

The N'Dama cattle genetic improvement programme: a review

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Summary

This paper reviews the successful N'Dama cattle genetic improvement programme implemented in a low input production system at the International Trypanotolerance Centre (ITC) in 1994, in The Gambia. The first part of the paper presents the genetic improvement programme. The second part deals with the analysis of the genetic improvement programme. The success of the genetic improvement programme expressed through genetic progress and the benefits for the farmers is encouraging. Recommendations to strengthen the implementation process in the field are made.

Résumé

Cet article se donne pour objectif de passer en revue le programme d'amélioration génétique du bétail trypanotolérant N'Dama. La première partie de l'article fait découvrir le programme d'amélioration. La seconde partie traite particulièrement de l'analyse du programme, cette analyse se base sur le progrès génétique obtenu et les bénéfices que peuvent en tirer les éleveurs. Pour conclure, certaines recommandations pour le renforcement du programme d'amélioration génétique sont proposées.

Keywords: N'Dama, Improvement programme, Low input system.

Introduction

The ability of some local breeds to resist trypanosome infection has been recognised, allowing use of trypanotolerant stock to be considered one of the major methods by which

sustainable animal production can be developed in tsetse-infested regions.

Open Nucleus Breeding Systems (ONBS) have been recommended in developing countries (Smith, 1988). Reports show that among the improvement programmes implemented, few are well designed, and are facing the bottlenecks of long-term sustainability and involvement of local farmers (Kosgey *et al.*, 2003).

This paper reviews aspects of the N'Dama cattle genetic improvement programme implemented at the International Trypanotolerance Centre (ITC), in The Gambia.

Programme Implementation

The breeding goal

The goal was discussed and agreed upon with the National Agricultural Research Services and representatives of the target groups. In 1990, a Food and Agriculture Organization (FAO) consultancy mission was conducted at ITC. The report revealed the importance of traits like disease tolerance, milk production, meat production and ability for traction (Dempfle, 1990).

A Participatory Rural Appraisal (PRA) study was carried out in 1996 (Bennison *et al.*, 1997). Based on the results, a bio-economic model was adapted utilising all known biological and economic relationships (Dempfle, 1986). This economic model was used to obtain an economic definition of the overall breeding goal. After reviewing the literature and the local production system, it was agreed in 1998 that the improvement programme should aim to increase milk and meat production without the loss of trypanotolerance and other adaptive traits.

Table 1. Overview of the chronological development of the N'Dama cattle genetic improvement programme.

Event	Period
Inception of ITC	1984
Food and Agriculture Organization (FAO) consultancy mission conducted at ITC	1990
Need for a coherent and comprehensive improvement programme expressed	1993
Proposal to support the organisation of the herd into an open nucleus herd	1993
BMZ agreed to financially support the proposal	1993
Launch of the programme	1994
Records on performance	1995
Workshop organized for breeding goal	1996
Purchase of replacement discussing animals (screening)	1996/1999
Breeding goal agreed	1998
Introduction of an animal model BLUP evaluation	1998
Introduction of mechanism to disseminate genetic progress	2001
Project PROCORDEL: enhance dissemination	2000
OPEC-FID: screening operation	2002
Establishment of two livestock multiplier associations	2002
Survey of farmer acceptance	2003

The breeding strategy

The strategy follows that of an ONBS, with selection based on individual performance and the performance of relatives. It is a three-tier scheme including the nucleus (ITC), multipliers and commercial farmers.

The following two activities can be distinguished:

1. generation of genetic progress; and
2. dissemination of genetic progress (Van Arendonk and Bijma, 2003).

To ensure that farmers use the genetic material, promotion of the improvement programme through communication with farmers and the government was very important. It involved a series of workshops, training, open days, farm visits, films and livestock shows, which demonstrated the benefits for the production of the N'Dama cattle breed.

Other programmes or activities also contributed significantly to the programme. Besides the technical aspects, socio-economic aspects have also been undertaken.

Selection criteria

Animals in the improvement programme are maintained under a low input management system

and details on the production system have been described by Agyemang *et al.* (1988). Animals are selected according to an index containing information on daily weight gain (between 15 months and 36 months in a high tsetse challenge area) and the 0–100 day milk yields of all lactations. The index integrates information on the animal itself and all relatives using animal model BLUP methodology.

Selection candidates are located at the ITC's stations at Bansang (a high tsetse challenge area). The station located at Keneba maintains the breeding herd of five sires and 400 cows. Each year, approximately 400 cows are mated to produce 100 male and 100 female calves. These calves are maintained at Keneba until weaning after which 95 males and 90 females are moved to Bansang. At any one time, approximately 230 males and 225 female weaners are present at Bansang. At the end of the testing period (at 36 months of age), 84 male and 80 female animals are available for selection.

Each year one to two males are selected out of 84 candidates for replacement of the breeding males. The second best males (around 10) are designated for use in the multiplication tier, whereas all others are sold to butchers to be slaughtered. From the 80 female selection candidates, 75 are selected and mated after which 55 animals are retained based on their first lactation performance.

Training and dissemination of genetic progress

Training was the starting point for strengthening the activities of the improvement programme. The overall objective is to enhance the ability to implement genetic improvement programmes, to deal with the issues and problems faced in the management of local indigenous breeds and to cope with new technical developments for the sustainable use of local animal genetic resources.

The cattle dissemination programme started in 2001 (Table 1). As of February 2004, 44 improved bulls have been distributed to individual multipliers in 26 villages. In February 2004, 169 offspring were registered in these multiplier herds.

For the genetic improvement programme to have an appreciable impact, two livestock multiplier associations, Gambian Indigenous Livestock Multiplier Associations (GILMA-Saloum and Fulladu), were established.

Opportunities for Improvement and Evaluation of the Scheme

The evaluation is essentially based on two main interacting criteria: the genetic gain achieved during the development of the genetic improvement programme and the uptake of results by farmers. We also want to address the question of the extent to which farmers and farming communities in Gambia and the West African region benefit from changes brought about by the genetic improvement programme.

Genetic gain

Collection of performance data over 10 years has permitted the estimation of genetic parameters as well as the genetic trends for growth traits (Figure 1). The estimated heritabilities for growth traits recorded in the scheme were moderate to high (Bosso *et al.*, 2002), ranging from 0.28 for weight at 36 months to 0.48 for weight at 15 months. The

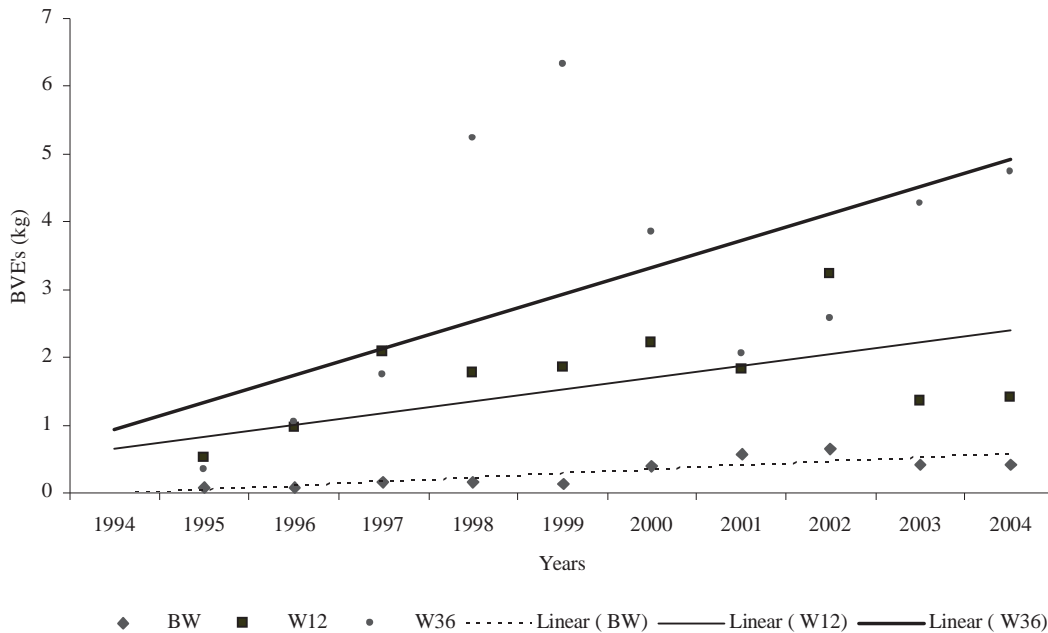


Figure 1. Genetic trend from 1994 to 2004 for body weight traits, showing the correlated selection responses per year for EBV of W36 (weight at 36 months of age), BW (birth weight) and W12 (weight at 12 months of age).



Figure 2. N'Dama cattle in its environment.

genetic correlation between weaning weight and weight at 36 months was high (0.69). Genetic and phenotypic parameter estimates are scarce in pure bred indigenous N'Dama cattle populations (Figure 2) and coupled with the results of the heritability factors, they support the promise of genetic improvement with respect to growth rates.

Average estimated breeding values (EBV's) of animals were calculated. The estimated increase in breeding value for W36, from 1994 to 2004, fluctuated between 0 to 6.32 kg.

W36 exhibited the largest genetic gain with a response of 0.40 kg per year. The other weight traits also exhibited positive, although smaller, amounts of genetic gain.

Support to farmers' associations

The newly formed associations remain fragile and more work is needed to strengthen them to improve their access to innovations, markets and services that enhance farm productivity and income. It is also essential to make the members of the associations aware that these associations are first and foremost instruments for them and respond to precise needs.

Interaction with farmers

A survey was conducted in 2003 in The Gambia. The objective was to assess the adoption of the genetic improvement programme. One of the most important benefits to farmers is the savings generated by the utilization of improved males; the cost of trypanocide drugs to control trypanosomosis and other diseases is drastically reduced (50%). This is very encouraging and is likely to translate in the future into higher mature live weight of animals and therefore higher sale prices.

Utilization of Indigenous Breeds

Given the encouraging results of the N'Dama genetic improvement programme in The Gambia, it has been shown to play an important role in the conservation and utilisation of N'Dama cattle. The programme has significantly influenced the utilisation and development of the N'Dama breed.

Benefits to farmers and cost of the improvement programme

The programme meets the important characteristics required for estimating incremental cost, because:

1. it addresses national development goals;
2. it is technically feasible;
3. it is economically attractive, while remaining broadly consistent with political and social constraints;
4. it is environmentally reasonable; and
5. it is financially realistic.

It appears that the N'Dama cattle genetic improvement programme will also benefit countries other than The Gambia.

Conclusion and recommendations

The N'Dama cattle improvement programme demonstrates that genetic improvement programmes for a low input production system are feasible. The success of the programme is expressed by the genetic progress achieved and this success has been transmitted to the farmers through the involvement of farmers and farming communities.

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