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The effects, and management, of breeding herd throughput on sow cost centers and total pig enterprises

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The segmentation of pork production into phases of production such as breeding herd, nurseries, and finishers has enabled the use of benchmarking production parameters to compare—and hopefully improve—profitability measures within those segments. Breeding herd throughput and efficiencies have been assumed to be proportionate with cost competitiveness and profitability. The common assumption is that maximizing the number of pigs over a segment's fixed and variable costs will lead to the lowest cost of production and maximize profitability. Common sense would tell us that more pigs weaned from each sow and crate per year will decrease the fixed cost per pig, thereby reducing cost per pig downstream in the finishing segment and improving profitability. Unfortunately, this common mentality misses the mark for total enterprise profitability through three potential fallacies:

- local breeding herd optimization versus total enterprise optimization
- lack of prioritization of production variation management
- lack of prioritization of output quality

This paper will address the breeding herd's throughput effects on the total pork production enterprise and potential management methods to consider.

Dr. Eliyahu Goldratt's Theory of Constraints contests the assumptions that maximizing local or segmented efficiencies will make the system as a whole more profitable. Although this theory is concerned with manufacturing principles, it is pertinent for any processes that deal with flows, such as pork production. For example, if a production system is designed for finishing space based on 22 pigs per sow per year, 25 pigs per sow per year may lead to lower cost per weaned pig, but may not help overall profitability. This increased sow productivity may yield more pig feet per year, but not more pounds of pork per year and potentially at a lower market value per pound. Therefore, making business and production decisions based on optimizing one segment without considering the entire enterprise will be deleterious to global efficiencies and profitability.

For example, this local optima vs. global optima mentality has historically lead to conflicts with production incentives for breeding herd staff, such as those based on pre-weaning mortality, farrowing rate, pigs weaned per mated female per year, etc. Although common sense could predict many of those conflicts between staff and owner concerning those incentives, we continue to make the same local optimizing type management decisions that often conflict with total profitability.

Being a biological production system, we accept and cope with variation on a daily basis that is probably greater than most manufacturing processes would allow. It is unrealistic to eliminate or avoid this variation, but it should be monitored, reduced, and managed. Most of the pork industry has constructed the grow-finish system to have a capacity equal to the "average" weekly flow out of the breeding herd. Unfortunately, breeding herd production variation usually results in over- or under-utilization of facility resources so that the annual sum utilization is less than the calculated average utilization.

We have become masters at "managing" this variation after it is on the doorstep. We vary weaning age to adjust for variation in numbers of litters due to farrow. We over- or under-stock buildings to adjust for numbers of pigs we receive into the grow-finish system. We vary the timing and market weight of groups as dictated by the variable number of pigs 'knocking at the door' to be placed into the finishing system. Unfortunately, this after-the-fact variation management often leads to further upstream and downstream variation. Historically, the pork industry has had the luxury of flexible markets that allowed for this fluctuation in process flow by accepting wide ranges of marketing weights with relatively little price differentiation. This variation may not be possible in the future with tighter marketing specifications and a more competitive marketplace for profit margins.

Every system involving multiple processes has a bottleneck in one of those processes. All other processes should be subordinated to the bottleneck to ensure the bottleneck's process is running the most efficiently. Ideally, this bottleneck is the most cost-expensive portion of the total process. In most pig production systems, the nursery-finish process is the bottleneck.

The general policies that increase bottleneck efficiency (and hence increase system throughput) include:

- Ensure the bottleneck is running. Minimize idle time.
- Consider out-sourcing bottleneck processes to help with variation in batch sizing and timing.
- Process only those products that will contribute to throughput today.
- Weed out products that are defective prior to the bottleneck.

Each of these principals has several specific implications for managing nursery-finish bottlenecks. However, this paper will focus on those that are pertinent to the breeding herd.

If the goal of the breeding herd is to ensure the bottleneck (nursery-finish segment) is running optimally, the breeding herd management is subordinated to the task of maintaining optimal production to supply that bottleneck. (Note that the goal is not to maximize production of the breeding herd, or even optimum breeding herd efficiency. Actually non-bottlenecks, like the breeding herd, *should* be idle part of the time.) The role of the breeding herd is to produce consistent numbers and quality pigs for the nursery-finish to process most efficiently.

With both biological and management-related variation in the breeding herd, perhaps the first variation control should be to over-size the breeding herd capacity compared to the finishing system. This allows the breeding output to fill the bottleneck process with the optimum numbers of pigs, even curing those weeks when the average weekly production is below par. Excess production can be sold off or moved to alternative finishing space rather than over-stocking the bottleneck.

The second step in breeding herd variation management is controlling the internal causes of variability in weekly production. This requires close study of the potential causes of the weekly variation such as:

- numbers of females bred per week
  - numbers of sows weaned
  - wean-to-estrus intervals and rates
  - breedable gilt pool inventory
  - breedable gilt pool estrous cycle vs. breeding needs
  - female death rates
  - female culling (voluntary and involuntary)
- percentage of females conceiving
  - female fertility
  - insemination effectiveness
- percentage of females retaining pregnancies
  - health
  - environment
  - post insemination management
- number of total born per female
- number of pigs born alive per female
- level of pre-weaning piglet mortality
- number of litters weaned per week

Once the causes of variation are known, measuring the ongoing variation in each parameter will indicate if the parameter is in control and which macro management measures to take. For example, if the goal is to ensure that a bottleneck is supplied with the appropriate number of pigs at weaning 95% of the time, the breeding targets should be set accordingly. The breeding targets should not be set based on the average farrowing rate, but should be increased approximately two standard deviations to meet breeding and conception targets 95% of the time. In most weeks, excess mated females can be culled (assuming that marginal cull sows were used to achieve the breeding targets), recycled for future breeding use, or can be shunted toward alternative weaned pig markets. These practices will increase nonproductive sow days, insemination costs per pig, and facility efficiencies, but will achieve the ultimate goal of optimize the real bottlenecks of the system and hence overall profitability.

Given current market conditions, the prioritization of driving costs out of production systems is high. The ease of isolating local efficiencies and focusing on maximizing those local efficiencies is tempting as a cost-reduction measure. However, this temptation must be resisted or the overall system's profitability will be reduced.