

Balancing Biological Potential with Production Constraints: Is it a Priority?

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■ Introduction

This is not an easy topic, and please don't think for a moment that I consider this topic a specialty of mine. However, it certainly interests me, and even more so as I have watched production units attempting to capture the genetic potential that they have been told is available to them through a specific line or genetic combination. The last thirty years have seen some significant changes take place with respect to specific traits or characteristics within the porcine species. For the most part, the biological changes that have been focused on, and related directly to the economic pressures that the industry continues to find itself under. These traits, as described by geneticists, would be "days to 100 kg", litter size, and "backfat at 100 kg". Neither the geneticist nor producer have spent a lot of time considering the changes that these economic traits have brought to production with respect to animal welfare/behaviour, facility requirements, disease resistance, physiological demands, or addition management requirements. In fact, on the contrary, improved genetic lines have often been expected to create "more for less" as it relates to human contact and management on a daily basis. What I would like to challenge each of you with during this workshop, is to assess, whether the present production industry, can handle the biological potential that our genetic lines already possess; and if so, what are the specific changes that will be required within production systems to meet the public's expectations related to animal welfare, care for our environment, and food safety. Ironically this will almost certainly be demanded at even a lower cost of production. If production systems are unwilling or unable to adjust to new biological potential who should define the limits that should be imposed on genetic selection? Who will be responsible for identifying whether specific trait selection has or will injure the ability to meet public and producer concerns related to animal care, etc?

■ Biological Potential

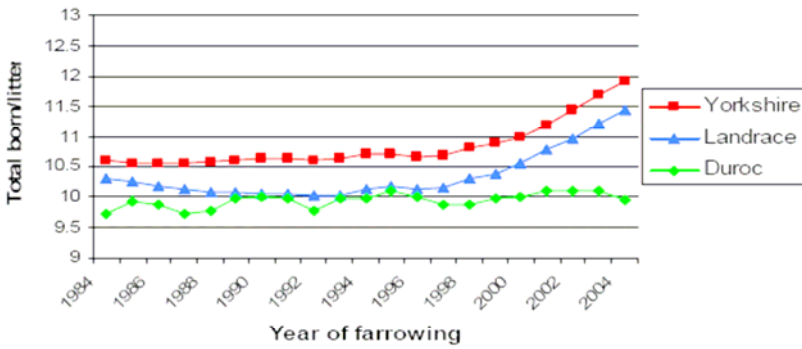
We needed some definable baseline off of which to spring as we enter into a discussion of this type. I chose to review the improvements made in the Canadian swine industry using data of those genetic pools that report to the Canadian Swine Breeders Association (CSBA, 2005). I recognize that this does not represent the entire industry; however, it does allow us to review trends that have occurred over the past twenty-five years and give us a perspective as to the priorities that have been placed on genetic selection. It is noteworthy that as you review these graphs (Appendix 1), you will see that in the case of backfat and growth rate, the improvement appears to be very consistent over the past twenty-five years. Litter size, however, appeared to be a less important trait until about ten years ago and as such has changed more aggressively over the past ten years. Focused almost exclusively on these traits, I suspect that we may have lost some important perspectives of other traits. These may in fact include mature body weight, skeletal capacity, organ capacity, or disease resistance. John Webb wrote five years ago: “ultimately our knowledge of genetics must reach a point where meat can be produced without a live animal”. This is certainly an intriguing thought. I am not sure that I can imagine that moment in time; however, I can begin to imagine the animals that may be used for the production of meat just prior to that moment; and frankly I guess, that picture concerns me from a number of perspectives.

The following lists the potential cascade of production events related to biological change in:

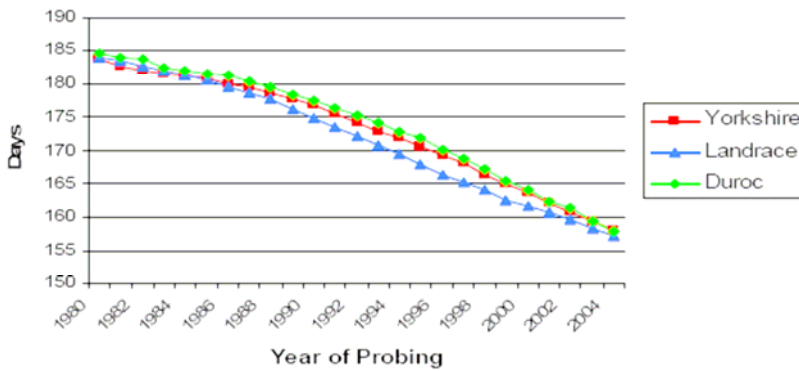
Litter size:

- Increase in breeding herd production numbers – pigs weaned per week per crate or per sow; pigs weaned per sow per year.
- Increase in birth weight variation
- Increase in preweaning mortality
- Increase in the number of piglets that are artificially reared from a very early age
- Increase in cost per pig to twenty-one days of age.
- Increase in growing herd mortality, increase in disease instability related to sows ability to imprint and stabilize the piglets immune system
- Increase in abnormal animal behavior – specifically naval sucking
- Increased number of animals being cared for by each stock person
- Demand for improved maternal potential to meet the needs of the litter size; i.e. milk production, feed intake capacity, underline, etc.
- Pressure on stocking density in farrowing crates and nurseries.

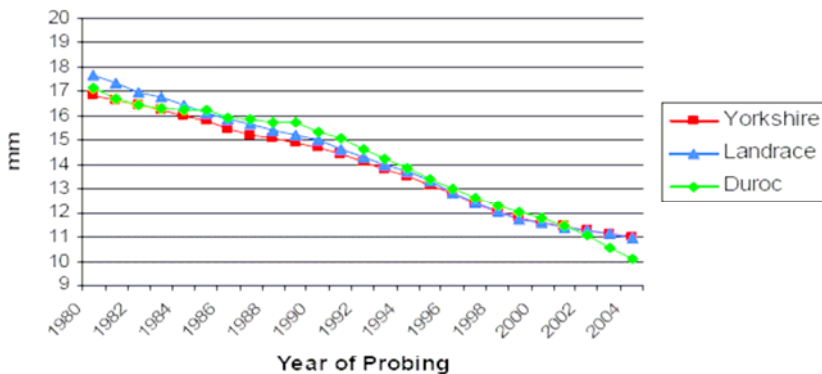
Genetic Trends for Litter Size



Genetic Trends for Age at 100kg



Genetic Trends for Backfat at 100kg



Age at 100 kg:

- Decrease in health resistance, not as robust a pig.
- Increased ambulatory problems (feet and legs)
- Pressure on throughput (pig flow); a nine week old pig is not 20 kg now it is 25-28 kgs
- Increase in weight for age and decrease in animal welfare, especially in farrow to finish units; financials often drive pigs marketed per week rather than kg of pork marketed per week
- Increased growth rate directly off set by heavier market weight.
- Increased growing herd mortality
- Increase in mature body size of maternal lines
- Decrease in female reproductive longevity; is it related to body size and/or leanness?
- Decrease in space in existing gestation stalls and farrowing crates for these larger sows.

Backfat at 100 kg:

- Increase in maternal line care
- Increase in shoulder sores
- Equipment driven welfare issues
- Increase in sow mortality
- Decrease in feed intake capacity, not consistent between lines
- Increase in feed efficiency
- Increase in carcass quality (lower backfat/greater lean)
- Increase in nutritional requirements and cost per metric tonne; but increase in efficiency of growth (i.e. more lean gain) and reduced cost per kg of gain.
- Decrease in meat quality ... drip loss, intramuscular fat, taste, etc.

■ **Observations Made and Lessons Learned in the Poultry Industry**

Dr. William Muir, working with quail at Purdue University suggests:

“Happy and passive means more productive animals”. Dr. Muir suggests that in classical breeding programs there is a potential for competition between animals to become worse and ultimately productivity declines,

specifically among the non-competitive animals. Accounting for competition in a breeding program will ultimately improve animal well-being which should lead to success for producer, consumer, and animals (William Muir).

Dr Keith MacMillan, Retired Poultry Veterinarian for Lilydale makes the observation of genetic selection: “nothing is free, gain captured in one trait will ultimately mean giving up something in another area.” He also comments:

- Growth needs to be balanced with skeletal development
- Skeletal development needs to be balanced with muscle mass
- Organ development needs to be balanced with growth; e.g. broiler congestive heart failure
- Competitive environment immediately leads to greater variation, lower performance, animal behavior issues, and increased mortality
- Increased variation leads to increased stocking density!!!
- Health risks associated with increased in-breeding coefficients
- Synthetic lines narrow the gene pool over the generations

■ **Swine Industry Response to Biological Change**

From my perspective, there are three ways to respond to biological change:

1. Accept it as it comes and increase the intensity within the production system to respond to the change.
2. Identify specific issues and request a change in the biological limit for that trait that most specifically impacts the production issue.

Combine 1 and 2 to continue to enhance production but at the same time identify up front the facility and management changes required to enhance animal welfare while adopting greater genetic potential in the animals being raised.

■ **Conclusions**

My sense is that the present swine production industry in North America is continuing to embrace biological potential as it is offered; with little reservation for difficulties that greater litter size, growth rate, or leanness may be bringing. This is very understandable, when you recognize the “commodity based-global industry” that our swine production units find themselves a part of.

However, if questions or challenges to the “status quo” go unheeded it would not surprise me to see future difficulties in production related directly to the absence of defined biological limits. Production constraints must be identified; any direct relationship to biological change defined, and solutions created to avoid this cascade of events.

■ References

- CSBA – Info, Volume 3 Number 3. August 2005. Genetic Improvement Trends in 2004. www.canswine.ca
- MacMillan, Keith. Personal communication
- Steeves, Susan A. (2005) Happy and passive means more productive animals. Source: Dr. William Muir. In: ssteves@purdue.edu
- Webb, John (2000) Swine Genetics for the Next 25 Years. In: National Swine Improvement Federation Conference proceedings. www.nsif.com