Life Cycle Assessment/Analysis

&

Weaning

Introduction.

Pre-weaning mortality and the physiological profile of the litter are not necessarily intrinsic. To understand what 3E Precision Husbandry must involve, we have to look at the three main contributing resources in the birth and rearing of the litter. Resources that feature in the methodology of life cycle assessment or analysis (LCA) that support understanding of the impact associated with every stage of the life cycle of a commercial process, product or service. Involving a thorough index of energy and materials, as resources within process, product or service; to understand the cumulative potential impact.

Considerations Before Weaning.

The challenges that precede, and those that immediately follow Weaning, are important to understand. The 3E Precision Metrics result of the number weaned is incidental. The fundamental issue of how husbandry is technically supported by the resource suppliers of genetics, nutrition, health and welfare care, and the engineering of the production system infrastructure, is key. This is measured and defined by the LCA of the pig as an individual.

This can be achieved through the implementation of collaborative technologies that are linked to the progeny of the individual parent female, through digital connection facilitated by the use of EID or RFID tags to each litter member (her progeny). These can be applied at weaning, the beginning of the individual and independent journey through the feeding herd. The tag introduces the interrelationship of various factors.

- Parent genetics Sire and Dam
- Production cycle (Parity) of the Parent female
- Sow Card Observation Details using:
    - Physical recording of Parturition Timing
        - Start/Finish
    - Pig Visioning Technology
        - Start/Finish

One example of pig visioning is the product development and support of the livestock tech company Serket. Included in their AI driven monitoring is:

- ***A***ctivity & ***I***nactivity - *early detection of weaker piglets*
- Feeding & drinking *beh**a**v**i**our – early awareness of regressive pigs*
- ***A***ggress***i***on – *early detection of aggressive vice e.g. tail, ear, flank biting*
- E***a***rly d***i***sease detection - *such as diarrheal onset*
- Real-time beh***a***v***i***oural analysis – *drinking, eating, urination/excretion relief, sleeping, social interaction*

This technology can be installed to monitor, and record lifecycle information for continuous generational turnover of feeding herd populations, building vast data libraries to inform machine learning. This has high value proposition for deriving 3E Precision Husbandry Strategic Management protocols. But it is only one element of what collaborative technology can provide. Underlying the causes of the list of factors being monitored will be the quality of what the birth mother is, and subsequently after colostrum intake has been digested and absorbed by each newborn, what the foster mother is providing through the udder. I would add to the monitoring list the colostrum period observation. As a small project for the lactation team, it is worth considering, if the business has installed computer visioning, visibly numbering the litter so that a study of data can analyses the response across the litter to colostrum intake. The point of collaborative technology is that along with AI driven monitoring there needs to be the addition of a comprehensive computer feed system working in tandem. An example of computer driven feeding is the Gestal system which gathers data that enables continuous development of total animal care within the principles of 3E Precision Husbandry.

These are just two examples of products with service support used here to show how the emphasis of collaborative technology is on combining all available technologies to capitalize the total investment made in each individual technology. This is when the 1+1+1 of genetics, nutrition and health care, combine in a 3E precision husbandry strategy become far greater than the sum of the individual parts.

Pig production requires a total connection, as the heart of the operation. The current dilemma is that a wholesale adoption of technologies that support the capitalization of the fundamental resources of genetics, nutrition and health care, represents an additional cost, and at present is mainly regarded as a theoretical cost benefit. Some people believe that agriculture suffers a 50-year lag in the comprehensive adoption of new technology. The industry doesn't have 50-years.

As described in a previous series 'The Pig as an Individual', there is already developing throughout global production an economic vortex where the management of sow retention has been neglected, in relation to the increasing failure to retain replacement females in the first two production cycles which is shortening the average lifecycle of herd sows. The economics of the failure to adopt new technology will dwarf that of the sow retention challenge. In the spirit of collaboration, new technology will play a huge part in achieving a renaissance in food production through intelligent farming, by removing the incumbent weakness in process control.

Weaning.

What is vital at the point of weaning is the physiological profile of each individual litter. There are several factors within the scope of litter management husbandry during lactation, that we either do not understand enough, or neglect under pressure of circumstance, to influence the development of the physiological profile of the litter towards an optimum level at weaning. The physiological profile is foundational to the future of the weaned pig from the nursery stage onwards.

The separation of mother and progeny in each of the production cycles within the breeding female's life cycle, across all mammalian species of livestock farming, is a forced strategy

that I will look at later in (this) part 3. It dramatically disrupts the biological rhythm of mother and progeny. It initiates a natural reproductive response in the breeding female, by triggering a return to the oestrus cycling of the reproductive process. The number of piglets and the physiological profile of the litter is an indicator of the potential strength of this return to oestrus. A litter that at weaning corresponds in size with the herd average of the number of born alive and the pre-weaning mortality reduction and records a litter weight with an average individual pig weight that hits the husbandry target for weight for age. Is a minimum requirement of 3E Precision Husbandry. This considers the variation across production systems.

This presents another example of the need for discussion between the husbandry team responsible for lactation management and insemination and the implantation period of early gestation. A strong eostrus that gives a clear timing signal for first insemination, and the management of social integration of breeding females in early gestation creates the best chance of the maximum fertilization of embryos, and the even distribution of the embryos at implantation in the uterus. The culmination of this in repeated production cycles leads to large and robust litters at weaning.

The weaned pig as an individual is the fulcrum of the Pig to Pork process. The variation in each population, of each generation of weaned pigs, from each linear production cycle of the breeding females' lifecycle, is the challenge faced by every husbandry team.

Back to Lactation.

We need to look at all the factors in lactation that contribute to the outcome we see in the weaner. Specifically, those that are negative in relation to the performance of genetic potential in the feeding herd stages. Lactation confronts what it is presented with at the birth of the litter in the number and condition of the pigs. The healthy establishment of lactation is also threatened by a compromised farrowing that has some possible causes that husbandry must try to mitigate. These include but are not exhaustive; a protracted parturition of a litter of small, weak piglets that fail to stimulate the process, pigs that become stuck inside the horns of the uterus, pigs that have died in late gestation or immediately prior to farrowing, pigs that are too large to be passed by the gilt or sow. Husbandry must respond to this.

NB. *One husbandry tip I found helpful over several years of commercial production farm experience was understanding that the horns of the uterus can be compared with a stocking or the long sleeve of the elegant gloves sometimes worn by a woman. As the husbandry team member inserts their hand into the horn, it is possible to begin to flex the fingers by opening and closing the hand, this has the effect of moving the membrane of the horn along the forearm, and drawing the uterus towards contact with the hand until the next pig comes to the grip of the hand and can be gently helped out through the vulva. This can be repeated until no further pigs can be reached even though farrowing will continue. A short period of rest is given to the mother and then the process is repeated until no more pigs are present in the uterus. I was able to carry out this mitigation because I have small hands and forearms, the first consideration when asking a team member to officiate.*

Once the intake period for colostrum has passed[1] for each individual litter, review the birth mother's data record from parity 2 onwards and understand her litter history. Decide whether from the physiological distribution of the litter profile, and the number of pigs in the litter there is a need to redistribute the litter in an equitable levelling-up across other litters that have completed the colostrum intake strategy and within a maximum of 3 days since. This can be repeated within the service/farrowing group for that week's farrowing. Try to limit the movement of each pig relative to their condition to just once. A final review of the total litter balance in terms of numbers should enable the team to concentrate on the care of each individual litter from this point through to weaning. Do not move piglets from litter to litter after this point (only in exceptional circumstances) as this is a bio-security risk within the environment of the farrowed group.

[1] *Discuss this with the husbandry team collaborating support of the specialist pig vet, nutritionist and genetics technical support.*

Maintain the strategic management protocols agreed in the collaboration between the business management, husbandry team, and resource supply support. These should include maintaining a regime of clean feed troughs after an agreed period (suggestion: 30 to 60 minutes) of feeding time, at any time of the day.

NB. *Lactation feeding technology as outlined above and employing machine learning to the library of data it develops will control drops to coincide with the feeding time of the individual animal. This is a considerable benefit in releasing husbandry time for the process controls outside of direct technological intervention.*

Environmental control is an over-arcing of the concentrated process controls of animal, nutrition and health husbandry. It is another vital element of the suckling period of the weaned pig, not many commercial infrastructures have a total control environmental system, this is because of the evolution of the industry's engineering support which has produced continuing innovation and improvement, creating a bolt-on effect that is not singular, and rarely collaborative. This is a factor in my own choice to accept the invitation of HALE Intelligent Farming to contribute to the founders' principal approach to the support of pig production, the genesis of which was to focus on the impact of heat stress globally. In our early discussions together, I spoke of my own approach to evaluating the environment for the suckling pig and the growth stages of the feeding-herd pig, when making farm visits. For the former, I lie down prostrate next to a farrowing crate where there is a litter of pigs. I watch, listen, try to understand any social threats, and experience the air flow and temperature. Try it, you will be surprised by what you can learn, and how much the process controls of technology can liberate husbandry time. For the latter it is bit more precarious a test as the pigs grow but I try to get near to the equivalent as I can.

The social observation of seeing and listening is important to the development of instinct in husbandry. And before we leave the weaned pig in this part of the series, I have a few thoughts to share.

Farrowing. If farrowing groups are multi-parous, it is worth considering the impact of the vocalizing that older sows do when feeding their litter. It is a sound that I believe helps to calm replacement gilts in their first parturition. A recording that plays on a reasonably timed repeat from the moment they are confined, and before any sows have farrowed.

Playing it before any farrowing is because any recording of a sow suckling her litter will include the squabbling piglets, and the noise that causes greatest distress to a farrowing gilt is the sudden and/or prolonged squealing of a piglet. Acclimatizing the gilt and settling the younger sows has a significant impact on the number of piglets weaned at the end of a lactation.

Removing the panels that divide farrowing pens to mix two or more litters at a point preceding weaning, is a risk that needs calculating. I believe the whole litter should be weaned together into its first experience away from the mother. Mixing litters together by removing dividing panels creates an optical illusion by distributing any ‘small’ pigs into a bigger visual pool, this creates misleading interpretations of how to balance the very first stage of life after suckling. It also risks the biosecurity of the nursery.

Some producers have a strategy to remove a percentage of the weaned pigs based on the smallest and to hold them back and given ‘special treatment’ especially where the system is a 3-week production schedule. These pigs are then introduced into the next weaned group. Small pigs at weaning usually surpass the development of their bullying, butterball siblings, in a very short and clearly observable time. EID and RFID tags will prove this, if you don’t believe me.

In part 4. I will move from Weaning to Weaned. I will also be attempting to persuade producers to consider that mythical 50-year pause between new technology and its adoption by the majority, by looking into the 3E One-Pig Analysis.