

On the Importance of Having Appropriate Yardsticks and Tools : Lessons from the Dairy Industry?

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The first two “work experiences” I had in the field of agricultural sciences were in dairy farming and dairy genetics and breeding. Since those days, I developed an interest and great appreciation for the great progresses that have been achieved by dairy industry and its culture of “benchmarking”.

Over the years, I had the chance to exchange with many dairy farmers and can testify that most dairy farmers are able (and often proud) to tell you everything about every single one of the cows in his/her herd: Annual production, pedigree (sire and dam), somatic cell counts, body conformation score, etc.

More than 2/3 of dairy farmers in Canada adhere to some sort of production monitoring and herd management program. In Canada and in many other countries where this type of system exists, every dairy farm is able to keep a very close tab on the annual production of each cow, the overall average of the herd and how well the herd is comparing to other herds in the same region or across the country.

What is impressive is that these farmers are all speaking the same “language” (and no, I don’t mean English!). The important parameters are well defined and the yardsticks (or benchmarks) well known to all farmers, large or small. For example, the Breed Class Average (BCA) is a milk, fat and protein index used by all milk recording programs across Canada. The BCA index allows fair comparison of cows of different breeds, ages and months of calving. BCA indexes of 100 were set at the average 305-day production levels determined from official records in 1952. In comparison, many cows in Canadian dairy herds have BCAs well above 200, which is twice the average production of 50 years ago. In 2012, the Holstein “Cow of the Year” was Eastside Lewisdale Gold Missy, who had a BCA of 318 (16,208 kg of milk over 305 days)!

Dairy farmers around the globe are supported by an impressive support industry that is using the information gathered on farms and the latest scientific information, mathematical models, and technologies to develop better genetic selection indices, feeding programs, and herd health management tools. The feeding of each cow can, therefore, be closely managed as a function of her production, lactation stage, etc. The decisions around breeding (mating) of the cow take into account her “breeding value”, which is an index computed using sophisticated mathematical, genetic and statistical models. Health and nutritional problems are rapidly identified through the regular and systematic monitoring programs and the comparison of actual production with the predictions from the models.

The result of this close relationship between this support industry and farmers and the use of these tools is highly impressive: In the USA and Canada, at the beginning of the 20th Century, each dairy cow would produce about 2,000 kg milk yearly, at best. At the end of the same Century, dairy cows were each producing about 8,000 kg of milk annually. The gains are not over since statistics are showing steady

yearly increases in milk production for the industry as a whole. These gains were largely achieved through genetic improvement, notably through wide use of artificial insemination. However, this all hinges on the systematic and standardized collection of information on thousands of dairy farms on a regular (monthly) basis and the analysis of this information using cutting-edge mathematical, genetic and statistical models.

What does this have to do with aquaculture???

I quite recently asked a close friend (and scientific collaborator) if he remembered the annual milk production of the cows on the dairy farm he worked for a few months as an exchange student in Denmark back in the late 1980's. Amazingly, he did! I then proceeded to ask him how fast a Clarias catfish or a Nile tilapia (two species he worked with quite extensively) would grow. He could not answer!

Of course, growth rate varies with the species, strains, the culture conditions, the water temperature, lifestages, season, photoperiod, ploidy (diploid vs. triploid), etc. However, how much handle do we truly have in understanding and predicting the effects of these different factors? How are we doing in terms of having proper models, yardsticks, benchmarks and tools to predict and management production and compare the productivity of different stocks or aquaculture operations?

The only example of proper benchmark I know is for the Atlantic salmon industry were the use of the "thermal-unit growth coefficient" (TGC model, also known as the GF3 model) is now very widely accepted. We know that a TGC of about 0.3 (GF3=3) is pretty standard for Atlantic salmon growing in sea cages and that some farms are achieving TGC of about 0.4 (or GF3 or about 4). I have also met many aquaculturists rearing other fish and crustaceans species that have developed their own yardsticks to identify "good" growth potential of their animals (in terms of average daily weight gain, number of days to market weight, etc.).

However, the "culture of benchmarking" has not made sufficient progress in our field. The best example of our shortcomings is the wide use of the specific growth rate (SGR), a growth model that doesn't properly represents the growth trajectory of most aquaculture species! (and doesn't even take into account the effect of water temperature). Everybody is still using a useless model without questioning its value! How can we expect to make progress?

I feel that as a whole the aquaculture industry could do a much better job defining the level of performance achieved on farms, adopting more robust and relevant models and making the yardsticks more systematic and better known. If the dairy industry is an example, very significant gain in productivity could be achieved over a relatively short period with the use of effective approaches.

Agree or Disagree? I am always happy to receive your feedback and suggestions.

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