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Assessing variation in breeding herd performance as part of the continuous improvement process

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Introduction

To assure productivity and, thus, success, business organizations must implement techniques that reduce risk to the business. This requires that management be dedicated to continuously improving processes associated with production. Success is most likely when management uses techniques that measure variation in operational efficiency, asset utilization, and quality of production.[6] Measures of variation increase management's accuracy in controlling processes at work in the business.

The composite effort to improve efficiency is commonly called the "continuous improvement process" or CIP. CIP includes all efforts by management to (1) examine and control internal business operations, and (2) benchmark these findings with operations and processes with those of other businesses. It is a continuum of specification, production, inspection, and redesign of the system. Process control, a part of the continuous improvement process, is employed by business organizations throughout the world to measure process variation. Because of the cost of CIP implementation, it is imperative that management be dedicated to and commit to actively engaging the system. Properly implemented, CIP uses measures of variation to create a coherent and logical approach to the controlling processes at work within the production system.[4]

In agricultural production systems, CIP is poorly understood and is not widely implemented. The swine industry is one of the unique areas in agriculture that can readily implement CIP techniques used in other production industries for two primary reasons. First, swine have a relatively short production cycle, particularly the reproductive cycle. This allows for frequent feedback of information that can measure progress. Second, large-scale production systems provide management with a constant flow of information about the success of management practices. This occurs even in conditions with relatively few data points—finishing close-outs, for example. The measurement of efficiency over time allows management to respond promptly to change. This information flow has become a major driving force in the restructuring of the overall swine production industry.

It has been suggested that techniques that measure variation be implemented by the swine industry to improve efficiency.[1-2,5] Practical applications that monitor variation in sow reproduction have not been reported, however. This paper outlines considerations that are important for success in implementing the continuous improvement process in sow reproduction.

The continuous improvement process and sow reproduction

Key to successful initiation of CIP in sow reproduction is

- recognition of predetermined system constraints,
- process specification,
- determination of processes critical for success, and
- determination of techniques best suited to measure process success.

Ultimately the information gained from the process specification and inspection must improve production processes or practices.

Predetermined constraints

Every production system has predetermined constraints that management has little opportunity to alter. In an animal production system, CIP begins with recognition of design constraints and biological constraints. Examples of design constraints include location, number of gestation and farrowing spaces, interval between farrowing groups, interval between replacement introductions, and others. Examples of biologic constraints include estrus cycle interval, gestation length, and weaning-to-estrus interval, among others. Recognition of these constraints helps establish realistic targets and reduces time and effort spent on processes that have little chance of being

improved. Management is cautioned, however, to keep an open mind to the discovery process as even these areas may offer opportunity. Optimally sow farms should operate with a rhythm dictated only by system design and biologic constraints.

Process specification

Management should clearly specify how each production process is to be executed. This requires training of employees. Process specifications should be maintained on the farm for ready reference. The detail should be sufficient to convey management's level of expectation as to performance.

Critical processes

In sow reproduction, five important areas should be monitored for optimum reproductive efficiency:

- inventory,
- production cycle interval,
- cost,
- product quality, and
- worker efficiency.

While each of these areas is interrelated, close inspection reveals very different types of information. Each production system is unique and we do not suggest that every system should monitor the same parameters; however, we suggest the following as examples.

Inventory stability

To match facility utilization with the biology of the sow, it is imperative that the farms operate with a rhythm or "time considered" uniformity. Initially, goals or targets for flow of inventories should match both in quantity and delivery interval depending upon the systematic and biological constraints previously described. As a part of the CIP continuum, management should strive to decrease variation in flow of pigs and other inventory items (feed, etc.) from station to station within the production system. Production systems that optimize flow can use "just in time" delivery mechanics, which in turn reduces input inventory levels and, thus, overhead expenses.

For example, an ideally managed 20 group system farm should have predictable variation in the number of sows bred each week, sows farrowing each week, and sows weaned each week. Additionally, there should be predictable variation in the number of weaned sows bred each week, gilts bred each week, and repeat breeders each week. If consistent and persistent levels of variation occur in each of these areas, it increases the likelihood of consistent and persistent variation in the number of pigs born each week, the number of pigs dying each week, and the number of pigs weaned each week. As management focuses on the degree of variation and not on the absolute numbers, the high risk areas are easily defined. Once defined, these critical areas can then be targeted for improvement.

This will not come as a surprise to most sow farm managers. They have long recognized the importance of inventory stability as evidenced by the posting of group inventory numbers in the offices of most farms. Tracking groups has been easy for farm managers because it only requires an inventory count. Managers understand that a consistent number of sows per breeding group usually equates with consistent throughput. Their concern over throughput targets is understandable since it has a significant impact on optimization of downstream nursery and finisher capacity and is critical to maintain steady cash income to cover expenses. Total reliance on the throughput standard expressed as "pigs shipped" can be a misleading indicator of farm efficiency, however. This is particularly true if evaluated in absolute values and not in terms of variation.

Possibly more important for throughput stability is consistency in the character of the herd population. For example, if herd management maintains stable variation in parity distribution, the variation in pigs born per litter should be more predictable. This emphasizes the need for the system management to clearly specify criteria for the culling process.

Variation in piglet inventory is also critical to monitor. Variation in piglet inventory at birth is a reflection of the efficiency of processes associated with sow management, that is, total pigs born per litter and pigs born alive per litter. Variation in piglet numbers during lactation primarily reflects individual sow mothering ability and farrowing house management processes. Variation in preweaning mortality is also a good indicator of farrowing house management. Stable herd populations with stable execution of farrowing house processes would be expected to have predictable variation in piglet inventory at any point in time.

Feed and supply inventories are frequently inspected in many production systems but are infrequently evaluated. In some systems there may be significant opportunity in examining these two areas.

Cycle efficiency

As mentioned previously, to be efficient sows must move consistently and persistently from station to station in the reproductive cycle. By describing the variation in the individual sow's ability to execute each interval within the reproductive cycle, management can determine the weak link in the process chain. Most reporting systems describe the length of each interval as an average herd value without describing the variation in terms of individual sow performance. By describing the variation in individual sow

performance, management can best determine if there are specific times during the cycle where sows are under-performing. Further, filtering the data gives management the opportunity to determine if subpopulations of sows are under-performing at specific phases of the cycle. For most production systems, the key intervals are wean-to-first service interval, gestation length, lactation length, and farrow-to-farrow interval. Other examples of key intervals are service-to-detect open interval, and entry-to-first service interval. It should be noted that there are key flow intervals that must be honored to sustain optimum efficiency and throughput—interval for breeding stock introduction, for example.

Cost control

Production cost is commonly cited as a measure of efficiency. However, to focus only on cost reduction may leave opportunities unrealized. Every aspect of asset allocation must be evaluated regarding its impact on variation in quality and marginal return. For example, should management start a process that ultimately limits sow feed intake during lactation, it will have a negative impact on sow milk production and the sow's metabolic state. The result will be increased variation in individual or litter weaning weight and sow reproductive performance.

Product quality

The best indicator of process execution during lactation is variation in individual pig weaning weight. Other indicators for which variation is assessed include number of pigs with deficiencies (e.g., inguinal hernia, umbilical hernia, swollen joint, abscess, etc.).

Worker efficiency

Variation in the outcomes of procedures performed by individual workers may show the quality of process execution. For example, it has been suggested that AI technician performance has a significant impact on reproductive performance.[3] Further, it is suggested that repetitive performance of a single job such as artificial insemination has a negative effect on performance (Flowers, personal communication).

Inspection and reporting outcomes

Success of any business process is judged on its ability to achieve a desired, planned, or attempted outcome. It is imperative that processes are inspected. This evaluation may be either quantitative or qualitative, depending on the characteristics of the outcome. Process control techniques allow management to predict with accuracy whether the quality of the outcome is within a predictable range of variation or whether the process is "out of control" and needs refinement. Establishment of the optimum level of measurement should be based on the required level of sensitivity. The greater the sensitivity, the less likely management will make an incorrect assumption concerning the outcome. Often, however, greater inspection detail results in higher cost of inspection.

Current benchmark standards of productivity are reported in terms of average herd performance. To improve overall efficiency, it is imperative that management track performance variation of each individual sow. Measures of variation commonly used in process control are standard deviation and coefficient of variation. It is suggested that producers more easily understand standard deviation.[1]

Summary

Once farm management has instituted the means to detect farm efficiency, this information can serve to benchmark other businesses, to improve efficiency in the operation, and sustain productivity.

"the devil is in the details" (source unknown).

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