

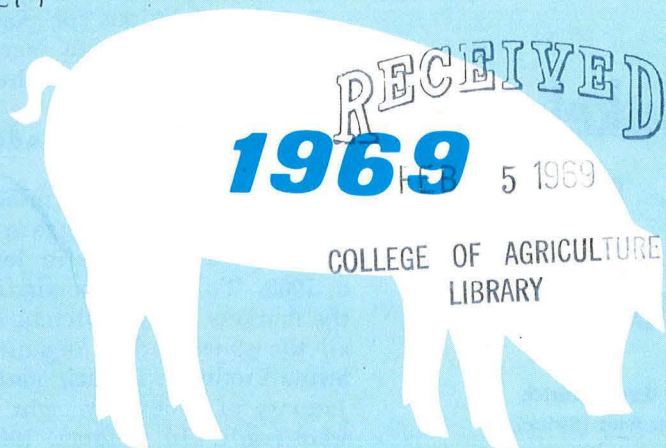
1969

EC69-219 Nebraska Swine Report

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NEBRASKA SWINE REPORT

- Marketing
- Disease Control
- Nutrition
- Reproduction
- Housing
- Meats

Prepared by the staff in Animal Science and cooperating
Departments for use in the Extension and Teaching programs

University of Nebraska College of Agriculture and Home Economics

E.F. Frolik, Dean

J.L. Adams

H.W. Ottoson

F.E. Eldridge

Director of Extension

Director, Agricultural Experiment Station

Director, Resident Instruction



Nickels For Profit Program

By Terry Schrick
Instructor (Swine)

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Issued January 1969, 9,000

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The Nickels for Profit Program was organized by swine producers to combat the decline in pork consumption per capita over the past 15 years.

Producers attending the first meeting two years ago took funds from their own pockets to start the program. Rolland Paul, then Secretary of the Iowa Pork Producers, was hired.

Questionnaires were sent to producers in 41 states asking what type of program they wanted and how they wanted this program financed.

When the questionnaires were returned and tabulated they showed that the producers wanted to establish a National Pork Producers Council. They wanted this group to be composed of and run by swine producers.

Next, producers said that they wanted to invest five cents per market hog, and that they wanted this to be a voluntary market deduction at the first point of sale.

The producers said that since the price of pork (as prices of all farm products do) revolves around supply and demand, that they wanted programs started that would sell more pork.

Under activities they wanted carried out to accomplish this producers listed these suggestions ranked in the following order:

1. Improve hog quality, leanness.
2. Improve hog marketing systems.
3. Research, action on disease.
4. Consumer education.

5. Paid advertising to consumer.
6. Standardized market grading.
7. Public relations for pork.
8. Expanding foreign markets.
9. Research on fats-health link.

10. Consumer attitude research.

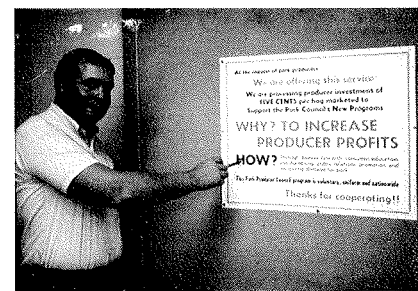
With these ideas in mind the Nickel Checkoff Program was started by a few states in January of 1968. To get the cooperation of the markets in the different states, all the states had to organize the Swine Producers in their states. In January of 1968 only eight states were ready. In October, 1968, 16 states were participating in the Nickel Checkoff Program with 25 states in some stage of organization.

In the first 10 months of the Nickels for Profit Program over six million head of swine have voluntarily had a nickel checked off. Nebraska has had over one million of this total.

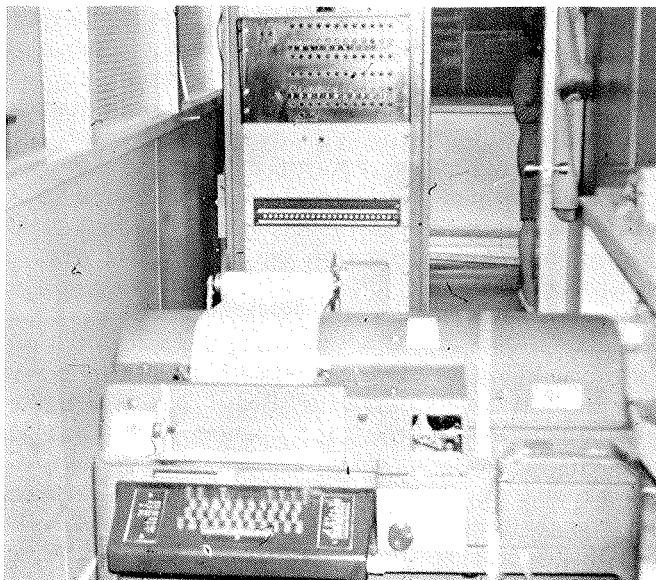
Numerous programs have been and are being carried on by the National Pork Council. Nebraska has made grants of \$1,000 to the Northeast Experiment Station and \$5,000 to the North Platte Experiment Station. Consideration is being given by the directors on a grant for research work on TGE.

Nebraska has 12 organized groups covering 44 counties with a membership of approximately 2,000. The National Pork Council has a membership of over 25,000 and is still growing.

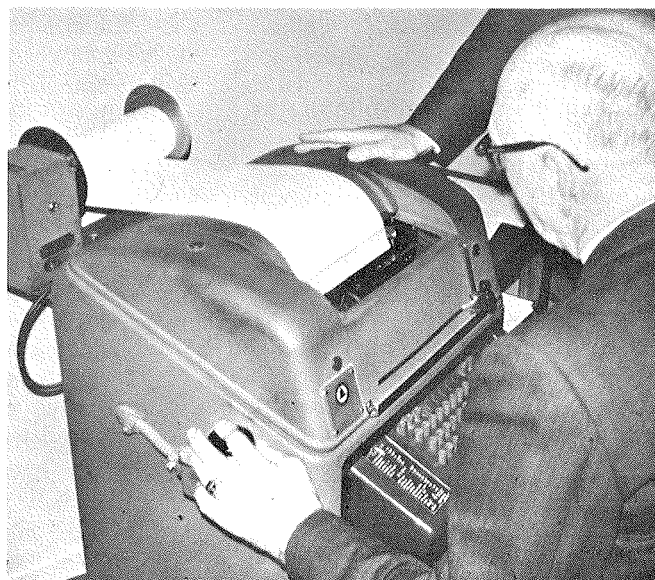
To make our state and national program complete, we hope to have every swine producer in Nebraska as a member of his local and state Swine Councils.



Dick Sorensen of Wayne, state vice president of the Nebraska Swine Council, points to the Nickels for Profit sign.



Teletype machine with broadcast repeater in background.



Buyer registers his bid by pushing button.

Teletype Marketing Program in Canada

By Leo E. Lucas

Extension Livestock Specialist (Swine)

Recently a group of Nebraska producers and this author made a trip to Toronto, Canada to view the teletype marketing program in Ontario. The following information will be a resume of this trip plus material provided by R. D. Kohler, Assistant General Manager of the Toronto Hog Producers Marketing Board.

First, let's review the history of swine marketing in Ontario, to see why the teletype marketing was developed. The basic reason for establishing this system was to market the commodity to obtain a better share of consumer dollars spent on meat and to do it in a manner where rapid sales are made efficiently and scrupulously fair to producer and processor.

In 1941, the Ontario Hog Producers Association was formed. It was not until 1945 that this association decided that something should be done toward the hog producer having a voice in the establishment of price he received for his production.

The directors of the Association, under the authority of the Farm

Products Marketing Control Act, 1937, at first tried to negotiate a minimum price with the processor with no success.

In January, 1950, Dr. Latimer of McDonald College was engaged to study the whole matter of export and domestic market conditions. His report was presented in April and one significant revelation was that marketing practices existed that denied the farmer bargaining power.

Agency Organized

In the latter part of 1952 a selling agency was organized and some bargaining advantages were realized. Up until the beginning of 1953, the Ontario Stock Yards in Toronto was the only open market to which Ontario produced hogs could be delivered and made available to different buyers.

The hogs delivered there represented about 6 to 10% of the Ontario production which meant that approximately 90 to 94% of the Ontario produced hogs were being delivered directly to processing plants, mostly by drovers and truckers. Most of these men had little knowledge of the number of

hogs to be marketed, nor knew where the demand was greatest or the market glutted. The bulk of them delivered their hogs to the same plant, week in and week out, for which loyalty they were paid so much per hog by the processor regardless of market value.

In 1955, the Ontario hog producers took over the marketing of their own hogs as a co-operative selling agency and began establishing marketing yards across the Province. This meant control of a sufficient number of hogs to influence the price to a greater extent.

No processor had enough direct deliveries to satisfy his requirements and now that the number of open market hogs had increased, the small processor was becoming a larger factor in the establishment of price. The percentage of hogs slaughtered by this group trebled in the period between 1953 and 1956. The network of marketing yards was expanded to the present total of 49.

By 1960, full compulsion was introduced, which meant that all producers marketing hogs for slaughter were compelled to mar-

(continued on next page)

Teletype Marketing

(continued from page 3)

ket their hogs through one of the marketing yards.

During the period from 1953 through 1961, the Association was faced with many criticisms by not only the packers but also some segments of the producers. During this period sales were handled almost entirely over the phone. The packer claimed that even though he bid .10, to .15¢ cwt. more for any offering of hogs they did not end up the day with extra hogs, but would have to pay the higher price for the balance of their buy that day. There were also accusations of allocation, favoritism, and lack of mechanical records to prove the hogs were sold to the highest bidder.

New Method

To counteract these reports, management began investigating other methods of sale, realizing that at some time in the future they would have to make a change. In 1958 the Bell Telephone system was contacted to see what they had to offer or suggest that would improve the situation. They came up with ideas, a form of teletype selling, recording of telephone conversations, etc., but all were far from being foolproof. For example, in the suggestion of teletype selling, if two buyers pushed their bid buttons at the same time it would have jammed the whole circuit.

It was not until the fall of 1960 that the system was developed to a point where it could be presented to the Board of Directors and to the Farm Products Marketing Board. It was accepted and went into operation in May, 1961.

Three things about Canada and particularly Ontario which affected the development of this system of teletype marketing are (1) All hogs across Canada are bought on a grade and dressed weight basis and this grading is done by the Federal Department of Agriculture, (2) The Provinces of Canada have laws which allow them to establish commodity marketing boards, and

(3) Approximately $2\frac{3}{4}$ million hogs are raised in Ontario, Canada each year.

As you can imagine, before sales are made, location and volume of hogs must be known. Each of the 49 marketing yards are strategically located in production areas, to accommodate the producers and to provide them with a marketing yard where the delivery charge would be at a minimum.

Communication with eight of the marketing yards is by T.W.X. Teletype and with the balance, by telephone. Two marketing yards operate five days a week and the balance operate from one to four days, depending upon the volume of production within the area.

The manager at the marketing yard receives all producers' hogs in the same manner. He unloads them into the yard, weighs them, tattoos them for carcass identification and pens them in lots to accommodate the capacity of the trucks available. Each marketing yard starts on its first day of operation with Lot #1 and the numbers are continued throughout the week until that particular marketing yard is closed.

As the messages are received from the managers of the marketing yards, giving the number of hogs available for sale, they are entered in a column under the yard name. A complete record of sales is also recorded there which shows the Lot number, the number of hogs in that Lot, the price at

which the hogs were sold, the time they were sold and the total sales for that marketing yard.

From this information, salesmen make up offering slips which are paper forms, showing the date, the marketing yard, the number of hogs to be offered. With this information the hogs can be sold.

Market Practice

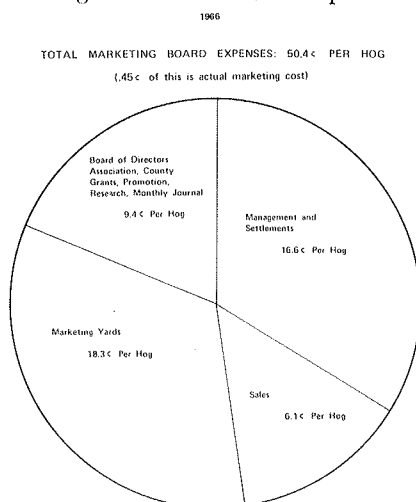
Each morning the Sales Division of the Ontario Hog Producers' Marketing Board has a meeting before the opening of the market at 9 a.m. At this meeting the marketing conditions at other terminal markets across Canada and in the United States are discussed. The price for 100 pounds of pork is determined from cut-out figures on the primal cuts and the price range and tape to be used are selected.

Tapes are available which are used on the master teletype machine to control the price range. Each tape has a one dollar range and is pre-punched to print the figures from high to low, in drops of five cent graduations until it reaches the low figure. If this point is reached without a buyer, the low figure is repeated three times, with a bell ringing between each printing, then it prints automatically "NO SALE."

The sales staff is not compelled to sell hogs below the tape limits and can withdraw the offering and offer it at another time. The control is similar to the open auction where the auctioneer says: "Going, Going, Gone." Many such tapes are on hand for all prices ranging up to \$50.00 per cwt.

If a buyer should bid within ten cents of the top of any tape, the sales staff would then instruct the operator to use a tape starting 25 cents a cwt. higher on the next offering, which means the bottom would also be higher. In this way buyers are given latitude to bid higher to get their hog requirements.

The Ontario Hog Producers' Marketing Board teletype system is unique with the exception of a similar system which has been operating in Manitoba since 1965.



Marketing Board expenses per animal.

Basically, the system is made up a master machine, the electronic broadcast repeater and 18 buying machines. The master machine looks very much like two standard teletype machines set together with a tape transmitter at its side. The broadcast repeater was designed specifically for them by the Bell Telephone Company and is about seven feet tall by two feet square.

How it Works

The buying machines look very much like a standard teletype with a large black button on the side which the buyer uses when he wishes to record a bid. Now, if you were to step into the selling office you would see the operator at the master machine and just ahead of her the broadcast repeater.

On the front of this broadcast repeater are 24 letters of the alphabet. Above each letter is an amber light and below each letter is a red light. Eighteen of these letters are actual buying circuits, six are spare loops in case of a malfunction. You would see the operator receiving an offering from one of the salesmen. She would begin typing and as she types you would notice on the front of the broadcast repeater that the amber lights are blinking, which indicates that each circuit is receiving the message simultaneously. You would also note on her copy, as the buyer does on his machine, the date being typed, the time of day, the marketing yard, the Lot number at that yard and the number of hogs in that Lot. She would then insert the price tape for the day into the transmitter and turn the key.

Basis of each sale is on "1" grade hogs and the buyer is assuming that all hogs in the Lot are "1's". He will not know how many there are until they are graded at his plant after slaughter. A price differential determines the price for the lower grades.

As the operator turns the key, this starts the typing of price over the circuit and you would notice if it was a \$30.00 tape that the \$30.00 is printed, there is a pause,

\$29.95 is printed, pause, \$29.90 price is printed, pause, and so on through the tape until one of the buyers registers a bid by pressing his bid button. At this point, all machines stop, a red light comes on under the buyers code letter on the face of the broadcast repeater and his code letter is automatically printed on his copy, as well as the copy on the master machine.

From this point on we are in locked circuit with the buyer and the operator will identify him by typing the plant name, the number of hogs that were purchased and the price that was bid. The buyer then types from his machine and confirms the purchase by printing O.K. and his initials. The operator will then go out on broadcast circuit where there is typing to all machines, and indicate the price the Lot of hogs sold at.

If a buyer should bid within the first fifty cent range of the tape a sale can be made within 30 seconds or less. If he should allow it to drop into the second fifty cent range or go to the bottom, it would take approximately one minute to complete a sale.

If a buyer on the western end of the circuit, at say Windsor, is interested in hogs at Toronto as is a buyer on the eastern end of the circuit, say at Hull, Quebec and by coincidence they are thinking the same price, if one should hit his bid button one-thousandth of a second ahead of his competitor, his light would come on and the hogs would be his. A buyer must wait until the last figure of each graduation is clearly printed or he must pay a five cent higher price.

The cost of this selling system is around \$3,000 a month and is covered by a charge levied against all buyers. The current rate is one and a quarter cents per hog on the number of hogs purchased.

The cost to the producer for selling his hogs through the Marketing Board is .45¢ per hog and .87¢ per sow.

Under directional order issued by the Board of Directors, all hogs produced in Ontario must come to 1 of the 48 yards operated by

the Sales Agency. These orders do not define any particular yard to which the individual producer or trucker must come, but leaves them a choice.

The one governing factor is that the hogs are sold F.O.B. the yard to which the hogs are delivered and the processor purchasing the hogs from any particular yard pays the transportation charges to his plant. The rates are set by mutual agreement of the agency, processor and trucker. If the producer or trucker does not bring his hogs to the yard nearest his farm or area, then the producer will suffer by paying a larger trucking charge than was necessary.

Advantages, Disadvantages

The question that now may be asked is what are the advantages or disadvantages of this system for Nebraska or other states. It appears this system has developed one of the most competitive systems of marketing yet devised. Other possible advantages are:

1. The producer employs own selling agency.
2. The association performs a policing action on dressing percentages and grades.
3. Producer has a neighborhood market where all hogs are sold to *highest bidder* within a short space of time.
4. Packers have an equal opportunity to bid on each lot of hogs offered. The identity of the successful bidder is known only to himself and the agency, which allows him to act independently of other packers.

With any system there are some limitations. These may include the following:

1. The producer would lose some freedom of marketing since he would have to sign a contract or something of a similar nature to market hogs through this system.
2. The system requires a third party or the U.S. Government to grade carcasses.
3. The hogs would have to be graded and sorted on a weight basis to be acceptable for purchase by most U.S. packers.

What About New Drugs In G-F Pig Diets?

By Murray Danielson
Assistant Professor, Animal Science
North Platte Station

Researchers are constantly searching for drugs or compounds that will help maintain the health of our domestic animals.

Millions of dollars are spent annually on drugs used in diet formulations. Each of these drugs plays a specific role in the maintenance of healthy animals.

Because one specific drug will correct or prevent the health problem in one group of pigs does not imply that it will do likewise in another situation. This is why we must have several drugs available and at the same time new ones being developed.

Profit a Must

By using these drugs pork producers anticipate a greater net profit and overall improvement of their animals. Greater daily gain and increased feed efficiency are prerequisites for an increase in net profit. Therefore, it is a must when adding drugs along with other ingredients to swine diets that the cost is offset by improvement in animal performance.

The studies reported here were conducted at the North Platte Station to evaluate two recently developed drugs used in growing-finishing diets.

Table 1. Live animal performance of pigs fed different levels of Spectinomycin.

	Treatments ^a		
	1 ^b	2 ^c	3 ^d
No. pigs	24	24 ^e	24
Av. initial wt., lb.	36.4	36.6 ^e	36.5
Av. final wt., lb.	209.5	211.9 ^e	207.3
Av. daily gain, lb.	1.77	1.79 ^e	1.74
Feed/lb. gain, lb.	3.30	3.29 ^e	3.28

^a Averages derived from all pigs on each treatment.

^b Negative control—Basal diet.

^c Basal diet plus 10 grams Spectinomycin.

^d Basal diet plus 20 grams Spectinomycin.

^e One pig removed because of abnormal gain.

Table 2. Live animal performance of pigs fed different levels of Carbadox.

	Treatments ^a			
	1 ^b	2 ^c	3 ^d	4 ^e
No. pigs	40	40	40	40
Av. initial wt., lb.	52.1	52.8	51.8	52.2
Av. final wt., lb.	204.6	202.2	204.4	201.8
Av. daily gain, lb.	1.82	1.79	1.83	1.79
Feed/lb. gain, lb.	3.39	3.40	3.34	3.34
Av. adj. B.F., in.	1.49	1.59	1.47	1.49

^a Averages derived from all pigs on each treatment.

^b Negative control—Basal diet.

^c Basal diet plus 5 grams Carbadox to 150 lbs., 0 grams from 150 lbs. to market wt.

^d Basal diet plus 10 grams Carbadox to 150 lbs., 0 grams from 150 lbs. to market wt.

^e Basal diet plus 25 grams Carbadox to 150 lbs., 0 grams from 150 lbs. to market wt.

During this past year a study was conducted with a relatively new drug called Spectinomycin.

Seventy-two crossbred pigs averaging about 33 lbs. were used in this study. They were randomly assigned to 12 pens, each containing 6 pigs (3 barrows and 3 gilts).

Each pen of animals was grouped from self-feeders on a 14% corn-soy diet (basal diet). Each pen was housed in a wooden shed with an adjoining hard-surfaced outside pen. Automatic waterers were accessible at all times.

Each of four pens of pigs of the 12 pens received one of the following three treatments, differing only in the level of Spectinomycin.

1. Negative control—Basal diet plus no Spectinomycin.

2. Basal diet plus 10 grams Spectinomycin per ton.

3. Basal diet plus 20 grams Spectinomycin per ton.

Performance of pigs in this study, shown in Table 1, was comparable for each of the three levels of Spectinomycin.

Another study was recently conducted with Carbadox. This drug was included in growing-finishing diets to determine performance of pigs to market weight.

One-hundred sixty crossbred pigs averaging about 52 lbs. were used on this study. They were randomly assigned to 16 pens, each containing 10 pigs with equal sex distribution within each pen.

Each pen of animals was grouped from self-feeders on a 14% corn-soy diet (basal diet). Housing was comparable for all pigs. In this study 40 pigs were used on each of the following treatments:

1. Negative control—Basal diet.

2. Basal diet plus Carbadox, 5 grams/ton to 150 lbs., 0 grams/ton from 150 lbs. to market wt.

3. Basal diet plus Carbadox, 10 grams/ton to 150 lbs., 0 grams/ton from 150 lbs. to market wt.

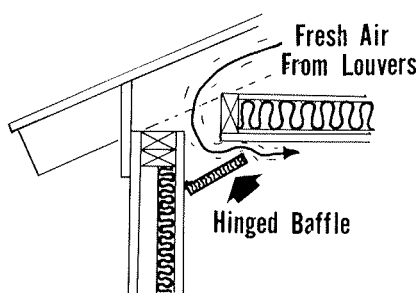
4. Basal diet plus Carbadox, 25 grams/ton to 150 lbs., 0 grams/ton from 150 lbs. to market wt.

The different levels of Carbadox were incorporated with the basal diet at the start of the study and included only until the animals attained approximately 150 lbs.

Figures in Table 2 indicate average daily gain and feed required per pound of gain were comparable for all four treatments. All treatments produced pigs with excessive back-fat measurements. This indicates that the individual treatments were not responsible for excessive back fat. This condition was likely due to the breeding of these particular animals.

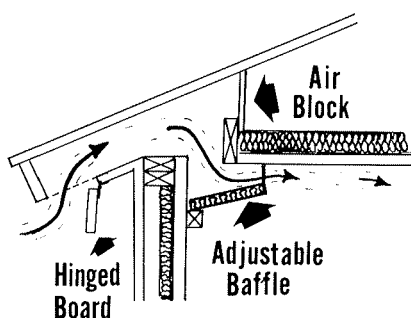
Consider Carefully

In summary, results of two studies show it would not be economically advisable to use these drugs. However, studies with these drugs in other swine herds in the United States have shown significant response in pig performance.



Baffled Slot Inlet

Fig. 1. Fresh air through gable-end louvers and the attic flows into the building through a narrow opening of the baffled slot inlet.



EAVE AIR INLET

Fig. 2. The eave air inlet permits air to flow into the building directly from outside.

Progress in Ventilation Systems

By E. A. Olson
Extension Engineer (Farm Buildings)

J. A. DeShazer
Associate Professor, Engineering

With the continued adoption of controlled environment used in swine production units in Nebraska, the design and installation of ventilation systems is as important as ever. The alert, progressive swine producer is very much aware that a well engineered and carefully managed ventilation system is a definite must to insure success of his controlled environment swine enterprise.

During the past five years swine producers have made great progress in accepting and adopting modern ventilation techniques. They have found that their enclosed buildings, when adequately insulated and equipped with a care-

fully designed and managed ventilation system, could be dry, warm and reasonably free of drafts.

Air Inlets Important

The wide acceptance of the baffle slot inlet system has made it possible to bring fresh air into a warm farrowing building without creating excessive drafts (Figure 1).

This method provides a way of introducing cold air into the building where the air baffle directs or "squirts" the air across the ceiling where it is warmed and mixed with warmer air in the building. The mixing or blending of the cold and the warm air prevents cold heavier air from dropping or settling directly into the animal area

where it will cause drafts and in turn chill the pigs.

Pigs are particularly susceptible to drafts. Buildings have been observed where the cold outside air is dumped into the animal area and consequently the pigs find it necessary to move away from the "cold spots" in the pen. This situation can often be found if windows are used as air inlets.

Since the slot inlet extends the full length of both sides of the building, a producer is assured of uniform air distribution to all parts of the building. (Slot inlets are generally not placed within 8 feet of exhaust fans). Wet or damp spots in a building can often be traced to the lack of adequate distribution of ventilation air within the building. Poor air circulation may cause odorous manure gases to collect in parts of the pen. When this happens there is good reason to suspect that these gases will retard swine growth and adversely affect feed conversion. More research is needed to help provide some answers in this area.

Two types of baffle slot inlets have been rather widely used in Nebraska. First, the system permitting the air to enter from the attic, which allowed for tempering of cold incoming air, was accepted. This method worked fine for winter conditions because solar heat gained from the roof and because warm air from the floor rises naturally to the ceiling where some of

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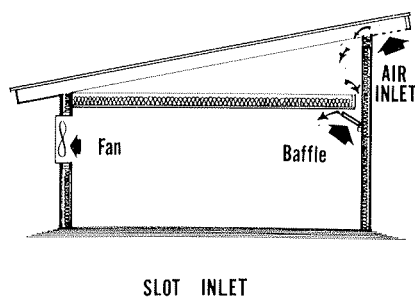


Fig. 3. The slot inlet system adapted to a narrow building being remodeled for swine use.

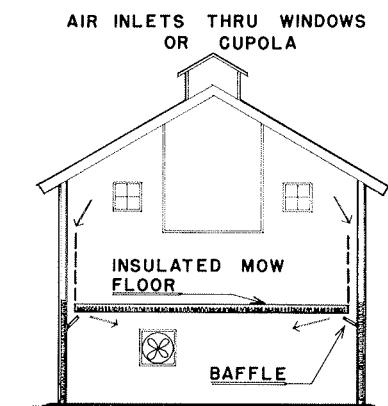
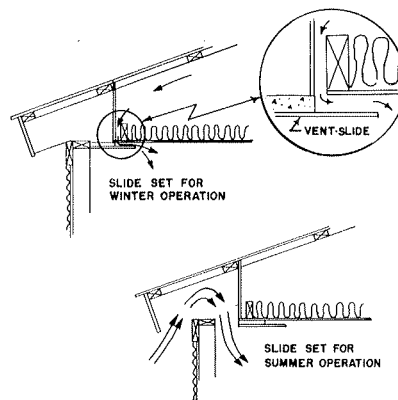


Fig. 4. In a remodeled barn the slot inlets can be installed at the hay mow floor line.



TWO-IN-ONE INLET SYSTEM

Fig. 5. The two-in-one inlet system. Top, slide closed for winter. Bottom, slide open for summer operation.

Ventilation Systems

(continued from page 7)

it continues to move through the insulated ceiling. However, these factors caused warmer, not cooler, air to be circulated into the building during warm summer months. This was largely responsible for the later adoption of the eave air inlet which has performed very satisfactorily (Figure 2). The addition of a board for closing this opening on the north or west side of the building has been useful to keep blowing snow from entering the building.

The slot inlet system can also be easily adapted when other buildings are remodeled or modified for swine production as shown in Figures 3 and 4.

Ventilation Fans

Efficient fans that have been carefully selected for the ventilation systems are also important in the total ventilation system. Fan efficiency of an otherwise efficient fan will not be maintained unless fans are given proper maintenance.

Dust and dirt that accumulate on the fan blades reduce the capacity for moving air. If you're interested in reducing fan operating costs, clean the fan blades periodically. This is not a difficult job. However, it is often overlooked. Fan shutters also need attention and should be cleaned frequently so that all moving parts move freely. A graphite type lubricant is generally recommended for moving parts to help prevent dirt and dust buildup.

A New Two-in-One System

A new idea which has the advantage of both types of inlets,

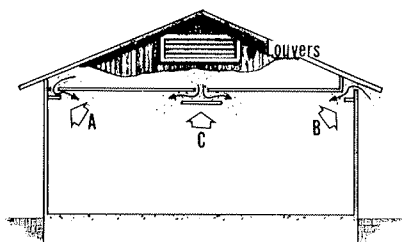


Fig. 6. Several ventilation inlet systems will be studied. Inlet "A" provides air flow through attic. Inlet "B" permits air flow through eave inlet. Inlet "C" is ceiling mounted baffle in center of building.

already discussed, has recently been developed by agricultural engineers at South Dakota University. It consists of two inlets, one for summer and one for winter.

To change this summer-winter convertible system, all that is needed is to move a vent slide board (Fig. 5), to the desired position. One push of the slide blocks air-flow from one seasonal system and opens the other. According to reports from South Dakota this two-in-one system has been operating very satisfactorily.

Northeast Station

The swine housing research facilities at the Northeast Station have provided an opportunity to study different ventilation systems. The controlled environment building(s) were designed and constructed with three different methods for bringing air into the building. These include:

1. Air introduced from the attic to the baffle slot inlet on the outside walls.
2. Air introduced by means of the eave inlet.
3. Air introduced from the attic to a baffled ceiling inlet located in the center of the building (Fig. 6). The evaluation of results obtained by using these different air inlet combinations should in the future provide practical information.

Model Research Studies

To develop guidelines for ventilation research, a 1/12 scale model of the existing swine environmental controlled building at the Northeast Station has been constructed. This flexiglass model was constructed so that the ventilation system (baffles, exhaust and inlets) pit depths, and slotted floor could be quickly changed. While only limited research studies have been made to date, the following general comments are evident at this time:

1. In the baffle system, with air entering from the outside wall, there seems to be differences in air velocities for the slotted and partially slotted floor system. More study is needed to more accurately assess these indications.

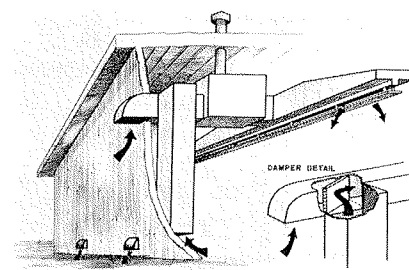


Fig. 7. Cutaway view of ventilation for the pig nursery which proportions amount of air brought into nursery. Heating unit is located between inlet and ceiling outlet.

2. The air velocities in the model, with an empty manure pit compared to a one-half pit for the baffle system, showed statistically significant differences. However, no specific conclusions have been reached at this time.

3. When baffled air inlets are used, the highest air velocities are observed to occur near the center of the model. When baffles are not used, the highest air velocity was observed near the side wall. These findings substantiate field observations and confirm the need for the use of baffles to reduce drafts near the outside walls.

More extensive research activity is needed to help verify the above general comments and to find answers to other complex ventilation problems.

"Pig Mama" Ventilation-Heating System

The research program with the Tuffy "Pig Mama" at the North Platte Station called for a high degree of temperature control of "draft-free air." A temperature range of 90 to 95° F is required for baby pigs, three days of age. Therefore, since a considerable quantity of heat was needed, a positive-pressure ventilation system was designed and installed. This pressure ventilation system is more expensive than the exhaust systems since it includes an insulated air distribution duct extending the full length of the building (Fig. 7).

The pressure system was designed so that there is continuous air circulation in the room. Outside air is mixed with the re-circulated air and heated before it is distributed in the room. The heated air

is then distributed to all parts of the room through a centrally located insulated duct which extends the full length of the building.

Heated air from this duct is distributed to all parts of the building by adjusting the baffle board located under the 4" slot opening in the bottom of the duct. By decreasing the space of the opening between the ceiling and the baffle, the air velocity will increase and volume of air-flow will decrease.

With the proper baffle adjustment, the warm air "squirts" along the ceiling to the outside walls, thus providing a blanket of warm air along the walls of the nursery. This air-flow arrangement has reduced the potential for harmful drafts on the small pigs, and caused the wall temperature to approximately equal the air temperature to provide a near ideal environment. This system has provided a very satisfactory environment in the pig nursery.

A similar type of ventilation system was designed and installed in the acclimation room adjacent to the pig nursery. Future research will include the effect of temperature, humidity and light intensities upon the growth responses of the baby pigs.

Armed with more definite facts on ventilation systems we should be able to design and build more efficient and effective, as well as more economical, ventilation systems.

Remember that the design and installation of a satisfactory ventilation system is a job for one experienced and skilled in this area.



Fig. 8. End view of ventilation model. Clockwise air flow pattern is caused by a non-baffled air inlet.

Feet, Leg Problems in Swine

By E. R. Peo, Jr.
Professor (Swine Nutrition)

Most of you have heard judges of swine breeding classes at the various livestock shows say "breeding swine should be straight moving, heavy boned, strong in their pasterns and standing on a large foot. Their legs should be set to support the weight of the body equally."

This description clearly defines what is needed in strength, quality and position of feet and legs to assure a long, trouble-free productive life in our breeding stock.

However, we seldom find individuals or groups of breeding swine which have all of the desired characteristics. Thus, we are forced to make judgments about selecting this boar or that gilt. Characteristics of feet and legs of the animal should be a strong part of the judgment.

Whether you are a breeder or a feeder, the animals you select for your particular production system must have the genetic capacity for strong, sound feet and legs if you hope to keep problems to a minimum. Some lines and even breeds of swine have disappeared because they had bad feet and legs. We cannot emphasize enough the importance of selecting swine with sound feet and legs.

Failure of feet and legs is one of the big problems of confinement feeding of swine. While genetics may be part of the trouble, stress factors such as concrete (solid or slatted floors), nutritional deficiencies and disease are probably the major ones.

Stress

Let us consider "stress" as a problem. How many of you have stood on concrete all day long? Those of you who have will recognize the common complaints "my feet are killing me;" "my joints ache" or "my back hurts."

These are complaints we can cry about, but what about "the non-talking pig." If he is hurting, we won't know about it until his gains decrease, he gets lame, goes down in his rear quarters or simply dies.

Now, this is not to "knock" concrete as flooring for confinement units, but we should recognize that a "non-giving" surface can cause problems.

What can we do about it? Here again, the selection of animals that can withstand the stress of concrete is a must. In addition, research is being conducted to determine factors which influence bone strength in pigs raised on concrete in con-

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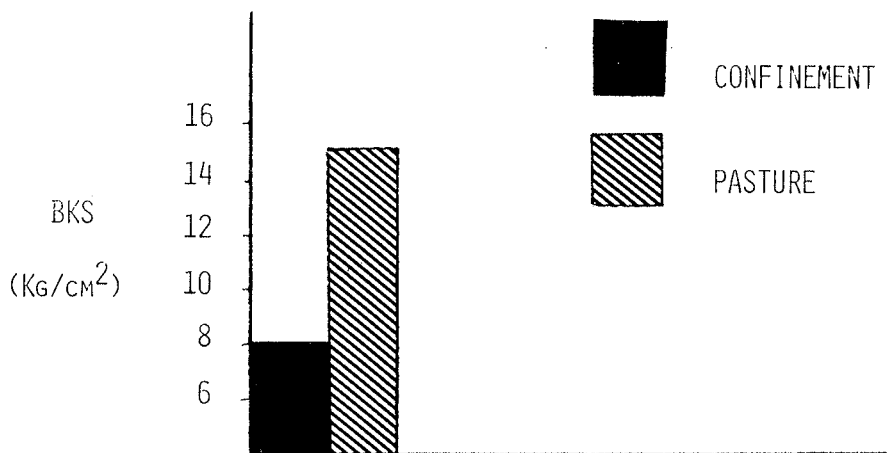


Fig. 1. Breaking strength of 4th metatarsal bone of G-F swine raised in confinement or on pasture. From Svajgr, A. J., 1968. Master's thesis, library, University of Nebraska.

Feet, Leg Problems

(continued from page 9)

finement and on solid or slatted floors. (A report on the effect of amount of slatted floor on bone strength in pigs is given elsewhere in this publication.)

During the course of a study on the magnesium and manganese requirements of swine raised in confinement on concrete and on pasture, researchers at the Nebraska Station found that pigs raised on pasture had stronger bones than those raised on solid concrete in confinement. The genetic makeup and the diets were essentially the same for both groups. Results of the study are shown in Figure 1.

The breaking strength of the 4th metatarsal leg bone of the pigs raised on pasture was nearly twice as great as the breaking strength of the bones of pigs raised in confinement.

Since diets and genetic makeup of the animals were the same for both groups, it was thought that there was either something in the soil or pasture, or exercise or kind of surface upon which the pigs were raised involved in the difference in breaking strength of the leg bones of the two groups of pigs.

With this in mind, the Nebraska research workers set up an experiment to study the effect of floor surface and size of exercise area on bone strength in pigs. Results of

Table 1. Nutrients involved in feet and leg problems in swine.

Nutrient	Symptoms
Vitamin "A"	General lameness, incoordination
Vitamin "D"	Stiffness, lameness, pigs go down, posterior paralysis, fractures, enlarged joints
B-Vitamins	
Riboflavin	Crooked front legs
Pantothenic Acid	Lameness, incoordinated, wobbly gait, goose stepping
Choline	Stiffness, weak bones, lack of rigidity of joints, incoordination
Pyridoxine	Lameness and stiffness
Biotin	Spasticity of hind legs, cracks in feet
Minerals	
Calcium	Poor bone formation, bowed, bent or broken bones
Phosphorus	Animal goes down in front or rear quarters, stiffness, enlarged joints
Magnesium	Weak front pasterns, knock knees, sickle hocked, reluctance to stand
Manganese	Stiffness, halting gait, painful, enlarged joints, reluctance to stand
Copper	Lack of rigidity of leg joints, hocks flexed, forelegs crooked and not useable
Zinc	Lameness and stiffness plus parakeratosis

this study are shown in Figure 2.

As in the first study, the breaking strength of the bones of pigs raised on concrete (solid or slat) was lower than the breaking strength of the bones of pigs raised on pasture. The possibility of the presence of factors in the soil or forage affecting bone strength was essentially eliminated with treatments 5 and 6, confined soil and pasture with forage destroyed.

Thus, it appears that exercise may be the major factor affecting bone strength since the pigs on pasture had more pen area for exercise than those on soil but confined to a small area. More research on the

effect of exercise on bone strength in pigs is planned.

Nutrition

Nutrition, particularly mineral nutrition, plays an important role in bone development. Major nutritional factors involved are shown in Table 1.

As you can see from the table, feet and leg problems are a deficiency symptom for several nutrients. However, most commercial supplements and premixes contain ample amounts of the vitamins and minerals listed in the table. Exceptions are biotin, pyridoxine and magnesium. Generally, these three are present in sufficient quantities in natural feedstuffs so that they do not need to be supplemented. Deficiencies might occur in rare instances.

Limit Feeding

Limit feeding of sows during gestation has become a common practice. In a limit-feeding program, daily feed intake is restricted to 3-6 pounds/head/day. It is important to recognize that limit feeding restricts **only energy intake**—not other nutrients.

Some of the leg problems that have developed in sows and their pigs are undoubtedly due to low intake of minerals and vitamins because the total diet of the sow was limited rather than just source of energy.

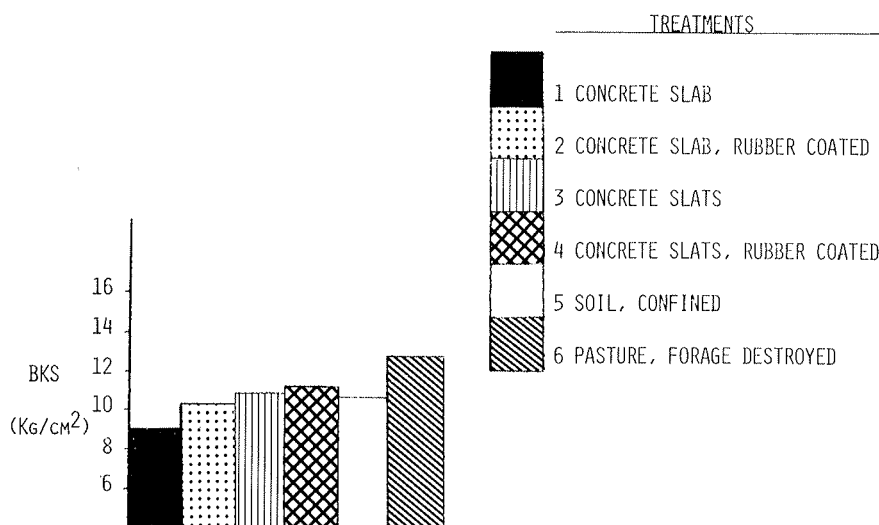


Fig. 2. Effect of floor surface and pen area on breaking strength of G-F swine. From Svajgr *et al.* (1968) *J. Animal Sci.* 27:1136.

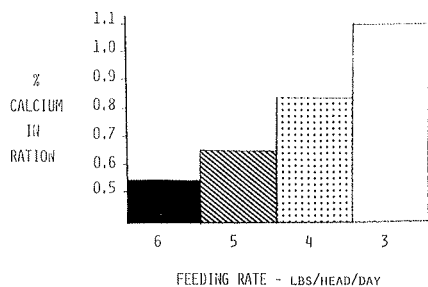


Fig. 3. Amount of calcium needed in ration of bred sows fed at different levels.

Until we know more about the effects of limit feeding, the daily requirements of the sow should be met for all nutrients regardless of whether 3, 4, 5 or 6 pounds are being fed. An example of the problem of meeting nutrient requirements under a limit-feeding program is shown in Figure 3. Note that the amount of calcium needed in the ration increases as amount of feed per head per day decreases.

The same relationship applies for other minerals and vitamins. It is a good practice to limit energy intake in bred sows in terms of reproductive performance and economics. However, exercise caution in limiting the intake of other nutrients. Remember, you can affect the performance of the pigs by how you feed the dam.

Diseases

Infectious diseases are also involved in feet and leg problems in swine. Some diseases are relatively easy to diagnose, others are not. However, disease must be considered as a possibility whenever problems occur. Erysipelas, Strep, Staph and PPLO infections are but a few of the diseases that can cause leg problems.

Navel illness is a common disease of baby pigs. For some reason the infection tends to settle in the knee, hock or shoulder joints of the pigs. The joint swells quite rapidly and the pig is unable to use the leg involved or is lame. Navel illness is difficult to prevent but clean farrowing quarters and equipment will help reduce the problem. The disease will respond to antibiotic therapy but prevention is better than trying to cure.

Increasing Baby Pig Survival

By Murray Danielson
Assistant Professor, Animal Science
North Platte Station

Surveys estimate that 25 to 30% of the pigs born alive in the United States fail to reach market age. This loss represents pigs who have, for the most part, the same potential in attaining market age as do their littermates.

Greatest death loss occurs the first few days after birth. Emphasis must, therefore, be placed on methods to improve this phase of baby pig life.

Industry has made available a commercial "Baby Pig Mama" in anticipation of increasing survival rate of newborn pigs. The University of Nebraska North Platte Station installed such a unit early in 1968.

The machine installed at the North Platte Station (Figure 1) has 108 individual wire cage units each measuring one foot wide, one foot high and two feet long. Located at the front of each cage is a shallow feed trough. Waste collection trays about one inch in depth are located below each of the three tiers of cages. The open wire mesh floors allow waste material to drop onto the trays.

The unit consists of 2 parallel rows of cages, 3 tiers high, 18 cages per tier, 54 units per row.

Mechanical Feeding

The Pig Mama consists of a suspended mechanical feeding unit which moves on a continuous over-

head track serving both rows. The unit makes one revolution every 90 minutes and can feed each pig every 90 minutes, 24 hours daily.

The feeding unit is equipped with two major compartments—one for the complete dry baby pig diet mixture and the other for water storage. The water compartment has a thermostatically controlled heating element to keep the water at a constant desired temperature.

Within the overhead track are two aluminum bars, equipped with several sets of perforations for each of the 108 cage units. Small metal pegs are placed in the perforations to indicate the amount of the diet to be dispensed at each feeding. With one peg, the pig is fed one cycle; with two, two cycles; and three, three cycles, etc.

As the Pig Mama travels along the overhead track a micro-switch system extending from the Pig Mama moves just above the surface of the aluminum bars. When the micro-switch makes contact with the metal pegs extending above the bars, the switch activates the Pig Mama, dispensing the desired pre-set diet for each individual pig.

Each cage is equipped with a feeding chute which facilitates movement of liquid diet to the feeding trough as it is dispensed from the machine. The chutes are spaced so the pig on the top tier is fed first; the pig on the middle tier second; and the one on the lower tier third.

Located above the track are automatic bulk storage and water inlet facilities that replenish the diet mixture and water compartments each time the Pig Mama makes a revolution.

The Baby Pig Mama is located in a renovated corn-crib. The room housing the units is 16' x 30' with a 8' 4" ceiling. The outside walls contain 3" insulation, 5" in

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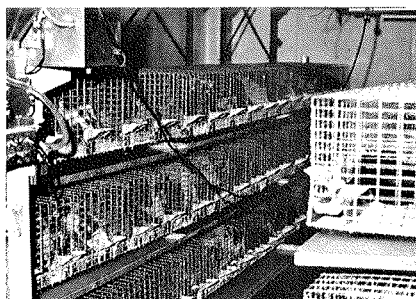


Fig. 1. The Pig Mama installed at the North Platte Station.

Baby Pig Survival

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the ceiling and perimeter insulation (2" x 24") between the floor and the foundation wall.

Ventilation

E. A. Olson, Extension Agricultural Engineer and Dr. James A. DeShazer, Research Engineer of the University of Nebraska Agricultural Engineering staff, cooperated in the design of a positive pressure heating-ventilation system.

The baby pigs are taken from the sow from 6 to 12 hours after birth. This amount of time appears to assure ample intake of colostrum. For the first eight hours in the unit the pigs are not fed.

The pigs as previously described permit the quantity of the liquid diet mixture to be increased as the pigs grow and their daily intake becomes more demanding. Attached to the two compartments of the "Pig Mama" is a third compartment for a starter diet. This compartment is mechanically independent from the other compartments. At four to five days after the pigs have been on the all liquid diet they are allowed a small quantity of starter diet. Likewise, as appetite increases the starter diet is increased.

Temperature

The room temperature is kept at 88° to 90° F. for the first three to four days. Thereafter, every second or third day the temperature is reduced from one to three degrees making the temperature after three weeks about 72° to 75° F.

The waste trays are sloped lengthwise toward the center of each tier. A constant water flow over the surface of these trays is permitted by a series of jets at the upper ends of each tray. This constant water flow provides adequate cleaning of the trays.

Humidity can be controlled to some extent with the ventilation system which is equipped with both a room-return air duct and an outside hooded fresh air return

duct. An insulated damper located at the junction of the two ducts permits desired proportion of air from the two ducts.

Acclimation Room

The pigs are removed from the Pig Mama at about 21 days and placed in an adjoining room 30' x 50' which is called the "acclimation room" (Figure 2). The room has two rows of eight pens each. The 5' x 12' pens are located back to back over an eight foot slotted disposal pit. Thus, $\frac{1}{3}$ of the floor area of each pen is slotted with the remainder of the floor solid and sloping $\frac{3}{4}$ " per foot toward the slotted area. The slats used in this installation are 5" wide with $\frac{1}{2}$ " spacing.

Automatic waterers are located over the slats to facilitate rapid removal of liquid waste.



Fig. 2. Group-feeding in the acclimation room.

Group Feeding

Pigs are introduced to competitive group feeding of from 40 to 50 pigs per pen. Feeding for the first two weeks is accomplished by means of a mini gruel-omatic. During the transition from the Pig Mama where they are individually fed to the acclimation room where they are group fed, the pigs appear to undergo no significant stress. It appears feasible a minimum change in the physical nature of the feed during this transition pe-

riod, permitted by the mini gruel-omatic, aids in reducing whatever stress might occur.

After the above described feeding regime pigs are again regrouped and subjected to a dry grower diet until they are ready to be removed from the acclimation area. During the summer months they remain in this area until they weigh about 40 lbs. and in the winter months approximately 60 to 70 lbs. They are then placed in growing finishing units.

Advantages

There are many reasons to believe the Baby Pig Mama has potential for the commercial swine industry. Some of the possible advantages:

1. Minimize the loss of baby pigs by sow crushing.
2. Saving pigs from sows that have milking or udder complications.
3. Removal from contaminated farrowing pens should mean less baby pig disease.
4. Pigs in a controlled environment should perform better.
5. All pigs, large or small, have an equal chance for an adequate diet.
6. Small pigs, pigs from large litters have a chance for survival, (ample dinner table space).
7. With a limited lactation period, sows should produce more litters over a given interval of time.
8. Simplified sow management with no need for lactation diets.
9. Possible elimination of iron injections.
10. Clipping of eye teeth not necessary.
11. Limited and more efficient use of farrowing house possible.

It is possible the swine industry has not taken full advantage of the growth ability and feed conversion of the baby pig. Research with the Pig Mama will give us a chance to explore that potential. Besides the dietary requirements of baby pigs, different diet combinations as well as management practices will be studied.

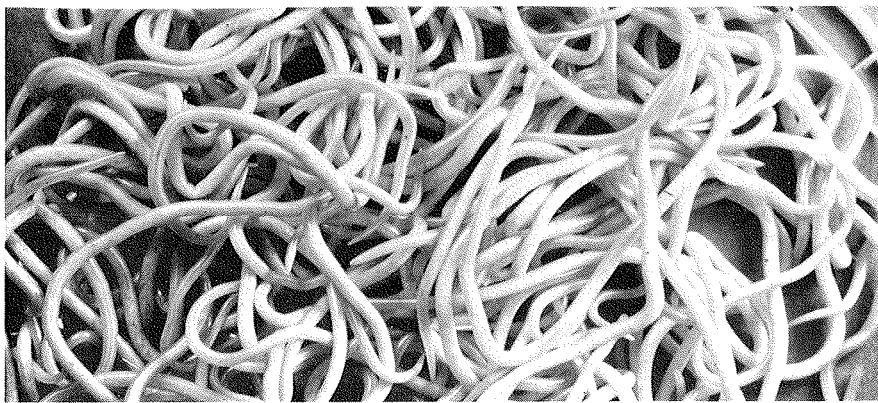


Fig. 1. The large intestinal roundworm of swine, *Ascaris suum*.

Worm Control in Swine

By Donald L. Ferguson
Assistant Professor, Parasitology
Department of Veterinary Science

In Nebraska the most common internal parasite of pigs is the large intestinal roundworm, *Ascaris suum* (Fig. 1). Commonly known as ascarids, these worms cost swine producers of the United States an estimated 50 million dollars a year. These losses result chiefly from inability of pigs to utilize feed efficiently, death of young pigs and condemnation of livers for human consumption.

You will find this worm in almost every swine herd in Nebraska and it is not unusual to find several hundred worms per pig. In a recent wormer trial conducted at the North Platte Station, 532 ascarids were recovered from the small intestine of a 140-day-old pig.

250,000 Eggs per Day

Each female worm produces large numbers of eggs (as many as 250,000 per day) which pass from the pig's intestine in the manure. When the worm eggs reach the outside, they are in an early stage of development and are not infective to pigs.

Within two to three weeks, especially when the weather is warm and the eggs remain moist, a tiny larva develops inside the egg shell. These eggs can withstand severe cold, most chemical disinfectants used to sterilize equip-

ment, and can survive up to seven years in soil.

Damage by Larvae

Pigs become infected with ascarids by consuming food and water contaminated with infective worm eggs. They rupture in the small intestine and infective larvae are liberated.

The larvae leave the intestine by burrowing into the gut wall and entering the blood stream, which carries them to the liver.

After a period of growth in the liver, the larvae travel to the lungs, passing through the heart on the way. In the lungs larvae burrow through air tubes to the windpipe. Coughing carries the young worms into the throat where they are swallowed and pass into the small intestine—this time to mature and grow to adults.

Adult worms in the intestine rob the pig of food, block the gut, and excrete substances which hinder digestion. They may migrate into the bile duct, stopping the flow of bile (Fig. 2). Worms in the bile tract cause the spread of bile into the flesh. Bile-colored pork is not edible. These carcasses are condemned and destroyed.

Common respiratory diseases are much more severe when worms are present. Virus pig pneumonia (VPP) is 10 times more severe in pigs with worms than in pigs without worms.

To prevent worms, keep your pigs from eating worm eggs. Regular treatment will kill the egg-laying female worms and stop the spread of worm eggs.

Control worm eggs already on the hog lots. Scrub the sow before farrowing. Farrow in a recently cleaned house. Keep the baby pigs away from worm eggs.

Whipworms

Pigs become infected with whipworms by consuming food and water contaminated with infective worm eggs. Each egg contains a tiny worm surrounded by a thick shell. Upon being swallowed by a susceptible pig, the young larvae are released, burrow into the lining of the large intestine and cecum.

Within a few days the young worms emerge. They attach to the lining of the cecum or large intestine of the pig and obtain nourishment from the body fluids (Fig. 3). Whipworms may cause considerable inflammation and irritation. When large numbers are present, they may cause a severe diarrhea.

In Nebraska many swine producers worm their pigs with piperazine. This wormer will effectively remove ascarids and nodular worms, but it will not effectively remove whipworms. Repeated use of a wormer that is effective against only one or two species may result in the build-up of other species. Because of the repeated use of piperazine in Nebraska swine, whipworms have become a serious problem in certain herds.

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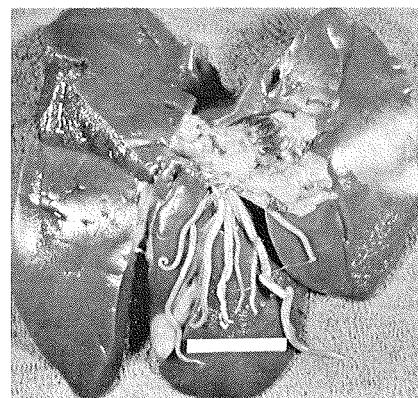


Fig. 2. Ascarids in the bile duct of the liver.

Worm Control

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Until the recent development of organic phosphates for worming of pigs, a suitable drug for treatment of whipworm infection in pigs was not available. These new organic phosphates have proven to be very effective wormers and they are relatively non-toxic when administered at the recommended level of treatment.

Lungworms

During a 12-month period (November, 1958 to October, 1959) a survey was conducted to determine the incidence of lungworms in Nebraska conventional swine. An average of 20% of the pigs examined at slaughter were infected with lungworms. The high was 34% in January and the low was 9% in May.

During 1968, a number of SPF pigs have been examined at slaughter to determine the incidence of lungworms in Nebraska SPF herds. To date, lungworms have been observed in 23 herds.

Lungworms impair swine production by injuring lung tissue, enhancing respiratory infection, and serving as vectors of virus diseases.

Female lungworms live in the air passages in the lungs. Here they produce large numbers of thick-shelled eggs which are coughed up by the pig, swallowed, and passed in the manure.

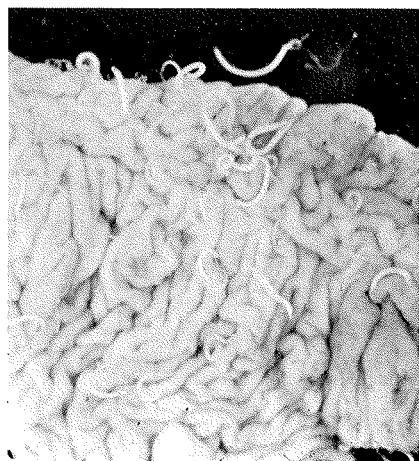


Fig. 3. Whipworms attached to lining of the large intestine.

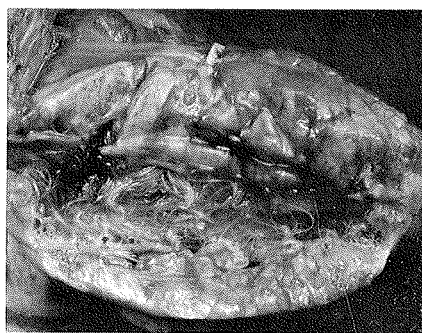


Fig. 4. Lungworms in the bronchioles of the lungs.

Various species of earthworms swallow the lungworm eggs, which hatch inside the earthworm. The larvae enter the walls of the esophagus, crop, gizzard, and intestine of the earthworm. Under favorable conditions of temperature, the larvae in the earthworms become infective to pigs in 3 or 4 weeks when consumed.

Pigs become infected with lungworms by swallowing earthworms which harbor the infective larvae. Lungworm larvae penetrate the pigs intestinal wall and are carried by the lymphatic and circulatory systems to the lungs. Here they complete their development and mate (Fig. 4).

An effective wormer is not available for removing lungworms from swine.

Lungworm infection in swine can be prevented by keeping pigs in lots where they cannot come in contact with infected earthworms. This may be best accomplished by eliminating manure piles, wet bedding and straw stacks in hog lots.

Infected pigs should be removed from lots on which they acquired lungworms and put in dry, clean pens that have slotted or concrete floors. They may be placed on temporary pastures that have not been used for several years to insure against further infection from swallowing infected earthworms.

Recommendations

To establish an effective worming program, anthelmintic drugs should be used to remove female worms before they reach egg laying age. Worm at weaning time and again 40-50 days later.

Swine Finishing Facilities— What Kind?

By R. D. Fritschen

Area Extension Specialist (Swine)
Northeast Station, Concord

What form should your swine finishing facilities take?

The swine producer of 1969 has several decisions to make, and, depending upon his preliminary planning, may become confused.

For example, several segments of the industry are active in promoting a particular building. Many such buildings have a particular feature or "gimmick" to aid in selling.

With high investment and interest commitments the hog producer of 1969 needs facts rather than gimmicks.

Terminology is confusing. Heated, insulated buildings have been called environment controlled when in fact controlling the environment is impractical and virtually impossible. Perhaps a more correct term would be environmentally regulated when referring to such units.

Search for Facts

The University of Nebraska announced in 1967 that it would make a substantial commitment in a search for facts pertaining to growing-finishing swine production. The commitment was in the form of a new housing-management research center at the Northeast Station. Initial construction began in 1967 and two units were completed in early January 1968. Subsequent construction includes four additional units plus an office-maintenance building. Research will take place over several seasons and will involve a number of hogs. However, initial tests and observa-



Two units on left are concrete tilt-up. Four units on right are concrete block.

tions have led to some conclusions.

One group of 120 hogs was assigned 60 to each unit to determine the effects of environment on performance. One building (unit A) was unheated, uninsulated and open to the south. A modification was made in the form of plywood panels installed on hinges and raised or lowered according to the weather conditions. Supplemental heat was provided until the pigs reached approximately 90 pounds. The source of heat was infra-red heaters, measuring 36 inches long. Each heater provided warmth for two pens and was turned on at approximately 5:00 p.m. and off at about 9:00 a.m.

The second building (unit C) was a heated, insulated, environmentally regulated unit. The thermostat was set at 72° F. Three systems of air intake were incorporated into unit C. No attempt was made to evaluate any particular ventilation system. Rather, it was the intent of the initial test to use a combination of all three systems to gain experience in their performance.

In addition to measuring the effect of housing environment on performance, the effect of slotted floors was evaluated. Each unit contains three pens of 25, 50, 75

and 100 percent slotted floor. The pens in units A and C measure 4 by 12 feet, providing approximately 8 square feet per pig. The feeders, requiring 5.8 square feet, were in the same location in all pens. Results are shown in Table 1.

Different amounts of slotted floor did not affect rate of gain in unit A. While efficiency varied somewhat, no distinct pattern developed within unit A. In unit C more variation in daily gain occurred but the difference was not great as was the case regarding feed efficiency.

When comparisons between units are made, season of year is expected to become a factor. Since the pigs were put on test January 18 the influence of ambient temperature upon performance could be anticipated in unit A. However, except for the unaccountable difference in feed efficiency on 50 percent slotted floors, 2.64 and 2.85 for units A and C respectively, there was basically no difference between units. When housing effects alone are considered and pooled as in Table 2, this is demonstrated more clearly.

Observation of the pigs' habits suggests a plausible theory why the feed efficiency in unit A was at least equal to that in unit C. It

Table 2. Housing effects on gain and feed efficiency.

	Bldg. A	Bldg. C
Av. daily gain	1.62	1.68
Feed/lb. gain	2.74	2.80

was noted that the pigs in unheated unit A conserved their energy by grouping together for mutual warmth. Their activities were somewhat organized to minimize movement, heat loss and thus energy. Those in unit C were more active as the temperature was maintained near 70 degrees, reducing the need for mutual inactivity and warmth. In addition a 25 watt light was on at all times, making activity and thus energy consumption more appealing. In a subsequent study unit C was left without light, which appeared to reduce activity.

The dunging pattern in a particular building has significance in two ways. (1) The time spent cleaning or scraping a partly slotted floor costs money and (2) the performance of pigs in messy pens is sometimes reduced. In buildings A and C the dunging pattern between different amounts of slotted floor was markedly different in terms of labor required. The 25 percent slotted floors required daily cleaning as the hogs dunged near the middle of the pens. The 50 percent slotted floor required occasional cleaning with some variation between pens. The 75 percent slotted floors rarely required cleaning.

While initial results of this multi-phase study are inconclusive one generalization can be made. It appears that hogs in less expensive units, such as unit A, receiving proper care can profitably compete with pigs produced in more expensive units.

Type of Slotted Floor

The particular type or style of cement slat used may influence performance. A 4-inch wide slat with round edges is used in units A and C. While the slat is four inches wide at its greatest width, the rounded edges result in only slight-

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Table 1. Effect of housing and slotted floor on performance of growing-finishing hogs.

% Slotted floor	Bldg. A (Modified open front)				Bldg. C (Enclosed-insulated)			
	100	75	50	25	100	75	50	25
No. pigs	15	13	14	15	15	14	15	15
Av. initial wt.	42.7	42.7	43.0	42.9	43.0	43.1	43.1	42.9
Av. final wt.	178.8	179.3	183.2	181.6	183.7	191.8	185.0	182.8
Av. daily gain	1.60	1.60	1.65	1.63	1.66	1.76	1.67	1.64
Feed/lb. gain	2.80	2.75	2.64	2.78	2.79	2.77	2.85	2.77

Days on test = 85

Swine Facilities

(continued from page 15)

ly over three inches of walking surface. With the round edges and the inch spacing between slats, the openings serve as a funnel where legs are more easily caught.

Upon observation it was thought that pigs reared on greater slotted areas (75 or 100 percent slotted) were more reluctant to walk and did so only when eating and drinking made it necessary.

Conversely, those on a lesser amount of slotted floor (50 or 25 percent slotted) appeared to exercise more. Because of the importance of soundness and strength of bone it was decided to critically test bone strength. Metatarsal bones of the lower rear leg were collected and broken in the laboratory to determine relative strength. Results are shown in Table 3.

The bone strength phase of the initial study indicates that bone integrity is not sacrificed when swine are grown on floors that are mostly slotted. Indeed, the reverse appears to be the case.

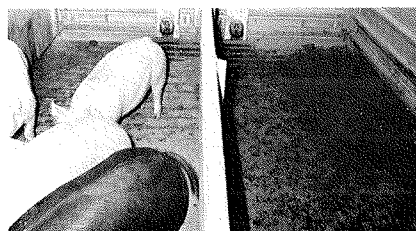
The type of exercise as well as the amount may be a factor in developing bone strength. A marked difference between particular groups of pigs and their susceptibility to feet and leg problems has been observed at the Northeast Station. It seems certain that as more swine are produced under confined conditions that more attention will be given to size and scale of bone when buying breeding stock.



Note right rear leg of pig in center is lodged between slots.



Close-up of slots. Slots are five inches wide, with sharp edge. Opening between slots $\frac{3}{4}$ to 1 inch in width.



Pen on right 25% slotted, on left 50% slotted. Note difference in cleanliness.

Table 3. Effect of slotted floor on bone strength.

% Slotted floor	100	75	50	25
Building A				
No. pigs	15	13	13	15
Rep. 1	197.55 ^a	181.85	179.75	149.65
Rep. 2	174.65	197.30	176.00	209.75
Rep. 3	188.70	180.00	167.75	168.20
Av.	186.97	186.38	174.50	175.87
Building C				
No. pigs	15	13	15	15
Rep. 1	191.75	181.00	166.75	202.10
Rep. 2	192.10	208.62	186.55	167.65
Rep. 3	183.05	151.25	175.45	168.55
Av.	189.12	180.25	176.25	179.43

^a Values are pressure required to supply the force to break metatarsal bones.

Environmental Effects

By Roger W. Mandigo

Assistant Professor, Animal Science

Many factors affect the consumers' decision to purchase pork and the selection of pork cuts. The yield and quality of this pork is important to all concerned.

To the producer it is the number of pounds of pork produced with a minimum of expense.

To the packer it is the yield of salable meat of the greatest desirable quality.

To the consumer it is the greatest amount of edible pork of desirable quality at a competitive price.

Thus, quality and quantity of desirable pork is of concern to everyone. Yet, we find too often at the consumer level pork which lacks the appeal and desirability which people feel is necessary.

There are many approaches that can be taken, and far too often it is easiest to blame someone else for the problems of our product.

Often pre-slaughter environment and methods of production are blamed for part of this problem. In many cases, hogs are produced today in a manner that bears little resemblance to the production practices of a few years ago.

Many new practices, such as slatted floors, concrete slabs, total confinement, total environmental control, new rations and diets, greater selection for meatiness and many other new things are constantly being developed and tested. What is the effect and influence of these and many other new or different practices on the ultimate acceptability and desirability of the pork products?

Very little information from con-

Table 1. Treatments used in study.

Pasture	60 x 120' pasture
Confinement soil	8 x 8' drylot
Concrete slat	8 x 8' slatted floor
Pad-slat	8 x 8' rubber padded slat
Concrete slab	8 x 8' concrete slab
Pad-slab	8 x 8' rubber padded slab

on Quality of Pork

trolled studies is available to answer these questions.

This study was started to investigate the influence of pre-slaughter housing environment on the yield and acceptability of fresh pork products. Concrete slabs, slatted floors and rubber padding were investigated. Treatments used are shown in Table 1.

Ninety-six barrows and gilts from the University swine herds were randomly assigned to the six treatments. The pigs weighed about 40 pounds at the start of the experiment and two pigs were removed from each of the duplicate treatment pens at 100, 150, 200 and 250 pounds. A standard growing-finishing ration used at the experimental farm was fed to the pigs.

Results

Following slaughter and chilling, the carcasses were evaluated for length, backfat, loin eye area, marbling score, color score, percent ham and loin, and percent primal cuts. Samples were removed for firmness and tenderness as well as a sample for chemical analysis.

The influence of the various types of housing and confinement is shown in Table 2. No significant effect of treatment was found for any of the traits measured. It would appear that the environmental systems in this study had little if any influence on the carcass. It should be stated that pigs in this study had more than the recommended space allowance, and thus were not stressed by lack of space that would likely be found

Table 3. The influence of slaughter weight on carcass traits.

Trait		100 lbs.	150 lbs.	200 lbs.	250 lbs.	Standard deviation
Carcass length	in.	23.9 ^a	27.3 ^b	29.5 ^c	31.2 ^d	0.85
Backfat	in.	0.8 ^a	1.1 ^b	1.4 ^c	1.6 ^d	0.02
Loineye area	sq. in.	2.3 ^a	3.1 ^b	3.6 ^c	4.0 ^d	0.38
Marbling score		1.3 ^a	1.6 ^b	2.0 ^c	2.7 ^d	0.62
Color score		2.4	2.2	2.2	2.6	0.56
Ham and Loin	%	38.8 ^a	37.1 ^a	36.4 ^b	35.5 ^b	3.18
Primal cuts	%	71.6 ^a	68.6 ^b	67.8 ^b	67.4 ^b	2.36
Firmness	mm.	5.5	5.1	5.2	5.2	0.95
Tenderness		12.0	11.5	10.9	11.2	3.07

Means with different superscripts are significantly (P .05) different.

in some commercial situations.

A discussion of each of these measurements taken on the pork carcasses may help in understanding what each trait measures. Carcass length is felt by some to be important in providing sufficient length to allow for large litters to be raised. It should be pointed out that the mean values shown in Table 2 report the average for all four weight groups. Table 3 should be consulted to see the effect of slaughter weight on length.

Backfat measurements are important to the pork industry in that there is no room for the over finished, wasty hog. Loineye area is an indicator of the amount of meatiness in the carcass. However, it does not provide an exact measure of the total lean in the carcass. Again, as in the case of length, these values are low because of the light weight hogs which were included in the average. Table 3 should be consulted to see the influence of slaughter weight.

Marbling score is very important to pork, and probably has been overlooked by many in the desire to remove fat from the carcasses. Marbling fat is the intramuscular fat or the fat inside the muscles. Marbling is closely related to flavor and juiciness of the cooked pork and should not be overlooked.

Color scores are also important because pale, flat-dull colored pork is not nearly as desirable as a bright pink colored lean. In both of these measures, the larger the score number the better the value.

Firmness is measured in millimeters of penetration of a steel ball into the fresh lean muscle. Many soft pork chops can be found in the supermarkets. The smaller the value for firmness and tenderness, the more desirable the score. Tenderness is definitely a problem for pork, although not as serious a problem as in beef. Tenderness values are the pounds of shear force required to shear through a 3/4 inch round core of the cooked fresh lean. The smaller the value, the less force required.

Ham and loin percent and percent primal cuts refer to the yield of salable lean meat from the desirable cuts of the pork carcass. The percent ham and loin is the most commonly used value to rank pork carcasses on lean value. The ham and loin represent the two most valuable cuts from the pork carcass. The values for ham and loin percent in these hogs are average to slightly below average in value. Primal cuts include the trimmed ham, loin, picnic, boston butt and belly. They will usually parallel ham and loin in ranking the merits of a group of pork carcasses.

Table 3 illustrates the type of growth commonly observed in hogs. With the normal market weights being between the 200 and 250 pound weight groups, the lower weight groups are used to illustrate the growth found in hogs. Mean values with different superscripts in the same trait are significant.

(continued on next page)

Table 2. The effect of confinement and floor structure on carcass traits.

Trait		Pasture	Confinement soil	Concrete slab	Concrete pad-slab	Concrete slab	Concrete pad-slab	Standard deviation
Carcass length	in.	27.8	28.0	27.8	26.9	28.2	28.3	0.85
Backfat	in.	1.3	1.2	1.2	1.2	1.2	1.2	0.02
Loineye area	sq. in.	3.4	3.3	3.2	3.3	3.2	3.1	0.38
Marbling score		1.9	2.0	1.9	1.7	2.2	1.7	0.62
Color score		2.4	2.2	2.4	2.3	2.4	2.3	0.56
Ham and Loin	%	37.2	37.4	36.0	36.8	36.4	38.0	3.18
Primal cuts	%	69.8	69.3	67.5	68.6	68.5	69.3	2.36
Firmness	mm.	5.3	4.8	5.5	5.4	5.0	5.4	0.95
Tenderness		12.2	11.3	10.0	12.1	10.5	12.2	3.07

Pork Quality

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cantly different in magnitude. The first four traits studied all increase in value with each increasing slaughter weight. This type of growth and development is commonly seen in all livestock.

It should be pointed out that a pig has the greatest percent ham and loin or primal cuts as a 100 pound pig. These values will decrease with increasing weight primarily because deposition of fat increases with increasing weight.

It should also be pointed out that a 100 pound pig is certainly not a very efficient weight to market a pig. Not only has the pig not yet achieved his potential for muscle development, but the fixed costs of slaughter and processing would be the same for the 100 pound pig as for the 250 pound pig in most cases.

Summary

From results of this experiment, it appears that these types of floor structure and confinement had little or no influence on the quality or quantity of pork. These are a few of the many types of confinement and housing that are in use today, and caution should be maintained in drawing conclusions from these data when compared to other types of housing and confinement. In addition, it should be remembered that these pigs had ample space allotments and were not overcrowded.

Certainly it should always be the objective of everyone in the pork industry to stress quality and not just quantity of pork. If the pork industry does not provide the consumer with a tasty, juicy, tender product at a competitive price, then the consumer will probably seek out an alternate or substitute to pork in the weekly menu.

It is not only important that we know what makes a cut of pork desirable, but also what every management and processing step will do to the ultimate appeal and acceptance of pork and pork products.

Selection for Ovulation Rate

By Dwane R. Zimmerman

Associate Professor,
Reproduction Physiology, Animal Science

Swine raisers appreciate the importance from a profit standpoint of farrowing and raising large litters.

An important secondary benefit is the greater opportunity large litters afford swine breeders to make improvement through selection. Larger litters result in the availability of more pigs from which replacement stock may be selected for the next generation.

This article outlines the research plan and summarizes the progress to date of a swine breeding experiment being conducted by the University of Nebraska Animal Science Department.

More Research Needed

The answer to the question, "Can Litter Size Be Improved by Selection?" cannot be answered with certainty at the present time.

There is little indication from experiments or selective registration programs where replacement boars and gilts have been selected from the larger litters that selection is effective.

Most experiment stations have estimated the heritability of litter size to be low (10% or less). This means that one would expect to obtain only about 10% of the advantage for which you select.

For example, if the replacement stock was selected from litters that averaged 4 pigs more per litter than the average of your herd (for example, litters of 11 vs. litters of 7), the predicted improvement in litter size the next generation would be .4 pigs per litter (10% heritability \times 4-pig selection advantage). If this estimate of the additive portion of the genetic vari-

ation in litter size accurately reflects the true situation, selection progress would be slow even when large selection differentials (as in the example just cited) are possible. These results suggest that the efforts of most swine breeders to improve litter size should be concentrated on providing a more optimum environment for the breeding herd rather than trying to select replacements on the basis of litter size.

It is difficult to determine from the experiments just cited how effective selection for litter size might be if the selection pressure was maximal. In most of the experiments the selection effort was divided; litter size being only one of several traits for which selection was practiced.

Breed differences in litter size suggest that selection was effective at some point in breed development. Perhaps natural selection for litter size (females with large litters supply more progeny for breeding than females with small litters) has exhausted much of the genetic variation for litter size that existed during evolution of the different breeds.

Another possible reason for the low heritability estimates for litter size may be the nature of the trait itself. Litter size is a complex trait determined by the successful completion of a series of complex physiological events expressed over a rather extended period of time.

To have large litters, females must produce large numbers of germ cells that are readily fertilizable, mate and provide an environment during gestation that will result in the survival to term of a high percentage of the embryos formed.

During this relatively long period of time, many environmental factors (nutrition, disease, climate and others) can affect the expression of litter size.

The Selection Experiment

The establishment of a population of swine composed of a combination of 14 of the older breeds available in North America was completed in 1965. The founda-

tion herd was then closed to outside introductions. This crossbred population should possess more genetic variation for reproductive traits than a single breed and should increase the opportunity for improving reproduction by selection.

Two separate lines have now been started from the foundation population. One line is being selected for ovulation rate (number of eggs produced) at the second estrous period. This trait was selected because ovulation rate determines the upper limits of litter size and can be measured on each individual female. This is done by surgically exposing the ovaries of each female during the middle part of the second estrous cycle and counting the numbers of corpora lutea (structures that represent ovulations) present on the ovaries.

The 50 gilts with the highest number of corpora lutea are selected as replacements for the next generation. No other traits are being considered in the selection program. The objective is to maintain a line of 40 farrowing gilts per year.

Similar numbers of gilts are being maintained in a second line (control line). All gilts produced by the control line are similarly observed for ovulation rate but no

selection is being practiced for this trait or any other trait.

Replacement stock is selected at random from each of the ovulation classes (10, 11, 12, etc.) on the basis of the frequency distribution of all control-line gilts on which operations were performed. This is being done to maintain the variation in ovulation rate present in the foundation population.

Boars for each line are selected at random from the available males produced in each line. The first generation selection was done in 1967. The 227 gilts on which operations were performed averaged 14.53 ovulations per gilt. The ovulation rate of the gilts saved for replacement averaged 16.56 for the select line and 14.58 for the control line.

Thirty-nine control and 38 select gilts farrowed an average of 8.21 and 8.46 live pigs, respectively. Second generation selection is nearing completion at this time.

This experiment is in its infancy and it will be several years before it can be determined how effective the selection for ovulation rate has been. Improving ovulation rate is basic to changing the litter size potential. Whatever genetic improvement that can be made in ovulation rate should make it possible to increase the number of progeny born.

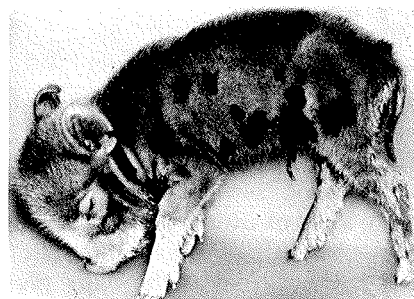


Fig. 1. Pig with TGE 48 hours postinoculation. Note severe diarrhea.

hours. These pigs will generally die within a few days. The clinical signs of the disease are vomiting in 18-24 hours following exposure.

This is followed by a severe diarrhea characterized by watery, yellowish feces frequently containing flecks of coagulated milk. The tail, legs, and buttocks become wet with feces and the hair matted (Fig. 1).

The pig becomes dehydrated, develops a persistent thirst and attempts to drink water from the floor. The pig becomes progressively weaker, has a tendency to pile as the body temperature drops, develops a shrill squeal when handled, has weak convulsions and dies in 2-5 days.

Loss of Body Fluids

On necropsy, baby pigs that have died from TGE characteristically have a marked dehydration or loss of body fluids. The stomach is usually filled and distended with a dry, hard, milk curd and the intestines are filled with fluids and gas.

The intestinal villi or finger-like projections on the intestines are shortened as a result of the viral infection (Fig. 2). These villi are responsible for absorption of food from the intestine and consequently when these structures are altered nutrition is impaired. These villi may be seen with a magnifying glass and shortening of these villi has been suggested as a test for the specific diagnosis of TGE. In pigs which recover from TGE, the villi grow back and are normal in 8-10 days following infection.

Older pigs when infected with
(continued on next page)

TGE Prevention Your Goal

By N. R. Underdahl
Professor, Swine Diseases,
Veterinary Science
M. J. Twichaus
Chairman, Veterinary Science
C. A. Mebus
Professor, Pathology, Veterinary Science

Transmissible gastroenteritis (TGE) is a severe disease of baby pigs and is considered in many areas as the most important disease affecting swine.

It has been estimated that more than one million pigs in 20,000 herds are involved each year.

In Nebraska, TGE has not been as great a problem as reported from

other states. However, the number of cases diagnosed as TGE has been increasing. This past spring, 13 herds were infected—twice the number reported for 1967.

Caused by Virus

TGE is caused by a virus which infects the intestinal tract. The mortality rate for pigs under 10 days of age is nearly 100%, but as the age of the pig increases the mortality rate decreases.

Baby pigs may be infected upon birth and clinical signs of the disease will be apparent within 24

TGE Prevention

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TGE virus may have some vomiting, a moderate to severe diarrhea, but recover in 24-48 hours.

Gestating sows frequently have more signs of illness than do feeder pigs. Lactating sows become sick at the same time as the baby pigs and with the added stresses of farrowing and lactation frequently become severely ill and there is cessation of milk flow.

Sows that have had TGE are immune for at least one year and the immunity is transmitted to the baby pig through the antibody in the colostrum. The colostral antibody will protect the baby pig from infection as long as the pig is nursing the immune sow. If the sow's milk flow is interrupted then the pig is susceptible to TGE and may become infected within two hours. It appears that the antibody in the milk neutralizes the virus in the intestine preventing the disease. If the antibody is discontinued, the virus multiplies and causes the disease.

Prevention

Prevention of TGE in baby pigs through immunization appears to be dependent on two factors: The sow must have circulating antibody in the blood to transmit antibody through the milk and secondly, the cells lining the intestinal tract of the sow must develop a local immunity to TGE.

The local immunity can only be produced by infection of the intestinal tract with TGE virus. The TGE vaccine marketed several years ago could produce a fair circulating antibody but no local immunity of the intestinal tract. When the vaccinated sow was exposed to TGE virus the sow not having intestinal immunity would become sick and the milk flow would decrease. The baby pigs then received less antibody and consequently became infected with TGE.

TGE virus can remain infective for years when frozen and for about three weeks at refrigerator tem-

peratures. At 75° it can remain infective for two days, but only for a few hours when exposed to sunlight. This stability in cold temperature probably accounts for its seasonal occurrence during the winter and early spring.

At the present time there is no vaccine available for the control of TGE and no effective treatment which will stop the death losses in infected baby pigs under 10 days of age. Control of secondary invaders in older pigs can be beneficial. The control of TGE at the present time must be handled by improved management practices. Recommended practices include:

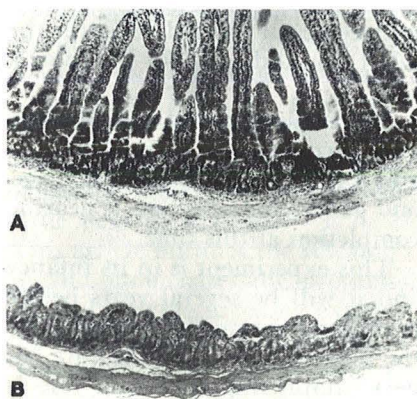


Fig. 2. (A) Normal villi of small intestine. (B) TGE infected intestine with villi shortened or eroded.

1. Not allowing visitors into farrowing quarters without disinfected boots and clean clothing.
2. Keeping dogs and birds out of the farrowing house.
3. Not borrowing equipment from other producers unless it is properly disinfected.
4. Not bringing new additions to the herd later than one month before farrowing.
5. Disposing of all dead pigs by burning or burying.

Control Difficult

Once a herd is infected controlling TGE is more difficult. Operators using central farrowing houses have more serious problems as the farrowing cycle must be broken before the disease can be brought under control.

Breaking the farrowing cycle can be accomplished by marketing a

group of sows due to farrow or farrowing a group in individual farrowing houses. The central house should be cleaned, disinfected, and rested for one or two weeks.

Those sows that have been infected and have lost their litters should be rebred. Those sows will transmit antibody in the milk and prevent TGE in the new litter. Sows that have had TGE and recovered during gestation 2-3 weeks before farrowing will transmit antibody to protect the litter.

Sows farrowed in individual farrowing houses during an outbreak of TGE can raise good litters providing good sanitation and management is practiced. If litters can be raised to 10 days of age then the severity of TGE is reduced and the death loss is much lower.

In caring for litters in individual houses, the herdsman should wear clean clothing, should disinfect his boots between each house, should care for youngest litters first and enter pens as little as possible.

Under most circumstances, a producer should not purchase bred sows to make up for losses from TGE. These new sows might be susceptible to TGE, lose their litters and prolong the infection.

TGE is a sporadic, highly infectious disease and one should be concerned with the dissemination from farm to farm. During an outbreak, improved sanitation, controlled movement of swine and sanitary disposal of dead pigs should be practiced.

Current research has given us much information on TGE. However, more has to be learned before prevention and control is feasible. Several experiment stations and others are working on TGE and answers to the many questions may be found in the near future.

However, until a vaccine or treatment for TGE is found the only control measure a swine producer has is to prevent the herd from becoming infected with TGE virus. Prevention of infection may be accomplished through sound management, isolation and control of swine movement.