

# **A Summary of the 13th Discover Conference on Sow Productive Lifetime**

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## **History of the ADSA DISCOVER Conference**

In 1997, the American Dairy Science Association established a conference series designed for open communication among academic and industry professionals on important topics in animal agriculture. Past conferences have discussed the need to preserve animal germplasm and the relevance of antibiotics in food animal production. Several past Discover Conferences have been related to milk production or the dairy cow in large part because the organizing staff has more experience with the dairy industry and could identify timely topics more readily that fit the Discover Conference concept. The 13<sup>th</sup> DISCOVER Conference focused on improving sow productive lifetime through all aspects of production. Future topics of research needed to improve sow productive lifetime were emphasized at the conference and are discussed further under each heading below.

## **Conference Setting**

The conference was held in Nashville, Indiana at the Brown County Inn on September 9-12, 2007. The location of the conference was a state park resort in the hills of Brown County, Indiana. This area of Indiana is known for its “charming, rustic architecture and warm interior that complement the panoramic view of wooded hills”. This site has been used for the majority of Discover Conferences largely due to the presence of activities that stimulate interaction among conference attendees and relaxation. Such activities include miles of hiking trails, lakes, and golf courses as well as pool and tennis facilities. Nashville, Indiana is also popular because of its location in the countryside, the large number of artist studios and galleries, and various craftsmen of all types.

## **The 13th Discover Conference on Food Animal Agriculture**

“Sow Productive Lifetime” was the title for the conference and was presented in cooperation with the U.S. Pork Center of Excellence with major funding provided by the National Pork Board. The organizing committee included David J. Meisinger, U.S. Pork Center of Excellence, Committee Chair; Mark Boggess, National Pork Board; Stanley E. Curtis, University of Illinois; Anna K. Johnson, Iowa State University; Locke Karriker, Iowa State University; Donald C. Lay, Jr., USDA-ARS; Mark A. Mirando, USDA-CSREES-NRI; Don Orr, JBS United, Inc.; D. Steven Pollmann, Murphy Brown LLC; and Ken Stalder, Iowa State University. The committee attempted to identify a mix of industry and academic speakers to address a variety of topics that

impact the productive lifetime of sows. The program allowed for in-depth discussion of current knowledge and exploration of factors that impact productivity of the sow including sow well-being, genetics, environment, health, reproductive performance, stockmanship, and nutrition. The program was designed to identify gaps in research and education in the topic area and to provide a direction for future research work.

## **Sow Productive Lifetime Introduction**

One reason to move to the wording of sow productive lifetime rather than sow longevity relates to the many definitions that sow longevity has taken on in the past. The definition can differ depending on type of study being conducted. Economic studies might use lifetime productivity whereas genetic, nutritional or other studies might be concerned with length of life, herd life, productive life, parity removed, or some similar measure. Pork producers tend to focus on culling and replacement rates as a measure of how herds are doing with the retention of females within their operations because this metric is frequently provided in record keeping summaries. However, when making comparisons across herds or to other studies, culling and replacement rate values can differ based on methods used to calculate values. In many cases, some of these values may be difficult to measure or obtain. If replacement gilts are purchased and their birth dates are not provided, there is no way to accurately arrive at a length of life measure.

Sow productive lifetime or length of productive life is described as the length of time from some initial event like herd entry, first mating, first farrowing, etc. until the animal is culled from the herd or is a mortality. Current sow culling rates are excessive and often sows are removed from the breeding herd before reaching their breakeven parity. This situation can affect overall herd profitability. Reasons for culling sows from the herd can be attributed to genetics, reproduction, nutrition, environment, and management.

## **Genetic Selection**

Studies have shown that sow productive lifetime, using the variables of stayability or longevity, is low to moderately heritable with reported heritabilities ranging from 0.05 to 0.25 (Gou, 2001; Crump, 2001; Lopez-Serrano, 2000; Tholen, 1996). Since heritabilities are low to moderate, environment plays a large role in determining the length of time sows remain in the herd. Additionally, there is a possibility that genetic by environment interactions could impact this trait. Sow productive lifetime is a trait that is measured at the end of the herd life and hence, it is not a timely trait to measure relative to other reproductive traits evaluated. However, sow productive lifetime is associated with many other traits. For example, a favorable association exists between sow productive lifetime and weak front pasterns (Grindflek and Sehested, 1996). Similarly, an unfavorable correlation between sow productive lifetime and leanness has been reported (Lopez-Serrano 2000). Some traits such as leg conformation should be evaluated early in life. This most frequently this occurs at selection. Additional research needs to be performed in evaluating traits that improve sow productive lifetime.

Commercial pork producers have relied on their genetic supplier to focus on improving economically important traits. Selection for sow productive lifetime is challenging for genetic suppliers due to the length of time sows must stay in the herd to reach the point in which the

performance for the trait is actually recorded. Genetic suppliers suggest to their commercial producers that they consider a constant replacement of sows with gilts to allow replacement of older females with genetically superior animals. On most farms, sows seldom produce 8 parities and therefore management may be limiting the actual genetic capability of sows to remain productive for a greater number of parities.

Molecular information should be obtained and preserved from sows that remain in the herd for some predefined number of parities that is indicative of longevity. Saving tissue for later molecular analyses would allow the discovery of genes or markers of interest which are associated with longevity. Additionally, researchers need to evaluate the differences in longevity traits between purebred parents and their cross-bred female offspring.

Reproductive failure has been consistently identified as the largest reason for sow culling and contributing to unfavorable replacement rates. Much like SPL, heritabilities of reproductive traits are low and are approximated to be below 0.10 (Rothschild and Bidanel, 1998). Many direct factors contribute to reproductive performance such as performance during the previous lactation. Indirectly, gilts retained from P1 females have been found to have fewer follicles compared to >1 parity sows (Ruttun-Ramos, 2007). Additionally, the repeatability of NBA of a particular sow does not reach 0.5 until approximately 6 parities (Ruttun-Ramos, 2007) further placing importance of not culling on the basis of poor number born alive from a single lactation. Many management, environmental, and genetic factors can contribute to the poor performance of a sow's single litter record. Things like boar fertility, herd health, A.I. stud factors, weather, and breeding technician differences.

## **Nutrition**

Nutrition has a broad impact on sow performance and productive life. Commonly, the inability of sows to consume adequate feed during lactation so that both maintenance and performance requirements are met will require a sow to mobilize energy stores from backfat and muscle. Excessive mobilization of body stores can ultimately result in a poor body condition at weaning and extending the number of days from wean to estrus. This increases the likelihood of culling due to subsequent reproductive failure. To circumvent this problem, some researchers recommend different feeding regimens for parity one females compared to those used for older sows (Boyd, et al., 2002). A hot topic of discussion at the conference was the implementation of continuous feeding throughout lactation.

Furthermore, differences in feeding management have been identified that may help sows avoid a negative energy and protein balance which ultimately cause sows to mobilize their body stores to support lactation and ultimately can adversely impact subsequent wean-to-estrus timing and productivity of the next litter.

## Management

Another aspect of the genetic by environment interaction that influences sow productive life is management. Most gilt development units (GDU) are kept at full production in case of disease outbreak at the GDU or sow farm. Therefore, constant supplies of gilts are available for the sow farm regardless of need. Training programs must be implemented to address the premature culling of sows from the herd. Then, with unified culling objectives, the managers must serve as the gatekeeper for the farm and begin culling sows from the herd based on factors that are related to voluntary rather than involuntary culling.

Managers of sow farms should not only serve as the gatekeeper for cull sows but also as a role model on sow welfare to their employees. The level of employee stockmanship has decreased on many sow farms. Lack of training combined with poor observation skills and self-motivation can adversely impact sow productivity.

The importance of sow productive lifetime has only been realized in the past 5 years. The economic effect of poor sow productive lifetime in herds is not straight forward because of calculation differences between studies and the trait(s) being evaluated (Rodriguez-Zas et al., 2006; Rodriguez-Zas et al.2003; Stalder et al., 2003; Dhuyvetter, 2000; Stalder et al., 2000). More studies need to be performed that evaluate the economic impact of increased sow productive lifetime and the economics of replacing sows with genetically superior animals. Furthermore, evaluations that demonstrate the importance of sow productive lifetime on an entire production system should be done. This should include a comparison performance of finishing pigs that are from a sow herd dominated by parity one and two females vs. the performance of pigs from a sow herd that has a distribution that includes a greater proportion of sows from parities 3 and higher.

Individual systems and the management schemes employed by the various production systems can significantly impact sow productive lifetime in individual herds and contributes to large farm/year effects on sow productive lifetime in published evaluations (Serenius et al., 2007; Serenius et al., 2006). Some producers place importance on hoof trimming whereas others might not have adequate or trained labor resources to trim sow hooves on a routine basis. More research is needed to discern the impact of hoof trimming or other specific tasks on sow productive lifetime. Furthermore, training materials are needed to teach barn workers how to properly trim sows' feet as this information is lacking in the scientific literature or the popular press.

Further research needs to identify employee training methods or protocols that accurately identify the reasons for culling on an individual sow basis. Previous research has identified as much as twenty-five percent of reported reasons for culling sows may be incorrectly identified (Knauer et al., 2007). Many management and financial decisions are based on performance records from a given commercial sow herd. If a considerable percentage of the culling reasons are inaccurate then there is a substantial risk of making incorrect management and / or financial decisions when they are based largely or in whole on the herd's production records.

Improved record keeping systems might allow for a better decision making process for commercial sow herds and their consultants, advisors, nutritionists, geneticists, and other suppliers. Instead of employees selecting a single reason from a list of reasons, the employee could report multiple factors that might have contributed to the sow's early removal from the herd. For example, if a sow did not return to estrus and was culled due to reproductive failure, the employee would need to record the days post weaning, body condition score of the sow, and the employee responsible for estrus detection. This might shed light a less obvious reason for sow culling.

## **Environment, Health, and Behavior**

Facilities also contribute to premature sow culling either directly or indirectly. Changes in gestation sow housing (from gestation crates to group housing) will require genetic suppliers and in-house gilt development units to emphasize selection for traits such as disposition, favorable feet and leg soundness, and items that contribute to what many are calling robustness. Since many pen designs are available, researchers should evaluate a variety of flooring, penning and other items and various combinations currently used or that potentially may be used in future gestation systems. When sows are housed in gestation crates, an increase in sow size relative to gestation crate size can contribute to dog sitting, lesions, and digit injuries and even amputation (Boyle, 2007). Thus, minimum gestation crate size requirements should be evaluated and revised accordingly (Boyle, 2007).

Genetic selection should take place in environments similar to those being that are being utilized on modern sow facilities. In upcoming years, selection for sow productivity may need to be conducted in group housing systems implying that there may be a genotype by environment interaction for some traits. Further, when commercial pig production facilities switch housing systems from crates to pens, similar housing systems for gilt development units may be warranted. Further, commercial producers might be interested in asking genetic suppliers what type of housing system is employed at their nucleus and multiplication facilities so that animals might be more likely to excel under conditions employed in their operation.

The current performance axiom authored by Curtis (2007) suggests that stress is negatively associated with animal performance. The effect of stress on sows can be visually observed in cases of hierarchal establishment in pen gestation systems. More research is needed to evaluate the relationships between social stresses and sow productivity. Additionally, more research work needs to be done to evaluate the additive effects of stressors in sow gestation housing systems. Further, work should be done to ultimately identify methods to reduce social stress (Boyle, 2007). Research efforts should focus on maximizing sow comfort during the gestation period.

Stressors such as subclinical diseases which are not readily observed can negatively impact sow productivity as well sow well being. Little scientific information exists which evaluates the impact of sow immunity on subsequent offspring immunity and related performance. Further research in this area will need to focus on the importance of immunity on sow productive lifetime.

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