pigs present in the sow's uterus. There is still a great deal of question as to why this high mortality occurs during the early stages of gestation and we here at the College are trying to find out some of the reasons for that. We do know that there is a female sex hormone called progesterone which is produced by the corpus luteum or yellow body present on the ovary that causes maintenance of pregnancy in the sow. We also know that there is a low level of progesterone in the animal's body at about the same time that we notice the greatest decrease in live embryos. We are conducting research at the present time whereby we are injecting progesterone into pregnant animals at the time of breeding and seven days after breeding. At the present time we are still in the exploratory phase of this, however, we have been able to increase the pig crop considerable with an injection at seven days after breeding. Theoretically this progesterone is holding up the level during the time that the fetus is being attached to the wall of the uterus to receive its nutrient supply. The progesterone is necessary to supply those nutrients from the uterine wall and feed the developing embryo as well as keeping the uterus in a quiet, receptive condition. There was an increase of 13 percent survival in the injected group over the control group which means approximately one more pig per litter when progesterone was injected in the bred animals. We are continuing in this experiment searching for the optimum dose level and the optimum period of injection.

There are numerous things that can interfere with fertility in the animal and we find that a great deal of the trouble lies in the fact that our females are abnormal in some manner as far as their internal reproductive organs are concerned. In repeat breeder animals, that is animals that have come back into heat to be

rebred, research on over 400 females has shown that there are bilateral barriers in 50 percent of the gilts and 16 percent of the sows. There were unilateral barriers in 14 percent of the gilts and 16 percent of the sows. These barriers refer to some type of abnormality in the reproductive tract such as a plugging of the oviduct which would keep the sperm from going up to meet the egg or keep the egg from coming into the uterus for implantation. It also includes cystic ovaries which may occur in our animals without known reason and also includes missing parts of the tract. It is not uncommon to follow swine across the killing floor and examine the reproductive organs and find that a portion of it is missing. It is rather common to find that one horn of the uterus is not connected to the cervix so that the sperm could only go up one horn of the uterus and fertilize the eggs that are shed by a single ovary.

It is generally assumed that double mating of our females will increase the size of our pig crop and it has been proven in our research that an increase of approximately 2 pigs or 18 percent can be brought about by double mating. Usually double mating refers to using two different boars in our commercial herds or rebreeding the same boar to a gilt on subsequent days. In this way we do get a greater concentration of sperm cells in the reproductive tract although some people doubt that this concentration is needed. Rather than a concentration it may be a freshness of the semen in the reproductive tract at the time of ovulation. The boar is little different from the sow in his reaction at puberty. Usually he attains puberty at a little earlier stage although again the attainment of puberty is based a good deal on weight for age. It seems that in all of our livestock that the better grown out animals will reach puberty at an earlier age and thereby show a greater physiological age although they are younger. During the act of copulation the boar produces approximately 200 cubic centimeters of semen with a concentration of one hundred million sperm cells per cubic centimeter. Usually it takes from 5 to 30 minutes for the boar to complete the act of copulation and this means that he will deposit in the neighborhood of 20 billion sperm cells in the reproductive tract of the sow. The sow's tract is roughly four to five feet long and this semen will spread out in the sow's tract shortly after coitus and reach into the upper regions of the oviduct to fertilize the egg.

Another source of infertility is the failure of the animals to show any sign of estrous of libido, which is the sexual urge. In animals such as this the best thing to do is put them with your market animals and get rid of them. The injection of hormones will bring about estrous, but usually the cost of the treatment is more than the animal is worth. A single injection of the estrogenic hormone will bring the animal in heat but she should not be expected to breed satisfactorily at that heat period. It would be necessary to wait until the second heat period which would be a normal one.

Probably the main disease that interfers with reproduction is Brucellosis. This disease results in a very high percent embryonic death which will reach as high as 100 percent but generally runs around 85 percent. In many instances the entire pig crop will be lost through this disease and certainly animals that are tested and found to have Brucellosis should be removed from the herd immediately.

The over use of boars often results in infertility. It takes approximately two weeks for a boar to mature the sperm that are present in the testes so that they will be capable of fertilization. We are not sure of the concentration of sperm cells in the boar's reproductive tract, but we do know that continued heavy use can deplete the supply of the mature sperm cells and the immature sperm cells

are not capable of fertilization to the extent of the mature ones. I dare say that most of us try to use a boar heavier than optimum conditions would allow. Young boars, that is boars that are under one year of age should be limited to one service per day and should not be bred over 25 services per season. Useage such as this will give the animal a chance to mature physically and strengthen himself for future services. A mature boar or one that is over one year of age can be used about twice as heavily as a young boar. Two services per day should generally be enough and approximately 50 services per season. I know that many of you are using a boar heavier than this and I have observed on many farms the use of a boar three and four times a day continually for the breeding season of three or four weeks. Certainly we cannot expect as high fertility and as many pigs from this heavy useage.

I have not stressed the nutrition picture as much as maybe I should concerning our vitamins and minerals. The main vitamin that we should be concerned with is Vitamin A. There is very little concern here if the breeding herd is kept on pasture where they have access to green forage because there is sufficient amount in our green forage to supply the Vitamin A needs of animals, however, if animals are kept under close conditions and are not allowed to range on pasture then Vitamin A should be added to the ration. The simplest method of getting Vitamin A as well as our B complex vitamins, which are also playing a part in reproduction is through the addition of green alfalfa leaf meal. This ground green alfalfa should make up from 10 to 20 percent of a ration and in this amount will supply adequately the needs of our breeding stock. The mineral calcium is important during pregnancy for the building of bones of the young developing embryos. Calcium and phosphorus are essential for the growth of the bone and animals that are deficient will show a rough, scaly skin and appear dirty. Periodically they will go off their feet and turn their legs inward which is a characteristic sign of rickets. A deficiency of calcium in addition to affecting the bone development of the embryos will also affect the let down of milk and the presence of milk in the sow. Calcium should be present in the ration with a minimum concentration of .59 percent. Iodine is also essential in reproduction in that it is needed for the development of the normal embryo and a most common sign of iodine deficiency is shown by pigs being born hairless and dead. This trace mineral can be added in as small an amount as 1 to 2 grains of potassium iodide weekly during the last three-fourths of the gestation period.

As you can see the reproductive picture is certainly affected by a number of different factors which I have tried to enumerate here for you. These include not only the physiological developments of the male and female, but the normal development of the anatomy as well. In addition to this we must carry our animals through diseases and supply adequate nutrition and sanitation at all times for the best development of our swine herd. Without baby pigs on the ground we cannot carry on a swine program.

CARE AND MANAGEMENT FROM FARROWING TO WEANING

Bernard W. Ebbing
Livestock Service Department
Rath Packing Company
Waterloo, Iowa

Management is the skill of putting the various parts of production together into a profitable enterprise.

I believe in the next 10 years we will see less people raising hogs, but those that are in business will be producing more hogs with much more capital and labor invested. When this is put on a 100 pounds of pork basis, it will mean less capital and labor per unit turned out.

It is my personal feeling that we will see an increasing number of producers raising 500 to 1,000 hogs a year. These producers will be using more concrete and confinement in raising of hogs.

I also believe that we are going to see a great change in the methods of handling swine feeds. We are seeing auger wagons in Iowa, we are seeing grain banks and bulk feed delivery coming into the swine business. Farmers deliver 3,000 bushels of corn and 1,000 bushels of oats to the local elevator and deposit them. He sets up rations with the elevator man based on the latest swine nutrition research furnished him by the University or his Feed Dealer. On a given day, the farmer calls the elevator and says, "I want 2 ton of gestation ration, 2 ton of lactating ration, 1 ton of growing ration, and 5 ton of finishing ration." The elevator operator mixes the various rations, puts them in the compartments of his 12-ton bulk truck and delivers them to the farm, where they are put in the respective self-feeders. He charges the grain used in these rations against the grain the farmer has banked earlier in the year. This elevator is charging, in most cases, less than a portable mill because he is selling the supplement. The farmer isn't spending a day getting lined up to grind and mix feed.

Management requires day-by-day and hour-by-hour decisions. No two sows farrow the same. No two sows milk the same. No two litters respond exactly the same, so the eye of the master is still very important. Our nutritionists have been of great help to us in developing top-notch swine rations. I am going to outline a few of the points I like to practice.

1) Blood test for brucellosis and leptospirosis on animals coming into the herd, and follow with another test in 30 days. Test for both of these diseases following lactation or when gilts are added to the breeding herd.

2) Vaccinate all animals for leptospirosis and erysipelas prior to breeding and give booster shots prior to rebreeding.

3) Don't breed gilts until 8 months of age. Breed 20 percent more gilts than you want to farrow during a given period (80 percent conception on single service is good. In hot weather it will be less.) Feed these gilts a 16% well-balanced protein ration two weeks prior to breeding.

4) Spray all breeding animals every three months with lindane for control of external parasites whether they need it or not.

5) Worm sows with piperazine at about 60 to 70 days of pregnancy.

6) After the gilts are bred, put them on pasture. You can hand feed about 6 pounds of a 16% protein ration a day to these gilts and sows during pregnancy and save 10 to 15 cents a day in your feed costs.

7) Three weeks before these gilts start farrowing, use a high-energy ration with 16% protein self-fed. These gilts, if they are the right kind to start with, will be weighing 400 pounds at a year of age when farrowing.

8) As the gilts farrow, use 300 pounds of bran in the ration with a 14% protein level for the first 4 or 5 days. I believe 5 pounds of Aurofac 10 per ton will be a big help in this ration (50 gm).

9) At birth, clip needle teeth, cut navels to one-half inch, ear notch, and disinfect both ears and navel.

10) Consider the use of 5 cc. mixture of hog cholera serum, erysipelas serum, and mixed bactrin for these baby pigs when they are 12 hours old.

11) Give injectable iron shots when pigs are four days old. Where pigs are on concrete, it may pay to give an additional iron injection at 3 weeks of age.

12) Castrate pigs at 10 to 14 days of age and take care of ruptures and originals at this time. Failures in surgery at this age are less costly and pigs respond much faster.

13) Don't bunch sows till pigs are 10 to 14 days old.

14) Vaccinate for hog cholera and erysipelas when pigs are about 5 weeks old.

15) Make a 15% protein ration for these lactating sows that is well-balanced with vitamins and minerals. I believe sows on confinement need more trace minerals than most of us have been accustomed to putting in the ration.

16) Most of us are dependent on a reliable feed manufacturer to supply us with a good pelleted creep ration. We have noticed that pigs on good milking sows that are being full fed are consuming very little creep starter before 4 weeks of age. We also know it pays to give these pigs additional iron injections.

17) These pigs are left on an 18% pig starter until 35 to 50 pounds, then shifted onto a complete well-balanced growing ration of 16% protein until they reach 75 pounds.

18) I don't see any advantage to weaning pigs before they are 5½ to 6½ weeks old. If you wean earlier I believe you will have some problems settling your sows for rebreeding. A sow's milk production drops off rather rapidly after six weeks of lactation.

19) There are always new problems....for instance, what's the answer to tail biting?

I would definitely encourage good swine producers to multiple farrow, with two sets of sows farrowing....say in December, March, June, September. This will mean they will market hogs about 8 times a year, they are a better credit risk at the bank, they are using their facilities on a year-round basis, and are cutting their overhead costs, plus furnishing pork to 175 million people on a year-round basis.

FEEDING THE BREEDING HERD

Fred Hale
Professor in Charge of Swine
Department of Animal Husbandry

There are many formulated rations that are successfully fed to the swine breeding herd. No one mixture is best under all conditions.

In planning a feeding program for the breeding herd, I am convinced that one should start with good green pastures and with a lay-out that is suited for proper rotation to take care of parasites, soil-born diseases, and a succession of growing green pasture crops. Pasture crops furnish an economical method and a very practical way to provide the brood sows and boars with exercise, sunshine, vitamins, high-quality protein, and unknown nutritional factors all of which help to keep the muscular tone and physiological functions of the brood sows body in a normal healthy condition.

All farm grains (except yellow corn) are deficient in Vitamin A potency. One acre of alfalfa pasture yielding only 1 ton of alfalfa hay would require about 4 tons of fresh green alfalfa. This one acre of green alfalfa pasture based on a conservative 24 milligrams of Vitamin A potency per pound will furnish $44.16 worth of Vitamin A. This figure is obtained where the selling price of one million units of crystalline Vitamin A acetate is 23 cents. Also one could figure the value of the B-Complex Vitamins, the protein, the minerals and unknowns furnished by good green forage crops for the breeding herd. In addition to supplying these vitamins and other nutrients, these green pastures have a certain value as appetizers, and conditioners. They tend to stimulate the appetite of the brood sows and to regulate their digestion so that they have a healthy, thrifty appearance not altogether accounted for by the nutrients in the ration.

The ingredients for the grain mixture should be selected to furnish the nutrients for the sows according to pasture or dry lot conditions and to method of feeding.

The following mixture will give good results: Mixture 1

Ingredient	Pounds
Ground milo (9% C.P.)	50.0
Ground oats	13.0
Wheat standard shorts	14.0
Green dehydrated alfalfa leaf meal (17% C.P.)	12.0
Meat scraps (50% C.P.)	5.0
Soybean Oil meal (44% C.P.)	5.0
Ground limestone	0.5
Salt	0.5
C. P. = 15.0% TOTAL	100.0

The above 15% C. P. mixture is for handfeeding when green pasture is not available. When plenty of green pasture is furnished one can replace the alfalfa meal with ground milo and reduce the meat scraps and soybean meal.

The pasture ration would then contain the following feeds: Mixture 2

Ingredient	Pounds
Ground Milo (9% C.P.)	64.0
Ground oats	13.0
Wheat standard shorts	14.0
Meat Scraps (50% C. P.)	4.0
Soybean oil meal (44% C. P.)	4.0
Ground limestone	.5
Salt	.5
C. P. = 13.3% TOTAL	100.0

As a thumb rule one can feed 6 pounds of ration 1 (dry lot) per sow per day for either bred sows or gilts. One can raise or lower this amount to take care of the condition and gains of the sows. These mixtures can be fed to the herd boars also. Between breeding seasons the boars will need about 6 pounds of the mixture per head per day as a guide. Raise or lower this amount according to the condition of the boar. Three weeks before breeding season raise the boars feed to what he will clean up in a thick slop in 15 to 20 minutes twice per day.

These feed mixtures are for hand-feeding. There are a few hog producers who self-feed their bred sows or gilts. It takes a very bulky ration for self-feeding. Hand-feeding takes less feed than does self-feeding. With a herd of 30 sows one could save enough feed by hand-feeding in one gestation period to feed out 10 pigs from weaning to a market weight of 200 pounds each.

Water

Bred sows and gilts require a minimum of 1 gallon of water per head daily during gestation, while a sow and litter will need 5 to 6 gallons of water daily during the lactation period. More water is required in summer.

Gains During Gestation

Gilts in good breeding condition when bred should be fed to gain about 100 to 125 pounds during the gestation period. This will support both the growth of the gilt and her developing litter and furnish reserves for the lactation period. Mature sows should be fed to gain from 75 to 100 pounds during the gestation period. Thin sows at breeding time or small gilts can be fed to make larger gains during the gestation period. These recommendations should be changed according to the condition of the sow or gilt.

Breeding Season

Many things are responsible for the number of pigs farrowed. A sow can be fed a deficient ration and farrow a large litter. Of course this cannot be kept up for a second or third litter. This fact brings to our attention, however, that there are certain critical periods during which the ration of the sow should be of a quality and quantity to meet basic reproduction needs. One of these critical periods is before breeding. At this time the quality of the ration is important. The sow or gilt at this time should not be fat, but in a smooth, lean breeding condition, and fed so that she is gaining in weight. This is

sometimes called flushing or conditioning. The first 30 days after the sow is bred is also a critical period for the developing embryo litter. Feed a high-quality ration at this time in the amount of 4 to 6 pounds per sow or gilt daily. The last 4 weeks of the gestation period is when the developing litter is making its greatest growth. Therefore, the ration can be raised so the sow or gilt will be getting 7 to 8 pounds per head daily during the last 5 weeks of the gestation period.

Supplements

A good protein supplement well fortified with minerals, vitamins and high-quality protein from a good feed manufacturer can be purchased to mix with home-grown grain if desired. A commercial vitamin B_{12} feed supplement can also be purchased from one's feed manufacturer and added to his ration to furnish about 6 or 8 milligrams of Vitamin B_{12} per ton of total ration.

The Protein supplements in the following table are examples of many that can be formulated for the breeding herd:

	Pounds	
Ingredients	Pasture Suppl.	Drylot Suppl.
Meat scraps (50% C. P.)	25.0	25.0
Soybean meal (44% C. P.)	59.0	44.0
Cottonseed meal (41% C. P.)	10.0	10.0
Alf. leaf meal, dehy. (17% C. P.)	----	16.0
Ground limestone	4.0	3.0
Trace-mineral salt (zinc)	2.0	2.0
Antibiotic Supplement	5.0 Grams	5.0 Grams
Crude Protein %	42.50	38.60
Calcium %	4.00	3.89
Phosphorus %	1.56	1.51

Eighty-two pounds of ground milo mixed with 18 pounds of the above pasture supplement mixture will give a complete mixture with 15 per cent crude protein. It will require 20 pounds of the dry lot supplement mixed with 80 pounds of ground milo to give a mixture with 15 per cent crude protein.

In the winter or in weeks of cloudy days where the sows cannot get some sunshine one can add one-half ounce of irradiated yeast (9,000 international units of Vitamin D per gram) to each ton of the protein supplement to furnish Vitamin D.

By adding a B-Vitamin pre-mix (obtained from your feed dealer) to the above supplements to furnish 5 grams of riboflavin, 10 grams of Pantothenic Acid and 25 grams of Niacin per ton of supplement one can increase the natural B-Vitamin content of the supplement to a higher level.

Immediately before and after farrowing (about 4 days before and 4 days after) the sow's ration should be made more laxative and the amount fed per day should be reduced to 4 or 5 pounds per sow. By adding 30 to 40 per cent wheat bran to the sow's regular ration, one will have the laxative ration needed at this time.

The adequate feeding and management of bred sows and gilts during the gestation period will result in more profit only if one can keep his herd free of parasites and disease.

BOAR TEST RESULTS
1959 - 1960

No.	Name	Birth	NF	NW	No. Teats	Sire	Dam	Breed	Day age 200 lb.	Gain	Eff.	Probe	Slaughter Pigs Ln.	BF in.	LE sq. in.	LC %	Sex	Index
1	J. C. Eckert Mason, Texas	9/10	12	10	12	Su Linda's Sensation 802281	Min Bee 1st 1938102	H	145	2.13	2.79	1.06	28.8 28.3	1.42 1.36	4.78 4.51	37.3 41.8	G G	153.0
2	Texas A. & M. College Station	9/26	8	8	14	L.G.B. Lone Star Turk 163N 244340	Tam Lady Hawk 9N 243605	Y	138	2.30	2.64	1.15	30.3 29.9	1.57 1.63	3.55 3.58	35.3 37.3	B B	152.7
3	Texas A. & M. College Station	9/24	10	10	14	L.G.B. Lone Star Turk 163N 244340	Tam Queen Hawk 7N 243603	Y	169	1.63	2.74	0.85	30.7 31.1	1.36 1.20	3.38 3.96	39.3 39.2	G B	150.7
4	Texas A. & M. College Station	9/26	8	8	11	L.G.B. Lone Star Turk 163N 244340	Tam Lady Hawk 9N 243605	Y	156	1.85	2.64	1.01	30.3 29.9	1.57 1.63	3.55 3.58	35.3 37.3	B B	147.4
5	Lester Glass Miles, Texas	8/3	13	12	12	Gil Rink Turk	L.E.B. Molington Bess	Y	137	2.08	2.74	1.08	29.5 31.2	1.68 1.55	3.96 4.06	36.3 38.9	G G	146.7
6	Texas A. & M. College Station	9/14	17	8	16	L.G.B. Lone Star Turk 163N 244340	Jay Hawk Queen 70M 210206	Y	148	1.92	2.73	1.07	29.3	1.40	3.74	37.7	B	143.8
7	Texas A. & M. College Station	9/14	17	8	14	L.G.B. Lone Star Turk 163N 244340	Jay Hawk Queen 70M 210206	Y	142	2.02	2.73	1.20	29.3	1.40	3.74	37.7	B	137.5
8	Lester Glass Miles, Texas	8/3	13	12	14	Gil Rink Turk 487M 215899	L.E.B. Molington Bess 43N 223956	Y	142	1.97	2.74	1.17	29.5 31.2	1.68 1.55	3.96 4.06	36.3 38.9	G G	136.1
9	J. C. Eckert Mason, Texas	9/10	12	10	12	Su Linda's Sensation 802281	Min Bee 1st 1938102	H	153	1.81	2.79	1.17	28.8 28.3	1.42 1.36	4.78 4.51	37.3 41.8	G G	133.5
10	J. P. Alford Waelder, Texas	9/13	13	8	10	D.K. Builder 57-9899	Maud 57-5080	L	150	1.67	2.86	1.08	30.5 29.5	1.22 1.44	3.99 3.93	39.5 36.8	G B	132.6

No.	Name	Birth	NF	NW	No. Teats	Sire	Dam	Breed	Day age 200 lb.	Gain	Eff.	Probe	Slaughter Pigs Ln.	BF in.	LE sq. in.	LC %	Sex	Index
11	J. P. Alford Waelder, Texas	9/13	13	8	14	D. K. Builder 57-9899	Maud 57-5080	L	138	1.89	2.86	1.21	30.5 29.5	1.22 1.44	3.99 3.93	39.5 36.8	G B	130.5
12	Texas A. & M. College Station	9/3	14	13	12	Lifeboy Victory 159167 (C.M.)	Macy High 467262	PC	145	2.10	2.80	1.18	26.8 27.5	1.52 1.85	4.17 4.04	36.6 34.8	B B	130.5
13	M. E. Syring Kenedy	9/26	12	10	14	Honeyboy 8-5 58-11001	Warkerfarms Daga 58-31-31966	L	147	1.85	2.78	1.20	30.7 29.0	1.45 1.32	3.98 3.82	37.4 37.1	G G	123.1
14	M. E. Syring Kenedy	9/26	12	10	16	Honeyboy 8-5 58-11001	Warkerfarms Daga 58-31-31966	L	147	1.88	2.78	1.24	30.7 29.0	1.45 1.32	3.98 3.82	37.4 37.1	G G	121.1
15	Texas A. & M. College Station	9/3	14	13	12	Lifeboy Victory 159167 (C.M.)	Macy High 467262	PC	160	1.76	2.80	1.23	26.8 27.5	1.52 1.85	4.17 4.04	36.6 34.8	B B	114.9
16	W. E. Strain Bellaire, Texas	9/17	10	10	10	B.F.H. Hightest 1 160,946 C.L.	Square D Texas Lass 1 159191	T	140	1.99	2.96	1.31	30.0 28.6	1.64 1.67	3.28 3.98	34.6 34.3	B B	111.0
	AVERAGE		12.1	9.9	12.9				147.4	1.93	2.77	1.14	29.5	1.49	3.96	37.3		135.3