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CROSSBREEDING WITH AFRICANDER DAM AS BASIS . 3. POST-WEANING GROWTH PERFORMANCE OF PROGENY OF VARIOUS SIRE-BREEDS

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OPSOMMING: KRUISTELING MET AFRIKANERKOEI AS BASIS : 3. NASPEEN-GROEIPRESTASIE VAN NAGESLAG VAN VERSKILLENDE VAARRASSE

Naspeen-groeiprestasie van 342 osse, afkomstig uit Afrikanerkoeie en Afrikaner-, Brahman-, Charolais-, Hereford- en Simmentalerbulle, is bestudeer. In 'n stelsel van intensiewe vetmesting, het laasgenoemde drie *Bos taurus* vaarras nageslaggroepe opvallend beter presteer as eersgenoemde twee *Bos indicus* vaarras nageslaggroepe. Onder ekstensiewe veldtoestande het alle kruisgeteelde groepe egter die Afrikanerkontroles geklop. Die nageslag van beide *Bos indicus* bulrasse het onder ekstensiewe toestande relatief beter presteer as onder intensiewe toestande. Die Simmentalerkruise het ook onder ekstensiewe toestande relatief beter presteer. Charolais- en Herefordnageslag het egter in 'n stelsel met 'n verbeterde voedingspeil relatief die beste presteer.

SUMMARY:

Post-weaning growth performance was studied for 342 steers out of Africander cows and by Africander, Brahman, Charolais, Hereford and Simmentaler sires. In a system of intensive fattening, the latter three *Bos taurus* sire-breed progeny-groups performed strikingly better than the former two *Bos indicus* sire-breed progeny-groups. Under ranching conditions, however, all crossbred groups outperformed the Africander controls. The progeny from both *Bos indicus* sire-breeds performed relatively better under ranching conditions than under intensive conditions. The Simmentaler crossbreds also performed relatively better under the extensive conditions. Charolais and Hereford progenies, however, performed relatively better in the improved nutritional system.

According to reviews of research on growth of cattle in Southern Africa (Naudé, 1965; Maule, 1973), it is well established that the purebred Africander lacks growth ability. It is thus reasonable to expect an increased growth potential when Africanders are crossbred. The degree of such improvement, the effect of various types of exotic breeds of sires and their interaction with the production system, however, need further investigation.

It is generally accepted that efficiency of beef production, as far as the slaughter animal is concerned, is mainly affected by rate of growth and feed conversion. However, as regards the production situation of the South African cattle farmer, it is of the utmost importance to consider additional aspects concerning efficiency of beef production in terms of net output per hectare. For instance, in order to cope with a planned balance of breeding stock and store animals on a well managed cattle farm, the latter must reach an acceptable finish within certain limits of age or seasons of the year. Furthermore, it is as far as is possible, economically desirable for a farmer to strive for a maximal turnover rate, whether he deals with feedlot animals or stores. The market demand for certain types of carcasses and the existing grading systems, must also be borne in mind. It is against this background that the growth performance of various Africander crossbred slaughter animals was examined in order to provide a greater degree of insight into the results which can be achieved.

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Procedure

Material

A total of 342 steers, comprising purebred Afrikander and crossbred Africander by Brahman, Charolais, Hereford and Simmentaler bulls were used in this study. The origin of the material has been described by Mentz, Coetzer & Els (1975).

Treatments

It was the aim of this study to simulate two production systems which are currently widely used in commercial beef production in Southern Africa. The treatments applied were as follows:

- Early slaughter system (ES): after being on veld for one post-weaning summer period, animals were brought into the feedlot for a 118-day individual fattening period on a corn-and-cob ration supplemented with protein and minerals. The average age of the animals at the end of the fattening period was 20 months.

- Late slaughter system (LS) : animals remained on veld grazing for a period of another year until the commencement of their second post-weaning winter. They received a standard phosphate : salt lick during summer, supplemented with protein (urea) during the winter. The average age of the animals at the end of the treatment was 29 months.

During the first year of the four-year study sufficient steers were available for only the early slaughter treatment.

Statistical analysis

Analysis of data followed the same pattern as reported by Mentz *et al.* (1975) with the exception that multiple comparisons were conducted by the method of Bonferroni (Miller, 1966). The effect of sire-breed, year, weaning date (covariant) and first order interactions were considered as possible sources of variation in the analysis.

Results

General growth performance

The mean squares for final mass and average daily gain of the steers in the two treatments (Table 1) indicate that all sources of variation had a highly significant effect on these variables. Furthermore, all first order interactions in respect of final mass and average daily gain were significant. The interaction between sire-breed and year could be due to the introduction of a new set of sires per breed each year, whilst the interaction between year and treatment appears to be due to the yearly variation in nutritional level of the veld, thereby affecting the performance of the steers in the late slaughter treatment. The interaction between sire-breed and treatment in respect of final mass and average daily gain is illustrated in Fig. 1.

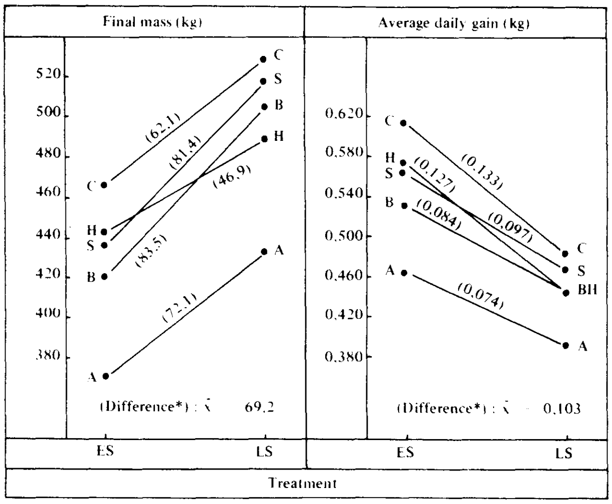
It is apparent (Fig. 1) that the sire-breed groups were not consistent in their response to the treatments. Comparing the relative performance of the sire-breed groups between treatments on the basis of their final mass and average daily gain, it appears possible to classify the Charolais and Hereford progeny as animals most likely to perform well on the early slaughter treatment. Conversely, the Africander, Brahman and Simmentaler progeny appeared to be relatively better adapted to the conditions of the late slaughter treatment.

Table 1

Mean squares for weaning mass, final mass and average daily gain (ADG) of steers

Source	df	Weaning mass	Final mass	ADG
Sire breed	4	7 715**	73 076**	0,129**
Year	3	16 839**	12 549**	0,093**
Treatment	1	163	329 041**	0,729**
Sire breed x year	12	404	2 554**	0,005**
Sire breed x treatment	4	531	2 890**	0,011**
Year x treatment	3	121	2 725**	0,028**
Covariant(1)	1	9 517**	12 333**	0,102**
Error	283	374	916	0,002

(1) Date of weaning *P <0,05 **P <0,01



*Difference between ES and LS values
A, B, C, H and S : Abreviations of sire breeds involved

Fig. 1 *Interaction between sire-breed and treatment for final mass and average daily gain*

The actual performance figures for the different progeny groups are presented in Table 2. The most striking result is the excellent performance of all the crossbred groups, and especially the Charolais progeny, as apposed to the Africander controls.

Performance of early slaughter steers during fattening

The mean squares for average daily gain, feed intake and feed conversion of steers during intensive feedlot fattening (Table 3) show that both the factors, sire-breed and year, affected the results significantly. As previously mentioned, the significant sire-breed x year interaction for average daily gain and feed conversion may be attributed to new sets of bulls per sire-breed used each year. The least squares means for the three variables studied are presented in Table 4.

Table 2

Least squares means for weaning mass and average daily gain (ADG) of steers (kg)*

Independent variables	n	Weaning mass	Final mass	ADG
Overall average	312	194,0	462,1	0,499
Sire breed				
Africander	84	175,5^{a}	407,1^{a}	0,429^{a}
Brahman	69	199,5^{b}	463,0^{b}	0,489^{b}
Charolais	49	203,1^{b}	497,7^{c}	0,551^{c}
Hereford	64	193,0^{b}	465,8^{b}	0,511^{bd}
Simmentaler	46	199,0^{b}	477,1^{b}	0,517^{d}
Year				
1968	106	200,7^{a}	445,6^{a}	0,464^{a}
1969	69	198,6^{a}	478,9^{b}	0,502^{b}
1970	82	171,1^{b}	465,7^{c}	0,545^{c}
1971	55	205,7^{a}	461,2^{c}	0,486^{d}
Treatment				
Early slaughter	155	194,8^{a}	427,5^{a}	0,551^{a}
Late slaughter	157	193,3^{a}	496,7^{b}	0,448^{b}

*Means within each factor that do not have at least one common superscript differ significantly ($P < 0,05$)

Table 3

Mean squares for average daily gain (ADG), feed intake and feed conversion during fattening

Source	df	ADG	Feed intake	Feed conversion
Sire breed	4	422 862**	10 798 040**	28,467**
Year	4	520 801**	1 623 603**	66,237**
Sire breed x year	16	48 346**	945 947	7,173**
Covariant (1)	1	50 181	494 157	22,620**
Error	159	24 499	576 411	3,298

(1) Date of weaning * $P < 0,05$ ** $P < 0,01$

Table 4

Least squares means for average daily gain (ADG), feed intake and feed conversion during fattening*

Independent variables	n	ADG (g)	Feed intake (g)	Feed conversion (kg)
Overall average	185	915	8 715	10,05
Sire breed				
Africander	50	774^{a}	7 851^{a}	11,03^{a}
Brahman	29	780^{a}	8 454^{b}	11,07^{a}
Charolais	35	1 018^{b}	9 000^{cd}	9,00^{b}
Hereford	26	1 016^{b}	9 146^{d}	9,25^{b}
Simmentaler	45	966^{b}	9 125^{d}	9,80^{b}
Year				
1967	30	971^{a}	8 916^{a}	9,42^{a}
1968	54	1 073^{b}	8 744^{bd}	8,23^{b}
1969	34	791^{c}	8 898^{a}	11,79^{c}
1970	40	791^{c}	8 454^{c}	11,26^{c}
1971	27	947^{a}	8 664^{d}	9,46^{a}

*Means within each factor that do not have at least one common superscript differ significantly ($P < 0,05$)

It is apparent from Table 4 that the three *Bos taurus* sire breed progeny groups performed strikingly better than the corresponding *Bos indicus* groups in respect of all three characteristics. Within these two comparable groups the data revealed very little difference between sire-breed progenies. Indeed, the Brahman progeny, although F1-crossbreds, differed very little from the Africander controls in performance during intensive fattening. From appropriate calculations it was evident that their accumulative gain was only 3,3 per cent greater than that of the controls as opposed to 31,4 per cent, 30,1 per cent and 24,7 per cent improved accumulative growth of the Charolais, Hereford and Simmentaler progeny groups, respectively.

Performance of late slaughter steers on veld as store-oxen

The mean squares for mass of steers at different stages in the late slaughter treatment are presented in Table 5. From these figures it is clear that sire breed and year had a significant effect on the results throughout the treatment. The least squares means for the data are presented in Table 6.

Table 5

Mean squares for mass of steers on veld at different stages

Source	df	Weaning	Age in months (1)				Final mass
			12	16	20	24	
Sire breed	4	3 570**	8 039**	15 047**	19 358**	22 655**	33 944**
Year	3	8 863**	1 585**	9 728**	37 230**	27 335**	10 953**
Sire breed x year	12	517	817	874	1 167	1 381	2 011*
Covariant (2)	1	4 058**	429	1 711	3 973*	3 299*	4 055*
Error	136	413	458	608	658	796	1 033

(1) Interpolated from monthly weighings
(2) Date of weaning
* $P < 0,05$
** $P < 0,01$

Table 6

Least squares means for mass of steers on veld at different stages (kg)*

Independent variables	n	Weaning	Age in months(1)				Final mass
			12	16	20	24	
Overall average	157	192	224	300	353	379	495
Sire breed							
Africander	42	177[a]	199[a]	265[a]	314[a]	336[a]	445[a]
Brahman	25	200[bc]	232[b]	309[bc]	365[bc]	391[bc]	503[bc]
Charolais	32	200[b]	237[b]	319[b]	374[b]	410[b]	527[b]
Hereford	24	186[ab]	217[c]	294[c]	347[c]	371[c]	486[c]
Simmentaler	34	200[b]	233[bc]	312[bc]	367[bc]	393[bc]	516[b]
Year							
1968	52	198[a]	233[a]	284[a]	311[a]	341[a]	478[a]
1969	35	198[a]	219[b]	311[b]	371[bc]	394[b]	519[b]
1970	42	168[b]	224[ab]	316[b]	377[b]	382[c]	498[c]
1971	28	205[a]	219[ab]	288[a]	355[c]	398[b]	486[ac]

(1) Interpolated from monthly weighings
* Means within each factor that do not have at least one common superscript differ significantly ($P < 0,05$)

The Brahman, Charolais and Simmentaler progeny had significantly greater weaning masses than the Africander controls, but at any later stage, all crossbred groups differed significantly from the controls. The accumulative mass increases of the Brahman, Charolais, Hereford and Simmentaler progeny were respectively 13,1 per cent, 22,0 per cent, 11,9 per cent and 17,9 per cent greater than that of the controls over the total period.

Discussion

The relatively poor growth performance of the *Bos indicus* sired groups, namely purebred Africander and Brahman crossbreds, during intensive fattening, confirm the results of numerous studies in which a decreased performance was observed with an increase in *Bos indicus* breeding (Damon, McCraine, Crown & Singletary, 1959; Rogerson, Ledger and Freeman, 1968; Brown and Cartwright, 1969; Maule, 1973; Mentz, Coetzer, Vermeulen and Coetzee, 1974; Willis, Menchaca and Preston, 1974; Moore, Essig & Smithson, 1975). In addition, it is clear that the Brahman crossbreds hold no advantage over purebred Africander in intensive production systems, whilst both aforementioned breed groups performed relatively better in the extensive than in the intensive production system. In the extensive production system the Brahman crosses outweighed the Africander controls by 13,1 per cent comparing favourably with the *Bos taurus* crossbred groups. This potential of the Brahman crossbreds is in agreement with the results of studies which indicated a satisfactory performance of Brahman crossbreds under semi-extensive or extensive conditions (Moran, 1970; Kennedy & Chirchir, 1971; Frisch, 1972; Joandet, Fitzhugh, Bidart & Molinuevo, 1973).

The difference in response to treatment between the Simmentaler crosses, on the one hand, and the Charolais and Hereford crosses on the other, is inexplicable. According to information on the potential of the continental large frame breeds (Cundiff, 1970; Cunningham, 1972; Naudé, 1974; Smith, Laster, Cundiff & Gregory, 1976), it might have been expected that the Simmentaler crosses would equal, to a certain extent, the response of especially the Charolais crosses to the treatments applied. The Charolais and the Hereford crosses can be singled out for their excellent performance during intensive fattening. Under ranching conditions in the late slaughter treatment, however, the Hereford crosses performed less favourably as regards final mass and mass gain. This could probably be explained as being due to the fact that the Hereford represents an early maturing cattle breed.

The present investigation was conducted to gain greater insight into the possibilities inherent in breeding the Africander to exotic breeds, and to evaluate the potential of the resultant crosses in certain production systems. Thus, although a study of the efficiency of growth *per se* did not fall directly within the scope of this study, a few remarks in this regard are appropriate. From research reviewed by Warwick & Cobb (1976) it appears that genetic differences in true maintenance cost are small. Therefore, the cattle breeder need not consider these differences in breeding programs. As regards the slaughter animal, the crux of a breeding system appears to be primarily a question of selecting the optimum genotype for a given production situation in terms of adaptation, carcass mass and carcass composition at a given age. Information on the carcass aspects of the animals in this investigation will be reported in a subsequent paper. It may be concluded that the present investigation confirms the significant sire-breed and treatment interaction for post-weaning growth as discussed in the review by Preston & Willis (1970). Furthermore, a variable degree of post-weaning growth improvement was demonstrated by Africander crossbreds in comparison with purebred Africander, depending upon the production system and breed of sire employed.

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