

**INSTITUT SENEGALAIS DE RECHERCHES
AGRICOLAS (I.S.R.A.)**

DEPARTEMENT DE RECHERCHES SUR **LES**
PRODUCTIONS ET **LA** SANTE ANIMALES

CENTRE DE RECHERCHES
ZOOTECHNIQUES DE KOLDA

BIB.

Zoot : Sélection

ZV 000 1495

1989

AN ALTERNATIVE SELECTION
SCHEME FOR NDAMA CATTLE
IN SENEGAL

By
Abdou FALL
M.S. Veterinary Doctor

REF. N° 030/CRZ/KOLDA
MAI 1989.

I. INTRODUCTION

A breeding programme aimed at the genetic improvement of the Ndama cattle in the Southern subhumid tse-tse infested zone of Senegal has been underway since 1972 by the CRZ* at Kolda which is a research station of the Senegalese Institute for Agricultural Research. Mass selection is performed on progenies of 200 heads of breeding females of the station herd. Improved bulls are introduced into village herds.

Research efforts directed toward the genetic improvement of local breeds have been subjected to criticism. The vulnerability of these programmes to criticism stems from their complex and costly nature. More over, they are long term undertakings and their impact on herd productivity is not only slow to appear but also is difficult to evaluate. Issues raised are relative to :

- I) What is the relevance the breeding programmes. i.e.
what is the position of the genetic factor as compared to other constraints facing livestock productions ?
- II) What should be the objectives and selection criteria for a multi-purpose production system ?
- II I) What is the most suitable breeding scheme capable of ensuring a wide spread genetic progress in an extensive production system characterized by a stressfull environment and seasonality in inputs and outputs.

This article attempts to give responses to the issues mainly for the Ndama cattle in the context of the Southern part of Senegal. The objectives, methodes, scheme and constraints of the ongoing selection programme are examined and the herd productivity collected on station are analysed in order to gain insights for the identification of avenues which can lead to the design of an efficient breeding programme.

. . . / . . .

* CRZ = Centre de Recherches Zootechniques de Kolda.

II. THE ONGOING BREEDING PROGRAMM

2.1 - Objectives and methode.

At a national level, increased meat output has been the main objective which dictated the orientation of research and developments efforts on livestock. This objective has been translated into the design and implementation, among other means such health care, of breeding programmes aiming at the genetic improvement of the beef potential of local ruminant breeds through mass selection. The animal base is composed of herd of limited number raised on station. Improved bulls selected from this herd are introduced into village herds.

2.2 - Selection criteria and scheme

Growth and reproductive performances as well as coat color and format are used as discriminatory traits for the choice of future parents. The brown coat color was presumed to be correlated to the Ndama attribute of trypanotolerance.

A first selection is performed on calves at 6 months of age on the basis of coat color and weight gain. The latter is also used for a second selection applied on 18 months old calf bulls. An individual test is then operated for 6 months on calf bulls of highest ^{merit} which constitute about 10 % of the initial stock.

A final selection occurs at the end of this phase and candidate bulls are ranked according to growth performances, weight gain efficiency, sperm quality and format.

2.3 - Evaluation of the breeding programme

As stated before, the evaluation of the breeding programme is a difficult task. We will however carry it out on the basis of two criteria (I) the growth performances obtained on station and (II) the number of improved breeding mâles introduced into village herds. Even though not comprehensive, this approach will help identify main drawbacks of this programme.

Results

The analysis of variance laid out in table 1 shows the significance of different factors included in the model for weight at different ages. Least squares means are shown in table 2.

Effect of season of birth

The season of birth have a significant effect on weights at all ages except for the weight at 24 months. Animals born from february to july have heavier weight than those born the rest of the year. The variation of weight due to season of birth depends of the period of the year (wet or dry season) when the animal reaches a given age.

Effect of age of dam

The effect of age of dam is significant from birth to 12 months. At 12 months, progenies of cows of more than 12 years of age are 19 % lighter than calves from 8 to 11 years old cows.

Effect of year of birth

The year of birth effect is significant for weights at all ages. Variation of body weight accross years may be the result of the influence of many factors such as the changes in management practices with varying supplemental levels, pasture availability dependant upon annual rainfall and the extent to which pastures have been damaged by fire, the genetic progress and the health situation.

Correlation and regression between means for weight (6 to 24 month weight) and means for rainfall during the relevant period of the study were negative and non-significant.

TABLE 1 ANALYSIS OF VARIANCE OF BODY WEIGHT AT DIFFERENT AGES

SOURCE	MEAN SQUARES									
	d. f		d. f		d. f		d. f		d. f	
		Birth		6 m		12 m		18 m		24 m
Season of Birth	3	246**	3	9335**	3	2972**	3	2932**	3	2056
Age of Dam	3	115**	3	1646**	3	1701*	3	1638	3	1859
Year of Birth	7	79**	7	2430**	6	2118**	6	7397**	5	17304**
Sex	1	227**	1	3494**	1	6298**	1	13051**	1	18900**
Season X Age of Dam	9	13**	9	443*	9	993*	9	915		
Remainder	644	11	708	213	583	488	423	756	290	1580

** P < .01

* P < .05

The regression of least square constants on year of birth (1 to 8) were calculated to determine any linear trend in body weight as shown in table 3.

Table 3 : Correlation and regression of least-square constant for weight on year of birth

Trait	Correlation	Regression
Birth	\$81	.38*
6 month weight	-.62	- 1.32
12 month weight	-.27	- .58
18 month weight	-.63	- 2.64
24 month weight	-.52	- 3.52

P < 0.5

Correlations and regressions are negative and non significant for the 8 years studied. These statistics have proven to be positive and significant from the previous analysis of the data over the period lasting from 1974 to 1980. Table 4 shows the differences in growth performances during these two periods.

Dramatic weight declines have occurred during the second period (1981 to 1988) as compared to weights in the first period of study (1974 to 1980). Even though the correlations of least square constants on year of birth were not significant their negative nature illustrates a negative trend of cattle body weight over years. With the non-estimation of genetic parameters (which will be performed) it may be difficult to associate this phenomenon to either environmental or genetic factors. However some observations may lead to the incrimination of environmental factors. The decline in growth performances may be attributed to changes in management practices and pasture availability. The level of supplementation has substantially dropped during the second period because of budget constraints. Moreover, tremendous pasture areas have been devastated by fire during 1985 and 1986. The gradual degradation of available grazing areas after 17 years of utilisation without any attempts to improve them may contribute to explain this situation. Hundreds of hectares are being encroached by woody species with a consequent decline in grass species density. In addition, half of the station pasture areas have been given ill-

The regression of least square constants on year of birth (1 to 8) were caculated to determine any linear trend in body weight as shown in table 3.

Table 3 : Correlation and regression of least-square constant for weight on year of birth

Trait	Correlation	Regression
Birth	.81	.38*
6 month weight	-.62	- 1.32
12 month weight	-.27	- .58
18 month weight	-.63	- 2.64
24 month weight	-.52	- 3.52

P < 0.5

Correlations and regressions are negative and non significant for the 8 years studied. These statistics have proven to be positive and significant from the previous analysis of the data over the period lasting from 1974 to 1980. Table 4 shows the differences in growth performances during these two periods.

Dramatic weight declines have occurred during the second period (1981 to 1988) as compared to weights in the first period of study (1974 to 1980). Eventhough the correlations of least square constants on year of birth were not significant their negative nature illustrates a negative trend of cattle body weight over years. With the non-estimation of genetic parameters (which will be performed) it may be difficult to associate this phenomenon to either environmental or genetic factors. However some observations may lead to the incrimination of environmental factors. The decline in growth performances may be attributed to changes in management practices and pasture availability. The level of supplementation has substantially dropped during the second period because of budget constraints. Moreover, tremendous pasture areas have been devastated by fire during 1985 and 1986. The gradual degradation of available grazing areas after 17 years of utilisation without any attempts to improve them may contribute to explain this situation. Hundreds of hectares are being encroached by woody species with a consequent decline in grass species density. In addition, half of the station pasture areas have been given up because of management constraints.

Table 4 : Overall least-square means for weight at birth, 6, 12, 18 and 24 months from 1974 to 1988

	n	Overall least-square mean (kg)		n
		1974-1980	1980-1988	
Birth	403	17.7	668	17.5
6 months	403	81.6	732	69.7
12 months	306	111.5	606	87.7
18 months	306	144.0	446	103.9
24 months	189	175.0	303	124.7

Effect of sex

The effect of sex was significant for weight at all ages with females lighter than males.

Effect of the interaction season of birth * age of dam

Weights at 6 and 12 months are significantly influenced by this interaction. Heaviest weights are obtained by calves born between february and july and wich are progenies of 8 to 11 old cows. Lightest calves are born between august and january and are progenies of young (2 - 3 years) and old (more than 12 years) COWS.

2.3.2 - Constraints of the breeding programme

2.3.2.1 - The first resultats of the analysis of cattle body weight on station give the evidence that a breeding programme under circumstances of a low nutritional plane may not be efficient in terms of increased productivity which is the main stated objective. The depression of growth performances attributed to the effects of environmental factors indicate that if a sustained and significant genetic progress is to be made in a stressfull environment such as that prevailing at Kolda, a great deal of efforts should concomitantly to the selection programme, be directed to the improvement of the nutritional an disease situation.

2.3.2.2 - Since the beginning of the breeding programme at Kolda an annual mean of 5 breedings males have been introduced into village herds. This is a major factor limiting the impact of the selection programme based on natural mating with regard to the size of the target regional herd totaling an estimated number of 350 000 Ndama breeding females.

2.3.2.3 - The limited size of the animal base raised on station causes a reduction of the genetic variability and the selection intensity which are important elements of the selection differential.

III. AN ALTERNATIVE BREEDING PROGRAMME

The stop of the genetic programmes and the focus on other more constraining factors facing the livestock sector has been advocated in Senegal. The genetic improvement of livestock is a complex and time-consuming process which can't be postponed. Advantages such as the introduction of innovations into village herds brought about through the genetic programme justify the allocation of resources and efforts to its implementation. It is however fundamental to design an efficient breeding programme with a clear definition of objectives, scheme and organisation which can fit the production system and apt to satisfy the needs of all persons involved in the process.

3.1 - Objectives

The planning of a breeding programme requires a clear formulation of objectives to ensure its success. The objectives of livestock owners must be taken into account. In the traditional production system cattle is raised for many purposes. Milk production is a major function of Ndama cattle. Milk yield is therefore used as selection criterion by cattle keepers. Growth performances are used as well. The consideration of meat and milk outputs may meet the livestock producers and national needs.

Adaptability of Ndama cattle in the tsetse infested environment deserves a great deal of attention.

A dual purpose (beef and milk) animal with a high degree of tolerance to trypanosomiasis seems to be the most relevant genotype in the Kolda context.

The main objectives of the breeding programme can then be stated as follow :

- 1) the improvement of the beef potential of Ndama cattle assuming that this is not antagonic to the development of its traction power ;
- 2) the improvement of its milk potential ;
- 3) the increase of the tolerance of Ndama cattle to trypanosomiasis.

3.2 - Method and criteria

Constraints associated to the use of artificial insemination dictates the adoption of mass selection.

Future parents will be selected on the basis of the following criteria :

- 1) dam milk yield ;
- 2) growth performances ;
- 3) an adaptability criteria which is yet to be identified.

Packed cell volume (PCV) might serve as an indicator of trypanosomiasis "the repeatability of the monthly PCV of cattle in contrasting situations ranged from 0.26 to 0.39 with a mean value of 0.32. This indicates the possibility of a heritability estimate sufficient to justify the cost of a selection programme. ILCA, 1986, p. 78".

.../...

3.3 - The selection scheme

Figure 1 gives the proposed selection scheme. It is characterised by :

- the test of calves bulls from village herds on station
- the shift of the present station role to a number of multiplication herds.

The multiplication herds are those traditional herds that have been single out because of their better management practices in terms of health care and feeding regime they apply. They will be converted into commercial herds receiving higher ranking bulls or semen from the station and selling breeding males to others herders.

Males progenies of high milk yielding cows from village herds are tested on station from 10 to 18 months of age. A final selection is performed at the end of the test on the basis of their growth performances. Best bulls are directed into multiplication herds.

3.1 - Requirements

The level and variability of cattle performances under village circumstances as well as the significance of the effects of factors causing variation are not precisely known. These information are needed as inputs to an efficient selection.

They can however be obtained through the design and the implementation of a recording system which will have the role to collect and analyse data pertaining to village herds productivity. A monitoring scheme involving 2 000 heads of cattle is presently conducted by the CRZ/Kolda. A substantial number of herds are also monitored by the SODEFITEX which is a development project intervening in that zone ? For the selection programme to have a regional impact it is required that this monitoring scheme be strengthened with personnel, logistic means and equipment with the involvement of all institutions concerned with cattle production in that region.

A second requirement deals with the organisation of livestock owners involved in the breeding process. The "Groupement d'Interet Economique :

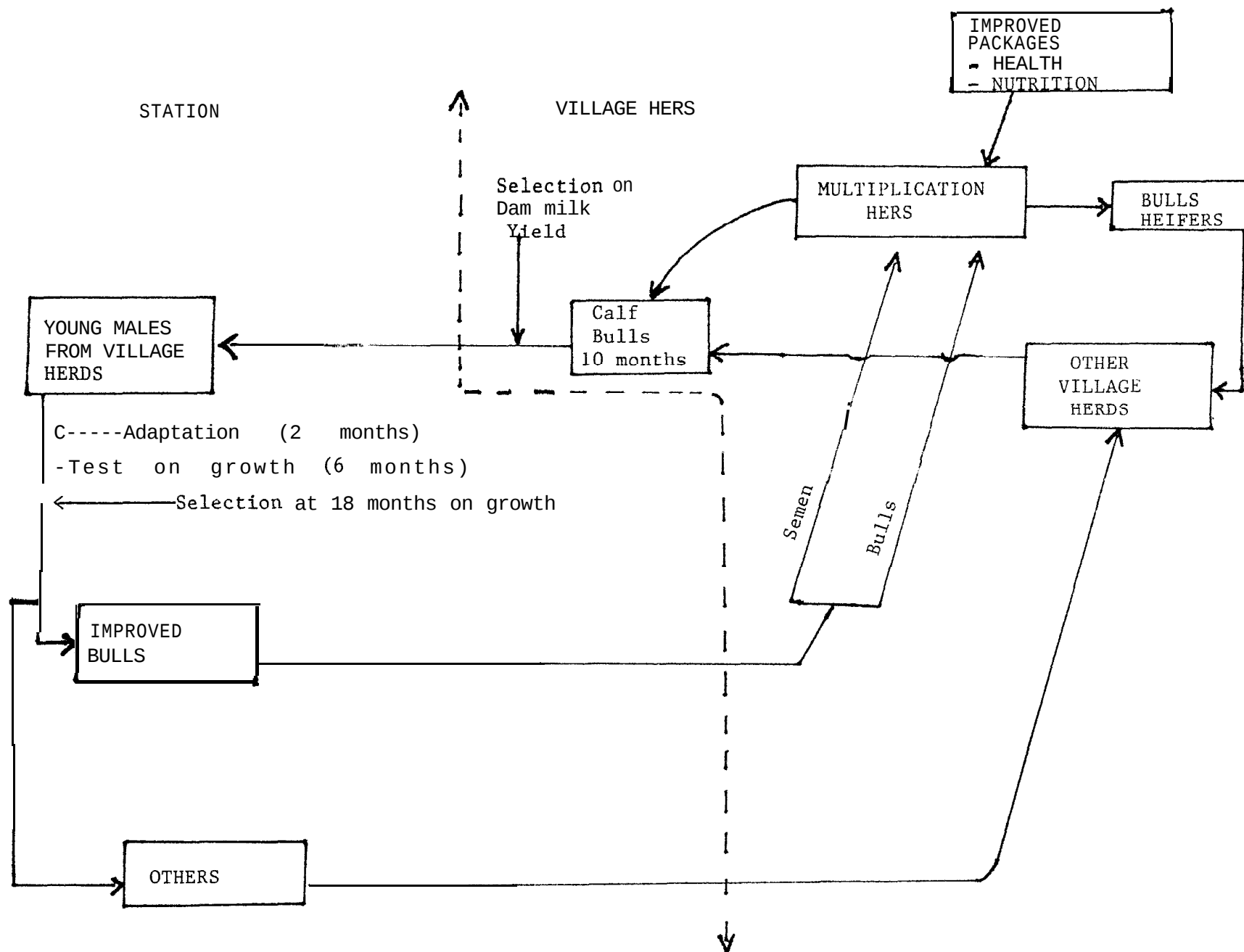


Figure 1 : The selection Scheme

GIE" in the new formulation of the cooperative system in rural Senegal. Its structure and functioning offer opportunities to farmers for them to have access to bank loans for the purchase of basic inputs such as veterinary products, supplemental feed, bulls, etc.. It is also a valuable tool at their disposal to facilitate livestock owners to market their products. An efficient functioning of the selection scheme can be achieved through the organization of livestock owners into GIE framework.

3.5 - Constraints

The lack of data on village herds productivity makes difficult the selection of calves only on the basis of their genetic merit. Correction factors needed to adjust performances in order to minimize the effects on environmental factors are not available.

Difficulties associated to the application artificial insemination will retard the selection process. Artificial insemination should be attempted in the multiplication herds with high management standards.

The available personnel, logistic means and equipment does not permit the wide spread impact of the selection programme.

3.5 - Implementation

Two major phases are identified for the implementation of this selection scheme :

Phase I (2 to 3 years)

- calves are selected on the basis of their dam milk yield estimated by livestock owners ;
- a recording and analysis system is designed and implemented ;
- livestock owners are organized into GIE ;
- multiplication herds are identified ;
- series of 100 calves are tested each year.

Phase II

- The system of recording and analysis is working fairly well ;
- the first results of the programme are evaluated ;
- findings from the first phase^{help} adjust and improve the selection programme.

R E F E R E N C E S

- 1 - FALL (A.), DIOP (M.), SANDFORD (J.), WISSOCA (Y.J.), DURRIN (J.), TRAIL (J. C.M.) (1982) - Evaluations of the productivities of Djallonke sheep and Ndama cattle at the Centre de Recherches Zootechniques Kolda, Senegal. ILCA Research Report n°3.
- 2 - HARVEY (R.W.) (1987) - Parmcard, Parameter card generation Program for LSMLMW Mixed Model Least-Squares and Maximum Likelihood Computer Program.
- 3 - ILCA (1986) - The African Trypanosolerant Livestock Network. Indications from results. 1983-1985.