

"Genetic Control of Abnormalities in Swine"

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Anatomical abnormalities typically impact 1-2% of all pigs born. In a summary of approximately 105 swine anatomical abnormalities and disorders that are known to have a genetic background (Nicholas, 1998), the true genetic control is known for approximately half of these traits. The others, for the most part did exhibit a "familial relationship" for those exhibiting the trait but it was difficult to determine the complete underlying genetic control. In other words these traits appear to have a greater occurrence within certain families (progeny of a sire or dam) but the complete genetic control is unknown.

There are several challenges when untangling the genetic component of an abnormality or disorder. The first is that the occurrence for many abnormalities can be very low and it may take a recording scheme across several herds to be able to determine if a trait may be more prevalent within certain families versus others and thus have a genetic component. This issue becomes more complex when the inheritance pattern is not straight forward and when there appears to be many gene pairs controlling the trait. Another challenge is in trying to understand the influence of environment on expression of the disorder, For example, a sire known to pass on genes for a defect may have animals in one herd that do not display the abnormality while in other herds, his progeny do have a greater incidence.

This has been the case for hernias particularly scrotal and umbilical hernias. It has long been considered that these abnormalities did follow a familial expression pattern, that

is greater predominance among progeny from some sires versus others. However, it has never been demonstrated that the occurrence of this trait followed a single gene inheritance pattern. In a study summarizing data on 30,500 litters from Germany (Thaller, et al., 1996) it was reported that scrotal hernias had heritability estimates that ranged from 0.03 to 0.19, depending on the breed. This demonstrates two points. The first is that multiple and probably many gene pairs are controlling possible outcomes. The second is the potential range in what can be occurring regarding genetic control. In some breeds this condition has an extremely small genetic component while in others it may be moderate in magnitude. Thus when crossing two breeds, when producing replacement females or market pigs, it can be difficult to predict the outcome. For example, two breeds may have minimal occurrence for an abnormality. This may be due to having favorable genes for this trait and experiencing minimal occurrence, but these favorable genes could be at different locations within the DNA for each breed. Once these breeds are crossed, unfavorable genes that are "hiding" in one breed or the other can exert control over the favorable genes and cause an increased incidence of an abnormality that what was observed in either of the breeds.

This was confirmed in a recent report (Plastow, 2004) in which scrotal ruptures were observed when a new terminal boar line was crossed onto an existing crossbred female type. In this case the percentage of scrotal hernias increased beyond was observed in the pure lines that made up these crosses. However, it was not consistent

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from herd to herd. Upon further investigation, they did determine that the heritability estimate was greater than zero, which indicates that there are multiple gene pairs controlling this trait and their inheritance pattern is consistent enough to select against this abnormality. In addition they also found two DNA markers for this trait, suggesting that there were 2 “gene pairs” that were exerting major control on this trait. Using these DNA markers along estimated breeding values (EBVs) or estimated progeny deviations (EPDs) the incidence of this trait can be further reduced. This also demonstrates that there can be many gene pairs with small effects along with a few gene pairs with large effects controlling a trait. Using both classical methods (selecting on the breeding value) along with DNA markers can speed progress.

There is a general thinking that when abnormalities occur and they have a genetic background that strict and deep culling among sire families should occur. This has two general problems. The first is that it could reduce the genetic base such that inbreeding would occur. This causes a reduction in genetic differences, which slows genetic progress and in some cases causes the appearance of new abnormalities not previously seen. The second concern is that culling all animals from families in which the trait is expressed may unfairly penalize high performing animals that are guilty only because they are from a certain family and may not be carrying genes that could cause an abnormality to manifest itself.

This information on the complex inheritance of genetic abnormalities can be used in commercial herds in several ways. The first regards recording. When abnormalities occur, it should be recorded in a consistent manner so that it can be tracked over time. If the total of abnormalities across all categories is no more than 1-2% than chances are the herd is “normal” for these conditions. If a particular abnormality occurs near or above the frequency of the historical herd average for all abnormalities then further investigation should occur. If it is an abnormality that has been documented to be under some genetic control, then it should be determined what the genetic commonality is between individuals displaying the abnormality. That is;

1). Are the abnormal pigs from the same sire? If most of the effected pigs are from the same sire than it is likely that it has a primary genetic cause.

- 2). Are their common grandsires (check both the sire(s) or dam(s) sides)? If there are common grandsires among the abnormal animals than genetics can be a primary cause.
- 3). If pigs are from pooled semen, can it be determined if the semen is from younger or older boars? Semen from younger boars in which there are pigs with abnormalities can indicate a genetic component, especially if older boars did not have pigs with abnormalities.
- 4). Are all or most of the pigs from gilts versus older sows? Records from older sows can show if they have had offspring with abnormalities while gilts won't have those records and probably have different sires compared to the sows. If only gilts are having this occurrence, environment can't be ruled out, but neither can genetics.
- 5). Is the occurrence of the abnormality consistent across pigs from different farrowing groups? All things being equal, an increased incidence among pigs in one farrowing group versus the groups before or after could indicate that it is more environmental than genetic. Determining environmental causes can be just as difficult as determining genetic causes.

Most genetic defects are not controlled by a single gene pair, which can make it difficult to develop a reasonable solution to a given increase in occurrence. Improved data recording and the use of molecular tools are improving our understanding of the genetic control of these traits. This should lead to a reduced incidence across the industry over time without limiting our ability to make genetic progress.

Literature Cited

Nicholas, F.W. 1998. Genetics of morphological traits and inherited disorders. pp. 71-104. in *The Genetics of the Pig*. M.F. Rothchild and A. Ruvinsky, eds. CAB Press Int. New York N.Y.

Plastow, G., S. Sasaki, T-P. Yu, N. Deeb, G. Prall, K. Siggins and E. Wilson. 2004. Practical applications of DNA markers for genetic improvement. pp. 153-165. Proc. NSIF Ann. Meeting, Des Moines, IA.

Thaller, G., L. Dempfle and I Hoeschele. 1996. Investigation of the inheritance of birth defects in swine by complex segregation analysis. *J. Anim. Breed. Genet.* 113:77-92.

"Clipping Pigs for Show"

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Each year during the Youth Fair season concern is heard about pigs that have had their hair clipped too short. There has been inquiry regarding direction on this issue for leaders and fair officials as they prepare for the 2004 Fair Season.

A trend in the showing of market hogs is to clip to a hair length of less than ½ inch or even shave the hair off of the pigs. If the hair is too short when the pigs are harvested, it is nearly impossible to remove the hair and hair follicle from the carcass during normal processing. The vast majority of pork processing plants leave the hide on the carcass before further processing. All hair must be removed from the hide for the carcass to pass USDA inspection. Carcasses in which the hair is not completely removed must be taken off the normal slaughter line and skinned, which slows plant operations. This causes the processor to spend more money in labor on each carcass that must be skinned and then the carcass is worth less because the skin is removed and causes excessive carcass shrinkage and makes the resulting pork wholesale cuts worth less. Consequently, the value lost due to increased labor and decreased market value often makes these carcasses unprofitable to the processor. Processors can refuse to purchase these hogs, because of the increased risk they must endure while trying to process the resulting carcasses.

For the 2004 Green and White Market Hog Show, the Planning Committee decided to implement a ½" hair length rule for this year's show. This new rule required that all pigs have a minimum of ½" hair over its' entire body. The show was held on February 7, 2004 and though there was some controversy with this new rule, overall the ½" rule worked well. The pigs were marketed through a packer that has in the past voiced concern over clipped pigs. We had no reported problems or concerns from this packer after they bought the pigs shown at the 2004 Green and White Show. As exhibitors and show officials learn and adjust to the new rule, further controversy can be avoided in the future.

What did we learn?

Exhibitors should not clip pigs shorter than ½" two to three weeks before the show. Show officials felt that the pigs that were boarder line for meeting the ½" standard had probably been clipped short earlier in January and the hair just didn't grow back as anticipated. Do not clip pigs less than ½".

The face and tail may be clipped shorter than ½". Shorter hair on the face and tail will not cause a problem at the slaughter facility. The processing lines at slaughter plants provide for difficult hair removal from these areas. If exhibitors want to clip the hair shorter on the face and tail they may be allowed to.

Pigs should be checked as they enter the make up arena, which will remove any concern over exhibitors adjusting hair length after the pigs have been checked.

The top of the magnetic strip on the back of a credit card is ½" from the bottom edge of the card, which works perfectly for checking pigs at the show and allows the exhibitor preparing for the show to monitor hair length during the clipping process.

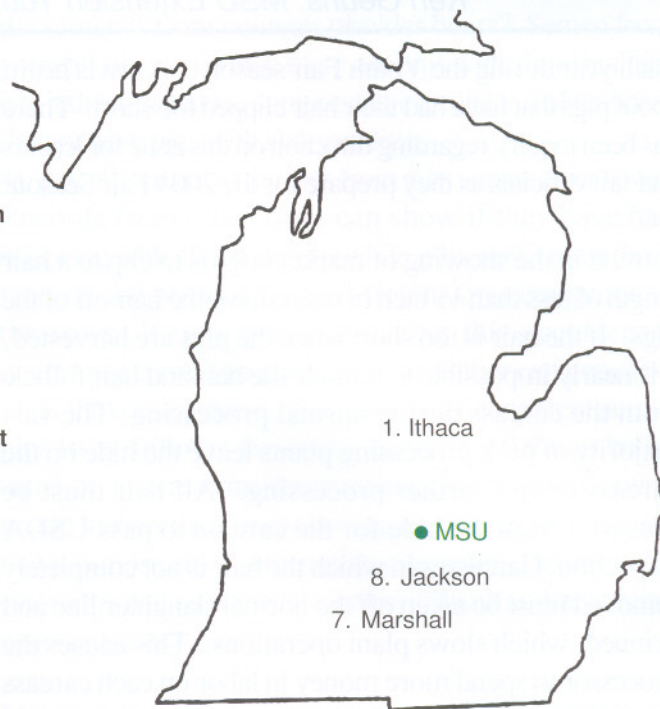
Routh Packing of Sandusky Ohio has sent a letter to all their hog buyers stating that Routh will not accept pigs that have been clipped too short (pigs with less than ½" hair length) in 2004. It is important for all fairs and project leaders to address the hair length issue now. Contact the buying station that will be receiving your fair pigs after the pigs are shown at the fair. Ask the buying station manager if excessively shorthaired pigs are difficult to market, then make appropriate adjustments to your fair rules. Leaders will be very valuable in assisting and mentoring exhibitors and their families with these changes.

Agents, leaders, and fair officials need to be prepared to address the concerns of exhibitors and their families. If you need further assistance you may contact Tom at (517) 788-5292, Jerry at (989) 875-5233 or Ken at (517) 353-2924.

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All comments and suggestions should be directed to:

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"Swine Team Electronic Update" *By Jerry May, MSU Extension Swine Agent*



Each week the Swine Team publishes an electronic newsletter delivered via email. This Electronic Update consists of a market update from Glenn Grimes and Ron Plain, news items important to the swine industry gleaned from other web sites, and information pertinent to the Michigan Swine Industry.

The Swine Team would like to increase the value of the Electronic Update by using the newsletter to keep Michigan producers abreast of current Swine Team events. At the same time we are looking to increase the number of Electronic Update subscribers. The newsletter is delivered free to anyone and is delivered either Friday evening or Monday morning. The Electronic Update subscriber list is confidential and the email is delivered as a "blind carbon copy" to maintain the confidentiality of the subscriber list. If you would like to receive the Electronic Update email Jerry May at mayg@msue.msu.edu and your name will be added to the subscriber list.