THE EVALUATION OF BREEDING STRATEGIES WITH THE OBJECTIVE OF ENHANCING SUSTAINABLE BEEF PRODUCTION IN NAMIBIA

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INTRODUCTION

The kind of breeding strategy to be followed in Namibia in particular, and in Southern Africa in general, depends primarily on the environment and level of management. As far as environment is concerned, it is general knowledge that beef production in Namibia is practised under an unstable and hazardous production milieu. With regard to management, it is a reality that a considerable number of small scale farmers from the more undeveloped areas in Namibia entered the beef production market, recently. In these areas a low level of management is usually practised and the level of nutrition is such that it cannot provide high demands. Furthermore, commercial farmers experience enormous increases in production costs, increasing pressure on the natural grazing as a result of bush encroachment and desertification against a slower increase in beef prizes. Therefore, in order to meet these challenges, it is essential that producers organise themselves in good time to ensure sustained productivity.

This critical situation convinced the Department of Agriculture and Rural Development to review and evaluate different breeding strategies in order to satisfy the following objectives:

- Develop a long-term breeding strategy suited to both communal and commercial production environments,
- improve sustained productivity,
- produce a product as close to the optimum marketingstage (age and condition) as economically and environmentally feasible and
- produce a high productive yield per unit area.

Diagram 1. Breeding strategies under evaluation

SYSTEM A:

	- SMALL FRAME
	- SANGA (INDIGENOUS)
PURE BREEDING	- MEDIUM FRAME
	- BONSMARA (SYNTHETIC)
	- LARGE FRAME
	- SIMMENTALER (DUAL PURPOSE)

SYSTEM B:

	(ALL PROGENY ARE SLAUGHTERED)
DAM LINES	- SMALL FRAME - PURE BRED
	- INDIGENOUS SANGA COWS
TERMINAL	
CROSS	- MEDIUM FRAME - PURE BRED
BREEDING	- INDIGENOUS AFRIKANER COWS
SIRE LINES	- PURE BRED BULLS
- SIMMENTALER	- CHAROLAIS
- SANTA GERTRUDIS	- HEREFORD

SYSTEM C:

TWO BREED		BRAHMAN
ROTATIONAL	X	
CROSSBREEDING		SIMMENTALER

MATERIAL AND METHODS

In consultation with animal scientists in the Republic of South Africa, it was decided to evaluate the following breeding strategies as illustrated in diagram 1. The project commenced in January 1992 and the comparisons have been based on the biomass principle developed by Van Schalkwyk (1974). This research is conducted at the Omatjenne Research Station (20° 24' S latitude, 16° 29' E longitude) situated in a sweet bushveld savanna in the central parts of Namibia. The average annual rainfall is 395 mm.

RESULTS AND DISCUSSIONS

Data is given as means over a period of three years (1992-94). The number of breeding cows in each breeding group and cow biomass mated since 1992, are presented in Table 1. With regard to both the pure Simmentaler and Afrikaner terminal breeding groups, the biomass mated, remained relatively constant over the period under review, while the other groups slightly increased in biomass (Table 1). This could be ascribed to the fact that these two groups are possibly under more stress due to their higher demands.

Table 1: Number of breeding cows & total biomass mated over 3 years (1992-94)

Breeding Groups	no. of cows	Biomass (kg)		
		1992	1993	1994
Simmentaler	31	14895	15231	14991
Bonsmara	36	15021	15434	16805
Sanga	45	14941	15590	15808
Sanga Terminal	45	14990	15670	16584
Afrikaner Terminal	35	14987	14612	14912
Simm x Brahman	36	15437	15745	1657

REPRODUCTIVE EFFICIENCY

The average calving percentage of the different breeding groups is reported in Table 2. Table 2 shows that all the breeding groups attained an excellent average calving rate of above 90 %, except in the case of the Afrikaner terminal group averaging 85.1%. This exceptionally high calving

rates can be attributed to the fact that all the breeding groups were continuously subjected to optimal levels of management and nutrition. It must be emphasized that Omatjenne Research Station is situated in a sweet bushveld savanna with exceptionally high quality grazing.

However, the exceptionally high fertility of both the pure Sanga and Sanga terminal groups is apparent from Table 2 and in agreement with other reports (Hetzel, 1988; Lepen, 1988; Scholtz, 1988; Schoeman, 1989; Moyo, 1990; Lepen, 1992). It is interesting to note that there was no actual difference between the calving rates of Sanga cows that suckled pure Sanga or Sanga crossbred calves and thus, concurs with results obtained by Scholtz, Lombard & Roux (1993).

The Afrikaner terminal group suckled pure Afrikaner calves during the first mating season (1992) during which they were exposed to larger frame bulls and obtained a calving percentage of 97.2% (Table 2). The calving percentage however, dropped to 77.1 % in 1993 and to 81.0% in 1994, when they suckled crossbred calves (Table 2). Therefore, it seems as if the Afrikaner cows have experienced an additional drain, probably due to the suckling of heavier crossbred calves resulting in longer lactation anestrus periods.

Table 2: Average calving percentage over 3 years

Breeding Groups	Average calving (%)			
	1992	1993	1994	Average
Simmentaler	96.7	90.3	93.0	93.3
Bonsmara	97.2	88.9	91.0	92.4
Sanga	91.1	100.0	95.0	95.3
Sanga Terminal	97.8	95.6	93.0	96.5
Afrikaner Terminal	97.2	77.1	81.0	85.1
Simm x Brahman	94.4	88.9	89.0	90.8

PRE-WEANING PERFORMANCE AND FETAL DYSTOCIA

The average birth mass and birth mass ratio of the different breeding groups are shown in Table 3. A greater percentage of fetal dystocia was experienced within the larger frame breeding groups (Simmentaler & Simmentaler and Brahman crossbreds) probably due to relatively higher birth masses, 41 kg and 36 kg respectively. This is despite of favourable birth mass ratios for both the Simmentaler (8.1%) and the Simmentaler and Brahman crossbred cows (7.8%). Contrary to that, the Afrikaner terminal group experienced limited and the Sanga terminal group no calving difficulties, despite extremely unfavourable birth mass ratios of 8.7 and 9.4% respectively. These results are in support of results confirmed by Scholtz *et al.*, (1993). Pure Sanga calves had an average birth mass of 28 kg and the Sanga crossbred calves an average of 32 kg, 14.3% heavier than the purebreds. The Sanga cows therefore restricted the birth mass of the crossbred calves well below 12.3 %, the mid parent value of 36.4 kg in the case of pure Simmentaler calves. This, together with the results of Gregory *et al.*, (1978) and Scholtz *et al.* (1993) is an indication that maternal restriction of offspring birth sizes may be evident if the difference between sire and dam lines are large enough. The Bonsmara and pure Sanga breeding groups showed no incidence of fetal dystocia.

Table 3: Birth mass & birth mass ration

Breeding Groups	Birth mass (kg)	Cow mass (kg)	Ration (%)
Simmentaler	41	512	8.1
Bonsmara	34	467	7.3
Sanga	28	360	7.7
Sanga Terminal	32	348	9.4
Afrikaner Terminal	38	438	8.7
Simm. x Brahman	36	461	7.8

WEANING PERFORMANCE

The weaning masses of the different groups are indicated in Table 4. From Table 4 it is clear that the pure Sanga and Sanga terminal groups produced calves with the lowest weaning masses (173.6 and 198.3 kg) the Afrikaner and Bonsmara intermediate (226.3 and 232.3 kg) and the Simmentaler and Brahman crossbreds and the pure Simmentalers, the heaviest weaning masses (250.7 and 257.7 kg). The crossbred calves weaned by the Sanga terminal group were 14.2% heavier than the pure Sanga calves. However, taking into account the total weaning mass produced over the period of three years (1992-94), summarized in Table 4, it is evident that the Sanga terminal (24 996 kg), Simmentaler and Brahman crossbreds (23 293 kg) and the Bonsmaras (22 949 kg) produced the highest total weaning mass, followed by the pure Sangas (21 890 kg), Simmentalers (21 381 kg) and the Afrikaner terminal group (20 339 kg). The lower total weaning mass produced by the Afrikaner terminal group can be attributed to a relatively lower calving rate.

The performance of the terminal sires mated to the Sanga and Afrikaner terminal groups is presented in Tables 5 and 6, respectively. In respect of the Sanga terminal group, the Simmentaler and the Charolais bulls produced more calves, 30 and 29 respectively, over the three year period, than the Hereford (26) and the Santa Gertrudis (26). However, the Santa Gertrudis produced the heaviest weaners (210 kg), followed by the Simmentaler (205kg), Hereford (202 kg) and the Charolais (200kg). In the case of the Afrikaner terminal group, the Simmentaler bulls again, produced the largest number of calves (28), followed by the Charolais (22), Hereford (16) and the Santa Gertrudis (15). Although the Santa Gertrudis produced less calves than the other breeds, they weaned the heaviest calves (239 kg), followed by the Charolais (237), Simmentaler (233 kg) and the Hereford (231 kg). Thus, in respect of both terminal groups, Simmentaler bulls produced the largest number of calves, whereas the Santa Gertrudis produced the heaviest calves.

Table 4: Average & total weaning mass

Breeding Groups	**Weaning mass (kg)**					
	92	**Total**	**93**	**Total**	**94**	**Total**
Simmentaler	252	7560	274	7399	247	6422
Bonsmara	221	7514	240	7185	236	8277
Sanga	171	6498	179	7852	171	7540
Sanga Terminal	193	8106	212	8708	190	8182
Afrikaner Terminal	228	7980	240	6228	211	6131
Simm x Brahman	251	7781	258	7734	243	7778

Table 5: Productivity of terminal sires (Sanga)

Breeding Groups	Total n of calves 1992-94	Weaning mass (kg)
		Average
Simmentaler	30	205
Santa Gertrudis	26	210
Charolais	29	200
Hereford	26	202

Table 6: Productivity of terminal sires (Afrikaner)

Breeding Groups	Total n of calves 1992-94	Weaning mass (kg)
		Average
Simmentaler	28	233
Santa Gertrudis	15	239
Charolais	22	237
Hereford	16	231

Table 7: Weaning mass produced per 100 kg cow mass exposed

Breeding Groups	Cow productivity (%)	
	1995	Average
Simmentaler	41.2	44.7
Bonsmara	52.5	45.4
Sanga	49.9	47.8
Sanga Terminal	53.9	52.9
Afrikaner Terminal	41.4	39.7
Simm x Brahman	48.8	46.7

COW PERFORMANCE

Cow productivity calculated in terms of weaning mass produced per 100 kg cow mass exposed, is illustrated in Table 7. With regard to weaning mass produced per 100 kg cow mass exposed, the Sanga terminal (52.9 %), pure Sangas (47.8%) and the Simmentaler and Brahman crossbreds (46.7 %) were the most productive groups, followed by the Bonsmaras (45.4%), Simmentalers (44.7%) and the Afrikaner terminal group (39.7%) (Table 7). On average, the Sanga terminal group was 10.7% more productive than the pure Sanga cows (52.9% against 47.8%). Therefore, terminal crossbreeding with small indigenous cows may succeed in improving the output of beef cattle farming as demonstrated by Scholtz *et al.* (1993).

Table 8: Carcass traits of oxen slaughtered at 21 months

Breeding Groups	Live mass (kg)	Carcass mass (kg)	Dressing (%)	Grading
Simmentaler	388.5	183.7	47.3	9 x A0: 1 x A1
Bonsmara	376.7	185.6	49.3	5 x A2: 3 x A3 1 x B2
Sanga	307.5	149.7	48.7	1 x A0: 3 x A1 4 x A2: 2 x A3 2 x B1: 1 x B2
Sanga Terminal	372.0	178.5	48.09	6 x A0: 4 x A1 2 x A2: 1 x B0
Afrikaner Terminal	397.1	203.7	51.3	4 x A0:2 x A1 1 x A2: 1 x A3
Simm x Brahman	395.3	197.8	50.0	4 x A0: 2 x A1 4 x A2: 2 x A3

POST-WEANING VELD PERFORMANCE

Oxen were slaughtered on an age constant basis (21, 27 & 33 months). The live and carcass weights, dressing percentages and gradings are summarized in Tables 8, 9 and 10. At 21 months, as given in Table 8, the Afrikaner terminal (203.7 kg) and the Simmentaler and Brahman crossbreds (197.8kg) produced the heaviest carcasses, the Bonsmaras (185.6 kg) and Simmentalers (183.7 kg) intermediate and the Sanga terminal (178.5 kg) and pure Sangas (149.7 kg) the lowest carcass weights. All the carcasses, except the Bonsmaras and to a certain extend the pure Sangas, were to lean at a slaughter age of 21 months. The Simmentaler carcasses were exceptionally lean.

Table 9: Carcass traits of oxen slaughtered at 27 months

Breeding Groups	Live mass (kg)	Carcass mass (kg)	Dressing (%)	Grading
Simmentaler	427	229	53.6	5 x B0
Bonsmara	413	223	57.8	1 x B2: 4 x B3
Sanga	308	164	53.3	1 x B0: 1 x B1 3 x B2: 1 x B3
Sanga Terminal	409	224	54.8	1 x B0: 2 x B1 1 x B2
Afrikaner Terminal	428	236	55.1	1 x B0: 2 x B1 1 x B2
Simm x Brahman	426	234	549	2 x B0: 1 x B1 2 x B2

Table10: Carcass traits of oxen slaughtered at 33 months

Breeding Groups	Live mass (kg)	Carcass mass (kg)	Dressing (%)	Grading
Simmentaler	561.3	285.0	50.8	1 x B0: 1 x B1 2 x B2
Bonsmara	547.5	284.8	52.0	1 x B3: 1 x B4 1 x B5: 1 x B6
Sanga	422.3	218.3	51.7	4 x B3
Sanga Terminal	529.6	276.6	52.3	2 x B2: 3 x B3
Afrikaner Terminal	545.5	279.5	51.2	1 x B1: 3 x B3
Simm x Brahman	601.3	313.2	52.1	1 x B1: 1 x B2 4 x B3

At 27 months the carcass weights of the Afrikaner terminal group, Simmentaler and Brahman crossbreds, Simmentalers, Sanga terminal and Bonsmaras varied between 236 and 223 kg, while those of the pure Sangas were 164 kg. The dressing percentages for all the oxen varied between 53.3 and 55.1%. The Afrikaner crossbred oxen were the heaviest (236 kg) and had the highest dressing % of 55.1%. The Simmentaler carcasses were still to lean, while those of the other groups grade fairly well.

In the case of the 33 months slaughter point the carcasses of the Simmentaler and Brahman crossbreds, Simmentalers and Bonsmaras were the heaviest, 313.2 kg, 285.0 kg and 284.8 kg respectively, the Afrikaner (279.5 kg) and Sanga terminal (276.6 kg) groups intermediate, while those of the Sangas were the lightest (218.3 kg). The Sanga crossbreds (52.3%), Simmentaler and Brahman

crossbreds (52.1%) and the Bonsmaras (52.0%) attained the highest dressing percentage, followed by the pure Sangas (51.7%), Afrikaner crossbreds (51.2%) and the Simmentalers (50.8%). The carcasses of the Bonsmaras were to fat, while all the other groups, except the Simmentalers, grade exceptionally well.

It is interesting to note that the difference in live mass between the pure Sangas and Sanga crossbreds at weaning, was 14.2% and increased to 21.0% at 21 months, 32.8% at 27 months and to 25.4% at 33 months.

CONCLUSION

Preliminary results presented, show that although purebreds such as the Bonsmara and Sanga performed exceptionally well, crossbred cattle may be more productive on condition that appropriate breeding strategies be practised under certain circumstances.

As purebred, Simmentalers will thus be best suited for weaner production which is in support of other authors such as Els (1988), Van Zyl (1990) and Lepen (1992). In addition to that, it is clear that the Simmentaler may play a prominent role in crossbreeding systems and specially as sire line in terminal crossbreeding.

Furthermore, the results support the view of other reports (Maule, 1973; Trail *et al.*, 1977; Hetzel, 1988; Scholtz, 1988 and Maree & Casey 1993) that indigenous breeds should form the cornerstone of sustainable livestock production in harsh and undeveloped or communal areas.

At a higher level of management input consideration could be given to the Bonsmara as it combines adaptiveness and relatively high productivity. Els (1988) and Van Zyl (1990) also find the Bonsmara as a productive pure bred and even recommend Bonsmara-type cows for crossbreeding.

Different straight- and crossbreeding results analysed by Venter, van Zyl and Coertze (1987) proved that Brahman and Simmentaler crosses perform excellent under extensive conditions which is also concluded in this report. It is however true that the potentially higher fertility of large crossbred cows, can only be utilized at a higher level of nutrition and management (Scholtz, 1988). Furthermore, Scholtz (1988) is of opinion that the continuous production of crossbred cows requires large managerial inputs.

Various authors (Venter *et al.*, 1987; Hetzel, 1988; Scholtz, 1988) stated that the role of indigenous African types eg. The Sanga or Nguni in different breeding systems demands further investigation. So far, several studies in Africa, as reviewed by Hetzel (1988) and confirmed by Scholtz *et al.*, (1993), proved that the Sanga, due to their adaptation, exceptionally high fertility and disease resistance, is ideally suited to be utilized as dam lines in terminal crossbreeding in more developed areas with a more complicated level of management. This research also found the Sanga group, mated to large frame bulls, as the most productive breeding group and is thus in agreement with previous reports by Hetzel (1988) and Scholtz *et al.*, (1993). Calving difficulties are absent and due to the high fertility and lower maintenance requirements of the smaller dam, which produces large offspring, a higher productivity is realized.

REFERENCES

Els, D. L., 1988. Kruisteling vir vleisproduksie. PhD thesis, University of the Orange Free State.

HETZEL, D. J. S., 1988. Comparative productivity of the Brahman and some indigenous Sanga and Bos indicus breeds of East and Southern Africa. *Anim. Breed. Abstr.* 56, 243.

LEPEN, J. M., 1990. 'n Vergelykende produksie-evaluering van die Nguni in intensiewe en ekstensiewe stelsel. M.Sc. (Agric)- verhandeling, Universiteit van Pretoria.

LEPEN, J. M., 1992. Evaluation of the productivity of six cattle breeds in Namibia. Progress report on research activities in Namibia. 71-80.

MAREE, C. & CASEY, N. H., 1993. Livestock production systems. Principles and practice. Agri-Development Foundation. Pretoria.

MAULE, J. P., 1973. The role of the indigenous breeds for beef production in Southern Africa. *S. Afr. J. Anim.* Sci. 3, 111.

MOYO, S., 1990. Evaluation of the productivity of indigenous cattle and some exotic beef breeds and their crosses in Zimbabwe. International Livestock Centre for Africa (ILCA) Research fellow, October 1 to December 31, 1990.

SCHOEMAN, S. J., 1989. Recent research into the production potential of indigenous cattle with special reference to the Sanga. *S. Afr. J. Anim. Sci.* 19(2), 55-61.

SCHOLTZ, M.M., 1988. Selection possibilities of hardy beef breeds in Africa: The Nguni example. Proc. 3rd. Wrld. Cong. Sheep & Beef Cattle Breed (Paris) 2, 303.

SCHOLTZ, M. M., LOMBARD, P. E. & ROUX, C. Z., 1993. Terminal crossbreeding as a breeding strategy for beef cattle in Africa. *Livestock Prod. Sci.* 1-16.

TRAIL, J. C., BUCK, N. G., LIGTH. D., RENNIE, T. W., RUTHERFORD. A., MILLER, M., PRATCHETT, D. & CAPPER, B. S., 1977. Productivity of Tswana, Tuli and crossbred beef cattle in Botswana. *Anim. Prod.* 24: 57-62.

VAN ZYL, J. G. E., 1990. Studies on performance and efficiency of pure and crossbred cattle in an arid bushveld environment. PhD thesis, University of Pretoria.

VENTER, H. A. W., VAN ZYL, J. G. E. & COERTZE, R. J., 1987. Evaluation of systems of straight- and crossbreeding in beef cattle in the R. S. A.