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Diet Mixing and Pig Performance

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Generally speaking, feed represents 65 to 75% of the overall production cost in a swine operation. Thorough consideration is often given to the inclusion of specific feed ingredients, proper diet formulation, cost, and the nutrient requirements of pigs within each respective production stage. The primary goal of a nutrition program is to provide a balanced diet to pigs that ensures appropriate nutrient consumption that maximizes performance. An aspect involving feed that may have a significant impact on pig performance and often times may be overlooked is feed mixer performance.

Mixer Performance

Mixer performance ultimately determines the uniformity of feed ingredients in swine diets. Delivering a uniform mixture of feed ingredients to ensure that pigs are receiving proper nutrient consumption is critical. There are several factors associated with mixer performance that may determine the dispersion of feed ingredients within a respective batch of mixed feed. These factors include the following: particle size, sequence of ingredient addition, buildup of material, overfilling or under-filling, and mixing time.

Particle size – large particle size variation between grain and micro-ingredients (ingredients that comprise 0.5 percent or less of the final feed) can result in increased segregation after mixing, especially with the incorporation of micro-ingredients. Furthermore, research data suggest a recommended desired dietary particle size would be 700 microns to optimize both pig performance and milling efficiency with an acceptable range between 600 to 800 microns in complete feeds.

Sequence of ingredient addition – in horizontal mixers, ground grain or soybean meal should be added first. In contrast, vertical mixers generally provide an optimal mix when the micro-ingredients are added early in the mixing process. An important consideration is that small amounts of ingredients may not be readily incorporated into feed because of "dead spots". Therefore, it is imperative to have detailed knowledge of your mixer's capabilities in regard to sequence of feed ingredient additions. Furthermore, worn equipment such as augers, paddles or ribbons may add to the problem of small amounts of ingredients not being properly incorporated.

Buildup of material – on internal equipment parts may reduce mixer performance. It is essential that equipment is maintained and cleaned periodically to ensure proper operation.

Overfilling and under-filling – can result in inadequate mixing. Based on each respective mixer's capacity, filling a mixer below 50% of its rated capacity is discouraged because it may reduce the mixing action and result in feed that is not uniform in composition.

Mixing time – should be measured for each respective mixer to ensure an acceptable distribution of all feed ingredients. A mixer efficiency test would be beneficial for an accurate determination of the appropriate mixing time for each respective mixer.

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Mixer Performance Test

Performance testing a mixer will consist of selecting a micro-ingredient, sample collection, data analysis and interpreting the results.

Selecting a micro-ingredient – It is important to select an ingredient, nutrient or tracer that is easily analyzed. Salt is the most common ingredient used to evaluate mixer performance (Groesbeck et al., 2007 and Herrman). The reason for this is that salt is common in most feeds, comes from one source and is relatively inexpensive and easy to assay. The sodium (Na+) or chloride (Cl-) ions from salt (NaCl) can be analyzed after mixing the feed sample in a water solution. In addition, salt is more dense than most feedstuffs and smaller than most other particles which presents an advantage when evaluating mixture performance.

Sample collection – collecting representative samples for a mixer performance test may be dependant on the type of mixer (vertical vs horizontal) and design. Samples should be drawn from pre-designated locations of the mixer or at even intervals during mixer discharge. At least ten samples are recommended to provide an adequate statistical analysis (test results are less accurate when fewer samples are used).

Data analysis – Herrman (KSU Extension Bulletin MF-1172) proposes the following; the percent Coefficient of Variation (CV) may be calculated and used to determine the effectiveness or uniformity of the mix using the following equation: $\%CV = s/y \times 100$, where the average salt concentration (y) is considered to be the mean and the standard variation (s) is the variation between samples.

Interpretation of results – According to Herrman (KSU Extension Bulletin MF-1172) a CV of <10% would be considered an excellent mix of feed ingredients and would require no corrective action, a 10 – 15% CV may require increasing mixing time by 25 – 30%. A fair mixture of ingredients would be considered a CV of 15 – 20%. Mixture time may need to be increased by 50% due to the following possibilities: worn equipment, overfilling or sequence of ingredient addition. Test results showing a CV of 20% or greater may be a combination of all the previously mentioned possibilities.

Research

A recent research study conducted by Groesbeck et al. (2007) investigated the effects of diet mixing time on nursery pig performance. A total of 180 weanling pigs were used in this study fed diets in two phases (0 to 14 days and 14 to 28 days). Dietary treatments included diets that were mixed for 0, 30, 60, 120 or 330 seconds per ton of feed mixed. Performance data from this study are presented in Table 1.

Table 1. Effects of diet mixing time on nursery pig performance

	Mixing time, seconds per ton of food				
Item	0	30	60	120	330
0 to 28 days					
Initial wt., lbs.	13.86	13.97	13.86	13.86	13.86
ADG, lbs.	0.73	0.89	0.90	0.94	1.02
ADFI, lbs.	1.04	1.23	1.18	1.25	1.32
G:F	0.67	0.72	0.76	0.75	0.77
Final wt., lbs.	34.3	38.7	38.9	40.3	42.5

Source: Groesbeck et al. (2007)

Results of this study show that increasing mixing time increased Average Daily Gain (ADG), Average Daily Feed Intake (ADFI), and improved gain to feed from day 0 to 28. This study also suggests that a mixer efficiency test resulting in a low CV (7 to 12%) is ideal for maximizing nursery pig growth performance. Additionally, Traylor et al. (1994) conducted a 21 day trial utilizing nursery and finishing pigs to evaluate the effects of mixing time on growth performance and found similar results.

Take Home Message

Realizing that different types of mixers have different optimal mixing times, regular evaluations of mixer performance will aid in using appropriate mixing times to establish the continuous delivery of a uniform mixture of feed ingredients, which in turn may have a significant impact on enhancing pig performance.

References

Goodband, R. D., M. D. Tokach, and J. L. Nelssen. The effects of diet particle size on animal performance. Kansas State University Extension Bulletin MF-2050.

Groesbeck, C. N., R. D. Goodband, M. D. Tokach, S. S. Dritz, J. L. Nelssen, and J. M. Derouchey. 2007. Diet mixing time affects nursery pig performance. J. Anim. Sci. 85:1793-1798.

Herrman, T. and K. Behnke. Testing mixer performance. Kansas State University Extension Bulletin MF-1172.

Traylor, S. L., J. D. Hancock, K. C. Behnke, C. R. Stark, and R. H. Hines. 1994. Uniformity of mixed diets affects growth performance in nursery and finishing pigs. J. Anim. Sci. 72 (Suppl. 2):59 (Abstr.)

Cull-Sow Feeding Programs

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Feeding cull-sows has not been a significant profit generating business for swine operations in the past. It has been considered at best a break-even venture when accounting for transportation, feed, morbidity, mortality, labor and other production costs. Feed price, efficiency of gain, and the added premium for heavy sows are the critical factors to consider whether a cull-sow feeding program is a profitable venture.

Considerations

One of biggest potential drawbacks to developing a pre-market feeding program for cull-sows is that 20 to 25% of sows removed form the herd are "non-performance" culls (physical and health problems). These cull-sows may be lame or still recovering from illness for one reason or another. Reproductive failures are typically associated with younger parity 1 and 2 sows that are very thin and light weight. Some sows may not be able to leave farms, travel to another location, be fed in large groups and economically gain enough weight to make the venture worthwhile. Additionally, performance may be negatively influenced by fighting, transportation induced lameness, and weather effects (inside sows being housed outdoors would experience sunburn, frostbite, etc.). Proper veterinary treatment and strict adherence to withdrawal requirements would be necessary due to the eminent marketing of the animals. Identification would also become an important component of treating a sick sow in a feedlot situation. There are no accurate figures available in the published literature on morbidity or mortality that would be experienced in a cull-sow feeding program due to the lingering effects of poor legs, mammary gland infections, overall physical weakness, and other health-related problems. "Performance" culling for small litters, reproductive problems, obesity, or behavioral problems accounts for about half of all cullings, with old age and death being the cause of 20 to 25% of cullings.

Cull-Sow Growth Performance

Several experiments have been conducted in the past determining the performance of cull-sows in a postweaning, pre-market feeding program. The performance of sows in those trials is summarized in Table 1.

Table 1. Summary of experiments evaluating performance of cull-sows after weaning.

	Experiment				
	Nebraska 1977	Texas 1977	Ohio State 1991	MN/SD/ND 1993	MN/SD/ND 1993
ADG, lb.	2.10	0.71	1.13	2.56	2.18
ADFI, lb.	13.3	6.7	7.6	12.6	12.2
F/G	6.3	9.6	6.8	4.9	5.6
Sow weaning wt., lb.	344	505	353	429	429
Lactation length, d	42	28	37	-	-
Feeding period, d	24	21	28	42	42
Housing	Individual	8-hd groups	Individual	Individual	Individual
Parity	Primiparous	Multiparous	Primiparous	Multiparous	Multiparous
Diet	CSBM	Not stated	CSBM	CSBM	Barley-SFM

In addition to the data shown above, the following important conclusions were drawn in these studies.

- It takes about two to three weeks for the udder to completely dry.
- Performance is quite variable.
- Sows lose more weight and consume less feed in week one postweaning compared to weeks thereafter. Lighter-weight, thinner sows, which wean heavier litters are likely to gain more weight and consume more feed postweaning than sows that are heavier, fatter, and less productive.
- In the Ohio State study, longer lactation resulted in greater postweaning feed consumption.
- Feeding a corn-soy diet was superior to a high fiber, barley/sunflower diet; providing a lower cost of gain.
- There was no economic or performance advantage to limit feeding sows during the first week postweaning versus full-feeding.
- Sows that were mated as they returned to estrus after weaning gained about .6 lb. more weight per day than open sows. They also ate 1.1 lb. more feed and had greater backfat accumulation. Carcass data at slaughter was not collected in this study, and what proportion of sow weight gain was maternal (carcass) or the products of conception (fluids and fetuses) was not determined. The practice of breeding cull-sows for added weight gain may be profitable for the producer, but not be beneficial for the packer/processor if the weight is not reflective of added carcass value.

Summary

Poorer feed conversion in dry sows result in higher cost of gain than those observed in grow-finish production. Reducing yardage costs by using low-cost facilities is necessary if feeding cull-sows postweaning is to be profitable. Prices for lower quality feedstuffs must reflect their inferior nutritional value in order to justify their use. The incidence of morbidity and mortality among cull-sows is not known. Market price must include an offsetting premium.

References

Moser, B. D., and D. R. Zimmerman. 1977. When to sell sows after weaning. Nebraska Swine Res. Rep. pp 20-21. E.C. 77-219. Univ. of Nebraska, Lincoln.

Shurson, G. C., G. A. Isler, K. M. Irvin, and G. A. Peterson. 1991. Traits affecting postweaning weight gain and feed intake of primiparous sows. J. Anim. Sci. 69:3487.

Shurson, G. C., R. A. Fisher, D. D. Koehler, G. W. Libal, and J. D. Crenshaw. 1993. Effect of energy intake and pregnancy status on rate, efficiency and cost of gain and on backfat changes in postweaning sows. Recent Advances in Swine Health and Research 3:38.

Tribble, L. F. and D. E. Orr. 1977. Gains and feed intake of cull sows following weaning. In: Proc. 25th Annu. Swine Short Course, No. T-5-125, pp 33-35. Texas Tech Univ. Lubbock.

Consider Needle-Free Injection Systems

Beth Franz, Extension Educator, Pork AoE, Cass County, Cassopolis

One reason producers hesitate to implement new production practices is that there may be no financial incentive to adopt new technologies. This may be the case for the needle-free injection technology that is becoming available today. Many producers argue that there is no incentive to make this management change and in the end implementing this new practice will cost more because of equipment and training procedures that need to take place. However, with the increasing demand for traceability and accountability from the consumer, needle-free injection may be a production practice that pork producers should consider.

Needle-free injection of medications and vaccines has been proven to be a technology that is comparable to needle and syringe delivery and should provide improved worker safety and reduce the incidence of foreign objects (i.e. needles) in meat. Studies have shown the needle-free injection method has a comparable efficiency with syringe and needle delivery. This method has also been deemed safe, preventing needle-stick injuries to employees and eliminating broken needles or needle fragments found in carcasses.

Studies and Results

In a 2002 report (Sebranek et al.) it was found that both injection methods produced similar serological response in vaccinated pigs. In this study, two trials, which included 130 pigs, were conducted to compare needle and needle-free injection when vaccinating for Pseudorabies virus and Mycoplasma hyopneumoniae. Pigs were divided into three treatment groups, unvaccinated controls, vaccinated with conventional needle and syringe methods and the third group received vaccinations with the needle-free injection device. Blood samples were collect from each group prior to vaccination and at 11-13 days post mycoplasma vaccination and 23-25 days

following the PRV vaccination. The immune response was evaluated to determine the serological response and results were recorded. Both injection methods increased serological response when compared to controls. In addition there was no significant difference in immunological response between the two methods (Table 1).

Table 1. Immune response to vaccine administered by different methods.[a]

Trial	Injection Type	M.Hyo.-	O.D. Values	PRV - S/P ratios
		Test 1	Test2	
	control	0.038	0.073	0.016
1	needle	0.515	0.426	1.124
	needle-free	0.559	0.407	1.259
	control	0.075	0.047	0.037
2	needle	0.377	0.259	2.116
	needle-free	0.449	0.241	1.874

[a]Adapted from Sebranek et al. 2002

In a similar study by the University of Saskatchewan Vaccine & Infectious Disease Organization it was also concluded that needle-free injection and intramuscular injection were equivalent. In this study, two groups of piglets at six and nine weeks of age were vaccinated against Actinobacillus pleuropneumoniae using the vaccine Pleurostar-APPa. A 1x18 ga needle was used for piglets receiving the intramuscular injection treatment and the second group received the vaccination via needle-free injection. For both groups the vaccination location was the right (primary) or left neck muscle. Following each treatment the amount of vaccine remaining on the skin surface of the neck was measured. Blood samples were taken at the time of the first and second vaccination and before being challenged with Actinobacillus pleuropneumoniae. At ten weeks of age piglets from each group were challenged with Actinobacillus pleuropneumoniae via aerosol in an enclosed chamber. Observation of the piglets took place for 7-day post exposure and lung tissue was examined for A. pleuropneumoniae lesions.

Results from this study indicated that both methods, syringe and needle and needle-free injection, were sufficient in delivering the vaccine to the piglets. All immune system indicators showed that both groups of vaccinated pigs developed similar antibody titers prior to being exposed to A. pleuropneumoniae. Furthermore both treatment groups developed parallel immune response and had comparable immune system protection to A. Pleuropneumoniae after vaccination. Results showed that both methods of vaccination were successful in protecting piglets from this disease.

Conclusion

Studies have shown that the needle/syringe and needle-free injection techniques are comparable when it comes to vaccine delivery, serological response and immune response. In addition, eliminating everyday use of needles on the farm, human safety should improve since there should be fewer needle stick injuries and the incidence of needle fragments and broken needles in carcasses should be dramatically reduced. Other benefits of the needle-free method will vary from farm-to-farm. Employee training and cost of implementing the practice ($2,000 - $3,000 for equipment) could deter smaller farms from adopting this method. Does adopting this method have advantages for the employees and pigs on your farm? Could this production practice help ensure that a safe product is delivered to the consumer? Each individual producer needs to weigh the pros and cons of this technology, consider their options and choose the production practice that makes the most sense for their farm business.

Resources

Baizer, L., et al, The Drug Delivery Companies Report, PharmaVentures LtD, 2001.
Evans, A., Intra-dermal Vaccination Series, Pig Progress, Volume 22, No 3, 2006.
Sebranek, J.G., et al, Feasibility of Transdermal, Needleless Injection for Prevention of Pork Carcass Defects, Iowa State University, NPB #01-146, 2002.
Wilson, P., et al, Needle-Free Immunization as Effective as Needle and Syringe Method, Manitoba Pork Council, 2004.

Managing the Sow and Gilt Estrous Cycle

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At times, managers of sow farms of all sizes are challenged by the availability of sows and/or gilts in standing heat. From large farms trying to adjust group size or time the introduction of additional females into the breeding herd; to small farms trying to have farrowing dates coincide with the demand for club pigs, there are instances when producers need to managing the timing of estrus or heat to meet the needs of the farm. Commercial products are available that assist managers with this process. To fully understand the application of these products it is helpful to be knowledgeable about the hormonal changes that take place during the normal gilt/sow estrous cycle.

Follicle Stimulating Hormone (FSH) is secreted by the anterior pituitary gland, a small gland at the base of the brain. FSH initiates the growth and development of follicles on the ovary, each developing follicle containing one maturing ovum (egg). As these follicles mature they secrete estrogen, which is responsible for typical signs of standing heat.

Luteinizing Hormone (LH) initiates the release of the ova from the ovary. Luteinizing hormone is also secreted by the anterior pituitary gland. Once an ovum or egg is released from a ruptured follicle, the remaining cells within the ruptured follicle continue to develop and form the Corpus Luteum. Collectively all corpus luteum are called the corpora lutea.

Considering that a normal sow/gilt estrous cycle is 21 days, the anterior pituitary gland will secret FSH late in the estrous cycle at approximately days 18-20. LH is then secreted on days 0 – 2 of the cycle to cause ovulation to occur.

The corpora lutea secrete progesterone. Progesterone is the primary hormone which maintains pregnancy. If the ova are fertilized and become viable embryos, they attach to the uterus. There is feedback to the corpora lutea that signals them to continue to produce progesterone and maintain pregnancy.

Prostaglandin is secreted by uterus. Prostaglandin fulfills two roles. First, if the ova are not fertilized, naturally there won't be embryos to attach to the uterus. When there isn't a pregnancy to maintain, at about day 14-17 the uterus will start to secrete prostaglandin into the blood stream. Prostaglandin causes the corpora lutea to regress ending the secretion of progesterone. As the corpora lutea regress, FSH will stimulate follicle growth on the ovary.

Prostaglandin's second role is to initiate parturition. During pregnancy as the fetus reaches maturation, at the appropriate time for the conclusion of that pregnancy, the uterus will secrete prostaglandin. Again prostaglandin will cause the copora lutea to regress stopping the secretion of progesterone but in this instance the result is parturition.

Products for altering the normal estrus cycle

P.G. 600®[1] is a combination of serum gonadotropin (Pregnant Mare Serum Gonadotropin or PMGS) and chorionic gonadotropin (Human Chorionic Gonadotropin, HCG). Pregnant mare serum and HCG mimic FSH and LH respectfully. In mature, pre-pubertal gilts, P.G. 600 will initiate estrus or heat in non-cycling pre-pubertal gilts that are nearing their natural initiation of puberty. Depending on the farm, gilts will reach maturity at about 170 – 175 days of age. Gilts experiencing estrus at this age are normally considered too young to breed. Skipping the first heat and breeding on the second or third estrus is the recommended management practice. P.G. 600 is not effective in cycling gilts. If the gilt is actively cycling and the corpora lutea are secreting progesterone, or the corpora lutea are in the initial stages of regression, P.G. 600 has no effect on initiating follicle development or egg release. P.G. 600 is very effective in synchronizing the initiation of first estrus in mature pre-pubertal gilts.

Research has shown that P.G. 600 will decrease the return to estrus interval in weaned sows but the economics of treating all weaned sows, including sows that would return to heat in 5 – 7 days with out treatment, is questionable. P.G. 600 is most effecting in treating sows with extended return to estrus intervals (7 – 10 days post weaning).

Matrix®[2] is a 0.22% altrenogest solution, a synthetic progestagen (progesterone). When administered at the label rate Matrix acts like progesterone and will extend the time period to the next ovulation. Once Matrix is discontinued, the anterior pituitary gland will be

signaled to secrete FSH, initiating follicle growth and estrus. The time period between discontinuing Matrix and standing heat is normally 5 – 7 days, similar to the return to estrus interval for weaned sows. Matrix must be fed daily, irregular feeding will result in poor results. Matrix is only labeled for gilts. If used for sows, producers must have a prescription for use from their veterinarian.

Prostamate®[3] and Lutalyse®[4], are products of various forms of the naturally occurring prostaglandin F2 alpha. These two products are the only prostaglandin products currently approved for use in swine in the U.S. If one of these products is administered at the labeled dose between day 21 and 42 of gestation, they will induce pregnant gilts/sows to abort and reabsorb the litter. Breeders wanting to synchronize groups of sows that are in random phases of their estrus cycle may breed females as the come in to heat, following up with a one time treatment of a prostaglandin F2 alpha product (i.e. Lutalyse or Prostamate) to induce the female to abort the litter. The sow/gilt may be bred when she returns to estrous, normally 5 – 7 days after treatment. Research has shown that there is no adverse affects on the subsequent litter.

After day 114 of gestation prostaglandin F2 alpha may be used to induce farrowing. Managers using prostaglandins in this manner must use caution. Late gestation is a time of final maturation of the developing fetus. Inducing farrowing prior to day 113 may result in the birth of weak, low viability pigs. Prior to treating pregnant sows with prostagladins to induce farrowing, breeding date must be recorded and expected farrowing dates must be accurately calculated. The thumb rule for using prostaglandins to induce farrowing is administration should be no sooner in gestation than one day before the average herd gestation length. For instance if the herd average for gestation length is 115, no sow should be induced to farrow before day 114 of gestation.

On September 5th the Pork Team hosted an AI seminar at the Gratiot County Youth Fair grounds in Alma. Anticipating that an adequate supply of gilts in standing heat would be needed for the seminar, eleven gilts were started on Matrix, Friday, August 17th. Each gilt was individually housed and given her daily dose of Matrix orally to insure that each female received a full daily dose. During the treatment one lame gilt was removed from the group. On Thursday August 30th each of the remaining 10 gilts were given their 14th and final dose of Matrix. On Saturday September 1st the remaining 10 gilts were treated with P.G. 600. Pork Team members discussed the need for the P.G. 600 treatment. In normal circumstances P.G. 600 would not be necessary if all gilts were cycling prior to the Matrix treatment. But in this instance the Pork Team wanted as many gilts to be in standing heat for the seminar as possible. It was agreed that by providing the FSH and LH like product (P.G. 600) five days prior to the seminar, and the day after receiving their last dose of Matrix, this would enhance the possibility that the gilts would be in standing heat during the seminar.

On Wednesday, the day of the seminar, six of the gilts were in standing heat, available for practicing heat detection and AI. The other four gilts were showing obvious signs of standing heat but were not yet ready to respond to heat detection methods. The 10 gilts were in standing heat over the next 24 – 36 hours.

This field application of using Matrix to adjust the estrous cycle was limited in size but does indicate that providing a daily dose of Matrix at the label dose will delay the onset of estrus. When the Matrix treatment is discontinued sexually mature gilts will come into estrus in 5 – 7 days.

Sources

Knox R. V., S. L. Rodriguez-Zas, G.M. Miller, K. L. Willenburg, and J. A. Robb. 2001. Administration of P.G. 600 to sows at weaning and the time of ovulation as determined by transrectal ultrasound. J. Anim. Sci. 79:796-802

Bates, R. O., J. Kelpinski, B. Hines, and D. Ricker. 2000. Hormonal therapy for sows weaned during fall and winter. J. Anim. Sci 78:2068-2071

Singleton, W and M. Diekman. Reproductive physiology and anatomy of the sow. Animal Science, Purdue University. Available: http://www.ansc.purdue.edu/swine/porkpage/repro/physiol/reppaper.htm

Estienne, M.J. and A. F. Harper. Using Artificial Insemination is Swine Production: Detecting and Synchronizing Estrus and Using Proper Insemination Technique. Animal Science, Virginia Tech. Available: http://www.ext.vt.edu/pubs/swine/414-038/414-038.html

P. G. 600, Matrix, Estrumate, Prostamate and Lutalyse product labels.

[1]P.G. 600 is a product of Intervet Inc., Millsboro, DE
[2]Matrix is a product of Intervet Inc., Millsboro, DE
[3]Prostamate is a product of AgriLabs, St. Joseph, MO
[4]Lutalyse is a product of Pfizer Inc., New York, NY

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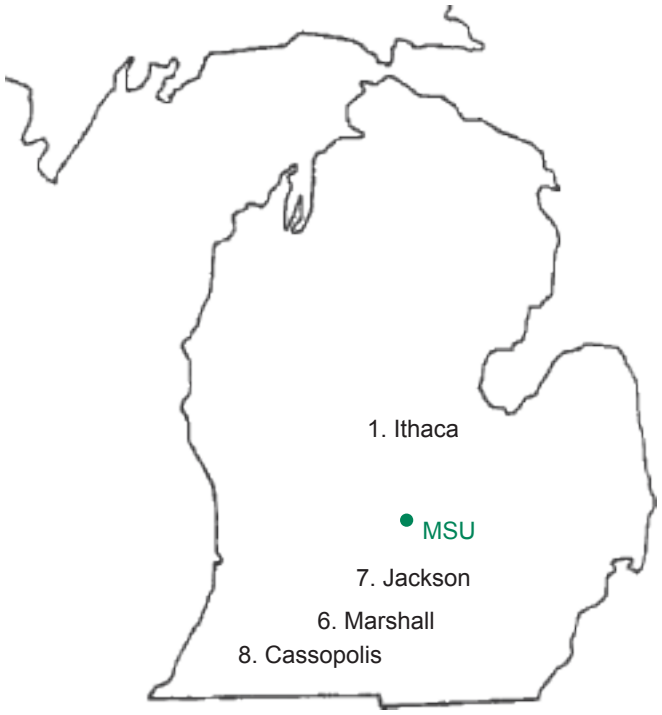

MSUE Pork Team Winter and Spring Programs!

Central MI Pork Meeting Date: December 12, 2007 Location: Harrison	**Management and Care of the Sow During Late Lactation and Pre-Breeding** Dates/Locations: Jan. 30 – Coldwater Jan. 31 – Zeeland Feb. 6 – Cassopolis Feb. 7 – Mount Pleasant
2008 Green and White Education Fair and Show Date: January 26, 2008 Location: MSU, East Lansing	**2008 Michigan Pork Producers Association State Informational Meetings** Typically held in late March!

Watch the MSUE Pork Team web site (http://web1.msue.msu.edu/aoe/pork/) and the December issue of the Pork Quarterly for further details!

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