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Sow Management: How Many Litters/Sow Should I be Targeting?

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Purpose Statement:

As producers in the swine industry continue to specialize their production efforts and enhance their managerial focus on finer and finer details, an appropriate issue to address is the impact sow attrition rates have on costs and returns. The primary purpose of this short article is to examine the impacts of alternative sow culling strategies on costs and returns, as well as examine sensitivity of optimal strategy selection to factors including costs of replacement gilts, feed ration prices, conception rates of the breeding herd, and weaned pig values.

Analysis:

To address the issue of identifying optimal sow attrition rates, we have updated the previous work of Dhuyvetter (2000). Dhuyvetter (2000) developed projected budgets for sow operations culling sows after their first through their tenth parities to determine if an optimal culling strategy exists. For clarity, note that a strategy of culling after the first parity results in an operation always having 100% gilts while a tenth parity strategy culls a smaller segment of sows across each of ten litters such that the on-going (or steady state) sow herd is comprised of 18% gilts (table 1).

The economic budgeting analysis conducted by Dhuyvetter (2000) is updated in this article to reflect current feed prices, sow and gilt prices, and building expenses. The specific adjustments made are:

Description/Unit	Dhuyvetter 2000 Value	Updated Value
Grain Price ($/lb)	$2.48	$4.50
Protein ($/ton)	$200.00	$300.00
Labor ($/year)	$33,000.00	$40,000.00

(Continued on Page 2)

What's Inside...

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Description/Unit	Dhuyvetter 2000 Value	Updated Value
Utilities, fuel, and oil ($/month)	$2,500.00	$3,500.00
Buildings/Gestation Crate ($/sq ft.)	$20.00	$21.00
Buildings/Farrowing Crate ($/sq ft.)	$30.30	$31.82
Equipment/Gestation ($/crate)	$180.00	$189.00
Equipment/Farrowing ($/crate)	$800.00	$840.00
Price of cull sows ($/cwt)	$33.37	$21.76
Price of cull gilts ($/cwt)	$42.03	$40.92
Price of cull boars ($/cwt)	$30.00	$16.76
Purchase price for gilts ($/head)	$200.00	$225.00

As shown in table 2 (line F), returns over total costs are negative ($/hd) for each of the ten evaluated culling strategies. This reflects the current situation of higher input expenses that are not currently offset by equivalent increases in revenue. While the existence of negative returns is certainly not desirable, it does not preclude us from using table 2 to identify the optimal culling strategy. Given the base assumptions underlying the cost-return budget (details are excluded from this paper, for finer details of budget assumptions see Dhuyvetter 2000), returns over total costs are maximized (i.e., losses minimized) when sows are kept for 9 parities. However, the difference in returns between parities 6 and 10 is rather small ($0.44/hd). Referring back to table 1 we see that the optimal 9 parity strategy implies an optimal herd comprised of 18% gilts, 16% parity two sows, 14% parity three sows, etc.

Given the assortment of assumptions that are necessary in any cost-return budgeting exercise, it is important to analyze sensitivity to some key assumptions that may impact returns over total costs and hence the optimal culling strategy. Table 3 shows the sensitivity of returns over total costs to the cost of replacement gilts and feed ration diets (note that base case results are the same as those shown on line F in table 2). When replacement gilts are valued at 25% less ($169/hd) than the base assumed value ($225/hd) returns over total costs increase by $1.77/head and are maximized when sows are culled after eight parities. However, when replacement gilts costs 25% more than the base of $225/head, returns over total costs are further reduced by $1.70, but the optimal culling strategy remains at nine parities. Table 3 also shows that while the assumed feed ration impacts returns, it does not impact the optimal culling strategy. That is, selection of a sow culling strategy is not influenced by feed costs.

A third sensitivity analysis considered the impact of alternative conception rates. In particular, following Dhuyvetter (2000) we considered scenarios where conception rates are +/- 10 percent of the base rates as well as scenarios where the rate improves or declines more rapidly (rather than evenly by 10%) such that conception rates for the tenth parity are +/-40% of the base rates. Results of these four scenarios, and the base case, are presented in table 4. While returns are impacted by conception rates, the optimal culling strategy remains an eighth or ninth parity approach. Of more interest is to note the asymmetrical impact that these scenarios reveal. In particular, the increase in returns associated with improved conception rates is notably less (in absolute terms) than the decrease in returns accompanying a setback in conception rates, providing strong evidence for the need to closely monitor actual conception rates.

The final sensitivity analysis considered the impact of alternative weaned pig values ($/hd). The value ($34.01/hd) assumed in table 2's base model was identified using a Kansas State University formula based upon grain, soybean meal, and market hog prices. Given the negative returns suggested by table 2, a likely question to be raised by readers of this article is what the impact of alternative output prices (weaned pigs) would be on culling strategies. While sensitivity analysis to wean pig prices, independent of changes in market hog prices may not be strongly advisable, table 5 helps answer this question by showing the results of considering situations where weaned pig values are +/- 25% of the base price. Results show that while weaned pig values certainly impact return levels, they do not alter the optimal culling strategy.

Implications:

Identification of optimal sow culling is an important component of a sound management plan by modern swine producers. Providing information to improve these managerial decisions was the focus of this article. The cost-return budgeting exercise summarized in this report reveals that the most economical time to cull a sow is after her eighth or ninth parity. It was also found that small differences in returns exist for any strategy keeping sows between six and ten parities. Consistent with expectations, sows should be culled sooner when the cost of replacement gilts decline. However, feed ration prices, conception rates of the breeding herd, and weaned pig values, have relatively little impact on optimal culling strategies.

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Dhuyvetter, K.C. "What Does Attrition Cost and What is it Worth to Reduce?" Paper presented at the Allen D. Leman Swine Conference, College of Veterinary Medicine, University of Minnesota, August 11-15, 2000, Minneapolis, MN. The article is also available at: http://www.agmanager.info/livestock/budgets/production/default.asp#Swine.

Tables for this article are continued on Pages 5-7

Swine Management Program in the Institute of Agricultural Technology Accepting Applicants

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Certificate programs offered through the Institute of Agricultural Technology (IAT) at Michigan State University provide students with practical training in on-campus courses and off-campus internship experiences. Several off-campus programs are offered in conjunction with community colleges around the state. The Swine Management program is two semesters in length and begins in the fall semester. It allows men and women the opportunity to specialize in the area of swine management with a one-year intensified program.

Students enrolled in the swine management program will develop a greater knowledge of swine enterprise management. The program includes a clerkship requirement which provides a thorough "hands-on" experience with members of farm staff to accomplish day-to-day, standard farm procedures. The swine clerkship at the MSU Swine Teaching and Research Center is designed to develop skills in modern, swine production. In addition to clerkships, students are required to complete courses from faculty and staff in the Department of Animal Science and a variety of elective areas.

Learning goes beyond the classroom and the clerkship for swine management students as they participate in

(Continued on Page 12)

Table 1. Parity Distribution and Production from Sow Herd

Parity prior to culling[a]	1	2	3	4	5	6	7	8	9	10
Percent of farrowings from each parity (steady-state parity distribution)										
Parity 1	100%	54%	38%	31%	26%	23%	21%	20%	18%	18%
Parity 2		46%	33%	27%	23%	20%	19%	17%	16%	15%
Parity 3			29%	23%	20%	17%	16%	15%	14%	13%
Parity 4				20%	17%	15%	14%	13%	12%	11%
Parity 5					15%	13%	12%	11%	10%	10%
Parity 6						11%	10%	10%	9%	9%
Parity 7							9%	8%	8%	7%
Parity 8								7%	7%	6%
Parity 9									6%	5%
Parity 10										5%
TOTAL	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
Average parity[b]	1.00	1.46	1.90	2.32	2.70	3.07	3.40	3.76	4.05	4.32
Sow inventory	1,220	1,196	1,188	1,184	1,184	1,182	1,182	1,179	1,179	1,180
Annual purchases	3,640	1,950	1,391	1,112	962	849	780	719	672	650
Replacement rate	298%	163%	117%	94%	81%	72%	66%	61%	57%	55%
Total litters/year[c]	2,860	2,860	2,860	2,860	2,860	2,860	2,860	2,860	2,860	2,860
Litters/sow/year	2.34	2.39	2.41	2.42	2.42	2.42	2.42	2.43	2.43	2.42
Born alive/litter	9.25	9.49	9.68	9.83	9.93	10.01	10.04	10.06	10.05	10.03
Weaned/litter	7.96	8.25	8.42	8.53	8.61	8.66	8.68	8.68	8.67	8.64
Weaned/sow/year	18.7	19.7	20.3	20.6	20.8	20.9	21.0	21.1	21.0	20.9
Total sold/year	22,756	23,599	24,078	24,399	24,614	24,758	24,823	24,839	24,792	24,704

a Represents the sow culling strategy. For example, "3" would indicate sows are kept for three parities at which time they are culled. Sows that do not breed back prior to their final parity are culled at the time they are open.
b Average parity is simply the weighted average parity. For example, the average parity for sows culled after their third parity is calculated in the following manner: (38.2% x 1 + 33.2% x 2 + 28.6% x 3) = 1.90.
c Based on farrowing 220 sows every four weeks.

(Continued on Page 6)

Table 2. Cost-Return Budget for a Farrow-to-Weaned Pig Operation

Parity Prior to Culling[a]	1	2	3	4	5	6	7	8	9	10
VARIABLE COSTS PER PIG SOLD:										
1. Grain	$7.24	$7.06	$7.04	$7.05	$7.11	$7.17	$7.25	$7.34	$7.46	$7.59
2. Protein	2.84	2.79	2.79	2.80	2.82	2.84	2.88	2.91	2.95	3.00
3. Base mix: vitamins, minerals, etc.	0.98	0.96	0.96	0.96	0.97	0.97	0.98	1.00	1.01	1.03
4. Pig starter	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5. Feed processing	0.56	0.54	0.54	0.54	0.55	0.55	0.56	0.56	0.57	0.58
6. Labor	8.79	8.47	8.31	8.20	8.13	8.08	8.06	8.05	8.07	8.10
7. Veterinary, drugs, and supplies	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
8. Utilities, fuel, and oil	1.32	1.27	1.25	1.23	1.22	1.21	1.21	1.21	1.21	1.21
9. Transportation and marketing costs	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
10. Building and equipment repairs	1.23	1.18	1.15	1.14	1.13	1.12	1.12	1.11	1.12	1.12
11. Breeding/genetic charge										
a. Depreciation	24.95	12.15	8.24	6.40	5.43	4.74	4.32	3.97	3.71	3.60
b. Semen	2.01	1.94	1.90	1.88	1.86	1.85	1.84	1.84	1.85	1.85
c. Interest	0.80	0.78	0.77	0.76	0.76	0.76	0.76	0.76	0.76	0.76
d. Insurance	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08
12. Professional fees	0.53	0.51	0.50	0.49	0.49	0.48	0.48	0.48	0.48	0.49
13. Interest on 1/2 variable costs	1.12	0.81	0.72	0.67	0.65	0.64	0.63	0.62	0.62	0.63
A. TOTAL VARIABLE COSTS	$54.44	$40.55	$36.24	$34.19	$33.18	$32.48	$32.17	$31.93	$31.88	$32.04
FIXED COSTS PER PIG SOLD:										
14. Depreciation on bldgs and equip	$4.41	$4.21	$4.11	$4.05	$4.02	$3.99	$3.98	$3.97	$3.98	$4.00
15. Interest on bldgs and equip	3.31	3.16	3.09	3.04	3.02	3.00	2.99	2.98	2.99	3.00
16. Ins. and taxes on bldgs and equip	0.82	0.78	0.76	0.75	0.74	0.74	0.74	0.74	0.74	0.74
B. TOTAL FIXED COSTS	$8.53	$8.15	$7.96	$7.85	$7.78	$7.73	$7.71	$7.69	$7.71	$7.74
C. TOTAL COSTS PER PIG SOLD	$62.97	$48.70	$44.20	$42.04	$40.96	$40.21	$39.87	$39.62	$39.59	$39.77
D. GROSS RETURNS PER PIG SOLD	$34.01	$34.01	$34.01	$34.01	$34.01	$34.01	$34.01	$34.01	$34.01	$34.01
E. RETURNS OVER VARIABLE COSTS (D - A), $/hd	($20.43)	($6.54)	($2.22)	($0.18)	$0.83	$1.53	$1.85	$2.08	$2.13	$1.98
F. RETURNS OVER TOTAL COSTS (D - C), $/hd	($28.96)	($14.68)	($10.18)	($8.03)	($6.95)	($6.20)	($5.86)	($5.61)	($5.57)	($5.76)
G. NET RETURN ON INVESTMENT	-32.1%	-14.1%	-8.1%	-5.2%	-3.7%	-2.7%	-2.2%	-1.9%	-1.8%	-2.0%

[a] Represents the sow culling strategy (sows are culled after the parity number listed).

Table 3. Analysis of Sensitivity to Replacement Gilt ($/hd) and Feed Diet ($/ton) Assumptions

	Parity Prior to Culling:									
	1	2	3	4	5	6	7	8	9	10
	Return over Total Costs, $/hd									
Cost of Replacement Gilt ($/hd) Sensitivity:										
$169 (25% Lower)	$(19.64)	$(9.80)	$(6.73)	$(5.27)	$(4.56)	$(4.09)	$(3.91)	$(3.80)	$(3.87)	$(4.11)
$225 (Base)	$(28.96)	$(14.68)	$(10.18)	$(8.03)	$(6.95)	$(6.20)	$(5.86)	$(5.61)	$(5.57)	$(5.76)
$281 (25% Higher)	$(38.28)	$(19.57)	$(13.64)	$(10.78)	$(9.33)	$(8.31)	$(7.80)	$(7.41)	$(7.27)	$(7.41)
Cost of Gestation/Lactation Diets ($/ton) Sensitivity:										
Diets 25% Lower	$(26.09)	$(11.88)	$(7.39)	$(5.22)	$(4.12)	$(3.35)	$(2.97)	$(2.69)	$(2.61)	$(2.75)
Base	$(28.96)	$(14.68)	$(10.18)	$(8.03)	$(6.95)	$(6.20)	$(5.86)	$(5.61)	$(5.57)	$(5.76)
Diets 25% Higher	$(31.77)	$(17.43)	$(12.92)	$(10.77)	$(9.71)	$(8.99)	$(8.68)	$(8.46)	$(8.47)	$(8.71)

Table 4. Analysis of Sensitivity to Conception Rate Assumptions

	Parity Prior to Culling:									
	1	2	3	4	5	6	7	8	9	10
	Return over Total Costs, $/hd									
Conception Rate Sensitivity:										
Base	$(28.96)	$(14.68)	$(10.18)	$(8.03)	$(6.95)	$(6.20)	$(5.86)	$(5.61)	$(5.57)	$(5.76)
Base +10%	$(25.88)	$(12.89)	$(8.89)	$(6.94)	$(5.77)	$(5.01)	$(4.80)	$(4.56)	$(4.75)	$(4.75)
Base -10%	$(33.05)	$(17.07)	$(12.13)	$(9.59)	$(8.31)	$(7.63)	$(7.38)	$(7.16)	$(7.17)	$(7.15)
Base to +40% at P10	$(28.96)	$(14.35)	$(9.65)	$(7.53)	$(6.25)	$(5.46)	$(5.09)	$(4.90)	$(4.84)	$(4.95)
Base to -40% at P10	$(28.96)	$(15.29)	$(10.98)	$(9.02)	$(7.98)	$(7.44)	$(6.95)	$(6.82)	$(6.82)	$(7.10)

Table 5. Analysis of Sensitivity to Weaned Pig Value ($/hd) Assumptions

	Parity Prior to Culling:									
	1	2	3	4	5	6	7	8	9	10
	Return over Total Costs, $/hd									
Weaned Pig Value ($/hd) Sensitiv-ity:										
$25.50 (-25%)	$(37.47)	$(23.20)	$(18.70)	$(16.54)	$(15.46)	$(14.71)	$(14.37)	$(14.12)	$(14.09)	$(14.27)
$34.01 (Base)	$(28.96)	$(14.68)	$(10.18)	$(8.03)	$(6.95)	$(6.20)	$(5.86)	$(5.61)	$(5.57)	$(5.76)
$42.50 (+25%)	$(20.47)	$(6.20)	$(1.70)	$0.46	$1.54	$2.29	$2.63	$2.88	$2.91	$2.73

Handling and Transportation for Swine Producers

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The work that goes into producing a good pork product doesn't stop when the animal leaves your door. Gentle handling and good husbandry skills improve the overall productivity of the animal and help to diminish any setbacks that the animal might encounter. In fact, research shows that the performance of finishing pigs is positively affected by good stockmanship. Pigs that are mistreated most often have lower weight gains and a higher number of days to reach market weight. When trying to improve the handling and transportation practices on your farm there are many different factors to consider. In this article we will discuss utilizing proper equipment, handling methods, both in the barn and on the truck, and tips to decide which pigs are fit for transport.

When reviewing the equipment you make use of on your farm you not only need to look at the tools the herdsmen use to move animals but the general condition and design of your buildings. Pigs resist movement if they are being driven from areas with different flooring types, temperature or wind variations (Jordahl, 2008). Opening curtains, installing extra lighting, preventing drafts and at times turning off the ventilation systems are all ways to help improve the handling process.

Pigs have a hard time adjusting to different lighting. Adding a light at the entrance of a loading chute or exit will facilitate animal movement out the door. Both pigs and cattle have a tendency to move from a darker place towards a brighter place (Grandin, 2002). Simple things, like opening curtains 30 minutes before moving animals so that animals adjust to the sunlight can make handling a less stressful event.

Loading and unloading animals can be one of the most stressful times on a farm for the animals and herdsmen. In order to insure ease at handling we need to utilize proper handling tools, maintain the correct environment and have the correct ramp design. When assessing the flooring types on your farm it has been found that all surfaces where animal movement takes place should be non-slip. A light broom finish or imprinted concrete can add traction to handling areas, decreasing slipping and injury. Another area of the swine barn that can be assessed is the loading chute. Research has shown that a pig's heart rate will increase as the angle of a loading ramp increases (Van Patten, 1978). An ideal ramp design for a non-adjustable ramp would have an angle of

(Continued on Page 8)

20 degrees or less. For adjustable ramps the angle should not be greater than 25 degrees. Cleats on a loading ramp also will improve the movement of the animal in the chute. It has been found that cleats should be spaced with the normal stride of the animal. For a 250 pound market pig cleats should be 1 inch x 1 inch and spaced 8 inches apart (Mayes, 1978). Adjusting the design of the loading chute will make loading and unloading a less stressful event on your farm.

Handling and transportation will be easier on your farm it you have well designed and maintained equipment. Another factor that you should consider is the need to have good management and well-trained people in your employment. Pigs are handled on farms many times at different stages for specific reasons. If pigs are accustom to close, frequent, gentle contact from the people that work the pens they are less likely to experience a setback in production and be easier to handle. Training employees to understand the behavioral principles of handling such as flight zone and point of balance is an effective management tool on farms (Grandin, 2001). Although we can train all employees on the basic handling principles we also need to take into account the attitude of the employee. Employee qualities like, patience, timing and being able to predict the movement of the animal, are all important in effective animal handling. Routine visual evaluation of your employees will help you determine which employees should be responsible for pig movement and handling on the farm.

When evaluating the effectiveness of your transportation practices you also need to look at the condition of the truck. Overloading of trucks is a major cause of stress and death loss in pigs. Studies have shown that severe overloading results in evidence of physical stress (Warriss, 1998). For longer trips the space allotment should increase 15 to 20% depending on the weather and temperature. In trips that are less three hours in length pigs will remain standing, while they will lay down for longer trips (Guise, 1998). Table 1 shows recommended transportation space requirements during cool weather by the National Institute of Animal Agriculture.

Table 1:

Average Weight, lb	Number hogs per Running foot of Truck floor (92-in, Truck Width)	Sq. Ft. Per Head
50	5.01	.53
100	3.3	2.32
150	2.6	2.95
200	2.2	3.48
250	1.8	4.26
300	1.6	4.79
350	1.4	5.48
400	1.2	6.39

From this table we can surmise that a 250 pound pig needs a minimum of 4.3 sq. feet of space during transportation to reduce stress and improve welfare.

Before loading the truck, employees need the skills to determine which animals are fit for transportation. The protocol used in this evaluation should be uniform amongst employees and stated in the farm's standard operating procedures. It is suggested by the National Pork Board that sows and pigs that are unable to walk or those that are ill or have sustained an injury should be humanly euthanized at the farm and not transported to market. Pig which are temporarily non-ambulatory, must be allowed sufficient time to recover before they are put on the truck. By making your employees aware of the standards that the animals must meet before being put on a truck will help prevent and reduce losses during transportation.

In conclusion, to maintain high standard for handling and transportation, protocols on your farm must address many factors. Constant evaluation of building and truck design and maintenance is essential. Furthermore handling practices must be regularly assessed and employee training must include effective techniques necessary for animal handling. Another resource that producers can refer to in order to set production practice standards on their farm are the Generally Accepted Agricultural Management Practices (GAAMPS (MDA GAAMPS website; http://michigan.gov/mda/0,1607,7-125-1567_1599_1605---,00.html)) that are available through the Michigan Department of Agriculture. Addressing handling and transportation methods on your farm can impact your bottom line.

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Hernias in Growing Pigs

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Two of the more common anatomical defects that occur on pig farms are scrotal hernias and umbilical hernias. These hernias typically occur at frequencies of 1.7 to 6.7%, but in some instances can increase or "spike" for a variety of reasons (Thailer et al 1996). The difficulty with these types of physical defects is that they often render the pig less valuable as a market pig and can cause morbidity and possibly mortality.

Umbilical Hernia

Umbilical hernias occur due to weakened supportive muscles around the umbilical stump or navel area of the

(Continued on Page 10)

pig. This causes the umbilical opening not to close properly and intestines protrude through the intestinal wall to form the "ball-like" structure often seen on the pig. The frequency ranges from 0.4 to 1.2% (Searcy et al 1994). Hernias are classified as direct or indirect depending on whether intestinal loops outside the abdomen are covered by peritoneum or vaginal tunic (indirect), or whether intestines directly contact skin (direct) (Grindflek et al., 2006). Intestines in direct contact with skin stimulate formation of adhesions. Umbilical hernias, of any size, are usually direct and therefore complicated by adhesions that can interfere with normal digestion. A moderate amount of adhesion should only somewhat reduce the pigs' performance and their carcasses should be of similar value to pigs that do not have this condition. However, problems arise if the intestines are ruptured during the slaughter process and the intestinal contents contaminate the carcass. Often these pigs are sent to specialty harvest facilities that can accommodate them and slaughter them with minimal risk of carcass condemnation. This re-sorting in the market chain causes the reduction in value.

The genetic control of umbilical hernias is not entirely clear. A "familial" cause has been suggested and a few specific genes have been recently shown to associate with this condition (Zhao et al., 2008). However in general this condition is not due to simple inheritance of a few genes. Environmental conditions definitely play a role in the incidence of this defect. It is thought that environmental compromises such as navel infections early in life may be linked to the incidence of this condition. Proper sanitation and hygiene may have a greater chance of reducing the incidence of this condition than trying to eliminate certain boars or dams.

If there is a genetic influence to this condition, it may be related to poor environmental conditions. This indicates there may be genetic variability controlling the musculature of the navel and those with a propensity with weaker navel muscles in a poor environment could trigger this belly rupture condition.

Environmental factors such as abnormal stretching of the umbilical cord (during farrowing or placing naval clips too close to the skin) or infection of the umbilical stump could contribute to failure of the umbilical cord opening to close. Investigation of a hereditary component is complicated by the nature of the defect. While there may be a range in the ability of the umbilical stump to close, the characteristic is not easily measured except in the extreme (categorical measure – affected vs not affected).

Scrotal Hernia

Scrotal hernias obviously occur only in males although the more encompassing category of inguinal hernia includes both genders. Inguinal herniation in females is rare and usually associated with intersexuality (Tianti et al 2002). Occurrence of scrotal hernia has been reported as 2% (Germany Gat), 5% (Iowa, Magee), 1-5% (Gat 2005), 1.35 and .22-.54% (Dutch, Charasu) and 0.6, 1.0 and 1.5% (Duroc, Landrace, York, Vogt et al 1990). It is thought that scrotal hernias are caused by failed obliteration of the process vaginalis after descent of the testis (Clarnette et al 1998), or from failed involution at the internal inguinal ring (Clarnette and Hudson 1997) such that it does not close off properly after the testes descend into the scrotum. This usually allows the distal jejunum and ileum to drop into the scrotum. If the intestines are present in the scrotum at the time of castration the intestines are either ruptured or "fall out" of the pig. Intestines may migrate to the scrotum after castration. It is difficult to surgically repair either rupture condition. It is typically advised not to try to repair umbilical hernias. Scrotal hernias can sometimes be repaired if found in early stages. However, in both cases, advanced hernia cases are extremely difficult, if not impossible, to surgically repair on a practical basis. Scrotal hernias more frequently involve the left side with an occurrence on the left about 5 times that of on the right (Magee 1951).

Genetic Causes

For years the appearance of scrotal hernias has been linked to certain boar lines and based on differences among sires within lines estimates of heritability of scrotal hernia has been estimated as 0.15 (Magee, 1951) and 0.2-0.6 (Gatphayak et al 2005). It has been shown that there are several genes that associate with this condition but do not have absolute control (Zhao et al., 2008). Likely Quantitative Trait Loci (QTL) have been detected on SSC1, SSC2, SSC5, SSC15, SSC17 and SSCX (Grindflek et al., 2006). If this condition is prevalent to either a single boar, or boar family (close relatives of a boar), the incidence of scrotal hernias may be primarily due to genetics. The elimination of the boar, boar family and other close relatives should reduce further incidence. However, since this condition is due to multiple genes, it is fair to say that there is a genetic contribution from the sow herd. Another unusual occurrence with this physical defect is that often the incidence may be small or not observed within the pure lines that make up the crossbred pig, but the incidence within the crossbred pig can by higher than in the pure lines that comprise it. This suggests that there may be a detrimental heterosis cause to this condition but this has not been fully substantiated. It also happens, within commercial herds, that two herds using the same dam and boar lines can have dramatically different incidences of this condition with one herd having little or no incidence and the other seeing a high incidence. This suggests there is a genotype by environmental interaction. When this occurs, there is something within the environment that is stimulating a particular genotype to allow for this condition to occur. It can be very difficult to determine the genetic cause when the underlying environmental factor or factors triggering this malady are unknown.

Conclusion

The occurrence of scrotal and umbilical hernias is often a frustrating concern for commercial farms. One can conclude that both environmental and genetic causes can stimulate the incidence of these physical defects. Neither trait is controlled through simple genetic inheritance, thus there are not simple procedures to reduce their incidence. If the incidence of either of these defects occurs through the introduction of a new boar or female line, farms should work with their genetic suppliers in a systematic approach to develop a plan to reduce the incidence of these maladies. In addition, farms should evaluate their own management and hygiene procedures to minimize environmental causes.

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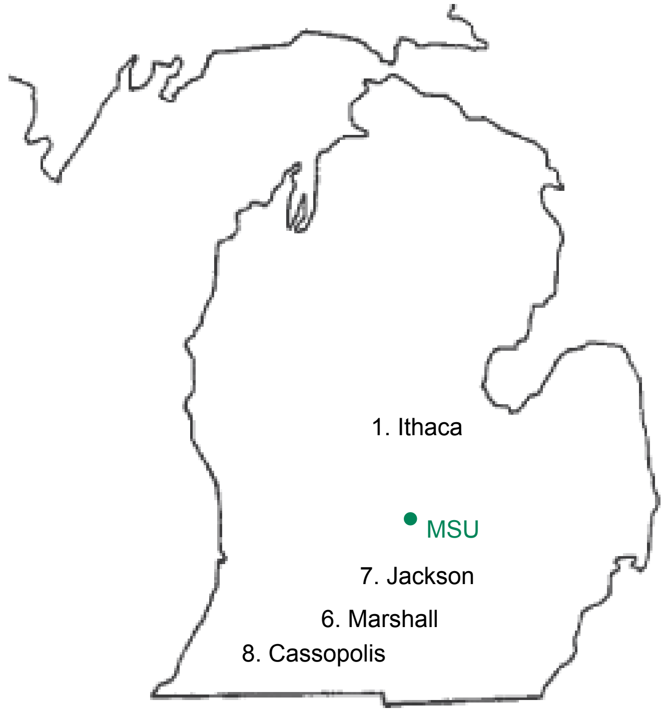

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