UTILIZATION OF A MOET NUCLEUS IN THE IMPROVEMENT OF THE GUZERÁ

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The Brazilian Guzerá is considered a dual purpose breed. However, until 1990, even among the so-called milking herds only a few practiced milked recording in a regular, organised and non-selective manner (i.e., recorded only the highest yielding cows). In 1992, when the Breed Society tried to give incentive to the use of modern techniques of animal improvement, there were only 228 lactations in official milk recording (Martinez, 1992), so the first step was to encourage official and non-selective recording. The current data bank includes 3,176 lactations of 1,755 purebred cows in 18 herds. In 1994 a sire progeny testing (PT) programme in pure and crossbred (x *B. taurus*) herds and a linked MOET selection scheme were initiated.

THE GUZERÁ MOET PROGRAMME

The MOET programme aims at the improvement of milk and beef traits for the environmental conditions and production systems considered economic for Central Brazil. Since the main market for sires of this breed is for production of milk and beef out of grass with medium-input levels, the selection process is conducted under these conditions.

The programme was initially financed by the breeders themselves with technical support and co-ordination of investigators of the Federal University of Minas Gerais and the Federal Research Organization, Embrapa–Dairy Cattle. The Breed Society has a technical development body responsible for the technical and operational aspects of the programme. Occasionally financial grants are obtained from research and development agencies.

The programme is designed to obtain 12 full-sib families per annum, with at least 4 females and one male, by hierarchical inseminating with 4 bulls. Initially, as no genetic evaluations were yet available, the donor cows were chosen from the associated herds by genetic screening (Timon, 1993) based on milk yield, amongst the cows with 305-d yield higher than 3000 kg and mature weight higher than 450 kg, the breed average (Winkler, 1992). The sires were chosen on the yield of relatives, amongst those with semen available. No attention was paid to type except that animals should be registered. Penna *et al*. (1998) and Penna (2000) presented further details. Presently, genetic evaluations are already available and selection of donor dams and sires are based on their estimated breeding value.

Donor cows are taken to a private company premises (CENATTE - Embryos) for fresh embryo transfers. A strategy of avoidance of reproductive damage to donors is adopted, with a maximum of 3 flushes per donor, depending on clinical status, at least at 60-d intervals. After completing the required number of embryos, the donor cows return pregnant to their farms of origin. Initially, a minimum of 8 pregnant recipient cows per donor were required, but nowadays, through ultra-sound sexing, the minimum was set to 4 female plus 1 male pregnant receptors.

After a 2-mo positive pregnancy is confirmed the receptor cows are transferred to a central evaluation nucleus, 400 km distant from the embryo-transfer centre. This is a private farm belonging to the major MOET partner, having the required technical and operational infra-structure to conduct the evaluation of animals. The owners were willing to host the programme with no direct financial gains, but with the aim of making it possible. Animal owners pay the equivalent of the beef commercial value of the animal for the keeping, plus the equivalent of 180 kg live weight to cover the costs of trait measurements and blood typing.

MOET male progeny are kept up to age 15 mo and female progeny up to the end of their first lactation, under commercial conditions, based on grass for growing animals and grass supplemented with silage or sugar cane-urea, plus limited amount of concentrates, according to yield, for dairy cows. The traits recorded are: weights, scrotal circumference, muscularity score, age at first calving, milk yield and composition, somatic cell counts and temperament.

The influx of donor cows to the embryo transfer centre is continuous, rather than annual, according to their reproductive status. A link is established with the breed at large for genetic evaluation purposes, because the nucleus farm also participates of the breed PT scheme and intentionally utilizes semen of other non-PT AI Guzerá bulls as well. All the contemporaneous animals in the farm are kept together, by categories, along with the MOET ones.

A single genetic evaluation of milk yield for the whole breed is performed utilizing the recording data obtained in the herds participating of the PT scheme, the MOET programme and other herds known to record all cows. The genetic evaluation is run by Embrapa-Dairy Cattle, using an animal model with the MTDFREML software. In 2001 there were 3,079 first-lactation records with normal termination cause, of both purebred and crossbred cows in 38 herds. Sires are evaluated on the basis of 305-d lactations. No records are discarded because of short lactation. A sire summary is published once a year. Some bulls of superior MOET families are being further progeny-tested.

RESULTS AND PRESENT SITUATION OF THE MOET PROGRAMME

In its initial phase the MOET programme faced problems causing delays, practically doubling the time required to attain the set targets. The main problem was the breeders' low investment capacity to finance the MOET of donor cows. Some of the initially chosen donors were very old (up to 19 yr) which resulted in a low multi-ovulation response. Some donors failed to complete the required family number due to unbalanced sex ratio. Other prejudicial factor was the establishment of health barriers for national foot and mouth disease control that isolated several herds with potential donors located outside the disease free region. Because of the risk aroused from the initial lack of reliable sire genetic evaluation some breeders were reluctant in investing much in large expensive MOET families. The programme was also affected by the withdrawal of a breeder with several potential donors and pregnant recipient cows.

In 1999 ultra-sound sexing of pregnant recipient was implemented. It had an important impact on operational decisions and costs, as MOET could then be stopped as soon as the required 4 female plus 1 male full-sib pregnancies were obtained. At this time genetic evaluations were already in place. There was a general agreement in ranking between the animal model-BLUP genetic evaluation for milk yield and the previous phenotypic selection of the donor cows, but this was not so for the sires that had been selected on their mothers yield. A total of 13 superior donor cows were therefore re-utilized, 6 of which had families culled because the sire had a negative PTA and 7 had not reached the required number of female full-sibs in the first trial.

The operational improvements implemented, the results obtained and the commercial interest aroused re-activated the rhythm of the programme and attracted new partners to invest in it. It is interesting, incidentally, to note that the breeders have invented several ways to participate. While some have both, animals and the financial resources to MOET them, others may have superior donor cows but not the resources, so they sell part or all of the future MOET progeny to other breeders wishing to participate. The sales of extra pregnant receptors above the programme targets have also been an important source of financial resources.

The efficiency of the MOET procedures is considered good, as indicated by the average 6.7 pregnancies per donor obtained in up to 3 flushes (Table 1). Losses from pregnancy diagnoses to birth were low and 3.2 female calves per donor were obtained (all cows included). However, the proportion of cows failing to adequately respond to the multi-ovulation treatment was high (Table 1). Automatic selection may be exerted for this trait, as $h^2 = 0.56$ was estimated for the number of transferable embryos in Nelore at the same unit (Peixoto *et al.*, 2002). Losses due to culling and deaths from birth to first calving were also low (4/67 or 6.0%).

Table 1. Numbers of donor cows, receptor cows, progeny born or sexed and percent females in full-sib families in the Guzerá MOET selection scheme

					Calves born or sexed		
	Donors[A]	Pregnant receptors		Losses[B]	Males	Females	
Donor cow status	N	N	Mean/donor[A]	%	N	N	%
MOET terminated, full-sib family status:	47	315	6.7	2.2	154	149	49.2
Completed 1st lactation	13	129	9.9	2.3	61	65	51.6
Failed to complete family	5	10	2.0	0.0	8	2	20.0
Family being completed[C]	29	176	6.1	2.3	85	82	49.1
MOET ongoing	15	46	-	-	18	21	53.9

[A]Includes also donors failing to respond to multi-ovulation treatment; [B]includes pre and peri-natal losses plus receptor´s death; [C]Includes all stages from foetus to lactation in progress.

The first sire summaries for milk yield were published in 2000 and 2001 (82 sires). The statistical model included the fixed effects of herd-year of calving, season, *Bos taurus* fraction and age at calving and a random animal effect. Average 305-d milk yield was 2,171$\pm$904 kg and h^2 = 0.26±0.05. As it may be seen in Table 2 most bulls were from the MOET scheme, many of them (45) sired by PT bulls. In spite of their lower reliability, the MOET bulls showed the highest PTA. They were also much younger, averaging 4.7 yr of age, and were all alive, while the others, when alive, were more than 10-yr-old.

Table 2. PTA milk and bulls alive at publication of the 2001 Guzerá sire summary

	Bulls	PTA milk			Reliability			Alive
Scheme	N	Average	Min	Max	Average	Min	Max	N
MOET	58	113.7	-76.3	244.7	0.51	0.46	0.60	58
Progeny Testing	10	49.4	-160.7	319.5	0.71	0.62	0.82	6
Other AI bulls	14	47.0	-183.7	201.7	0.72	0.61	0.83	1

Eight bulls born in the MOET nucleus are currently being progeny tested, 7 have semen been sold by AI companies and 5 are being used to sire MOET families. Up to now 4 nucleus-born females (average PTA milk = +423 kg) have already became donors.

The nucleus programme is considered consolidated. The advantages of nucleus breeding in developing countries pointed out by Smith (1988) were confirmed in this work. Up to the present moment, 19 breeders were involved in some way in the programme and according to recent understandings this number is due to increase. The donor cows were from 14 herds. Stockastic simulation indicated high inbreeding levels for MOET selection nucleus of small size as the present one if they were closed (Marx, 1997). Thus, keeping the nucleus open and enlarging it are the next challenges. These two aspects require intensifying genetic screening and therefore the number of milk recorded cows in the breed.

CONCLUSIONS

The results indicate that it is commercially feasible to implement a MOET selection scheme in dairy Zebus provided that embryo transfer is efficient. The logistics of a central MOET station proved adequate to the Brazilian conditions. The cooperation of breeders and research institutions was essential for the implementation and consolidation of the programme. It is necessary to intensify the genetic screening in the Guzerá breed to identify superior unrelated animals. The MOET scheme speeds up improvement of dairy zebus allowing intense and wide utilization of high genetic merit sires.

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