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# Farmer-Owned Packing Plants

By: Ron Plain, Extension Economist, University of Missouri-Columbia

In the fall of 1998, hog prices dropped to the lowest level in 40 years. The primary reason prices reached such disastrously low levels was that, for a period of nearly three months, the number of hogs ready for market exceeded the capacity of packers to slaughter them. This mismatch between production and slaughter capacity, and the disastrous consequences for hog producers, has generated a lot of interest in producer-owned packing plants. The National Pork Producers Council, as well has other groups of hog farmers, has expressed interest in the possibility of owning and operating hog slaughter facilities.

This paper outlines ten items about the business of pork packing which hog producers may want to consider before investing in a packing plant.

**1. Periodically, the U.S. has a shortage of hog slaughter capacity**

Hog production is both seasonal and cyclical. The number of hogs ready for slaughter is usually greatest during the fall months of every fourth year. During the fall of 1998, weekly hog slaughter exceeded 2 million head for 14 consecutive non-holiday weeks. In order to kill this many hogs, most packing plants operated six days per week and some IBP plants killed hogs seven days per week. At such times, hog packers tend to make outstanding profits (and producers lose money) on each hog they slaughter.

**2. Periodically, the U.S. has a surplus of hog slaughter capacity**

Hog production is both seasonal and cyclical. The number of hogs ready for slaughter is usually lowest during the summer of every fourth year. During the summer of 1996, weekly hog slaughter dropped below 1.7 million head for 16 consecutive weeks. At such times, hog packers tend to lose money (and producers make outstanding profits) on each hog they kill.

**3. Hog packers have earned good returns in the last two years**

**Packers have been more successful at raising hogs than hog producers have been at packing.**

Hog slaughter set a record (101 million head) in 1998. Indications are that this year's slaughter will be slightly higher. As one would expect, packer profits have been much greater than producer profits during this period.

**4. Historically, meat packing has not been a very profitable business**

Compared to other major industries, meat packing has been a low profit business. The latest Value Line Investment Survey indicates their index of total returns for all major businesses for the 5 year period ending in July 1999 was 128.5%. The 5 year total returns for an investment in some companies who are major hog packers were:

| | |
|---|---|
| IBP | 71.7% |
| ConAgra | 81.3% |
| Hormel | 96.5% |
| Smithfield | 102.5% |

Each of these firms under performed the market average. In general, grocery stores did much better. Kroger stock's total return was 323.0% and Safeway Inc. had a total return of 770.7%. Of course, the big winners in the past 5 years are technology stocks. An investment in General Electric 5 years ago would have earned 445.2%, Intel had a total return of 876.7% and Dell Computers a staggering 7048.0% total return on its stock.

Granted, past performance may not be indicative of future

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What's inside...



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*(Comparison...continued from page 1)*

earnings, but remember.... in 1980, the nation's largest hog packer was Wilson Foods, followed by John Morrell, Armour and Sipco. None of these companies have survived as independent firms.

Thorn Apple Valley closed a 14,000 head per day hog slaughter plant in July 1998 and filed for bankruptcy a few months later. TAV pork processing plants have been sold; but, the packing plant remains closed and is unlikely to ever reopen.

**5. Packers have been more successful at raising hogs than hog producers have been at packing**

Smithfield, Cargill, and Seaboard are packers which have successfully acquired large numbers of hogs. Two large hog producers, Tyson Foods and Premium Standard Farms, have gotten into hog packing. After 32 months of operating the Marshall, Missouri, slaughter plant, Tyson sold it to Excel. PSF filed for bankruptcy protection within 2 years of opening their Milan plant.

**6. The number of hog packing plants has been declining**

In the last 17 years, the number of federally inspected hog slaughter plants has declined by 45.5%. The decline has been greatest for small and mid-sized plants. The number of plants which slaughter between 1,000 and 2,000 head per day has declined by 85% since 1981. The number of plants slaughtering over 6,000 head per day has increased by 190%.

**7. Packing plant size has been increasing over time**

The average number of hogs slaughtered per federally inspected hog slaughter plant has been steadily increasing for the past 20 years. In 1981, 21.1% of federally inspected hog slaughter occurred in plants killing over 6,000 head per day. Last year, such plants accounted for 87.3% of federally inspected hog slaughter.

There are numerous reasons for the increase in plant size. Many large plants operate two kill shifts per day. This reduces the fixed cost per hog by doubling the amount of pork being produced per square foot of kill-and-cut space.

The chain speed in large hog slaughter plants has been steadily increasing. North America's newest plant, the Maple Leaf Foods facility in Brandon, Manitoba, has a chain speed of 1125 head per hour. Once double shifted, this plant will kill over 18,000 hogs per day. High chain speed has several advantages. Because it reduces the time from kill to cooler, there is less shrinkage of carcass weight and less decline in the pH of the meat, thus reducing the amount of PSE pork. Fast chain speed also forces a high degree of discipline on the labor force.

Economies of size also encourage bigger plants and ownership of multiple plants. The number of employees involved in selling pork and pork by-products is not much different between a small single shift plant and a large multiple plant firm.

The export market for pork has been one of the most lucrative in recent years. A large firm killing 30,000 plus hogs per day can more easily justify opening overseas sales offices than can a small firm killing only a couple thousand hogs per day.

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**Federally Inspected Hog Slaughter Plants**

| Head Slaughtered Per Year (1,000s) | 1981 | 1984 | 1985 | 1987 | 1990 | 1993 | 1996 | 1999 |
|---|---|---|---|---|---|---|---|---|
| | number of plants | | | | | | | |
| <1 | 899 | 894 | 894 | 811 | 676 | 557 | 477 | 438 |
| 1-9 | 269 | 241 | 222 | 196 | 198 | 194 | 161 | 166 |
| 10-99 | 110 | 107 | 105 | 88 | 88 | 78 | 71 | 70 |
| 100-249 | 23 | 26 | 17 | 13 | 15 | 12 | 16 | 13 |
| 250-499 | 26 | 19 | 22 | 13 | 11 | 8 | 9 | 4 |
| 500-999 | 23 | 21 | 16 | 25 | 9 | 7 | 3 | 5 |
| 1000-1500 | 28 | 20 | 20 | 13 | 9 | 10 | 5 | 2 |
| 1500+ | 10 | 13 | 14 | 23 | 22 | 25 | 28 | 30 |
| **Total** | 1388 | 1341 | 1310 | 1182 | 1028 | 891 | 770 | 728 |

Source: USDA's Livestock Slaughter, Annual Summary

**Federally Inspected Hog Slaughter Plants**

| Head Slaughtered Per Year (1,000s) | 1981 | 1984 | 1985 | 1987 | 1990 | 1993 | 1996 | 1999 |
|---|---|---|---|---|---|---|---|---|
| | percent of federally inspected hog kill | | | | | | | |
| <1 | 0.3 | 0.3 | 0.3 | 0.4 | 0.2 | 0.2 | 0.2 | 0.2 |
| 1-9 | 0.9 | 0.9 | 0.8 | 0.8 | 0.8 | 0.6 | 0.5 | 0.4 |
| 10-99 | 3.9 | 4.3 | 4.1 | 3.9 | 3.9 | 3.2 | 3.0 | 2.9 |
| 100-249 | 4.2 | 5.7 | 3.2 | 3.1 | 3.1 | 2.0 | 2.5 | 2.2 |
| 250-499 | 11.3 | 8.2 | 9.5 | 7.0 | 4.6 | 3.0 | 3.7 | 1.3 |
| 500-999 | 19.6 | 19.3 | 15.1 | 16.1 | 8.0 | 5.2 | 2.2 | 3.2 |
| 1000-1500 | 38.7 | 29.7 | 32.0 | 12.9 | 14.1 | 13.9 | 7.8 | 2.5 |
| 1500+ | 21.1 | 31.6 | 34.8 | 55.8 | 65.2 | 71.8 | 80.3 | 87.3 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

Source: USDA's Livestock Slaughter, Annual Summary

(Comparison...continued from page 2)

**8. The packer share of the pork dollar is decreasing**

In 1970, kill and cut packers captured 31.2% of the consumer's pork dollar. In 1980, their share was 24.9%. By 1990, the kill and cut share of the consumer's pork dollar had dropped to only 14.6%. In 1998 their share was 18.3%. Although this was the highest packer's share of the 1990s, it was still less than for any year prior to 1985.

**9. If you think hog packers will make huge profits in coming years, buy Smithfield stock**

There is a less risky way to take advantage of packer profits than investing in a start up firm to kill hogs -- simply buy the stock of one of the major pork packers. It takes a great deal of money to construct and operate a hog slaughter facility. One objective of a packer is to buy hogs cheap. How likely is it that a start-up packer will be able to both out bid established packers for hogs and return a profit on operations?

**10. If you are concerned about getting your hogs killed in the future, sign a long term marketing contract with a major packer**

Approximately half of next year's hog production has already been sold to packers by way of long term contracts.

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# New Study Finds Following GAAMPs Reduces Soil Phosphorus Levels

By: Charles Gould, MSUE Nutrient Management Agent

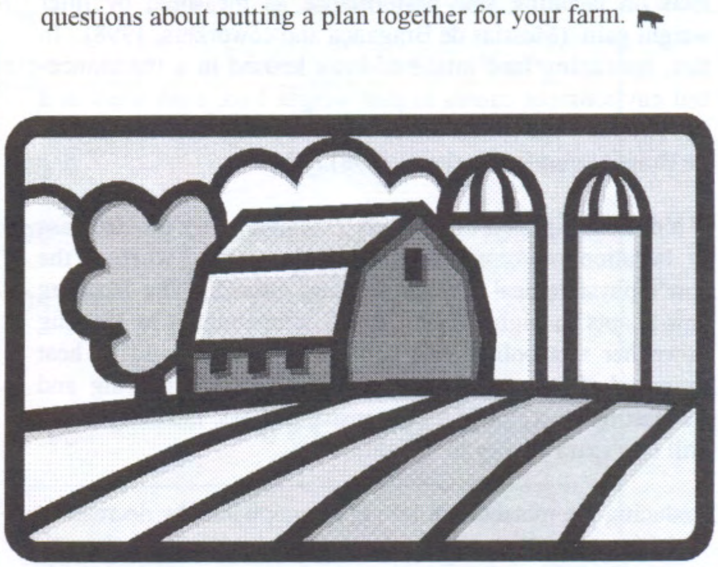
Manure management guidelines were adopted in Michigan in the late 80's for livestock farms to limit soil phosphorus increases to levels that met agronomic needs and were below levels that provided undue risk to surface waters. These guidelines make up the Generally Accepted Agricultural Management Practices (GAAMPs) for manure management. The manure GAAMPs, as it is called, is updated annually to keep it current with new technology and legislation. It is based on sound science and common sense.

Even though the manure GAAMPs is based on sound science and common sense, there has not been any long-term studies substantiating what it purports to do – effectively manage phosphorus. Recent research findings from Michigan State University's Kellogg Biological Station indicate that following the Michigan manure GAAMPs does in fact, achieve the goal of responsible soil phosphorus management.

The study was initiated to determine if the diligent application of manure management guidelines on a commercial dairy operation with 113 distinct crop management fields was achieving the desired result of controlling increases in soil phosphorus levels. Comprehensive soil phosphorus levels (base line data) were determined in 1992, and again in 1997 after five years of guideline observation. The 113 distinct fields monitored were classified according to 1992 Bray P1 phosphorus levels: below 150 lbs/A (62%), between 150 and 300 lbs/A (35%), and greater than 300 lbs/A (3%). In 1997, the percentages in each category was 70, 30 and zero, respectively.

It is interesting to note that fields that started above 300 transitioned to a lower category. Of those that started in the intermediate category, 20% moved to a lower category and 46% showed lowered soil phosphorus levels in 1997. Fields initially in the lowest category remained in that category in 1997. Soil sampling is currently underway to determine if there has been more change in soil phosphorus levels over the past two years.

So what are the implications for swine producers? The most obvious is that manure GAAMPs will help producers manage soil phosphorus levels. More importantly however, is that to follow these recommendations requires a manure management plan. Everything that should be included in a plan is outlined in the manure GAAMPs, which is available at your local Extension office. Once a plan is developed and followed, it provides protection under Right To Farm Guidelines. Call your regional swine Extension agent if you have questions about putting a plan together for your farm.



# How Does Heat Stress Affect Sow Performance During Lactation?

By: Juliana Pérez Laspiur[1] and Dr. Nathalie L. Trottier[2]
Department of Animal Science, Michigan State University

Depressed performance in lactating sows due to heat stress is an important economic factor in the swine industry during the summer season in North America and all year round in countries near the equator. When subjected to high ambient temperatures sows experience increased weight loss and decreases in milk production; yielding depressed litter weight gain and lengthening the interval from weaning to estrus. Heat stress is characterized by increases in body temperature, respiration rate and heart rate, and decreases in feed intake, thyroid hormones, and corticosteroids.

Several cooling systems are available to help sows cope with heat stress, namely snout coolers, water drippers, and water-cooled pads. Snout coolers increase convective heat loss and water drippers increase evaporative heat loss, however water-cooled pads are preferred by sows under heat stress (Bull and coworkers, 1997). While these may help alleviate some of the heat stress effects, significant improvements in lactation performance have been lacking. Interestingly, the mechanism by which heat stress decreases lactation performance is still poorly understood.

Various investigations have been performed to address the question of how high environmental temperatures affect sow performance during lactation. So far, research indicates two potential ways this is occurring. The sow regulates its metabolism rate by decreasing feed intake; this in turns reduces heat of digestion. Decreased feed intake was thought to be the factor responsible for the decreased lactation performance seen in sows under heat stress. A recent study shows that a decrease in feed intake due to heat stress has only minor effects on lactating sow performance as measured by litter weight gain (Messias de Bragança and coworkers, 1998). In fact, restricting feed intake of sows housed in a thermoneutral environment causes higher weight loss, than sows in a hot environment with a lower voluntary feed intake (Messias de Bragança and coworkers, 1998).

If a decrease in feed intake only explains partly the decrease in lactation performance, the question arises whether the sow's physiological mechanisms are altered. The lactating sow adapts to high environmental temperatures by slowing down her metabolism rate to decrease the amount of heat produced. Getting rid of excess heat through panting and increasing heart rate is an expensive process, meaning that it will cost extra energy to the animal.

Reducing the metabolism rate is accomplished by decreasing activities via a decrease in the thyroid hormones and corticosteroids. These hormones control the rate at which body reserves are mobilized, thus decreasing the supply of nutrients to the mammary gland and milk synthesis (Prunier and coworkers, 1997). The decrease in the sow's metabolism rate is thought to be the major factor affecting litter growth in a hot environment (Black and coworkers, 1993; Messias de Bragança and coworkers, 1998; Prunier and coworkers, 1997).

Another potential mechanism is a redirection of blood flow to the skin, which may decrease blood flow to other organs including the mammary gland (Black and coworkers, 1993). If a redirection of blood flow occurs, then a decrease in milk production could be explained by a decrease in nutrient availability to the sow udder, therefore decreasing litter growth.

With this in mind, we have been conducting research at Michigan State University to learn more about reducing heat stress in lactating sows. The objective of our project is to determine if manipulating the amino acid nutrition of the sow improves the lactating performance under hot environmental conditions. The purpose is to increase the ability of the sow to deal with high temperatures without compromising productivity. Arginine is an amino acid involved in controlling blood flow. It is hypothesized that arginine may be an important factor increasing blood flow to the mammary system. We think that increasing arginine levels in lactating diets will optimize milk production through increased heat dissipation and increased blood flow to the mammary gland. Three dietary treatments with different levels of the amino acid arginine (low: 0.96% arginine, med: 1.34% arginine, high: 1.73% arginine) are being tested under two room temperatures, 70°F (Comfort zone) and 85°F (Heat-stressed). Lactation performance of the sows and heat stress indicators are being monitored as well as piglet suckling behavior.

Preliminary data on sow feed intake (fig. 1), sow weight loss (fig. 2), litter weight gain and vital signs (table 1) are reported. Feed intake was decreased by 25% with an increase in room temperature but was not affected by dietary treatment. In the comfortable room, the medium level arginine diet promoted feed intake, possibly by an ideal balance of amino acids.

Sow weight loss was greater in heat-stressed rooms compared to the comfortable rooms. This was accompanied by a 50% increase in respiration rate, and a significant increase of 1.3° F in sow body temperature. However, in the comfortable rooms, additional weight loss was avoided with the medium

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(Heat Stress...continued from page 4)
arginine level diet. Litter weight gain was not affected by dietary treatment or by room temperature. There was no indication that dietary arginine levels influenced milk production. The study is currently in progress. Additional sow performance data will allow definite conclusions to be made in the near future.

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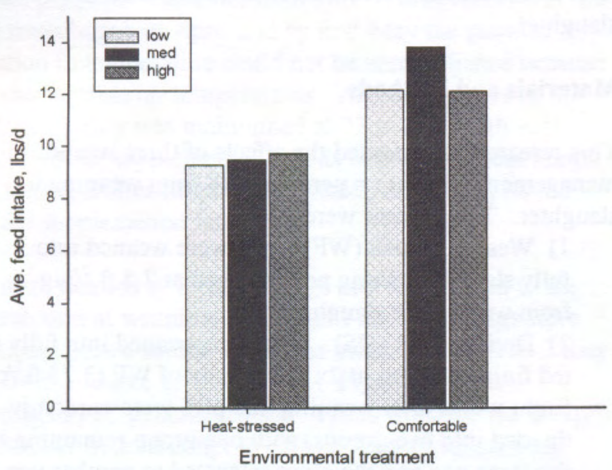


Fig. 1 Effect of environmental temperature and dietary treatment on sow feed intake during a 21-d lactation period.

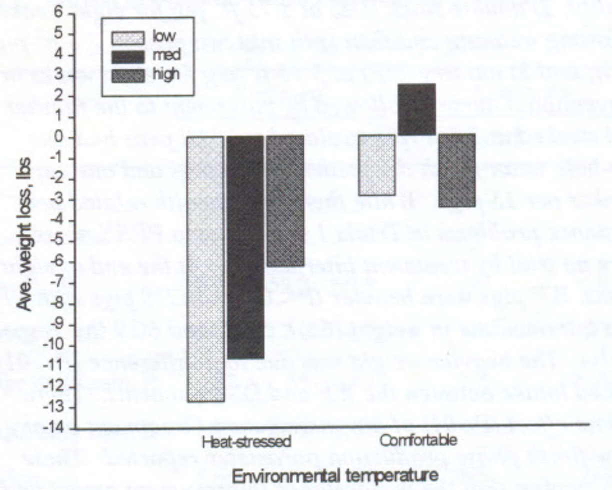


Fig. 2 Effect of environmental temperature and dietary treatment on sow weight loss during a 21-d lactation

Table 1. Effect of environmental temperature and dietary treatments on sow vital signs and lactation performance

| Item | Heat-stressed | | | Comfortable | | |
|---|---|---|---|---|---|---|
| | Low[a] | Med[b] | High[c] | Low | Med | High |
| Vital signs: | | | | | | |
| Resp. rate, bpm | 82.6 | 111.2 | 96.9 | 47.0 | 43.5 | 52.9 |
| Heart rate, bpm | 104.3 | 103.7 | 100.3 | 104.7 | 105.2 | 109.2 |
| Body temp., ° F | 103.9 | 103.8 | 104.2 | 103.0 | 102.3 | 102.8 |
| Lactation performance: | | | | | | |
| Piglet wt. gain, lb/d | 0.59 | 0.54 | 0.55 | 0.61 | 0.58 | 0.58 |

[a] Diet containing 0.96 % arginine.
[b] Diet containing 1.34 % arginine.
[c] Diet containing 1.73 % arginine.

# Effect of Wean-to-Finish Management on Pig Performance

By: Michael C. Brumm, Angela K. Baysinger, Robert W. Wills, Edgar T. Clemens, Robert C. Thaler[1]

**Summary and Implications**

*An experiment consisting of three trials was conducted to determine the effect of wean-to-finish management systems on pig performance. Treatments consisted of: 1) wean-to-finish single stock (WF) at 7.5 ft²/pig from weaning (17 day mean age) to slaughter in a fully slatted finishing facility; 2) double stock (DS) at 3.75 ft²/pig for eight weeks following weaning and then split into two pens at 7.5 ft²/pig each; and 3) nursery (NF) at 3.75 ft²/pig for eight weeks in a conventional nursery followed by movement to the finisher and stocked at 7.5 ft²/pig to slaughter. All pens had one two-hole wean-finish dry feeder per 15 pigs and one cup-drinker per 15 pigs. While there were health related performance problems in Trials 1 and 2 due to PRRS, there were no trial by treatment interactions. At the end of eight weeks, WF pigs were heavier (P<.01) than DS pigs with NF pigs intermediate in weight (63.1, 59.2, and 60.9 lbs, respectively). The heavier weight was due to a difference (P<.01) in feed intake between the WF and DS treatments. There was no effect (P>01) of any management treatment on any grow-finish phase production parameter reported. These data suggest that the performance improvement associated with wean-to-finish production systems occurs during the first eight weeks postweaning. They also suggest that the response can be expected even when health challenges occur in a production system.*

**Introduction**

Designing production systems for pig flow used to be relatively simple. Following weaning, pigs were moved to a nursery for four to eight weeks and then moved to a grower-finisher facility. The nursery was designed for pigs from 10 to 45 pounds and the grower-finisher was for pigs from 45 pounds to slaughter. Engineers, farm managers and consultants all had experiences with these facilities. They knew what the temperature requirements and associated heating costs were, what stocking density gave the best pig performance and economic return, and how much manure was produced per facility per year.

The advent of wean-to-finish facility management has changed many producers' thoughts regarding facility needs and pig flow considerations. Instead of designing nurseries for six to eight groups of pigs per year (turns) and finishers for 2.7 to 2.8 turns per year, wean-to-finish facilities are designed for 2.1 turns per year. Instead of having one nursery and two finishers as the ideal planning combination, we now are concerned about pairing up wean-to-finish facilities having 2.1 turns per year with finishers having 2.7 turns per year. Producers, engineers and their advisers are asking questions about stocking strategies to maximize performance and economic return, manure production values for environmental regulators, heating systems, feeder selection and a host of related questions.

While the popular press has carried numerous reports of producer experiences with wean-finish facilities, there have been no published studies designed to compare the effects of common management systems on weaned pig performance to slaughter.

**Materials and Methods**

This research investigated the effects of three weaned pig management systems on performance from weaning to slaughter. The systems were:

1) Wean-to-finish (WF). Pigs were weaned into fully slatted finishing pens stocked at 7.5 ft.²/pig from weaning to slaughter.

2) Double stock (DS). Pigs were weaned into fully slat ted finishing pens at 2x the density of WF (3.75 ft²/pig). Eight weeks after weaning, the pigs were randomly divided into two groups, with one group remaining in the same pen and the other relocated to another pen in the same facility. Pigs then were grown to slaughter at 7.5 ft.²/pig.

3) Nursery moved to finisher (NF). Pigs were weaned into a nursery and stocked at 3.75 ft²/pig. Eight weeks after weaning, they were located to the same finisher as WF and DS and grown to slaughter at 7.5 ft²/pig.

The growing-finishing facility used in this research is located at the University of Nebraska's Haskell Ag Laboratory near Concord, Neb. It is a five-year-old double wide, naturally ventilated, fully slatted facility with 8 foot x 14 foot pens. The cement slats are 7 inches wide with a 1 inch slot.

The nursery was mechanically ventilated with unvented heaters. Pens with 5 ga woven wire flooring measured 8 feet x 8 feet with a gate inserted in one corner to restrict usable pen area to 56.25 ft². Minimum winter ventilation was provided by a single speed fan exhausting from the manure storage area under the decks. Because of reduced pig density in this experiment, the minimum ventilation was 6.7 CFN/pig.

There were 15 pigs per pen for the WF and NF treatments and 30 pigs per pen for the DS. Pen size was not adjusted in the event of pig death. There was a two-hole wean-finish feeder and one bowl-drinker for every 15 pigs. Heat lamps were used as the supplemental heat source for the WF and DS treatments. Comfort mats were used in all treatments and pigs were floor fed 3X daily for the first week after weaning.

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A commercially available nursery diet sequence was used. Diets were switched during the eight-week nursery phase based on a preplanned feed budget to 40 lbs body weight. Corn-soybean meal based diets in meal form containing 2% added fat were formulated to contain 1.1% lysine from 40 to 55 lbs, 1.0% lysine from 55 to 80 lbs, .88% lysine from 80 to 130 lbs, .73% lysine from 130 to 190 lbs, and .60% lysine from 190 lbs to slaughter.

Temperatures in the nursery were maintained at 84 to 86°F the first week after weaning and were programmed to decline 3 to 4F° per week thereafter until 70°F. However, two of the three trials began in April and by mid-May the planned reduction in temperature could not be accomplished because of higher outside air temperatures. Air temperature in the finishing facility was maintained at 73 to 76°F with heat lamps used for supplemental heat as necessary. Heat lamps were removed after three to five weeks, depending on the need for supplemental heat.

Pigs were weaned at 17 days of age and transported to the research unit at weaning. In Trials 1 and 2, the pigs were purchased from a source 100 miles away, and in Trial 3 they were from a source 70 miles away. Pigs were barrow offspring of PIC genetic crosses. Trials were started in April and October in an attempt to pair up heating seasons and minimize any effects of season due to large variations in heating expenses.

**Results and Discussion**

In Trials 1 and 2, gut edema was diagnosed by attending veterinarians on weeks two through four following weaning. It was most severe in the WF and DS treatments. In Trial 1, only the WF and DS treatments received medication while in Trial 2, all pigs were medicated. There was no evidence of gut edema in Trial 3.

The diagnosis of gut edema coincided with an increase in messy pens. For the first four to six weeks after weaning, the pigs walked "with" the cement slat and dunged on top of the slat. They then tracked this material throughout the pen with tracking reaching its peak about four weeks after weaning. They only dry area in the pen was directly under the heat lamp vs the nursery treatment with woven wire flooring which had no tracking of manure. Based on gross observations, it appeared that there were increased humidity and ammonia levels due to this tracking in the WF/DS facility.

Pigs in Trials 1 and 2 had many health challenges due to complications associated with PRRS, while in Trial 3, no such comlications were evident. However, there were no trial by treatment interaction for pig performance during the nursery phase, suggesting that health status of the pigs was not a factor in the response to wean-to-finish management during the nursery phase.

In spite of the health problems noted for Trials 1 and 2 and the differential treatment of gut edema, WF pigs performed better than DS and NF pigs during the nursery phase (Table 1). The response appears to be due to greater feed intake, resulting in faster daily gain, with no difference in feed conversion. Even though temperatures in the nursery were set on the low end of the thermoneutral zone to limit the possibility of heat stress during the nursery phase, feed intake was lower for the NF vs WF treatments.

**Table 1. Impact of wean-to-finish regimens on weaned pig performance during the nursery phase.**

| | Regimen[a] | | | Contrasts | |
|---|---|---|---|---|---|
| Item | WF | DS | NF | WF vs NF | WF vs DS |
| No. pens | 12 | 12 | 12 | | |
| Weaning wt, lbs | 11.2 | 11.2 | 11.2 | NS[b] | NS |
| 56 day wt, lb | 63.1 | 59.2 | 60.9 | NS | <.01 |
| CV 56 day wt%[c] | 14.6 | 17.0 | 14.7 | NS | NS |
| Average daily gain, lb | .92 | .86 | .89 | NS | <.01 |
| Average daily feed, lb | 1.53 | 1.42 | 1.47 | <.1 | <.01 |
| Feed:Gain | 1.66 | 1.66 | 1.64 | NS | NS |

[a]WF – wean-to finish; DS – Double stock; NF – Nursery
[b]NS – Not significant (P>.1).
[c]Coefficient of variation of within pen weight

The reduction in performance for DS vs WF is probably related to group size. In the range of group sizes used in this experiment, there is good evidence that increasing group sizes results in a decrease in daily feed intake and daily gain. However, the reduction in individual pig performance doesn't outweigh the overall improvement in pig weight gain per unit of floor space, a critical factor when assessing the economics of various wean-to-finish strategies.

Many would argue that the NF treatment allocated too much space per pig compared to conventional nurseries which are typically stocked at no more than 3 ft$^2$per pig. This space allocation was chosen to: 1) match the allocation of the DS treatment, and 2) provide sufficient space so there would be a minimal chance that space restriction during the nursery phase would negatively affect performance. It's quite possible that many of the reports in the popular press of improved performance for wean-to-finish are due to nursery facility limitations. These limitations involve inadequate space, improper feeder design for the heavier pigs now common in nurseries, improper temperature sequencing, etc. The NF treatment was designed to remove these limitations if possible.

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(Wean-to-Finish...continued from page 7)

Wean-to-finish treatments did not affect performance during the growing-finishing phase (Table 2). Average daily gain was similar for WF, double stocked pigs that remained in the same pen (DSS), double stocked pigs that were moved to new pens (DSM) and NF pigs. Treatment also did not affect variation in weight within a pen as judged by the coefficent of variation of weight when the first pig from the pen was marketed. There was also no effect of treatment on daily feed intake or feed conversion efficiency.

**Table 2. Impact of wean-to-finish regimens on pig performance during the finishing phase.**

| | Regimen[a] | | | | Contrasts | | |
|---|---|---|---|---|---|---|---|
| Item | WF | DSS | DSM | NF | DSM vs DSS | WF vs NF | WF vs DSS+DSM |
| No. pens | 12 | 12 | 12 | 12 | | | |
| Weight when 1st pig sold[b] | 224.8 | 217.3 | 220.5 | 220.7 | NS[c] | NS | <.05 |
| CV market weight,%[d] | 9.3 | 11.3 | 10.4 | 10.5 | NS | NS | NS |
| Average daily gain, lb | 1.88 | 1.88 | 1.85 | 1.85 | NS | NS | NS |
| Average daily feed, lb | 4.91 | 4.82 | 4.88 | 4.88 | NS | NS | NS |
| Feed:Gain | 2.61 | 2.61 | 2.60 | 2.64 | NS | NS | NS |

[a]WF – wean-to finish; DSS – Double stock stay in same pen; DSM – Double stock moved to new pen;
NF – Nursery moved to finisher
[b]Average pen weight when first pig removed for slaughter at 240 lbs or greater.
[c]NS – Not significant (P>.1)
[d]Coefficient of variation of within pen weight when first pig removed for slaughter.

The four-pound advantage at 56 days for NF vs DS (Table 1) translated into a 2+ day advantage to market since there was no difference between treatments in daily gain during the grow-finish period. With weekly weighings and a numeric, but nonsignificant reduction in weight variation within a pen, WF pigs were 5.9 pounds heavier than the average of both DS and NF treatments when the first pig weighing 240 pounds or greater was removed for slaughter.

## Conclusion

These results support the reports in the farm press of improved performance for pigs housed in wean-to-finish management systems. Feed intake during the nursery phase was elevated for wean-to-finish housed pigs, resulting in faster daily gains during the eight-week nursery period. The lack of trial by treatment interactions suggests that the response is not influenced by the health status of the pigs during the nursery period. These results will be used in a production system model to examine the economics of wean-to-finish production systems versus conventional systems with nurseries and grow-finish facilities.

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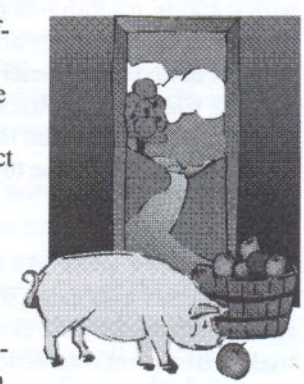
# Are You Interested in Alternative Feedstuffs?

The Swine AoE Team gets two to three calls each month from brokers, warehouses, or companies wanting to know if we know of any farmers interested in feeding unspoiled, uncontaminated, human food, dairy processing by-products, or pet food to swine. These products are frequently the "ends" of production runs, by-products from processing other foods, or from damaged containers. They are presently being sent to landfills, with the manufacturer seeking other options because of cost and environmental compromise. These products are suitable as feed for swine and an agreeable price for both parties can frequently be reached. In the past few months we have gotten calls to help move pizza dough, ice cream, cheese, dog food, and pasta noodles.

Do you presently feed an alternative feedstuff to your hogs or do plan on doing so in the near future? Would you like to be contacted by the Swine AoE Team when they learn that a new and different product has become available? If you would like your name put on a confidential list of interested pork producers, please contact Dale Rozeboom by phone at 517/355-8396, by fax at 517/432-0190, or by e-mail at rozeboom@pilot.msu.edu. As stated, the list will be confidential and your name will not be given to anyone. Our plan is to have you get in contact with the source company if you desire to do so.



# Effects of Group Size, Floor Space on Pigs Evaluated

By: B. Wolter, M. Ellis, S. Curtis, E. Parr and D. Webel

**Abstract**

*The similar growth performance observed between large and small group sizes at reduced floor-space allowance in this experiment supports the hypothesis that the required floor-space allowance for maximum growth rate may decrease with increasing group size. Moreover, within groups of 100 pigs, placing several multiple-space feeders together at a single location compared to placing the feeders in multiple locations doesn't improve pig performance*

Modern pig housing systems are expensive to construct and operate. Historically, the number of pigs per pen (i.e. group size) and the floor area allowed per pig (i.e. stocking density) have been key factors in the design and use of pig houses.

Pigs typically have been penned from weaning to market weight in groups of 10-30 animals. Now, however, group sizes of 50-100 or even more are being advocated by some as a management strategy that is claimed to minimize housing costs, maximize housing use and improve overall profitability.

Research has demonstrated that pig performance in the nursery stage varies with number of animals per group and floor-space allowance. (NCR-89, 1984; McConnell et al., 1987; Spicer and Aherne, 1987; Kornegay et al., 1993). Housing pigs at reduced floor space and/or in increased group sizes has been shown to have a negative influence on feed intake and growth rate (Kornegay and Notter, 1984). Curtis (1996) suggested that the effect of group size on voluntary feed intake might be due to greater social tension resulting from competition for access to feeders. Therefore, allowing pigs kept in large groups access to multiple feeding locations compared to those with just one location may improve feed intake and weight gain, as a result of reducing the effect of social rank during feeding activity (Hansen et al., 1982).

McGlone and Newby (1994) observed no differences in growth rate for grow-finish pigs reared in groups of 40, 20 or 10 when pigs were kept at a constant floor-space allowance (0.74m$^2$per pig). They analyzed pig postures over a 24-hour period via time-lapse video to determine free space(i.e. the total floor space not occupied by any pig at any particular moment). Free space increased with group size under constant floor-space allowance. In a second experiment, none, half or all of the free space, respectively, was removed from pens holding groups of 20 pigs. Removing all the free space had a detrimental effect on pig performance, but removing half did not. Therefore, where large group sizes are employed in commercial operations, perhaps total space per pig can be decreased without reducing growth rate. However, for relatively large group sizes (i.e. 100 pigs), there is a lack of data related to effects of and interactions between group size and floor-space allowance on pig preformance.

Two experiments were conducted to evaluate the effect of pen design on nursery pig performance.

Experiment 1 was conducted to quantify the effects of and interactions between group size (20 versus 100 pigs) and space allowance on weanling pig performance. Experiment 2 was conducted to evaluate the effects of feeder location (multiple versus single) in large groups on the performance of weanling pigs.

**Experiment 1**
**Materials and Methods.**
This experiment was conducted to assess the effects of two group sizes (20 [small] or 100 [large] pigs per pen) and two floor-space allowances (calculated requirement less 50% of calculated free space [reduced]) on performance of weanling pigs. The experiment was carried out in two trials with each trial having four replicates. The research was carried out as the Burton Russell Swine Research Farm, United Feeds, Inc., Franfort, Ind.

Floor-space allowance was kept constant for the first four weeks post-weaning and for the period of weeks 5-9. The allowance was based on bodyweight using the formula (Petherick and Baxter, 1981): floor-space allowance (m$^2$)=k x bodyweight$^{0.667}$, where "k" is equal to a constant (0.030) (Edwards and Armsby, 1988; Gonyou and Stricklin, 1998). The bodyweights assumed in these calculations were 14 kg and 45kg, which were the predicted end weights for weeks 1-4 and 5-9, respectively. Free space, as described by McGlone and Newby (1994), was calculated for both group sizes using formula Y=0.179 +0.002092X, where "Y" is the free space in square meters and "X" is the number of pigs per group. McGlone and Newby (1994) developed this formula using pigs weighing 93kg; therefore, a ratio incorporating the estimated floor-space allowances for the bodyweights of the pigs assumed in our study (14kg and 45kg) was used to determine the free-space values used. The reduced floor-space allowance was estimated by subtracting half of the determined free space from the calculated requirement. Pen sizes were adjusted at the beginning of weeks 1 and 5 (Table 1).

Crossbred pigs were weaned at 16 ± 0.2 days of age and allotted to treatment at 22 hours post-weaning. Pigs were randomly allotted to treatment pens on the basis of gender and weight.

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*(Effects of group size, floor space, continued from page 9)*

**1. Floor-space allowances (Experiment 1)**

| | | —Floor space allowance (m²)— | |
|---|---|---|---|
| Group Size | Weight range | Calculated requirement | Calculated requirement less 50% calculated Free space |
| Large | 5-15 | 0.17 | 0.13 |
| | 15-40 | 0.38 | 0.28 |
| Small | 5-15 | 0.17 | 0.15 |
| | 15-40 | 0.38 | 0.32 |

Pigs were housed in an insulated, mechanically ventilated, curtain-sided nursery house with tri-bar flooring and were give *ad libitum* access to a six-phase dietary regimen formulated to meet or exceed National Research Council (NRC; 1998) nutrient requirements (Table 2). Pens were equipped with one nipple drinker per 10 pigs and one four-space nursery feeder per 20 pigs, giving four centimeters of feeder-trough space per pig. Feeders were positioned in the center of the pen for all pen designs and wer accessible form both sides. Water nipples were placed at equal intervals on one wall in each pen. Each room accomodated one replicate of the the trial.

Air temperature was maintained at 22-25°C using a thermostatically controlled heater and fan ventilation. During week 1 post-weaning, supplemental heat was provided via propane brooders. Room temperature and relative humidity were measured and recorded.

**2. Dietary phases, duration of feeding and calculated nutrient ratios (Experiments 1 and 2)**

| | Dietary phase | | | | | |
|---|---|---|---|---|---|---|
| Item | I | II | III | IV | V | VI |
| Feeding weight range (kg) | c[a] | 4.5-8.9 | 5.9-9.5 | 9.5-14.0 | 14.0-22.7 | 22.7-36.3 |
| Diet form | Pellet | Pellet | Meal | Meal | Meal | Meal |
| Calculated analysis | | | | | | |
| Crude protein % | 26.75 | 24.66 | 22.17 | 20.89 | 21.14 | 20.45 |
| Lysine, % | 1.85 | 1.82 | 1.48 | 1.30 | 1.30 | 1.25 |
| Calcium, % | 0.93 | 0.96 | 0.78 | 0.83 | 0.76 | 0.76 |
| Phosphorus, % | 0.85 | 0.83 | 0.76 | 0.73 | 0.66 | 0.65 |
| ME, kcal/kg | 3,425 | 3,381 | 3,243 | 3,235 | 3,230 | 3,215 |

[a]First 48 hours post-weaning

Pig performance data were analyzed as a randomized block design using the general linear model (GLM) procedure of SAS (1990). Pen was considered the experimental unit. The model included effects of group size and space allowance, trial and replicate nested within trial.

**Results and discussion**

Pig weight and variation in weight (as indicated by the coefficient of variation for each weigh period) are given in Table 3. Trial had an effect on pig weight, but there was no interaction between trial and other treatments. Feed intake data for weeks 1-4 and growth-performance data for weeks 1-9 are given in Table 4. There were no interactions between group size and floor-space allowance for any of the variables evaluated for either week 1-4 or weeks 1-9.

**Effect of group size**

Pigs in large groups were lighter at the end of weeks 1, 4, and 9 post-weaning compared to pigs in small groups (Table 3). Variation in live weight was greater for the pigs kept in large groups at the end of week 9 (Table 3). Pigs in large groups had lower average daily gain (ADG) and the average daily feed intake (ADFI) during weeks 1, 2-4 and 1-4 (Table 4). Although mordibidity was less than 1% in all treatment subgroups, caretakers reported having increased difficulty in identifying and treating sick pigs in large groups compared to the small groups.

Similarly, Korenegay and Notter (1984) found that for weaning pigs (bodyweight less than 30 kg) at a constant floor-space allowance, ADG and ADFI decreased as number of pigs per group increased (from 3 to 32 pigs). However, other studies have employed fewer pigs per pen than the current study to evaluate any effect of group size on pig performance during the grow-finish period, and results have been inconsistent. In growing pigs (20-60 kg), Petherick et al. (1989) observed lower ADG for pigs in large groups (36 pigs per pen) compared to smaller (8 or 16 pigs per pen). Similarly, Gelhbach et al. (1966) reported decreased performance with an increased number of pigs per pen (8 versus 16 pigs) in the grower period. Randolph et al. (1981), however, found no performance differences between group sizes of 5 and 20 during the grow-finish period (20-90 kg). Hyun (1997) observed a lower ADG for pigs in groups of 12 compared to 2, 4 or 8 pigs per group during the growing period; however, similar ADG was observed for pigs penned in these group sizes during the finishing period. McGlone and Newby (1994) found similar performance by pigs in groups of 10, 20, and 40; however, pig injury and morbidity were increased for pigs in groups of 40.

**Effect of Floor Space**

At the end of week 1 post-weaning, pigs given reduced floor-space allowance had similar bodyweights as those given adequate space (Table 3). However, pigs given the reduced floor space were 0.41 and 1.64 kg lighter than pigs given adequate floor-space at the end of weeks 4 and 9, respectively. Floor-space allowance did not affect variation in piglet weight at any point during the study (Table 3). This is in agreement with Kornegay et al. (1995), who found no effect of floor-space allowance on variation in in pig live weight. In addition, floor-space allowance did not affect

*(continued on page 11)*

## 3. Effects of group size and floor-space allowance on piglet weight and variation in piglet weight (Experiment 1)

| | -Group size- | | —Floor space— | | Mean | —Level of significance— | | |
|---|---|---|---|---|---|---|---|---|
| | Large | Small | Required | Reduced | SEM | GS | FS | GS x FS |
| Number of pigs | 1,600 | 320 | 960 | 960 | — | — | — | — |
| Weight, kg | | | | | | | | |
| Start of week 1 | 5.31 | 5.31 | 5.31 | 5.31 | 0.006 | NS | NS | NS |
| End of week 1 | 6.66 | 6.80 | 6.71 | 6.74 | 0.025 | <0.001 | NS | NS |
| End of week 4 | 14.75 | 15.42 | 15.29 | 14.88 | 0.107 | <0.001 | <0.01 | NS |
| End of week 9 | 38.94 | 41.08 | 40.83 | 39.19 | 0.262 | <0.001 | <0.01 | NS |
| CV, %[b] | | | | | | | | |
| Start of week 1 | 13.6 | 13.5 | 13.5 | 13.6 | 0.06 | NS | NS | NS |
| End of week 1 | 14.3 | 13.8 | 14.3 | 13.8 | 0.37 | NS | NS | NS |
| End of week 4 | 15.0 | 14.5 | 14.6 | 15.0 | 0.42 | NS | NS | NS |
| End of week 9 | 12.3 | 11.1 | 11.5 | 11.9 | 0.41 | <0.05 | NS | NS |

[a]NS = not significant
[b]CV = coefficient of variation values were determined from the pen means

ADG during week 1 (Table 4). However, pigs given reduced floor-space had lower ADG for weeks 2-4, 4-9, and 1-9 (Table 4).

Kornegay and Notter (1984) observed that both ADG and ADFI increased with increasing floor-space allowance per pig, and a similar but smaller effect was found for feed conversion efficiency. In the current experiment, floor-space allowance did not affect ADFI during weeks 1-4 (Table 4). However, gain:feed (G/F) was higher during the period of week 1-4 for pigs with a greater floor-space allowance.

The effect of reducing 50% of the free space on performance was similar in large and small groups. This supports the hypothesis of McGlone and Newby (1994) that, as group size increases, it may be possible to reduce the total amount of floor space per pig without hindering performance.

However, the relationship between group size and floor space was not directly tested in the current study, and further research is needed in this area.

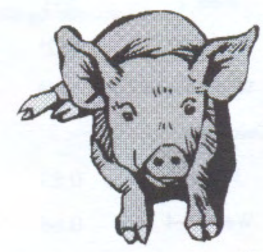
Decreasing floor-space allowance per pig may lead to increased social tension and a higher incidence of aggressiveness in pigs (Ewbank and Bryant, 1972; Randolph et al., 1981: Curtis 1996). In this experiment, however, there were no signs of tail or ear biting, as a result of either increasing group size or reducing floor-space allowance

## 4. Effects of group size and floor-space allowance on piglet performance (Experiment 1)

| | -Group Size- | | -Floor space- | | Mean | -Level of significance- | | |
|---|---|---|---|---|---|---|---|---|
| | Large | Small | Required | Reduced | SEM | GS | FS | GS x FS |
| Number of pigs | 1,600 | 320 | 960 | 960 | — | — | — | — |
| Daily weight gain, g | | | | | | | | |
| Week 1 | 193 | 212 | 204 | 201 | 3.0 | <0.001 | NS | NS |
| Weeks 2-4 | 385 | 411 | 407 | 389 | 4.6 | <0.001 | <0.01 | NS |
| Weeks 1-4 | 337 | 361 | 356 | 342 | 3.7 | <0.001 | <0.01 | NS |
| Weeks 5-9 | 624 | 662 | 659 | 627 | 6.2 | <0.001 | <0.001 | NS |
| Weeks 1-9 | 503 | 535 | 531 | 507 | 3.8 | <0.001 | <0.001 | NS |
| Daily feed intake, g | | | | | | | | |
| Week 1 | 200 | 221 | 213 | 209 | 3.9 | <0.001 | NS | NS |
| Weeks 2-4 | 553 | 590 | 574 | 568 | 9.6 | <0.01 | NS | NS |
| Weeks 1-4 | 465 | 498 | 484 | 478 | 7.4 | <0.001 | NS | NS |
| Gain:feed | | | | | | | | |
| Week 1 | — | — | — | — | 0.015 | <0.05 | | |
| CR | $0.98^{a}$ | $0.93^{b}$ | — | — | — | — | — | — |
| CR-50 | $0.94^{b}$ | $0.93^{a}$ | — | — | — | — | — | — |
| Weeks 2-4 | — | — | — | — | 0.008 | <0.05 | | |
| CR | $0.70^{ab}$ | $0.72^{ab}$ | — | — | — | — | — | — |
| CR-50 | $0.70^{ab}$ | $0.68^{a}$ | — | — | — | — | — | — |
| Weeks 1-4 | 0.73 | 0.73 | 0.74 | 0.72 | 0.004 | NS | <0.05 | NS |

[a,b]Means with differing superscripts for a variable with interaction between group size and floor-space allowance differ (P<0.05)

**Experiment 2**
**Materials and methods**
This experiment was conducted to assess the effects of group size and feeder location on pig performance. The designs were: (1) large group size (100 pigs per pen) with multiple (five) feeder locations; (2) large group size with a single feeder location, or (3) small group size (20 pigs per pen) with a single feeder. The experiment was carried out in two trials, each trial having four replicates. The research was conducted in the same facility as Experiment 1.



(continued on page 12)

*(Effects of group size, floor space, continued from page 11)*
A total of 1,760 crossbred pigs were weaned at 17± 0.2 days of age and allowed to treatment 22 hours post-weaning. Pigs were randomly allotted to treatment pens on the basis of gender and weight.

The same dietary regimen as Experiment 1 was followed (Table 2). The same management protocol as described for Experiment 1 was employed in this experiment. Pigs in all treatments were given the same floor-space allowance

(0.17 $m^2$ per pig). In the large groups, feeders were positioned in either the center of the pen for the single-location design or in five different places for the multiple-location design. For the small group-size pen, the feeder was positioned in the center of the pen.

Pig performance data were analyzed using the GLM procedure of SAS (1990). Pen was considered the experimental unit. The model included effects of treatment, trial and replicate nested within trial. To test the effect of feeder location on feed disappearance, the feeder was considered the experimental unit. The model used to evaluate effects of feeder location on feed intake within the two large-group-size pen designs, included effects of feeder location, trial and replicate nested within trial.

**5. Effects of group size and feeder location on piglet performance (Experiment 2)**

| | Treatment | | | |
|---|---|---|---|---|
| Item | Large-multiple | Large-single | Small-single | Mean SEM |
| Number of pigs | 800 | 800 | 160 | — |
| Weight, kg | | | | |
| Start | 5.58 | 5.58 | 5.57 | 0.049 |
| Week 1 | 6.86 | 6.84 | 6.88 | 0.049 |
| Week 4 | 15.59[a] | 15.58[a] | 16.01[b] | 0.102 |
| CV, %[c] | | | | |
| Start | 10.5 | 10.6 | 10.8 | 0.14 |
| Week 1 | 11.5 | 11.6 | 11.7 | 0.25 |
| Week 4 | 12.5 | 12.8 | 12.8 | 0.47 |
| Daily gain, g | | | | |
| Week 1 | 183 | 179 | 188 | 6.6 |
| Weeks 2-4 | 416[a] | 416[a] | 435[b] | 4.3 |
| Weeks 1-4 | 358[a] | 357[a] | 373[b] | 3.5 |
| Daily gain, g | | | | |
| Week 1 | 205 | 205 | 211 | 6.8 |
| Weeks 2-4 | 612[a] | 627[a] | 655[b] | 8.3 |
| Weeks 1-4 | 510[a] | 521[a] | 544[b] | 7.1 |
| Gain:feed | | | | |
| Week 1 | 0.89 | 0.88 | 0.88 | 0.018 |
| Weeks 2-4 | 0.66 | 0.66 | 0.67 | 0.009 |
| Weeks 1-4 | 0.70 | 0.69 | 0.69 | 0.008 |

[ab]Means within the same row with different superscripts differ $P < 0.01$
[c]CV = Coefficient of variation values were determined from the pen means

**Results and discussion**
Pig weight, variation in weight (as indicated by the coefficient of variation for each weigh period), and growth performance data are given in Table 5. There was an effect of trial on pig start weight, but no interaction between trial and treatment. Feed-disappearance data are given in Table 6.
Pigs in large groups, compared to those in the small groups had similar live weights at the end of week 1, but lower weights at the end of week 4 (Table 5). Variation in live weight was not affected by pen design. Pigs in both of the large group treatments had lower ADG and ADFI for weeks 1-4 and 2-4 compared to pigs in the small groups (Table 5). Pen design did not affect G/F. Morbidity and mortality were less than 1% in all treatment groups.

Similarly, Morrow and Walker (1994) found no difference in growth performance or feed intake between pigs kept in pens of 20 animals with single-spaced feeders placed either side-by-side or apart. These authors also found no effect of feeder placement on either queuing behavior or number of enforced withdrawals from the feeder in pigs kept in groups of 20.

**6. Effects of feeder location on feed disappearance (Experiment 2)**

| | Feeder location | | | | | |
|---|---|---|---|---|---|---|
| Item | 1 | 2 | 3 | 4 | 5 | Mean SEM |
| Week 1 | | | | | | |
| Feed disappearance, kg/d | | | | | | |
| Large-multiple | 3.55 | 5.18 | 4.46 | 3.74 | 4.22 | 0.497 |
| Large-single | 4.26 | 3.31 | 4.13 | 3.99 | 4.78 | 0.493 |
| Small-single | 4.22 | — | — | — | — | — |
| Week 2-4 | | | | | | |
| Feed disappearance, kg/d | | | | | | |
| Large-multiple | 13.56 | 13.84 | 12.54 | 11.41 | 9.43 | 1.223 |
| Large-single | 13.67 | 11.61 | 13.47 | 11.45 | 11.60 | 1.639 |
| Small-single | 12.91 | — | — | — | — | — |

Those results, together with the results of the current study, suggest that feeders positioned in multiple locations within a pen do not result in higher levels of feed intake compared to feeders positioned together at a single location.

Feed disappearance was similar for all feeder locations in both large-group pen designs (Table 6). However, in the large

*(continued on page 13)*

*(Effects of group size, floor space, continued from page 12)*
group, multiple-feeder location pens, feed disappearance during week 1 tended to be higher for feeder location M-2 (Table 6). For weeds 2-4, feed disappearance tended to be numerically lower for feeder location M-5 in large group, multiple-feeder location pens (Table 6).
Social facilitation of feeding behavior has been reported in early weaned piglet, i.e. piglets were stimulated to feed when they observed penmates doing so (Wood-Gush, and Csermely, 1981), and may explain, in part, the tendency here for pigs in large-group-size, multiple-feeder location pens to consume more feed from a single location (viz., location M-2)

compared to other locations in the pen. In addition, other pen features, such as resting, drinking, and excretion areas, have been shown to influence the pig's preference for a feeding location (Petherick, 1983). Additional research is needed to understand the feeding behavior of pigs placed in large groups and/or allowed different feeder placements within a pen.

**Implications**

Results of this experiment indicate that penning weanling pigs in groups of 100 compared to groups of 20 pigs lowers weight gain and increases variation in bodyweight, and that reducing floor space by removing one-half of the calculated free space reduces piglet weight gain. However, the similar growth performance observed between large and small groups sizes at reduced floor-space allowance in this experiment support the hypothesis that the required floor-space allowance for maximum growth rate may decrease with increasing group size. Moreover, within groups of 100 pigs, placing several multiple space feeders together at a single location compared to placing the feeders in multiple locations doesn't improve pig performance.

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# Tour Ontario

Educational and fun! Come along on a four-day, bus tour of the Ontario pork industry June 21-24. The MSU Swine AoE Team and the Ontario Ministry of Agriculture, Food and Rural Affairs have put together this tour for interested Michigan pork producers. Stops will include the Ontario Pork Congress, Maple Leaf Foods, Premium Pork, Shur-Gain Feeds, the University of Guelph, and more. A more detailed, tentative itinerary is provided below. The total price of the trip will be about $190 per person, and includes bus travel, lodging, and some meals. Space is limited (42 passengers) and participation will be on a first-come, first-serve basis. If you would like to be a part of this enjoyable and informational tour, <u>make your reservation by contacting Barb Sweeney by phone at 517/355-8396 or by fax at 517/432-0190.</u>

## Michigan Pork Producer Ontario Tour

June 21 - 24, 2000

<u>June 21 (Wednesday)</u>

8:00 AM — Leave Lansing

Afternoon — **Premium Pork**
Enterprise of 7,500 sows, units recently completed or currently under construction. Learn more about facility design alternatives, new equipment, production plans and goals for this enterprise.

Evening — Pork Barbecue hosted by Premium Pork

<u>June 22 (Thursday)</u>

Morning — **Maple Leaf Foods - Maple Leaf Packing and Shur-Gain Feeds**
Visit with Maple Leaf Packing personnel about: (1) procurement of hogs from Michigan, (2) their carcass merit program, (3) increased packing capacity in Canada, (4) prospect of producer-owned cooperative slaughter and processing plants, (5) importance of animal care during transportation to market and (6) the merits of world-wide vertical integration of pork industry

Shur-Gain operates an 850 acre research farm at Burford, Ontario where products and nutrition pro grams for all ages and stages of livestock and poultry are developed.

Afternoon — **University of Guelph**
Visit with researchers about: (1) eliminating odor from hog manure, (2) evaluating the public's response to pork production, (3) alternative housing systems, (4) genetic selection of boar-taint free pigs, (5) alter natives to raising pigs without antibiotics, and (5) reducing the incidence of gastric ulcers.

Evening — **Dine and Visit with Ontario Producers**
Sharing of experiences in pork production, including slides or video shared by two producers from Michigan and two producers from Ontario.

<u>June 23 (Friday)</u>

All Day — **Ontario Pork Congress**

<u>June 24 (Saturday)</u>

Morning — **Farm Visit - Liquid Feeding System**
View liquid feeding system that utilizes ensiled grains and human food wastes. Learn more about differ ences in animal efficiencies, feed costs and nutrient excretion.

1:00 PM — Return to Michigan

# Differentiation in Carcass Merit Systems

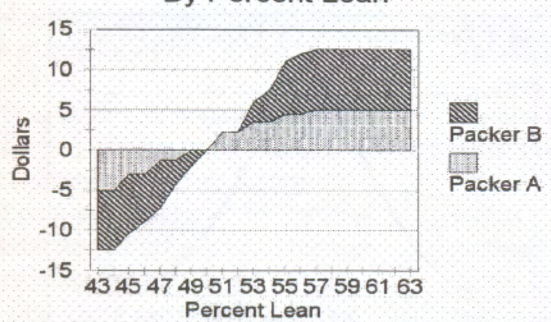
By: Dr. Ronald O. Bates, State Swine Specialist, Michigan State University

In recent history, pigs were either purchased on a live weight basis or on a simple carcass merit program where carcasses were differentiated by last rib backfat measured on the midline. Today several differing technologies exist to estimate carcass merit and range from ultrasound systems to fiber optic probes. Each packing firm has developed their own system to purchase pigs. Each system accounts for the particular methods used to evaluate differences in carcass merit and each premium system reflects the reward for the type of pig desired by the packing firm. Packers also differ on how premiums are determined. Some packers base their premiums on a dollar amount above and below an established base carcass grade. Other packers use a percentage above and below the base price paid for carcasses.

Each packer has their own specifications for the types they pigs they wish to buy. Some packers want heavier weight pigs while others want lighter weight pigs. Others prefer pigs with certain meat quality characteristics while others are not more concerned with total lean yield.

One characteristic has become nearly universal among packers. Virtually all carcass merit systems have a premium plateau for carcass grade. For example Figure 1, represents the premium schedule for two packers. The schedule of payment is quite different but their overall tendencies are the same. Packer A has smaller discounts and premiums for percent lean than Packer B. This suggests that Packer A may have a

FIGURE 1. PREMIUM SCHEDULE By Percent Lean




wider range of products to develop and can use pigs that greatly differ for percent lean. Packer B however, heavily discounts pigs under 50% lean and does not pay any premium until a carcass is greater than 52% lean. Obviously Packer B concentrates heavily on lean yield and may not have as broad of product mix as Packer A. However both Packers stop premium increases as percent lean increases. Packer A stops their premium increase at 57% lean while Packer B stops their premium increase at 56%. What this suggests is that both packers believe carcasses higher in percent lean than their stated top premium are not worthy of higher premiums even though lean yield is higher. Extremely high percent lean carcasses have processing difficulties that offset their perceived higher value.

Often there is a question with how well particular systems reward pigs that differ for percent lean or carcass merit. This is an interesting question because percent lean in pigs follows a normal distribution, which indicates a natural range in percent lean among different kinds of pigs. Pigs from a farm whose average is 52% lean will have individual pigs range from 45 to 59%. Applying the range and underlying proportion of pigs within the range to different carcass merit grids is somewhat difficult and is rarely done.

In Figures 2, 3, and 4 are three graphs which demonstrate the range and proportion for groups of pigs that average either 50%, 53% or 56% lean, respectively. For each group of pigs the range in percent lean along with the associated proportion of pigs within the range was applied to the two carcass merit systems shown in Figure 1.
Premiums and discounts for each buying system was estimated across each group of pigs an average premium per cwt calculated. The results are listed in Table 1.

FIGURE 2. DISTRIBUTION OF PERCENT LEAN Avg=50%

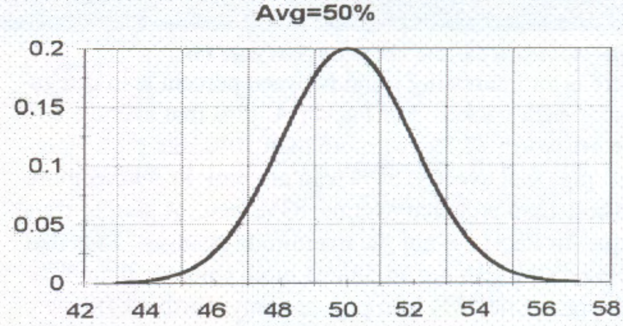



**Table 1. Carcass Merit Premiums (Discounts) By Percent Lean Category and Grading Program**

| | 50% Lean | 53% Lean | 56% Lean |
|---|---|---|---|
| Packer A | $0.27 cwt | $2.66 cwt | $4.25 cwt |
| Packer B | -$0.82 cwt | $3.56 cwt | $6.74 cwt |

There are several interesting points illustrated within Table 1. Packer A would pay $1.09 more for pigs that average 50% lean compared to Packer B. On the other hand, for pigs that average 53% lean Packer B would pay $0.90 cwt more than Packer A and at 56% lean those pigs bring $2.49 more with Packer B than Packer A.

*(continued on page 16)*

# Pork Quarterly


All comments and suggestions should be directed to:

MICHIGAN STATE UNIVERSITY EXTENSION

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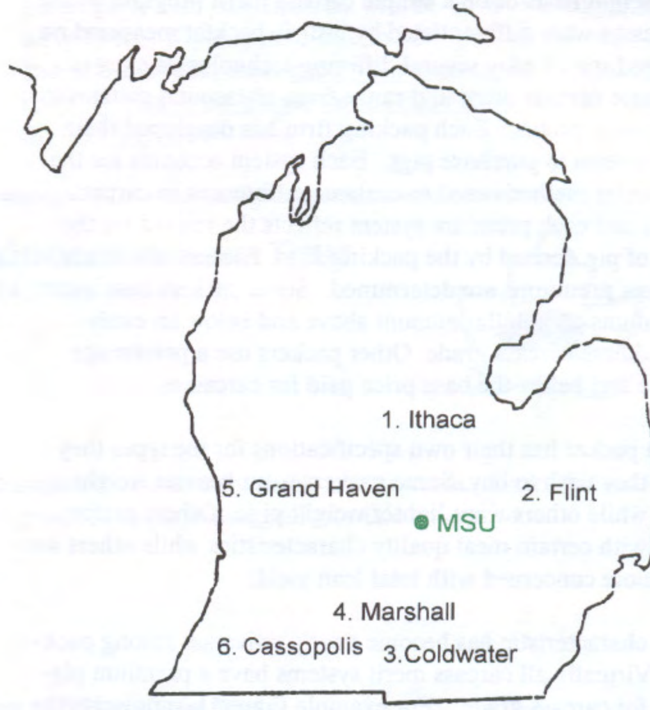


*(Differentiation in Carcass, continued from page 15)*

There is an interesting trend between percent lean categories for each Packer. For Packer A, pigs that average 53% lean are worth $2.39/cwt more than 50% lean pigs. However, pigs that average 56% lean are only $1.59/cwt more valuable than pigs that average 53% lean. A similar trend is true for Packer B but the magnitude changes. Pigs that average 53% lean are $4.38/cwt more valuable than 50% lean pigs while 56% lean pigs are only worth $3.18/cwt more than 53% lean pigs.

This does demonstrate how different packers value pigs differently. Packer A provides more opportunity for producers to provide pigs that differ greatly for percent lean while Packer B places high premiums for pigs that excel for percent lean and severely discounts pigs that are lower. Producers, which have an option regarding packers they market to and marketing contracts available, should closely evaluate how their pigs are evaluated and which buying programs provides them the best options.

There are several other important factors that must be evaluated when evaluating buying systems. Two important ones are the transportation costs and base price. Transportation costs may very well dictate which packer a producer must work with. During negotiation of marketing contracts transportation expense must be a part of the discussion. The base price a packer pays can negate much of the differences in premiums offered between packers. Within the above example if Packer A has a base which is $1.00/cwt higher than Packer B, the advantage for Packer B with 53% lean pigs is erased while for 56% lean pigs, Packer B's advantage is compromised.

**FIGURE 3. DISTRIBUTION OF PERCENT LEAN**

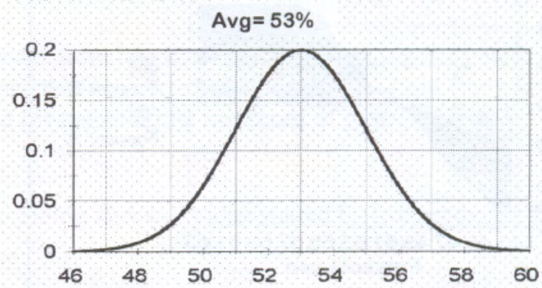


**FIGURE 4. DISTRIBUTION OF PERCENT LEAN**