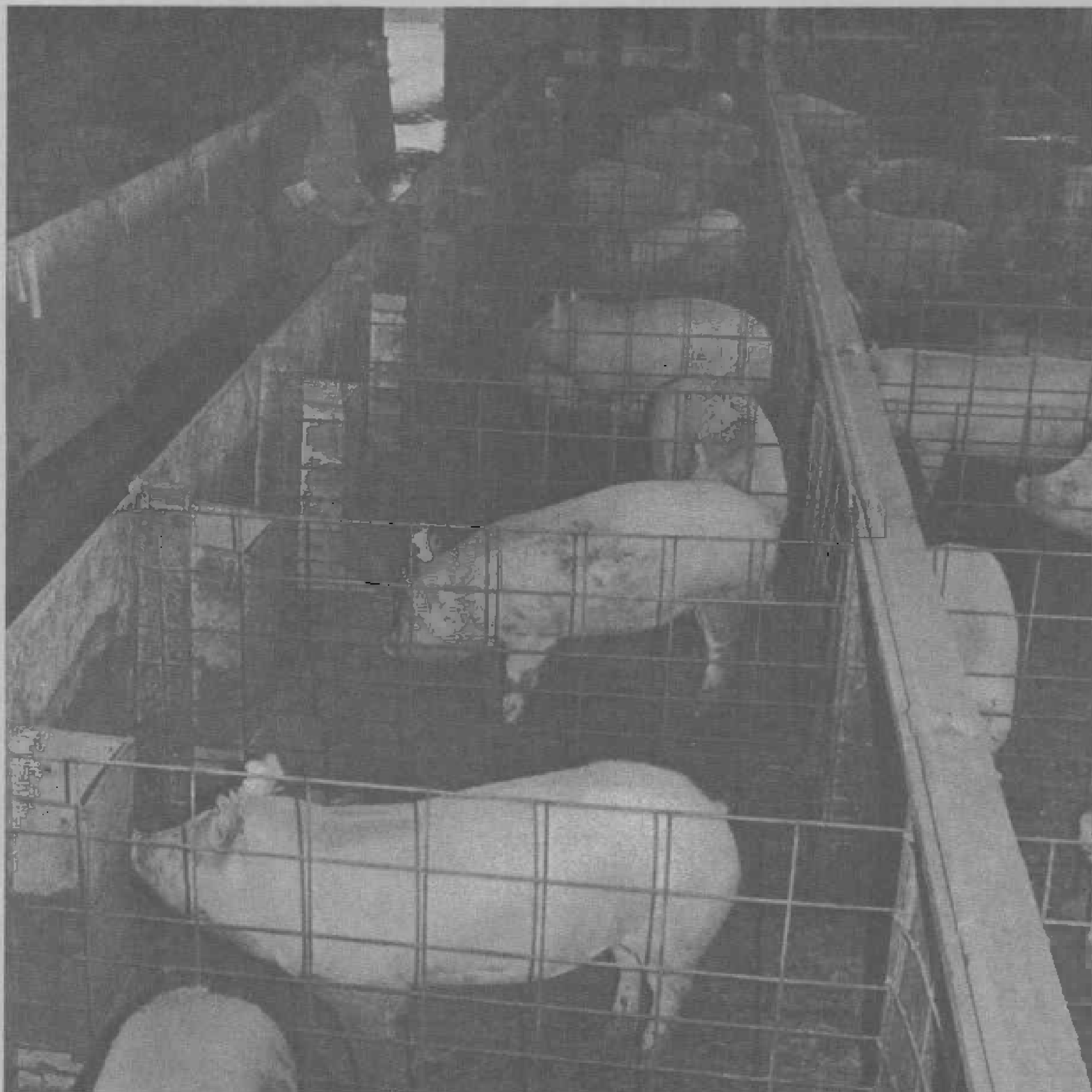
Reports of the

26th Annual Swine Day



Special Report 731
February 1985

Agricultural Experiment Station
Oregon State University, Corvallis

CONTENTS

26th ANNUAL OSU SWINE DAY

Saturday, February 16, 1985
Withycombe Hall, Campus

Morning Program - Presiding - Steven L. Davis

9:00 am	Welcome - Michael J. Burke
9:15 am	Basic Ventilation Considerations. James A. Moore
9:55 am	Further Evaluation of Triticale and Canola Meal in Grower-Finisher Rations. David C. England
10:20 am	Break
10:40 am	Potentials For and Experiences With Ivomec as a Systemic for Swine. Donald E. Hansen, John Hansell, Louis Hesse
10:40-12:00	Using Home Computers for Budgeting in Swine Production. Gene Pirelli. Room 107. Come-and-go short illustration and discussion sessions.
11:00 am	Effective Utilization of Natural Ventilation in Swine Facilities. James A. Moore
12:00 noon	Lunch - Roast Market Hog served by the Withycombe Club
12:30 pm	Industry Reports - Lou Hesse, Pres., Oregon Pork Producers Council - Dorothy Conley, Pres., Oregon Pork Producers Council Auxiliary - Ron Pittman, National Pork Producers Council - Jeanne Pittman, National Livestock and Meat Board

Afternoon Program - Presiding - Mark Stillwell

1:00 pm	Production and Carcass Value Effects of Feeding Corn vs. Barley Rations With and Without Added Fat. David C. England
1:30 pm	Remodeling Farrowing and Nursery Facilities. James A. Moore, Gene Pirelli
1:30 pm	(Concurrently) Pork's Contributions to a Healthful Diet. Jeanne Pittman. Room 209.
2:10 pm	Management Tips for Breeding Efficiency. Jerry Gourley, John Hansell
2:30 pm	Discussion and Question-Answer Session
3:00 pm	Adjourn

WHO'S WHO IN THE DAY'S EVENTS

Burke, Michael J. - Associate Dean and Director, Academic Programs, College of Agricultural Sciences, Oregon State University

Conley, Dorothy - Pork Producer; President, Oregon Pork Producers Council Auxiliary, Monmouth, Oregon

Davis, Steven L. - Professor and Head, Department of Animal Science, Oregon State University

England, David C. - Professor, Department of Animal Science, Oregon State University

Gourley, Jerry - Pork Producer, Albany, Oregon

Hansell, John - Pork Producer, Hermiston, Oregon

Hansen, Donald E. - Assistant Professor, School of Veterinary Medicine, Oregon State University

Hesse, Louis - Pork Producer; President, Oregon Pork Producers Council, Beaverton, Oregon

Moore, James A. - Associate Professor, Department of Agricultural Engineering Oregon State University

Pirelli, Gene - Polk County Livestock Extension Agent, Dallas, Oregon State University

Pittman, Jeanne - Pork Producer; Director, National Livestock and Meat Board Sheridan, Oregon

Pittman, Ronald - Pork Producer; Director, National Pork Producers Council, Sheridan, Oregon

Stillwell, Mark - Jefferson County Extension Agent, Madras, Oregon State University

Acknowledgments

An *ad hoc* advisory council consisting of representatives of the Extension Service, Oregon Pork Producers Council, Oregon Pork Producers Council Auxiliary, and other pork producers assisted in development of the general theme and specifics of the program. The Withycombe Club and Clark Meat Science Laboratory personnel prepare and serve the roast market hog lunch.

COVER: OSU Swine Center, West Campus Way.

BASIC VENTILATION CONSIDERATIONS

James A. Moore
Extension Agricultural Engineer
Oregon State University

Most would agree that all buildings that house livestock need some ventilation. The real discussion begins when trying to determine how much ventilation should be provided. Any discussion of how much ventilation is needed must start by asking, why do we ventilate?

The answer to that question varies with season, type of building and floor, number and age of livestock and the waste handling system. The four reasons we ventilate are to remove (1) moisture, (2) gases, (3) organisms, and (4) heat. Under most conditions we ventilate in the summer to remove heat and in the winter to remove moisture. When the rates are adequate to remove heat or moisture, the organisms and gases usually are diluted enough and present no problem.

CHARACTERISTICS OF AIR

The heat and moisture produced by different sizes and stages of swine have been measured. Other researchers have studied the characteristics of air and determined the moisture and heat-carrying capacity of air at different temperatures. The higher the air temperature the greater its ability to carry moisture in the form of water vapor. This and other properties of air are shown on a psychrometric chart.

We utilize this characteristic when determining the air necessary for winter ventilation to carry water vapor, urine, and spilled water from the building. Also important to remember is that cool air sinks and warm air rises. This knowledge is used in locating and sizing air inlets in natural and mechanical ventilation systems.

An adequate air flow rate can be calculated using the number of animals in the building and outside air conditions. This has been done for general conditions and the recommended ventilation rates are listed in cubic feet per minute (cfm) per head in Table 1. These rates are designed to remove adequate moisture in the winter and heat in the summer.

Table 1.

	Weight lb	Ventilation, cfm/hd Cold weather rate	 Mild weather rate	 Hot weather rate
Sow and litter	400	20	80	500
Prenursery pig	12-30	2	10	25
Nursery pig	30-75	3	15	35
Growing pig	75-150	7	24	75
Finishing pig	150-220	10	35	120
Gestating sow	325	12	40	400
Boar	400	14	50	300

From Midwest Plan Service No. 8-Swine Housing & Equip.Hdbk.

NATURAL AND MECHANICAL SYSTEMS

There are two possible systems you can select to provide the required ventilation air. These are natural and mechanical systems. The natural system does not use fans, but instead relies on the wind and animal heat to move air.

The advantage of this system is its low cost and knowing you can still move enough air if the power fails. On the negative side, these buildings are often overventilated because of the lack of control over the flow rate. Because the wind is one of the driving forces, the location and building design (inlets and outlets) must reflect the needs of a natural ventilation system.

Large growers most often use this type of system to ventilate housing for finishing hogs and gestating sows where over-ventilation causes few problems.

The second type of ventilation system is mechanicalventilation and, as the name implies, it uses fans to provide the required air flow rate. The advantages include precise control of the air flow rate to match the needs of the livestock in the building. This control also allows the reduction of drafts. In cases where supplemental heat needs to be added, the mechanical system provides a way to distribute and blend the warmer air. Mechanical ventilation systems are common in farrowing houses and nurseries. The major disadvantages of the system are the initial and operating costs. There can be problems during hot weather when a power outage stops all fans in a building full of hogs.

POSITIVE OR NEGATIVE SYSTEM

Assuming you have decided to install a mechanical system, you first need to calculate the ventilation needs of the animals to be housed. It is then relatively simple to select a fan or series of fans to provide the necessary air flow rate. Once the fan(s) arrive, you have a choice of blowing air into or out of the building. When the fans pull the air from the building and exhaust it outside, it is called a negative pressure system. This is because the static air pressure inside the building is less than outside or atmospheric pressure, hence it is negative. When the fans blow the outside air into the building, they are creating a build-up in pressure in the building which is referred to as a positive pressure ventilation system.

The negative pressure system is the most common. The major disadvantage of the positive pressure system is that when the warm, moist air is under pressure and moving from the room it moves into all the cracks in the building. As the air moves toward the cool outside (in winter), the moisture condenses in the walls, in insulation and in the attic. This makes the insulation wet, causes it to get heavy and sink in the wall, reducing the insulation effectiveness. The moisture eventually can cause structural problems.

In the discussion above, the phrase "static pressure" was used. This refers to the difference between the air pressure inside and outside the building. This pressure difference can be measured quite simply, and knowing the static pressure is helpful in selecting a fan and adjusting inlets.

The drawing in Figure 1 shows a section of clear plastic tubing partially full of water bent into a "U" shape. This "U"-tube can be placed inside or outside the building; however, one end of the tube is exposed to the outside air pressure and the other to the inside conditions. These units are commonly called manometers.

If the system were a negative pressure system, the air would be trying to move from the outside into the building. In Figure 1, this would mean the unit was inside the building and the outside air would be pushing the water up the tube connected to the inside of the building . The air pressure would be pushing from the outside toward the inside.

Your system operates best when the manometer shows a difference of between 0.05 and 0.1 inches of water. With pressures below this, it will be difficult to uniformly distribute the incoming air. Pressures above this are generally caused by inadequate inlet area and these excess pressures reduce the fan capacity and efficiency.

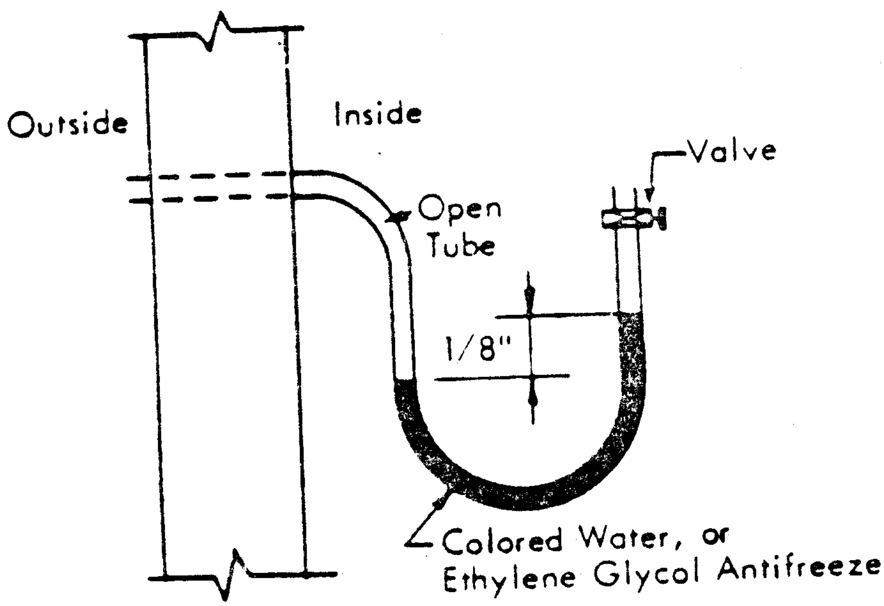


Figure 1-Manometer used to determine building static pressure

INLETS AND OUTLETS

Inlets are perhaps the most important part of the ventilation system. In both the natural and mechanical systems, the inlet controls the direction, path and distribution of fresh air into the room. By opening or closing the inlet, the velocity and, therefore, the distance the air flows into the room are regulated.

Since more air is required as the season changes, the inlet should be adjusted to maintain the air flow path, velocity, and distribution. Inlets can be self-adjustable, such as the weighted curtain, or adjusted manually as temperatures change through the season.

The locations of the inlets should be planned after the sleeping and dunging areas have been selected. Feeders and waterers also influence inlet selections. The best air is required in the sleeping area; the poorest air is directed to the dunging area.

Summer inlets require lots of turbulence and volume since their purpose is to cool the building and animals. In winter, the air flows are much less and drafts are of great concern. In most cases, two different inlet systems are needed for the seasons.

Outlets in mechanical systems usually can be located on any wall. Generally, air should not have to move more than 40 feet to get to a fan. Locating the fan away from the wind or providing a baffle will ensure uniform and consistent flow rate as the fan discharges into the wind. The outlet in natural systems should be at the ridge to ensure the warm, moist air is exhausted from the building. In single sloped buildings, the outlet should be along the top of the tallest wall.

Control components need attention throughout the year. While a few fans are controlled by timers, most are controlled by thermostats. The thermostats should be checked against an independent thermometer; disregard the readings on the dial. Humidity control is preferred since winter ventilation is designed to remove moisture; however, these control sensors have not proven reliable in the environment of the hog house.

In addition to fans, the inlets need to be checked. If an inlet is left too open, the cool air moves slowly into the room and may just fall onto the nearest pen or crate. Inlets open too wide are subject to backdrafts which may carry warm moist air into the attic where condensation and perhaps freezing will occur. Inlets closed too tightly will require high velocities of incoming air that will travel too far into the room causing uneven distribution and drafts.

FURTHER EVALUATION OF TRITICALE AND CANOLA MEAL IN GROWER-FINISHER SWINE RATIONS

Anamaria Varela, D. C. England, P. R. Cheeke, and R. Dickson

INTRODUCTION

Triticale is a relatively new synthetic crop derived from crossing Durum wheat with rye; it shows promise as a feed grain because of the high levels of crude protein and essential amino acids, and especially, by having nearly double the lysine content of corn.

Canola meal is a by-product of the extraction of oil from low glucosinolate, low erucic acid cultivars of rapeseed (Brassica spp.). Canola meal is widely utilized in Canada where rapeseed is produced as a source of edible oil. Previous research has shown adverse effects of the rapeseed cultivars with high contents of glucosinolates. Glucosinolates are compounds which inhibit the normal functioning of the thyroid gland, reducing animal performance. Canola meal produced from a mixture of the canola cultivars contains about 37 to 38% crude protein with an amino acid content which compares favorably with that of soybean meal.

Recently, producers in Oregon and other western states have developed a strong interest in canola meal as an alternate to soybean meal because of a favorable difference in price. Therefore, since both triticale and canola meal offer good sources of supplemental energy and protein, the objectives of these studies were:

1. To evaluate triticale as a potential feed grain for growing-finishing swine by comparing it to corn, barley, and wheat.
2. To evaluate canola meal as the sole source of protein supplement for growing-finishing swine by comparing its effectiveness to that of soybean meal.

MATERIALS AND METHODS

Two trials were conducted. Trial 1 consisted of 96 individually fed Yorkshire pigs (equal numbers of barrows and gilts). This provided 16 barrows and 16 gilts for comparison of each grain source ration, and 24 barrows and 24 gilts to compare canola meal vs. soybean meal. Corn, triticale, and barley were compared as cereal grain sources, with soybean meal (SBM), and canola meal compared as protein sources. All diets were in a meal form, and formulated to contain 15% crude protein. The ingredients used in the different rations are shown in Table 1. The triticale utilized in this trial was selection M75-8655, now named variety Flora. It was developed by the Oregon State University Crop Science Department.

Table 1. Composition of Rations by Percentage of Each Ingredient for Trial 1

RATIONS[a]								
CORN			TRITICALE			BARLEY		
CORN	75.5	71.5	TRITICALE	77.5	74.5	BARLEY	77.5	74.5
SBM	18.0	0.0	SBM	16.0	0.0	SBM	16.0	0.0
CANOLA	0.0	22.0	CANOLA	0.0	19.0	CANOLA	0.0	19.0

[a] All rations had: 0.5% Vitamin Premix, 0.5% Trace Mineral Salt, 1.0% Dicalcium Phosphate, 3.0% Molasses, and 1.5% Limestone.

In Trial 2, Yorkshire pigs in groups of eight per pen were used. Corn, triticale, barley, and wheat were compared as the cereal grain sources; SBM and canola meal were compared as the protein sources. This provided 16 barrows and 16 gilts for evaluation of each grain source ration, and 32 barrows and 32 gilts for comparison of canola meal vs. soybean meal. All diets were fed in pelleted form. Water was available ad libitum in both trials. The triticale for this trial was provided by ARCO Seed Company, El Centro, California. Ration formulas for Trial 2 are shown in Table 2.

Table 2. Composition of Rations by Percentage of Each Ingredient for Trial 2[a]

#1		#2		#3		#4	
CORN	75.5	CORN	65.5	BARLEY	77.5	BARLEY	69.5
SBM	18.0	CANOLA	28.0	SBM	16.0	CANOLA	24.0
#5		**#6**		**#7**		**#8**	
WHEAT	75.5	WHEAT	65.5	TRITICALE	84.0	TRITICALE	78.0
SBM	18.0	CANOLA	28.0	SBM	9.5	CANOLA	15.5

[a] All rations had: 0.5% Vitamin Premix, 0.5% Trace Mineral Salt, 1.0% Dicalcium Phosphate, 3.0% Molasses, and 1.5% Limestone.

In both trials, average starting weight was 69 lb, and the average finishing weight was 223 lb. The pigs were weighed at the beginning of the trials, and weekly, until approximately 210 to 215 lb, and then every three days until they reached slaughter weight (220 lb). Carcass data for both trials consisted of carcass length, average backfat thickness (an average of measurements taken at the first rib, last rib, and last lumbar vertebrae), and loin eye area (LEA). For Trial 1, both gilts and barrows were slaughtered, but for Trial 2 only the barrows were slaughtered.

The data for both Trial 1 and Trial 2 were analyzed by least-squares analysis of variance to determine whether significant differences for performance and carcass traits existed among the grain-source rations or between the protein supplement source rations.

RESULTS AND DISCUSSION

The means for performance and carcass traits for grower-finisher pigs fed different cereal grains in balanced rations in Trials 1 and 2 are presented in Tables 3 and 4, respectively. In Trial 1, differences from cereal grains were not significant for any of the traits considered except for backfat thickness (BFT). Pigs fed corn diets had more BFT than those fed triticale (1.31 vs. 1.22 in) or barley diets (1.31 vs 1.19 in); backfat thickness was statistically not different for the pigs fed triticale vs. barley. Thus, corn, triticale, and barley rations as used in this trial gave similar results, except for backfat thickness.

Table 3. Comparison of Grain-Source Rations for Grower-Finisher Pigs in Trial 1

	CORN	TRITICALE	BARLEY	SIGNIFICANCE[1]
ADG (lbs/day)	1.74	1.80	1.74	NS
FE (lb feed/lb gain)	3.82	3.85	3.92	NS
CARCASS LENGTH (in)	31.35	31.40	31.72	NS
BFT (in)	1.31[a]	1.22[b]	1.19[b]	P<.01
LEA (Sq. in.)	4.25	4.34	4.42	NS

[1] NS: P > .05

[2] Within row, means with different superscripts are significantly different.

In Trial 2, differences among cereal grains were not significant for any trait except dressing percentage (Table 4). Pigs fed the triticale rations had the highest dressing percentage and those fed the barley rations had the lowest (78.0 vs. 75.4%; $P < 0.05$). Differences in dressing percentage among corn, triticale, and wheat source rations were not significant, but pigs fed the barley rations had significantly lower dressing percentage than each of the other rations. Carcass traits were taken from barrows only in this trial.

Table 4. Comparison of Grain-Source Rations for Grower-Finisher Pigs in Trial 2

Performance and Carcass Traits	CEREAL GRAIN					
	CORN	BARLEY	WHEAT	TRITICALE	SIGNIFICANCE[3]	
ADG (lbs/day)	1.70	1.60	1.56	1.56	$P > .05$	NS
FEED/DAY (lb/day)[1]	5.39	5.46	5.14	5.07	$P > .05$	NS
FEED/GAIN	3.24	3.47	3.32	3.24	$P > .05$	NS
DRESSING %[2]	76.9^{a}	75.4^{b}	77.2^{a}	78.0^{a}	$P < .01$	SIG
CARCASS LENGTH (in)[2]	31.30	31.20	31.00	31.10	$P > .05$	NS
BFT (in)[2]	1.34	1.24	1.24	1.32	$P > .05$	NS
LEA (Sq. in.)[2]	4.55	4.60	4.62	4.78	$P > .05$	NS

[1] Data obtained on a group basis (four pens per ration).

[2] Data obtained from barrows only (16 per ration).

[3] Within a row means with different superscripts are significantly different.

In Trial 1, pigs fed rations containing SBM had significantly higher ADG (1.85 vs 1.67 lb/day) and better FE (3.65 vs 4.07) than those fed rations with canola meal as the protein supplement. Differences in carcass measurements were not significant. Results in Trial 2 are in close agreement with those in Trial 1 (Table 5).

Table 5. Comparison of Canola Meal vs. Soybean Oil Meal as the Sole Protein Supplement Source in Rations for Grower-Finisher Pigs

	SOYBEAN OIL MEAL	CANOLA MEAL	SIGNIFICANCE[1]
		TRIAL 1	
ADG (lbs)	1.85	1.67	P < .01
FE (lb feed/lb gain)	3.65	4.07	P < .01
CARCASS LENGTH (in)	31.61	31.37	NS
BFT (in)	1.28	1.20	NS
LEA (Sq. in)	4.32	4.36	NS
		TRIAL 2	
ADG (lbs)	1.70	1.52	P < .01
FE (lb feed/lb gain)	3.09	3.55	NS
CARCASS LENGTH (in)	31.25	31.08	NS
BFT (in)	1.31	1.27	NS
LEA (Sq. in.)	4.32	4.36	NS

[1] NS: P > .05

In Trial 2, the only significant effect of protein source was on ADG. As in Trial 1 pigs fed diets with SBM as the protein source had a higher ADG (1.70 vs 1.52 lb) than did those fed canola meal. Males had a higher ADG than females (1.74 vs 1.48 lb/day). Carcass data were obtained on males only; FE was available on a group basis only; mean differences were similar to those in Trial 1.

General recommendations from Canadian research is that canola meal can be used to provide as high as 50% of the supplemental protein for growing-finishing pigs without impaired performance. In our trials, soybean meal gave better animal performance results than did canola meal as the only source of protein supplement. These results indicate that canola meal, when used as the total protein supplement source in grower-finisher rations, is not adequate for achieving maximum performance.

For Pacific Northwest swine producers, cereal grains with higher crude protein content have special importance through the potential of reducing the amount of protein supplement required. In Trial 1, analyzed crude protein content of corn, barley, and triticale was 8.7, 8.0, and 10.1 percent, respectively; in Trial 2, these were 9.0, 10.7, and 13.3 percent respectively, and was 9.0 percent for wheat.

In general, results of these experiments indicate that decreasing the amount of protein supplement in accordance with increasing protein content of the grain source had no adverse effect on performance or carcass characteristics. Thus, with appropriate relative prices of the different grains, those with higher protein content can result in lower ration cost without adverse effects through decreased requirement for supplemental protein.

SUMMARY

Comparisons among corn, triticale, barley, and wheat showed no significant differences in their effects on performance or carcass traits, except for greater BFT in corn rations in Trial 1, and lower dressing percentage for the barley rations in Trial 2. There was a consistent superiority of SBM over canola meal for the production traits when each was used as the only protein supplement source. Grains having higher protein content produced similar performance and carcass results with additions of lower amounts of protein supplement than was required to balance rations utilizing grains having lower protein content.

CONTROLLING PARASITES IN SWINE WITH "IVOMEC"

Donald Hansen, D.V.M.
Extension Veterinarian
College of Veterinary Medicine
Oregon State University

"Ivomec" is one of a new group of broad spectrum antiparasitic agents called avermectins. It inactivates parasitic worms, mites, lice and grubs. The susceptible parasites become paralyzed and are thereby killed. "Ivomec" is unrelated structurally to any of the presently available wormers. Cross resistance does not occur with any other antiparasitic agent.

The drug has not been cleared by FDA for use in swine. However, experimental work has been done in swine herds throughout the country. Based on the data collected, "Ivomec" has been shown to be effective in reducing the following internal and external parasite burdens in animals tested:

Gastrointestinal roundworms	98-100%
Lungworms	98-100%
Kidney worms	98-100%
Trichina worms	100%
Lice	100%
Mites (mange mites)	100%

In a recent study at Ohio State University, sows were treated with "Ivomec" to control mange (Sarcoptes scabei). Ivomec was given at 300 μg/kg (1 ml/70 lbs), 8-37 days prefarrowing and eliminated the infection within 7 days and prevented its transmission to their litters, with no untoward effect. In a second study, "Ivomec" at 300 μg/kg (1 ml/70 lbs) eliminated mange in weaned pigs from 16 litters, while controls in both studies remained infected.

The agent is injected under the skin (SC) just behind the ear. Every pig in the contact group must be treated to prevent reinfection. A last caution--pigs must receive a full dose of "Ivomec" so it is recommended that you refill before using the last dose in the syringe. (Many times this last dose is short.)

A spokesman for Merck (manufacturer of "Ivomec") did not know when the product would be cleared by FDA for official use in swine. In the meantime, use of the product could qualify under the "Extra-label Use" clause of drug regulations.

An effective scabies control program for a farrow-to-finish swine facility could be based on a single treatment of sows with "Ivomec" just before movement to the farrowing house. Any outbreak in growing pigs could be controlled by one injection of all in-contact pigs, and would be treated upon arrival. The other broad spectrum activity of "Ivomec" against worms and lice would be an added benefit in such a program.

EFFECTIVE UTILIZATION OF NATURAL VENTILATION

James A. Moore
Extension Agricultural Engineer, OSU

Natural ventilation is attractive because it is cheap. These systems do not require the initial cost of fans or the operating cost to continuously move air. Natural ventilation can be used very effectively in buildings housing gestating sows and finishing hogs from 50 pounds until market weight. The system is not recommended for farrowing houses and nursery buildings because they often are over ventilated. This can be a major problem when trying to maintain a warm environment for younger pigs. Natural systems do not have the control that mechanical systems offer.

The air flow required in the building is determined by the number and size of animals in the building and independent of how the air is moved through the building. The flow of air in a natural system is caused by wind blowing into and through the building and by the rising warm air from the heat of the animal bodies. The more animals in the building the better the system should work in the winter time. Winter ventilation is to remove moisture while summer ventilation volume is increased perhaps 20 times and is designed to remove heat. Both of these air flow rates are usually enough to remove undesirable gases, odors, and disease organisms.

In both summer and winter the warm moist air should go out the open ridge in a gable roof building. The ridge opening should be a minimum of 3 inches wide and for buildings wider than 30 feet, add 1 inch of opening per 10 feet of building width. In areas of high rainfall it may be desirable to place a ridge cap above the open ridge to keep out rain and still allow air to exhaust. Summer conditions need more air and wall panels can be removed on both walls to allow more air flow. Reducing the air flow in the winter can be accomplished by closing up most of the openings. Generally, do not close either wall up tight, rather leave a small opening (Figure 1).

In a single slope roof unit there should be a continuous opening along with top of the tallest wall. Opening big windows or removing the front wall or panels will allow more air movement in the summer to cool the building.

Let's use an example to explain the design principals of natural ventilation. The building in this example is a single sloped roof with a solid floor over 3/4 of the area. A four foot slatted section runs across the front of the building covering a small pit to collect and store the waste. A 3-foot walkway goes along the very front of the building its entire length (Figure 2).

During the summer a 6 inch slot across the entire back of the building allows air into the building. The entire front is removed during the summer to allow more air flow and provide cooling. The air enters from both the front and back and moves up and out the top of the open front.

The winter inlet air is high on the front wall and baffled to direct air down the front wall into the walkway (Figure 2). After falling down the front wall the air moved across the slats and up the solid floor toward the bedding area at the back of the pen. The summer inlet is closed to keep the sleeping area relatively warm.

As the air drops down the front wall and moves toward the back it blends with the room air and is warmed. This flow pattern allows the air to sweep the floor evaporating water and drying the floor. As it warms it rises to the sloping roof and moves toward the continuous exhaust opening at the top of the front wall. A one inch insulation board is recommended to keep the warm moist air from hitting the cool roof and allowing the moisture to condense causing a wet dripping roof. The insulation also reduces the high summer temperature by insulating the heat from the sun on the roof.

This pattern provides the "best" environment back in the sleeping area and the "worst" air at the slats which is the dunging area. All other openings must be closed to insure the designed air flow pattern. Air coming in from the back or ends will cause cold spots and create drafts.

To ensure the proper air flow, all other openings, windows, doors, openings on the end of walls, etc., must be shut in the winter. These openings can be used to allow more ventilation during hot weather.

This brief description was intended to assist you as you consider building new facilities or remodeling existing buildings. I would be glad to work with you in greater detail when you get ready to make some changes in your swine facilities.

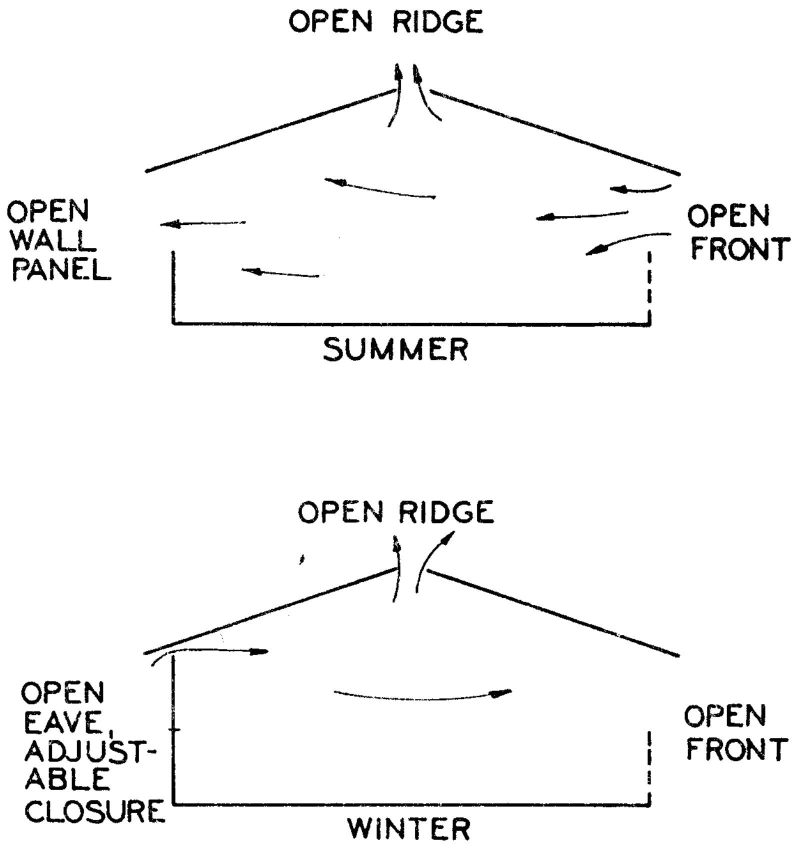


Figure 1. Air flow patterns in a naturally ventilated gable roof building.

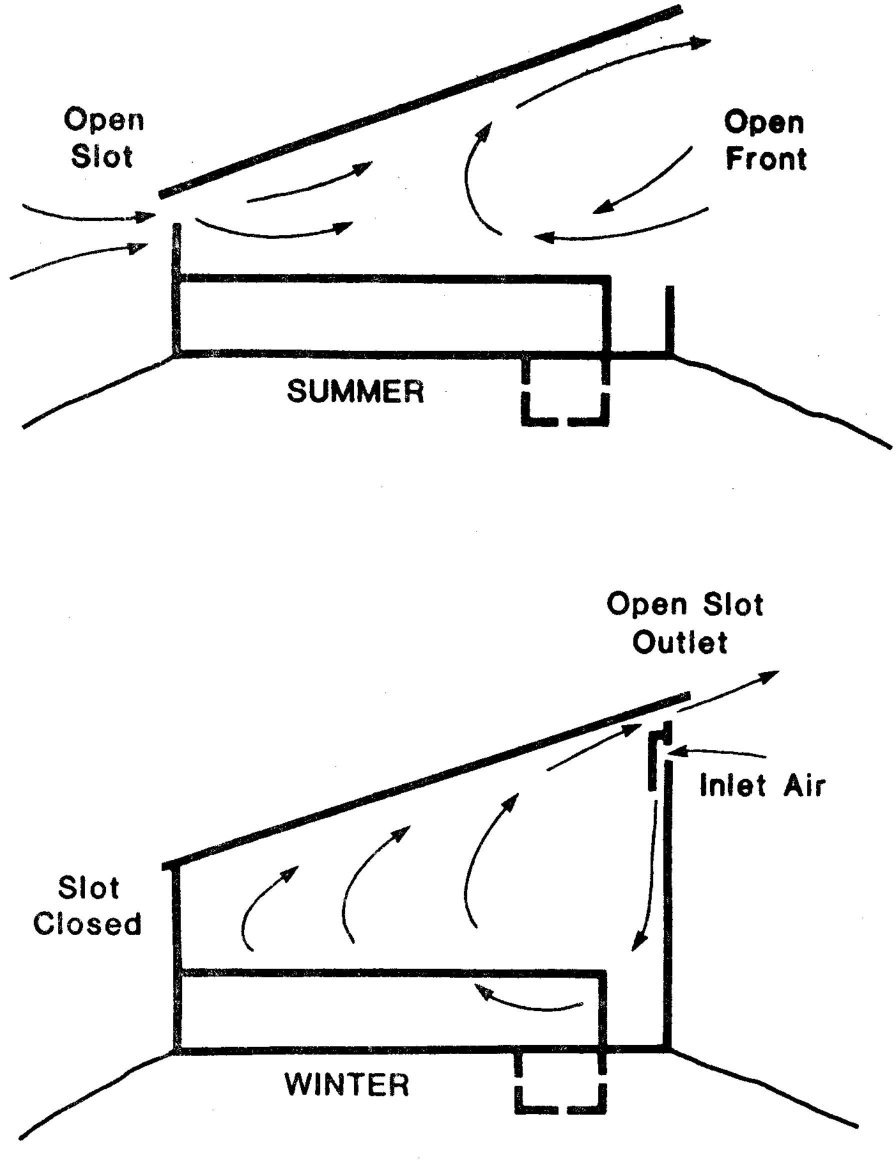


Figure 2. Air flow patterns in a naturally ventilated single slope roof building.

PRODUCTION AND CARCASS VALUE EFFECTS OF FEEDING CORN VS. BARLEY RATIONS WITH AND WITHOUT ADDED FAT

D. C. England, C. G. Chitko, M. Uhden, R. Dickson
P. R. Cheeke, P. T. Bellatty
Department of Animal Science
Oregon State University

INTRODUCTION

Barley is a major locally produced feed grain in the Pacific Northwest. In general, barley supplies 15 to 17% less metabolizable energy, but more protein, in swine rations than does corn. Because of lower energy content, barley rations on the average result in more units of feed required per unit of gain than do corn rations. Addition of fat is a common way to increase the energy content of barley-based rations when such is desired.

Barley rations tend to produce leaner carcasses than do corn rations. To the extent that increased leanness occurs and results in higher selling price, the economic value of barley relative to corn in grower-finisher rations is enhanced.

To evaluate growth rate, feed efficiency, measures of carcass merit, and relative selling prices of carcasses based on the National Pork Producers Council proposed Lean Guide Pork Value program, experiments were conducted to compare corn-soy and barley-soy rations for grower-finisher pigs. The rations compared were: (1) barley-soy; (2) barley-soy plus seven percent fat; (3) corn-soy; and (4) corn-soy plus seven percent fat. Fat was added to the barley-soy ration to provide energy approximately equal to that of the corn-soy ration. Fat was added to the corn-soy ration with expectation that it would increase the range of differences among ration groups in carcass backfat thickness with consequent influence on relative values of carcasses.

MATERIALS AND METHODS

All rations were fed in meal form. Two trials were conducted with 24 barrows and 24 gilts in each for a total of 24 animals of each sex fed each ration. All were individually fed from a starting weight of approximately 70 pounds to a finish weight of about 225 pounds. All pigs were weighed weekly throughout the trials. As individuals approached finish weight, they were weighed twice weekly if needed, to closely conform to the desired finish weight. All were slaughtered at the OSU Clark Meat Science Laboratory for collection of carcass data. Data were analyzed by analysis of variance to determine significance of differences in production and carcass traits from rations. Data for live weight at slaughter, carcass weight, and backfat thickness at last rib were used to determine average Lean Guide Pork Value differences among ration groups.

A third trial, concurrent with Trial 2, measured growth rate, feed efficiency and live backfat for pens of two barrows or two gilts; slaughter data were not obtained for these.

RESULTS AND DISCUSSION

Comparisons among the four rations for average performance and carcass traits are shown in Table 1 for the individually fed pigs.

Table 1. Averages for Performance Traits and Carcass Measurements for Individually Fed Grower-Finisher Hogs Fed Different Diets

	RATION				
Grain Fat (7.0%)	Barley -	Barley +	Corn -	Corn +	Statistical Significance
Avg daily gain (lb)	1.75	1.82	1.86	1.88	NS[1]
Avg daily feed (lb)	6.33	6.50	6.47	6.10	NS
Avg feed/gain (lb)	3.64	3.60	3.47	3.28	NS
Avg carcass length (in)	31.7	31.8	32.0	31.5	NS
Avg carcass backfat (in)[2]	1.16	1.20	1.23	1.32	NS
Avg loin eye area (sq in)	4.75	4.54	4.42	4.42	NS
Pork Value Guide index[3]	102.0	101.4	101.1	99.9	

[1] NS = differences not significant; $P > .05$.

[2] Based on average of three measurements.

[3] See Table 2.

Differences among ration groups are not statistically significant for any of the measured performance or carcass traits. Although differences are not statistically significant, the trends of the results suggest that increased energy in the ration decreased feed required per unit of gain and also decreased leanness of carcasses. The Pork Value Guide index of values of carcasses from pigs fed the different rations (Table 1) reflects the differences in carcass fatness or leanness. On the average, carcasses from pigs fed the corn plus fat diet had Lean Guide Value equal to the average for market hogs (99.9 vs 100%), whereas corn without added fat, barley plus added fat, and barley without added fat had values of 1.1%, 1.4%, and 2.0% greater than the average market hog and, more directly relevant to this experiment, were superior by those percentages to the hogs fed corn plus fat. On the average, pigs fed the barley rations had value 1.7% above average market hog value while pigs fed the corn rations had value 0.5% above average market hog value. The results indicate that sale of carcasses on the basis of estimated lean content would enhance the economic value of barley relative to corn as the grain portion of grower-finisher rations. Addition of fat to either barley or corn rations reduced unit value of carcasses.

Table 2. Lean Guide to Pork Value Based on a Percentage of Average Market Price[a]

Live	Carcass[b]			Last Rib Fat Thickness (in)				
Wt. Lb.	Wt. Lb.	.7	.8	.9	1.0	1.1	1.2	1.3
200-210	146-153	104[c]	103	102	101	100	99	98
211-220	154-161	104	103	102	101	100	99	98
221-230	162-168	104	103	102	101	100	99	98
231-240	169-175	103	102	101	100[d]	99	98	97
241-250	176-182	102	101	100	99	98	97	96
251-260	183-190	101	100	99	98	97	96	95
261-270	191-197	100	99	98	97	96	95	94
271-280	198-204	99	98	97	96	95	94	93
281-290	205-212	98	97	96	95	94	93	92

a Muscle and fat quality assumed to be acceptable, + 1.5% for thick muscling and - 1.5% for thin muscling.

b Based on 73% dressing percentage.

c Percentages based on average 1981 prices; however, when calculated on 1982 prices, no major changes were evident.

d Represents the average hog marketed in 1980-81.

(From Larry Heidebrecht "The Pork Value Approach...Paying for Value, 25th Annual Swine Day, Oregon State University, February 1984)

Results of Trial 3 are shown in Table 3.

Table 3. Averages for Performance Traits and Live Backfat Measurements of Group-Fed Grower-Finisher Hogs Fed Different Diets

	Ration				
Grain Fat (7.0%)	Barley -	Barley +	Corn -	Corn +	Statistical Significance
Avg daily gain (lb)	1.97	1.91	1.96	1.94	NS[1]
Avg daily feed (lb)	6.62[a]	6.52[a]	6.87[b]	6.04[c]	Sig[2]
Avg feed/gain (lb)	3.39	3.48	3.52	3.13	Sig[3]
Avg live backfat (in)	1.00	0.97	0.98	1.00	NS

[1] NS: Not significant; P > .05.

[2] Sig: Values with different superscripts are significantly different (P<.05). The following were significantly different for daily feed intake:

1. Rations containing fat vs non-fat; higher for non-fat rations.
2. Barley + fat vs corn non-fat; corn non-fat higher.
3. Barley non-fat vs corn + fat; barley non-fat higher.
4. Barley + fat vs corn + fat; barley + fat higher.
5. Corn-nonfat vs corn + fat; corn-nonfat higher.

[3] Sig: The following were significantly different for feed/gain:

1. Barley + fat vs corn + fat; barley + fat less efficient.
2. Corn-nonfat vs corn + fat; corn-nonfat less efficient.

Results from Trial 3 compare with those from the individually fed animals (Table 1) as follows:

1. Differences in average daily gain from rations were not significantly different in either of the trials.
2. The order of average daily feed intake was similar; daily intake decreased significantly or as a trend as energy content of the ration increased.
3. Feed/gain was in agreement in that corn + fat required the least feed per gain; adding fat to barley did not improve feed efficiency.
4. Live backfat thickness was not significantly different among the ration groups in Trial 3 and there was no trend of increased fatness with increased energy in the ration as there was for individually fed animals.

SUMMARY

In each trial, the only real or apparent benefit of adding fat was a trend or actuality of reduction of feed/gain for the corn plus fat ration; there was no apparent benefit of adding fat to the barley ration. The trend for carcass backfat thickness was unfavorable from inclusion of fat in either corn or barley rations; this trend is reflected in the Lean Guide Pork Value program as a reduced unit price for carcasses from pigs fed either grain source ration with added vs. no added fat.

REMODELING FARROWING AND NURSERY FACILITIES

James A. Moore
Extension Agricultural Engineer
Oregon State University

The design procedure in remodeling a farrowing or nursery facility is quite similar to the process in designing the ventilation system for a new unit. The slope of the floor waste handling system, and building width are fixed and in most cases unchangeable. The location and layout of the pens are flexible and their orientation influences the ventilation system. This is most important when trying to make the "best" environment near the swine sleeping area.

To simplify the rest of the discussion, I will make assumptions that will be common in remodeling most buildings, but not absolute. The purpose of this paper is to share the design process with you, to better help you understand the basics of ventilating a swine building, in this case, a farrowing or nursery facility.

In remodeling a building to convert it to a farrowing or nursery facility, the required air flow rate is the first item to be calculated. This is determined by the size and number of animals in the building. A table shown in an earlier paper entitled "Basic Ventilation Considerations" contains the suggested air flow rates for hogs.

For the remainder of this paper, let's remodel a farrowing unit as an example, to demonstrate the process. The suggested air flow rate for winter conditions (the most critical season) is 20 cubic feet per minute (cfm) per sow and litter. Knowing the number of crates/pens and multiplying by 20 cfm will provide the desired minimum air flow rate. The room should have a ceiling. The inlet air will be drawn into the attic through eave openings or louvers in the end of the building in the gable.

By bringing the inlet air through the attic, two good things happen. First, we eliminate the effect of wind blowing on the inlet and varying the quantity of air that moves into the room. By bringing air through the attic, we temper or warm it before bringing it into the room. Some heat will be lost from the room to the attic and this is a way to save or utilize room heat.

The fan(s) will be selected to provide less than the minimum air flow rate, as discussed above. Select a fan to provide 80% of the minimum to accommodate those times when one or two crates are empty and you need less air. The fan system should have the range to provide 4 to 5 times the total minimum flow rate for warm winter ventilation needs. The summer air flow rate must also be satisfied. This can be accomplished by fans or by opening windows to allow large air flow rates.

Know the number of animals in the room to determine the maximum and minimum flow rates. A variable speed fan should be readily available to satisify your needs. The other choice, especially in a larger unit, is to select several fans which can come on as the thermostatic control demands. Buy a good quality fan and get capacity curve to show how much air is being discharged at various speeds and against various room static pressures.

The room size and pen or crate layout dictate the location and size of the inlets and the placement of the exhaust fan(s). The fan pulling air from the building creates a negative pressure and outside air rushes into the room in an attempt to satisfy that negative pressure. As the fresh air comes through the inlet into the room it has a velocity which carries it into the room. The purpose of the inlet is to control the velocity and direction of the flow. The maximum distance to direct and control the air flow is about 18 feet. For rooms less than 18 feet wide the one inlet can be used to distribute the air. For rooms wider than 18 feet two inlets should be used to provide draft free, uniform air distribution.

Inlets are commonly placed along the side wall (one or both walls) or placed in the center of the building. They direct the air both ways along the ceiling toward the outside walls. The exact location of the inlet and where one, two, or more are used may be dictated by the pen or crate location in the room.

The air is usually directed along the ceiling or sometimes down the outside wall. Typically, the air is directed to the dunging area first and then moves to the sleeping area. However, it should be blended with the room air and moved through the room without causing drafts at any location in the room. It should sweep the floor to evaporate moisture and pick up gases before moving toward the outlet.

The inlets, when placed in the middle of the room or along the wall, are not continuous or open all the way along the wall. Rather they may be only 2 feet of opening and then 6 or 8 feet of solid wall, then another 2 feet of opening inlet. The exact amount of opening depends on the density and demands of the animals (sows) in the building.

Using the farrowing room as an example, we can move 20 cfm through a one-foot opening when the slot width is 3/8 of an inch. This velocity will be about 650 feet per minute (fpm) and the air jet will travel about 6 feet before it decays.

This information tells us that for a room 12 to 14 feet wide, an inlet down the middle, one foot long, will provide 20 cfm each way. This 40 cfm will provide enough air for two sows. If the crates run across the room you will need a one-foot-wide inlet every 9 feet. This assumes that each crate is 5 feet wide or a total width of 10 feet for two crates.

For buildings less than 36 feet wide, the fan can be placed on any wall. For buildings wider or longer than this, a second fan should be placed on the opposite wall to reduce the travel distance of the exhaust air. For smaller buildings, the fan can be placed on either wall. If the fan is placed on the wall towards the prevailing wind, a hood or baffle should be used to reduce the effect of the wind on reducing the discharge rate of the fan.

These comments are intended to assist you in selecting and providing an adequate ventilation system for your facilities. They are not complete and I would be glad to talk with and assist you in designing the proper ventilation system for your facilities. Proper ventilation does not cost, it pays.

TROUBLESHOOTING A MECHANICAL VENTILATION SYSTEM

Ventilation systems are one of the most important components in a swine operation. Unfortunately, they are often neglected and usually in need of attention and maintenance. When properly operating they, like health care, nutrition and breeding, are a necessary part of a sound swine operation.

Before you can troubleshoot the ventilation system, you must know what it is designed to accomplish. This means you should calculate fresh air requirements of animals housed in the building. Suggested ventilation rates in cubic feet per minute (cfm) per head are listed in Table 1. The capacity of the system for summer and winter conditions can be calculated using the fresh air values and number of animals.

Once the air flow rate, in cubic feet per minute (cfm), has been calculated, it is relatively simple to select a fan or fans to provide that quantity of air. Select one to operate against at least 0.05 inches or perhaps 1/8 inch of static pressure. Assuming you have the proper fan or fans for your building, maintenance becomes the major issue. Some studies have shown that dust buildup on the blades, around the housing and on the louvers can reduce the efficiency by up to 35%. Removing dust from the motor will let it run cooler and promote a longer life. Oiling louvers or shutters will reduce sticking and lower the pressure required to open.

Properly operating fans are only as good as the control system. Thermostats to start and stop fans should be checked at least annually. Disregard the numbers on the thermostat dial and calibrate your controls against an independent thermometer. Make sure the thermostat is out of drafts, away from inlets and heaters, and reflects the desired temperature for the hogs.

Inlets are perhaps the most important and least understood part of a ventilation system. In ventilation needs shown in Table 1, the summer rates are 10 to 20 times larger than those recommended for cold weather. This wide range requires different inlets to insure proper distribution of the fresh air in the room without causing drafts. It is important that inlets uniformly distribute the air throughout the room. The incoming air should blend with the in-house air to increase its temperature which increases its water-carrying capacity. The inlets should direct the blended air over the floor to allow it to pick up moisture and carry it from the building.

Table 1.

	Weight lb	Ventilation, cfm/hd Cold weather rate	Mild weather rate	Hot weather rate
Sow and litter	400	20	80	500
Prenursery pig	12-30	2	10	25
Nursery pig	30-75	3	15	35
Growing pig	75-150	7	24	75
Finishing pig	150-220	10	35	120
Gestating sow	325	12	40	400
Boar	400	14	50	300

From Midwest Plan Service No. 8-Swine Housing & Equip. Hdbk.

The inlet location is decided after the pen layout has been determined. The cool incoming air is introduced into the pen at the dunging end and circulates towards the sleeping area. The animals will always sleep in the best environment (warmest and best air) and dung in the coldest area. This changes as the season changes from winter to warmer weather.

Below are a few of the more common problems and solutions you may find as you review and evaluate your ventilation system:

PROBLEM--Some odors, ammonia, or high humidity in the room air.

SOLUTION--The building is underventilated. The controls need to be adjusted to increase the fan's output to move more air. The fan needs to run faster (if a variable speed) or longer if on a timer. The heater control will need to be raised if a constant room temperature is to be maintained. This is the MOST COMMON PROBLEM in swine buildings.

PROBLEM--Fan motor laboring; doors are difficult to open against the static pressure.

SOLUTION--Inadequate air inlet area. Open inlet areas into room or in some cases attic. Starved inlets may force air to flow up through manure gutters or pits bringing foul air into the room.

PROBLEM--Wet attic or ceiling insulation.

SOLUTION--Inlets too wide. Inlet does not properly meter incoming air and allows backdraft of building air into attic. This carries moisture into attic where the air cools and moisture condenses. Adjust inlets by reducing opening to maintain flow only into the room.

PROBLEM--Pigs not dunging in proper place, creating messy pen.

SOLUTION--Improper inlet location or opening (design or adjustment). There can be several problems causing messy pens, but improper ventilation is the MOST common. Cold air dumping in sleep area will drive pigs to sleep in another part of the pen.

PROBLEM--Heating costs too high.

SOLUTION--Building overventilated. Once the system is providing adequate air, the minimum flow rate may be too high. Reduce fan speed. Trying to reduce air flow rate by restricting inlet area causes high static pressure and possible drafts in parts of the building.

MANAGEMENT TIPS FOR BREEDING EFFICIENCY IN SWINE

John S. Hansell
Pork Producer
Hermiston, Oregon

This is a description of methods used by Hansell Brothers, Inc., to attain breeding efficiency in my commercial, semi-confinement, farrow-to-finish swine operation. The production practices have been exceedingly productive for 25 years.

I do not de-emphasize the importance of any aspect of my swine operation. However, it seems that breeding or reproduction efficiency has to top the large list of the many important aspects of swine production. As we all know, if you do not get the sow(s) bred there is little else that matters in this business.

To expand: The management and science of breeding efficiency not only includes "getting sows bred" but should emphasize the number of healthy pigs sold per litter per year, and other economic values (Table 1). Considering the impact of breeding or reproduction efficiency for the number of pigs sold per litter underscores the significance of breeding efficiency in an operation. Perhaps reproduction is many times greater in importance than production for an efficient swine operation. At any rate, the essence of breeding management is to enhance the profitability of the breeding herd through breeding efficiency.

Table 1. Economic Values of Swine Productivity

Pigs Sold Per Litter	Sows Needed to Market 2,000 Hogs Per Year [a]	Value of Marketings [b]
7.0	124	$189,175
7.5	114	202,688
8.0	109	216,200
8.5	102	229,713
9.0	97	243,225

[a] Assume 2.30 litters/sow/year.

[b] Based on pigs sold/litter x 2.30 litters/sow/yr. x 235 lbs./head x $.50/lb. x 100 (sows).

My goal for breeding efficiency is to increase the number of pigs per litter marketed per year. Improvement in volume marketed makes good economic sense. Optimizing the output of pigs sold returns more profit to the production of marketed hogs, as illustrated in Table 1. Likewise, the cost of maintaining the breeding herd (about 33% of the total cost of production) is reduced by increasing the output.

Genetics and Environment for Breeding Efficiency

Breeding efficiency and performance are determined by genetic composition and environmental factors. Table 2 shows the approximate influence of genetics and environment on some economic characteristics. Generally, the lower the degree of trait heritability the higher the response to environmental conditions. Environment can include about anything of a non-genetic nature that contributes to the total setting of the confined breeding herd. It is also important to understand the interaction of genetics (genotype and phenotype) to environment for breeding efficiency and performance.

Table 2. Genetics and Environment Influence on Economic Characteristics

	Percent Caused By	
Trait	Genetics	Environment
Birth weight	0	100
Litter size weaned	7	93
Weaning weight	8	92
Daily gain	30	70
Feed conversion	30	70
Loin eye area	45	55
Backfat	50	50

Although it is worth noting, I am not going to attempt a lay explanation of classifying genotypes and environments to determine which combinations result in important productive interactions for breeding efficiency. I will leave that task to the swine geneticist. However, my management scheme for breeding efficiency is influenced by these interactions, and it is necessary to speak about some of these interactions in applied terms.

The first indication of imbalance of the animal and the environment is a reduced reproductive performance. There are a host of environmental factors affecting breeding efficiency. The most important are management, nutrition, and health. Although none should be separate from the other, management is most important and can influence the quality of the other two.

Management and Selection For Breeding Efficiency

Management for breeding efficiency begins with the proper selection of superior boars, sows, and gilts. My selection procedure for breeding stock is based on a firm set of criteria that predicts and evaluates the best anticipated performance for breeding efficiency in each animal. My selection criteria are focused on phenotype and, when possible, on genetic background (traits) or genotype.

My first step in the selection process begins with identifying the top producing crossbred females in the herd. I use production records and visual appraisal for identification. The major criteria used to identify and evaluate sows for the breeding herd are: prolificacy and litter size, mother and milking abilities, correct anatomy, health, and adaptation to the production system. Gilt replacements in the breeding herd are selected and evaluated on the maternal characteristics and litter production (9 or more healthy pigs farrowed alive per litter) of their dam, correct anatomy, health, adaptation, and potential for fertility, litter size production, mothering and milking abilities.

The selection process for females for the breeding herd is conducted on a continuous basis. A sow or gilt is part of the herd as long as she meets essential production criteria. The optimum, average parity for my sow herd is 5 to 5.5 farrowings.

My second concern is the selection of the closest thing I can find to a purebred boar that would be above average or superior to the herd in economically significant and productive traits. Since the boar is the only breeding stock imported into the operation, improvement in breeding efficiency and performance is relative to him. Selection criteria for the boar are similar to the criteria for female selection. There are differences, however. My standards for boar selection are: typiness, correct anatomy (including testicle development), libido, parentage traits, growth potential and carcass merit, health, and tested or evaluated performance (seldom available).

Breeding System

I use three breeds in my breeding program. For service boars, I primarily maintain, on a percentage, 52% Yorkshire for prolificacy, carcass length, libido, mothering and milking ability traits, and cleanliness in confinement; 27% Hampshire for growth, leanness, and carcass merit; and 20% Duroc for growth and carcass merit, and hardiness.

The three breeds are alternately used for a three-way backcross in a cross-breeding system. Thus, my breeding scheme is Y x H x Y x D x Y. I predominately exploit the Yorkshire breed because in my cross-breeding system, when compared by sire-of-dam breed, the Yorkshire-related sows invariably farrow more pigs per litter and produce a greater volume of essential milk than the other breeds. The sequence of breeds in my cross-breeding system also contributes to an increase in survival of pigs born alive.

Coincidentally, recent scientific research findings (Burris et al. 1983) on conception and pig survival by breed concur with my performance data.

Breeding Management

Proper management of preferred breeding stock is essential for breeding efficiency. Management neglect of the breeding herd, especially the boar, is a major cause of poor breeding efficiency. Altering the animal's natural behavioral response for reproduction by certain management techniques or environment can have a negative effect on efficiency. Often we make the animals adapt to our production system with little regard to their natural reproduction needs. When there are fewer obstacles and challenges confronting the breeding herd, there is often an improved conception rate with less embryonic and fetal loss.

To emphasize, most aspects of reproduction and breeding efficiency (fertility, libido, estrus, and ovulation) are frequently affected by environmental conditions.

We double breed, assisted with hand-mating, every sow and gilt. They are bred twice in a 24-hour period to unrelated boars of the same breed. The sows are removed from their litter 30 days post-farrowing. They are taken in groups to the breeding area, full-fed a high energy ration, and bred back on the first heat period after weaning. We wean three times per week. This method allows us to manage the sows in fewer numbers, diffuses the frequency and number of breedings per boar, and synchronizes estrus in the sow.

The gilts are grouped by age (220 days), taken to the boar area 14 days before first introduction to the smaller service boars, flushed, and given fence-line and short contact periods in their pen with a vasectomized boar. Ideally, I like to have a gilt bred when she is approximately 235 days old or after she has had at least two estrus cycles. The gilt is bred as she comes naturally in standing heat.

I believe breeding efficiency is marked in the gilt by maturity, genetic composition, health, good nutrition (flushing), stimulation, and conditioning. Table 3 shows gilt litter production averages of pigs born alive relative to age of the gilt at first breeding in my operation.

Table 3. Averages of Gilt Litter Production Relative to Age of Gilt

Age of Gilt at First Breeding	Average Pigs Born Alive
220 - 235	7.8
235 - 245	10.1
245 - 255	10.7
255 - 265	10.4
265 - 275 [a]	8.1

[a] Conducted for experimental purposes. Not economically feasible.

A good environment affects breeding efficiency. Whether the effect is heat or cold, night or day, or seasonality, the effect must be minimized to enhance breeding efficiency. I try to provide a comfortable environment for the breeding herd during the hot and cold periods of the year. The effects of seasonality are met by exposing the gilts to additional lighting during winter. The breeding area is roofed and skylighted.

I have repeatedly stressed that good management is one of the keys to successful breeding efficiency. Good, sensible management of the boar cannot be compromised for breeding efficiency. The boar must be respected for the vital contribution he makes to a successful breeding program. A good environment and good nutrition are minimum requirements for maintaining the boar.

I maintain a ratio of 1 boar for 38 sows. About 33% of my service boars are used for gilts and small sows. The other percentage of service boars is preserved for large, older sows. A sufficient number of fertile boars is necessary for successful reproduction efficiency.

When a new boar is introduced into the herd, he is health checked and acclimated to the breeding facility. He is double-bred to several gilts to check fertility. A young boar is used no more than 3 or 4 times per week. The older boars are used more frequently. I record and compute the frequency and number of matings for each boar, date used, used for first or second breeding, and relationship to sow conception. Boars frequently related to poor sow conception are culled.

Nutrition

One of the most dynamic factors for breeding efficiency is proper nutrition for the breeding herd. It not only represents a substantial cost of production but also represents a significant requirement for reproduction.

Of course, the nutritional requirements for the boar, sow, and gilt are different for each depending on their disposition for reproduction or breeding efficiency. I maintain the boar on a low energy ration so he does not become overweight. The sow is maintained throughout her existence as a reproductive entity. Throughout each phase of her productive life, she is nutritionally and physically maintained for breeding efficiency.

From a nutritional standpoint, the gilt is unique because she is integrated with each stage from starter through finisher development until puberty. At 5 months, she is separately full-fed a low energy ration during a conditioning period before being taken to the breeding area. After she is placed in the breeding area, the gilt is given a higher energy ration for flushing. The gilt, like the sow, is not allowed to get overweight. Feed efficiency is decreased, and reproductive problems--poor conception rate and increased stillbirth rates--are higher in overweight sows and gilts.

After breeding, the sow and gilt are full-fed a medicated gestation ration for a short period before entering the gestation area. According to some reports (Rattray 1977), a high feeding level of the gilt before and after mating has been associated with an increase in embryo mortality. This is contrary to my gilt nutrition program results.

Health

The health status of the breeding herd is important for successful breeding efficiency. It can be gauged by a number of important health-related manifestations pertaining to reproduction such as the number of stillbirths and mummified fetuses farrowed per litter, especially in younger sows. My stillbirth average per litter is 0.8, and mummies per litter is 0.05.

The primary infectious disease influencing breeding efficiency that I vaccinate for is leptospirosis.

One of the most significant health problems associated with breeding efficiency is stress. A disturbance or imbalance of any environmental factor related to breeding efficiency can induce stress and, consequently, affect the success of breeding efficiency.

Summary

I have intentionally tried to respect the knowledge of those who read this presentation of my opinions and personal mangement practices for breeding efficiency in swine. Therefore, I have purposefully accentuated, as concisely as possible, only the most important aspects on this subject pertinent to me and my swine operation.

Whether it is a boar, sow, or gilt, each animal uniquely has different husbandry requirements and biological distinctions in the scheme and determination for breeding efficiency. Successful breeding efficiency is contingent on the response of particular genetic or physiological material to an environmental influence. Environmental conditions of the breeding herd are the most important factors for breeding efficiency--including management awareness of requirements of the herd for breeding efficiency.

The economic values gained from enhanced breeding efficiency are foremost in importance. Potential profitability of the breeding herd can result from breeding efficiency.

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