



EDITORIAL

Animal breeding and development – South American perspective

Animal breeding science may add support to the development of livestock production by focusing on the farmers' problems. Traditionally, livestock production has had a major economic and social role in South America, as a source of food, fiber, transport and draught, generating jobs, economic activities and trade. The value of beef, chicken meat, pork and cow milk produced rank among the six most important agricultural products in the region (soybeans and sugar cane ranking second and third). Important growth has occurred in the past few decades, e.g. between 1961 and 2010 the human population multiplied by 2.6, while the annual chicken meat production multiplied by 54, the number of eggs by 6, cow milk by 4.5, pork by 4.8, beef by 2.8 and greasy wool by 2.6. Animal products are an essential part of human nutrition in the region, accounting for more than half of the 80 g/capita/day total protein supply, and contribute to nutrition in other world regions as well, e.g. South America accounts for about one-third of the world beef and chicken meat exports, being the largest world exporter of these commodities (FAOSTAT). Family production adds to the social dimension, e.g. just in Brazil, some 600 000 farms produce less than 10 l of cow milk/day, two-thirds of which do not sell any of it, producing just for subsistence.

Livestock production has contributed to the regional development, which in turn has influenced the possibilities for adoption of new production techniques. Pasture oriented systems prevail for ruminants. The ruminant production is continuously displaced by expanding agriculture towards areas of less costly land and labour. In the last few decades developments in many fields have occurred, including improved pasture species, fertilizers, pasture management, roughage production and conservation, irrigation, feeding with new agricultural by-products, concentrate and mineral supplementation, vaccination and health care. More productive genotypes are required to match the new circumstances. Of course, underlying any material development, human development and social stability are needed, which are being painfully and steadily gained in the region.

Animal breeding is an essential part of livestock development, providing the genetic basis for it, in a continuous process of adapting the genetic resources to the changing production circumstances. Migration has been, and continues to be, a major driving genetic force, i.e. via importations of stock and genetic material for breed substitution and cross-breeding, which has radically altered the genetic make up of the local livestock populations. Many of these operations have been carried out by practical *entrepreneurs*, sometimes in spite of opposing expert opinion. In the last century, experts believed that the introduction of *Bos indicus* would ruin the cattle industry in Brazil, although nowadays the Nelore, Brahman and other zebu beef breeds prevail all over the tropical part of South America.

The development of local breeds has also played an important role, again sometimes initially opposed by experts, e.g. the dairy Gir and Guzerá zebu breeds, which were improved by a few empirical pioneers in the 1950s, when most considered it unthinkable that *B. indicus* could be dairy animals. The breeds have now, via established progeny testing and MOET programmes, become some of the few world sources of tropical dairy germplasm with modern genetic evaluation, which has granted the breeds an amazing commercial success both in Brazil and abroad. Genetic evaluation programmes are nowadays rather common in beef and dairy cattle and in sheep, and expected progeny differences (EPD) are increasingly substituting show ring prizes as the basis for commercial decisions, e.g. in Brazil about half the beef cattle semen sold is presently from 'EPD sires', reflecting a (very slow) change of minds initiated at universities some 60 years ago, when the show ring experts lecturing on animal breeding became gradually substituted by quantitative geneticists usually with a PhD from North America or Europe. However, although the objective selection on function is an improvement over the subjective selection on form, the concept of total economic merit is not yet generally applied in practice, except in chicken and pigs. Too much emphasis is placed on single traits, such as milk yield in dairy

and growth rate in beef animals. Yet some rather surprising results became evident upon formal definitions of economic objectives and selection criteria, such as realizing that milk protein and fat have negative economic values for farmers when these components are not paid for by the dairy plants, or the finding that reducing dairy cow weight is more rewarding than increasing milk yield, due to the impact of maintenance needs in low input systems. Hence the selection for growth is uneconomic in dual purpose breeds.

Crossbreeding is widely practised in different species but has a unique role in dairy production in tropical South America, where the local naturalized breeds have been replaced over the last century, not by a breed, but by *B. taurus*/*B. indicus* crosses, which account for the large majority of dairy animals. There are nowadays over 20 million such cows, the world largest crossbred dairy herd, maintained by farmers for decades. The widespread pasture-oriented, dual purpose systems utilizing *B. taurus*/*B. indicus* crosses milked with the stimulus of the calf have been very successful. As a consequence the Brazilian dairy production has grown 4% per year over the last decade and Brazil now ranks as the fifth largest cow milk producer country. This has eliminated the need for importation of milk products.

Tropical dairy production has a very high potential and – contrary to the common Northern Hemisphere views – does not pose particular challenges any more than other production systems elsewhere. While it is indeed difficult to produce in the tropics with the North American/European model of high yielding cows with high levels of concentrate feeds and other inputs, made possible with agricultural support, tropical systems in South America offer comparative advantages, as the production strategy relies on the exploitation of the ample solar energy for the efficient photosynthesis of fast-growing C_4 grasses and of water availability. Pasture quality is not high and concentrates are relatively expensive, as they are needed to feed humans or monogastric animals. However very high stocking rates are possible. Adapted cattle such as the *B. taurus*/*B. indicus* crosses may conveniently graze facing heat and parasite challenges. Therefore they are an essential part of the production system, circumventing the lack of adaptation of the *taurus* and the low yield of the *in-*

dicus. Expensive buildings or equipment to control the environment are not necessary and chemical control of parasites may be minimal, and therefore the tropical dairy systems may be very competitive. The notion that high production per cow is desirable, instead of high profit, has been very harmful to the progress of the dairy industry. As in the rest of the world, South America currently faces the continuous health and fertility deterioration in the high-yielding main-stream breeds, calling for urgent research on alternative *B. taurus* germplasm sources.

It should also be noted that because of carbon sequestration and the lower secondary emissions from machinery and other inputs, pasture systems reduce the net greenhouse gas emissions in comparison to confinement systems, reducing also ammonia volatilization and erosion, although they pose a challenge on nitrate leaching.

Heterosis in the predominant dairy crosses (Holstein/Gir and Holstein/Guzerá) in Brazil has been shown to be of major economic importance, being present in most traits and adding up to an impressive profit superiority of the F_1 over other crosses, particularly in low input systems. The ways to implement continuous replacement with F_1 's are currently being explored, such as heifer production in specialised centers, through ovum pick-up and *in vitro* fertilization with enriched X-chromosome semen. The procedure has already been commercially practiced by a large cooperative in Minas Gerais, which offers F_1 heifers pregnant with F_1 or other female embryos as a service to its member farmers. These results were recently reviewed by Madalena et al. (2012, Dairy cattle genetics and its applications in Brazil, Livest. Res. Rur. Dev., submitted).

As indicated by the above examples, animal breeding has contributed to the development of South American livestock industries and will indeed continue to do so, although much time and effort could be saved by focusing research, teaching and divulgation on the immediate farmers' needs, to provide them with a sound basis for efficient livestock production.

F. E. Madalena

Independent consultant

<http://www.fernandomadalena.com/>
contact@fernandomadalena.com