Sow Herd Management
and Health Interactions

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Reproductive Efficiency and Critical Control Points

As we consider the economically significant diseases that effect the sow herd we must first consider the major contributing factors that determine the $26.00-$32.00 range in the real cost of a weaned pig (Dial, 1992). These factors are:

1) Non-productive sow days
2) Pre-weaning mortality
3) Farrowing rate
4) Born live
5) Still born pigs

According to David McClaren (1992), “the costs associated with the breeding herd generally remain constant. Therefore, pigs/sow/year (PSY) becomes a very important determinant of economic returns to a swine farrowing enterprise”. There are two major factors that determine the number of PSY. They are the number of sows that farrow/breeding group and the number of pigs weaned per sow. Each of these factors can be considered a critical control point (CCP) and each of these CCP’s is likewise influenced by many other control points that must be considered.

As an active participant in a pork production system you recognize and intuitively understand that the ability to produce and maintain a steady through put determines the long term sustainability of a profitable pork production unit. Any factor that interrupts the flow or through put of pigs in a production system will have an adverse affect on profitability. Areas in the production scheme where an interruption of through put can occur need to be identified. The interaction of disease with in the system and management scheme will need to be assessed. An effort has been made to demonstrate a few of the critical control point (CCP) considerations for the farrowing rate part of this example (see fig 1 attached).

The critical control points that contribute to the determination of the **farrowing rate** (with a range of 75%-87.2%) can be depicted in the following manner:

Farrowing Rate (75%-87.2%)
- a) Conception rate (85%-90%)
- b) Seasonal infertility
- c) BCS
  - i)Gestation nutrition
- d) Health/abortion
  - i)Parvo, Lepto, PRRS, SIV, other bacterial inf
- e) Nutrition
- f) % sows bred by 7 days (80%-94.8%)
  - i)AI technician
  - ii) Semen quality
  - iii) Estrus detection
  - iv) Environmental temperature
  - v) Wean to 1st service interval (5.2 d)
    - Lactation nutrition
    - Sanitation (behind sows)
    - Parity
    - Health (uterine bacteria)

The weaning average also determines the P/S/Y. The critical control point considerations that can contribute to the weaning average (with a range of 8.5-9.9) are:

Weaning Average (8.5-9.9 pigs)
- Born Live (10-11.1)
  - Genetics

- Farrowing interval
- Parity
- Management (intervention)
- Health (Parvo, PRRS)

b) Death Loss (11%-15%)

- Crate design (crushing)
- Environ control
- Lactation quality
- Puerperal diseases

In the eighth edition of Diseases of Swine there are 35 causes of abortion identified in categories that include: nutritional causes, viruses, bacteria, pyrexia, hostile environment, mold, parasites, toxicities, teratogens, and farrowing complications. This same text identifies 27 causes of neonatal diarrhea as well as many other puerperal diseases that may affect the newborn or very young pigs. It is a common practice in the face of an increased number of abortions to draw blood on sows and determine the parvo v, PRRSv and lepto titers of the sows. In regularly vaccinated females this serology is of very little value unless it is utilized in conjunction with a paired sample obtained from the same female 2-4 weeks later. SIV titers in non-vaccinated sows can be used to suggest the exposure of the sow herd to SIV. The best source of diagnostic information can be found in virus that may be isolated from the fetus or fetal membranes.

Herd Health/Biosecurity

"Herd health" is a term that helps define economical pork production, yet different producers define herd health in different ways. As production goals change, the definition of a "healthy" herd may change. “Biosecurity” encompasses all of the precautionary measures taken by each production unit to limit the spread of endemic pathogens within the farm and to prevent the introduction of non-endemic pathogens onto the farm.

As with the saying "an ounce of prevention is worth a pound of cure", preventing production loss by preventing disease is often cheaper than trying to prevent production loss by treating disease. Many health problems can be resolved or controlled by management procedures without the use of antibiotics. Producers with healthy herds often use less antibiotics, decreasing their costs, while marketing their hogs sooner with less potential for violative drug tissue residues.

Disease control is one of the most challenging areas for producers and veterinarians in swine production. Biosecurity is often perceived as keeping diseases out of a swineherd. However, excluding disease from a herd is nearly impossible because of the natural presence of pathogens - the endemic pathogen load - in all swineherds. Therefore, the goal of a biosecurity program is to keep out pathogens that the herd has not been exposed to and to minimize the impact of endemic pathogens. With a good biosecurity program, optimal growth can be reached by minimizing the negative effects of sub-clinical illnesses. High reproductive performance can be achieved with a decrease of costly factors such as embryonic loss or pre-weaning mortality due to disease. This publication introduces key elements of an effective biosecurity program. A final plan can be developed in cooperation with your herd veterinarian to best accommodate constraints for a given operation.

Transmission of Infectious Diseases

Infectious diseases are transmitted by both direct and indirect contact. Some diseases such as atrophic rhinitis and Mycoplasma pneumonia are spread primarily by direct contact of one animal with another. Other pathogens are transmitted indirectly on clothing, hands, boots and shoes or through contamination of feed, water, vehicles, soil, bedding, air, utensils and premises. Pathogens transmitted via this means include: Actinobacillus pleuropneumonia, Brachyspira (Dysentery), Escherichia coli, Erysipelas, Pasteurella, Pseudorabies, Salmonella, Swine Influenza virus (SIV), Streptococcus, TGE, and Tuberculosis. Leptospira and other disease agents may be carried from one premise to another in streams. Rodents also may be a factor. Birds have been shown to transmit TGE and Salmonellosis. External parasites and insects may also transmit disease.

Pigs that recover from infectious diseases may become carriers; that is, they may harbor organisms and shed them for varying lengths of time and serve as a source of infection for other swine. Swine dysentery, Pseudorabies and Brucellosis are examples of carrier state diseases. Diagnostic testing and other methods of identifying carrier animals may be desirable to eliminate diseases from the herd.

Stresses of various types may affect a pig's resistance and ability to produce immunity. Stresses increase corticosteroid secretions, which interfere with defense mechanisms by reducing the number of circulating white blood cells and interfering with antibody formation.

Survival of Pathogens

Some organisms can survive for long periods of time in the environment, sometimes for years. However, survival times are extremely variable. When a specific disease problem occurs in the herd, the survival time, carrier state in the animal, and method of transmission should be assessed to identify special sanitation requirements needed to aid control and prevention. The choice and strength of a disinfectant can be influenced by specific disease problems. Certain viruses may require special consideration. Parasite eggs are extremely resistant, but thorough cleaning will remove most of them from the environment and reduce their numbers significantly.

Pathogenic (disease-causing) organisms usually favor a temperature close to that of the host animal. However, TGE virus is fragile in a warm environment and seems to survive better in a cold or frozen climate. This accounts for the increased prevalence in winter. Parasite eggs have been shown to hatch at temperatures as low as 40^0 to 50^0F. These and other examples indicate that cold is not usually a deterrent to survival or transmission of disease agents. In fact, low temperatures prolong the lives of most organisms and freezing actually preserves bacteria, mycoplasmas, and most viruses.

The ultraviolet rays of the sun are very effective in destroying infectious agents. However, they do not penetrate deeply and do not pass through glass. Direct sunlight can be used effectively to destroy microorganisms on surface areas and at no cost to the producer.

Artificial Insemination as a Health Strategy

The protection of the health status of today’s pork production units has moved into ever sharper focus as PRRS and other pig pathogens continue to cause performance set backs that cost producers a great deal of money. Today we use the term “biosecurity” to describe all of the herd health measures that must be considered to maintain a high health status.

Management practices are aimed at securing the health of the pigs on the farm. Artificial Insemination (AI) has been identified as one of the management tools that can be used to aid in preventing the introduction of non-endemic pathogens onto a pig farm. The use of artificial insemination practices allows for increased productivity and production efficiency by:

1) Decreased health risk through proper isolation
2) Reduced building costs
3) Controlled variance in pigs

Decreasing health risk through proper isolation

Health security measures aimed at the herd level should include proper isolation and acclimation of all incoming replacement animals. This acclimation and isolation period may last up to 60 days to allow for proper serological monitoring of animals to avoid the introduction of non-endemic pathogens into the breeding herd. Genetic selection should be approached with the goal of minimizing the risk of introducing disease into your herd. It is possible for those managers who are not committed to proper isolation and acclimation of replacement animals to close their herds and introduce the new genetics required to make production improvement through the use of Artificial Insemination (AI).

Modern boar studs today must receive new boars periodically to assure genetic progress. Before choosing a boar stud you should be sure that the stud utilizes proper isolation techniques. All reputable boar studs allow an isolation period to assure that if new boars are incubating infectious disease at the time of delivery then the boar will develop clinical signs and diagnosis and treatments can be implemented. The isolation period protects the receiving farm from any disease agents that may have infected the boars prior to or during transportation. The minimum health concern of most boar studs would include: Pseudorabies (PRV), Brucellosis, Porcine Respiratory and Reproductive Syndrome (PRRS), Porcine Respiratory Corona virus (PRCV), Transmissible

Gastroenteritis (TGE), Actinobacillus pleuropneumoniae, swine Influenza (SI), and Leptospirosis.

The health status and pathogen profile of boar studs is typically monitored on a monthly basis if not more frequently. Individual medical records are maintained on each boar. These medical records should include background from the source farm as well as from the isolation unit. All deaths that occur in isolation or in the stud itself should have a complete written necropsy record with histopathological findings and any other diagnostic investigations. All routine serological, tissue, and fecal records are to be included in the monitoring protocol.

Individual doses of semen are generally extended with a low inclusion level of antibiotics to limit the spread of bacterial pathogens in the semen. Table 1 identifies the bacteria that have been identified in boar semen. It is important to note that there are some bacterial pathogens that are commonly found in boar semen.

Table 1

Commonly Found	Infrequently Found
Staphylococcus spp	Corynebacterium spp
Pseudomonas spp	Streptococcus spp
Escherichia spp	Proteus spp
Klebsiella spp	Serratia spp
Citrobacter spp	Bacillus spp
Micrococcus spp	Enterobacter spp
Eubacterium spp	Aerobacter spp
	Bordetella spp
	Mycoplasma spp
Spirochete	Brucella suis
Leptospirosis	Actinobacillus
	Pasteurella spp
	Erysipelothrix rhusiopathiae
	Salmonella spp

In addition to bacterial pathogens some viruses can be transmitted through the semen and some viruses can contaminate a semen sample (Table 2). It is particularly important to recognize that PRRS virus can be transmitted in boar semen. A Polymerase chain reaction (PCR) test has been developed to detect the presence of the DNA material of PRRS in semen in an effort to determine a PRRS "free" status of semen.

PRRS Note: The presence of PRRS virus in boars appears to adversely affect sperm quality especially at high doses. It is also known that PRRS is transmitted in the semen and boars breeding naturally may serve as a source of exposure to naive sows in the breeding herd. For this reason an AI stud that is well monitored can provide assurance that PRRS is not being spread through the semen.

Table 2

Viruses Identified in Boar Semen
Transmitted through Semen
Pseudorabies
PRRS
Porcine Parvo virus
African Swine fever
Semen Contaminant
Adenovirus
Cytomegalovirus
enterovirus
Foot and Mouth Disease
Hog Cholera
Japanese Encephalitis
Reovirus
Swine Influenza
Swine Vesicular Disease
Transmissable Genital Papilloma

The interaction of PRRS virus with farm specific pathogens and management factors contribute to the complexities of this viral disease. In one study (Polson et al, 1994) it was estimated that it cost an additional $7.50-$15.00 to grow pigs to market weight when the nursery pigs were PRRS virus infected. The PRRS virus on this farm allowed for the proliferation and expression of many other secondary bacterial pathogens on the farm. This additional cost was a result of the 14-30 additional days that were required to reach a market weight of 245 pounds.

It is apparent that there are numerous diseases associated with seminal transfer and these diseases can be a reflection of a stud's management. For this reason many boar studs conduct a pre-purchase disease profile and a "vet-to-vet" conference before allowing new boars to be delivered to the isolation unit of their boar stud.

Reduced building costs

When artificial insemination practices are employed in either new facilities or in current facilities the building costs are reduced since the animal spaces formerly allocated to boars may now be used for females. A typical 250 sow facility that normally would have required 12-13 boars to breed naturally will now only require 3 boars or less for emergency use or estrus detection and stimulation. These savings may be calculated as follows:

	Natural service	**AI**
Boar spaces	13	3
Sow spaces	250	259
Annual production-pigs	5000	5188
Fixed costs	$100,000	$100,000
Fixed costs/sow space	$400.00	$384.60
Fixed cost/pig/year	$20.00	$19.28
$$ available for semen	0	$4,000.00
$$ available per dose		$7.23

In the previous example this simple calculation of savings allows a 250-sow unit to reduce the fixed costs of producing pigs by $4,000.00. This added income could then be used to purchase semen. This simplistic calculation of savings considers only the changes in number of spaces allocated to females. With this change in allocation, the number of female spaces went up with a subsequent ability to increase pig flow through the facility. It is believed that the savings will be even greater when the labor factors are considered.

Controlled variance in pigs

Another distinct advantage of AI in swine appears to be the reduction in the variation in the number of females that conceive, which in turn makes the number of pigs born alive more predictable. The ability to predict and forecast pig flow numbers is incredibly important as we manage the flow through a production system. Since the breeding barn drives the system, once the breed targets are met and live born goals are achieved, the number of pigs produced becomes more predictable (variation decreases). It is the variation in pigs weaned which plaques most swine farms.

The reason that AI reduces variance is based on a few key factors:

1) Inferior semen (boars) on any given day is discovered and removed from use.
2) Only semen of known quantity and quality is used.
3) Only quality matings are counted.

Conclusions:

There are many factors and critical control points that need to be considered when evaluating the performance and productivity of the sow herd. Proper isolation and acclimation of the gilts combined with high health boars or semen sources is important to assure that the overall health of the breeding herd is maintained at a high level to prevent pathogen proliferation and spread.

Literature cited:

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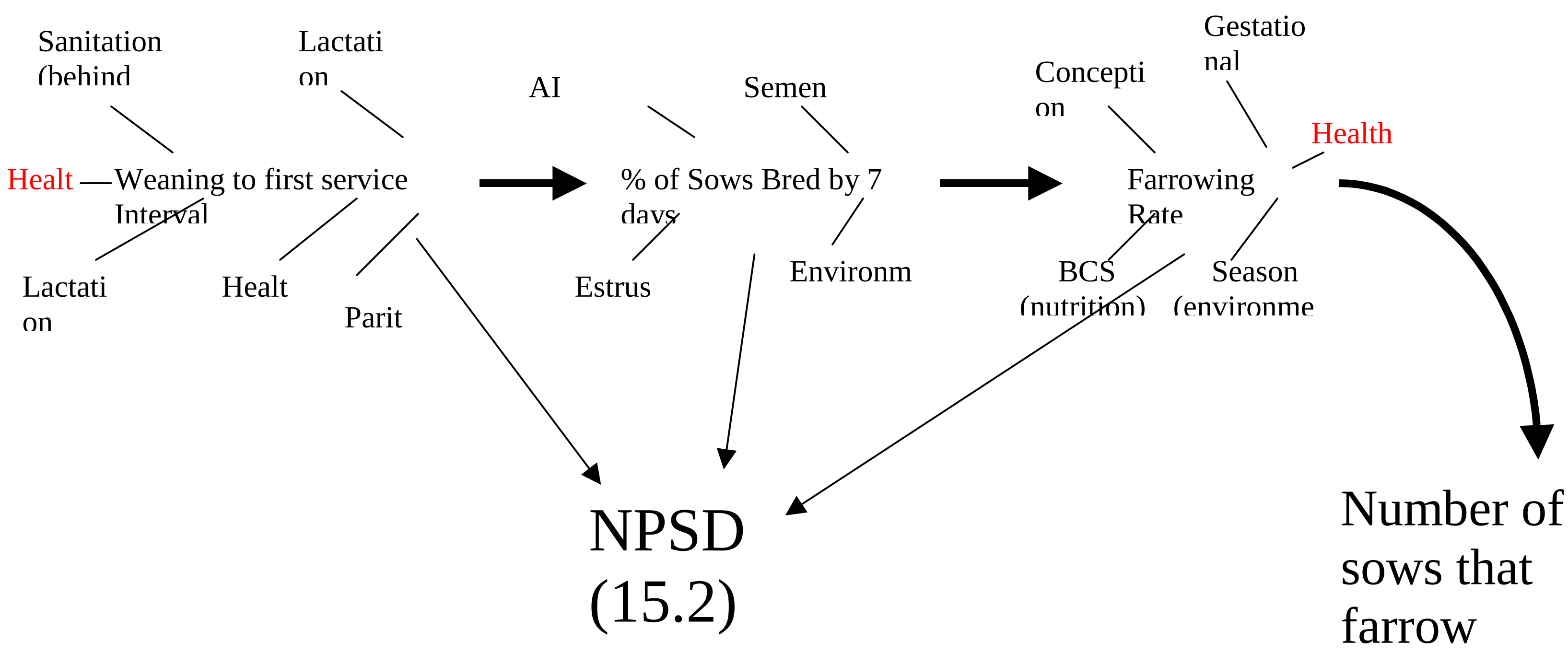
Fig 1



Sanitation (behind
Lactati on
AI
Semen
Concepti on
Gestatio nal
Health
Healt
Weaning to first service Interval
% of Sows Bred by 7 days
Farrowing Rate
Lactati on
Healt
Parit
Estrus
Environm
BCS (nutrition)
Season (environme
NPSD (15.2)
Number of sows that farrow