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THE ROLE OF THE INDIGENOUS BREEDS FOR BEEF PRODUCTION IN SOUTHERN AFRICA

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In this paper I propose to discuss the performance of the indigenous breeds of Southern Africa, wherever possible making comparisons with European (exotic) breeds and crossbreds. Much of this, I know, will be familiar to you. However, it is an opportunity to look at the potential of the indigenous stock and to consider in what way they could contribute to increased meat production in Southern Africa.

In discussing the role of the indigenous breeds, there are 2 points, in particular, to keep in mind:

(1) The indigenous breeds form the bulk of the cattle owned by the African peoples throughout Southern Africa; thus, for example Joubert and Boyazoglou (1972) give the number of indigenous (or "non developed") cattle in South Africa in 1970 as 4,6 million out of a total of 12,6 million. 40% of the total are owned by Bantu farmers. (Hirsel, 1968).

(2) The levels of husbandry and management and the attitude of many of the African people to their cattle are such that productivity is often extremely low and little or no increase in production through the introduction of improved "breeds" is possible until the traditional methods of husbandry are changed. Hisel *e.g.* (1968) reported that carcass weights of cattle owned by Bantu farmers had declined from 240 kg in 1944-45 to 196 kg in 1966-67 and that carcass quality had also tended to decline.

However, there is now an urgent need to develop improved types of cattle to meet the rapidly increasing demand for meat; this is true for much of Africa south of the Sahara and it has led, in several countries to a number of government sponsored schemes to produce cattle suitable for African renching, such as the Ankole Masaka scheme in Uganda (Trial, Sacker and Fisher, 1971). It is also worth mentioning here that with the latest techniques in the storage and transport of semen it is now possible to obtain comparatively large numbers of crossbred cattle without going to the expense of importing beef bulls.

Much of the research and development work carried out in Africa in the last 20-30 years has been concerned with the improvement of indigenous breeds for milk and less work has been done to compare indigenous breeds in respect of reproductive performance, growth, efficiency of feed conversion and so on. But, at the same time, considerable improvement in productivity of individual breeds had been achieved, to the point where, due to their hardiness they give a very good account of themselves in environments that would preclude the breeding of purebred "exotic" cattle. Some work has been carried out to compare European with indigenous breeds, presumably in better environments, *e.g.* at Omatjenne in South West Africa, though only one indigenous breed – the Africander – was originally included. (Borstlap 1964, 1969). Vorster's major crossbreeding study carried out in Rhodesia 20 years ago (Vorster, 1964) showed the disadvantages that attended the use of European breeds in a difficult environment.

The Indigenous Breeds.

In Table 1 I have listed the 12 basic breeds, with their related breeds or varieties ie: the Landim of Mozambique is shown as a variety of the Nguni. Of the 12 breeds only the Angoni is classified by Mason and Maule in *'The Indigenous Livestock of Eastern and Southern Africa,'* as a zebu, the remaining breeds all belong to the Sanga group.

With the possible exception of the Nguni and the Nkone all the indigenous breeds are primarily meat producers and the best known for its beef quality is the Africander. It is by far the most important breed numerically and is widely distributed throughout Southern Africa. I have not included the Boran, as it is a native of East Africa nor have I included the Brahman, which is of American origin but both breeds are important competitors of the indigenous breeds.

Much of the information on the productivity and performance of indigenous breeds comes from studies of single herds of one breed and with one exception no detailed comparisons of 2 or more breeds appear to have been made. Thus in Rhodesia studies of the Mashona, Tuli and Nkone have been and are being carried out at separate stations, but the 3 breeds have not been directly compared with each other. The exception I referred to is the project now in progress at Mazabuka in Zambia to evaluate two Zambian breeds (Angoni and Barotse), the Boran (introduced from Kenya a good many years ago) and the Africander; the 4 breeds are also being crossed with each other but at the moment only a limited amount of data is available.

In addition to the work at Mazabuka, comparisons of indigenous breeds or crossbreds (mainly with European breeds) are in progress at the Central Animal Breeding station in Mozambique, at a number of stations in Botswana where Tuli, Bonsmara and Africander bulls are being crossed with Tswana cows, at Vaalhartz Research Station in South Africa and at Neudam in South West Africa, and there may well be other work that I do not know about.

Some idea of the typical liveweights of the various breeds, can be obtained from the data in Table 2. These have been taken from various reports, and published papers

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Table 1.

The Indigenous breeds of cattle in Southern Africa.

	Recognised Basic breeds.	Related breeds and varieties.	Countries/areas where bred	Approx. numbers
1.	AFRICANDER		S. Africa and all neighbouring countries	8 000 000
		BONSMARA *	Transvaal	
2.	ANGONI		N.E. Zambia	175 000
		MALAWI ZEBU *	Malawi	
		Mozambique Angoni	Mozambique	
3.	BAROTSE		W. Zambia	
		Baila (Tonga x Barotse)	Kafue flood plain	275 000
		Angola (porto Amboin)	Angola	1 000 000
4.	BASUTO		Lesotho	
5.	DRAKENSBERGER	Uys	W. Natal	
		Tintern Black	N.E. part of O.F.S.	
6.	NGUNI	SWAZI *	Swaziland	500 000
		LANDIM *	Mozambique	100 000
		BAPEDI *	Transvaal	
		Bavenda (Sibasa)	N.E. Transvaal	
7.	NKONE	(Syn: Manguni) Govuvu	Metabeleland, Rhodesia	20 000
8.	MASHONA		Mashonaland, Rhodesia	
9.	OVAMBO		S.W. Africa	
		Kaokoveld (large variety of Ovambo)	S.W. Africa	
10.	TONGA	(Syn: Shorthorned Sanga)	Zambia	450 000
11.	TSWANA		Botswana	1 400 000
		Batawana	N.W. Botswana	
		Mangwato	E. Botswana	
		DAMARA *	S.W. Africa	
12.	TULI		S.W. Rhodesia E. Botswana	10 000

* indicates separate breed status, *vide Mason and Maule (1960).*

and from The Indigenous Livestock of Eastern and Southern Africa by Mason and Maule (1960).

Several writers refer to the wide variation found in adult liveweights within a breed or herd; thus Richardson (personal communication 1973) gives the range in adult body weight of Nkone cows as 350 to 550 kg and 2 separate reports on the Nguni herd at Mpisi give widely different average cow weights, *e.g.* at 1, 2, 3 and 4 years Report A gives: 357, 504, 646 and 696 lb and Report B gives 457, 645, 732 and 784 lb, differences of around 100 lb at each age. (Mahadevan 1964, John 1973).

The heaviest breeds are the Africander, Drakensberger and Bonsmara, bulls of all 3 weighing around 900 kg and cows over 500 kg. However, I could find no precise figures for the Drakensberger and it is possible that it is the heaviest of the three. The smallest breed is the Ovambo, with cows weighing about 160 kg. The Bavenda and Malawi zebu appear to come next. However, so much depends on the nutritional level and on husbandry that considerable range in liveweight of animals of comparable age within a breed has often been observed (*e.g.* Walker 1964, for the Angoni in Zambia).

In any assessment of the indigenous breeds the first consideration is their ability to survive and reproduce at a rate sufficient to provide a reasonable surplus for sale each year. I do not propose to deal with adaptability and hardiness but to confine myself to their performance traits, that is to say, growth, particularly to weaning, weaning weight, postweaning growth and fattening, especially in relation to age at slaughter. I will also have something to say about crossbreeding.

I would like to mention one point made by Helen Turner of Australia, namely that indigenous breeds, because of their adaptation to harsh environment, might prove

to be invaluable as experimental animals in any fundamental research into a clearer understanding of these adaptations (Turner, 1967).

Reproduction and Calf Survival.

Calving rate.

It is generally accepted that among the ordinary unimproved cattle in Africa, including inferior crossbred types, calving rates are extremely low and calf mortality is high. Boyens (1964) estimated the average birth rate in African herds as seldom exceeding 50% and often between 30 and 40%, and calf mortality at 20-25%. Morais Gradil (1970) gave a 16% annual calving rate and 34% conception rate. Without doubt low calving percentage and high calf mortality are the results of poor nutrition, poor husbandry and poor management. There are, too considerable seasonal effects, depending partly on when cows are mated as well as on their age and other factors and yearly calving data within herds can vary considerably. For example, in Vorster's crossbreeding experiment, the yearly calving percentages varied over the 13 years from 42% to 87%; the lowest calving

Table 2.

Adult Liveweights in kg.

BREED	L.W. of ♂♂	L.W. of ♀♀	steers	Reference
DRAKENBERGER	± 850			
AFRICANDER	± 817 (745/6yr)	± 590 (525/8yr)	450-650 (6 yr old of veld)	
BONSMARA	800-1000	550		
TULI	770-820	500-550		Rose, 1961 a & b
NKONE	727-820	455-500		Rhod. Fmr. 1970
BORAN	550-675	350-450 348-374	up to 660	Zambia: Ann. Rep. Res. Branch 1969
BAROTSE	580-710	400-485 357-387		Zambia Ann. Rep. 1969
ANGONI	545-725	325-475 311-350	600	Zambia Ann. Rep. 1969
MASHONA	545-660	320-410		
TONGA	500-560	300-360		
TSWANA	507	397	480	
NGUNI	430-680 590	225-450 360	590-725	Brown 1959 Mahadevan 1964
LANDIM	645	420 (elite) 300-420		De Pinto Morgato 1961b
BAPEDI	up to 680	360-520		
MALAWI Zebu		275-350		Malawi Vet. Dept. Ann. Rep. 1966.
BAVENDA		275-335		Mansfelt & Skinner 1962.
OVAMBO	230	160		Rouse 1970

Note: Where no reference source is stated, the data have been taken from Mason & Maule: The indigenous livestock of Eastern and Southern Africa (1960).

percentages generally occurring in years when rainfall was below average and a high calving percentage in one year often being followed by a low calf crop the next.

It is difficult to give overall breed averages for calving percentage partly because of seasonal effects but also because it is strongly influenced by nutrition and management. Yet, from scattered information in the literature some breeds do have a reputation for high fertility. The Boran is probably the outstanding breed in this respect, calving rates of 90-100% being no exception (Meyn, 1970) but both the Tuli and the Nkone in Rhodesia have a reputation for high fertility, whereas the reverse is true of the Africander.

Some idea of breed differences can be obtained from the data given in Table 3.

Although no breed comparisons are strictly possible, Vorster's data (1964) for the calving percentage of crosses between 'native' [? Nkone type] or European cows (Hereford/Africander crosses) and Hereford, Africander, Native or crossbred (A x H) bulls, over a period of some 12-13 years, are remarkable for the small differences that occurred between the various crosses: (see Table 4).

I have included data for the percentage of F_1 and F_2 calves reared from birth to 3 years, as these give some indication of the influence of breed on survival rate. Irrespective of the breeds of bull used in the F_1 the 'native' cows reared, on average 6,5% more calves than the "European" cows (significant at 5% level). Furthermore the survival rate of calves sired by Africander bulls out of either native or European cows was markedly lower and was lowest for calves with most European "blood". Vorster concluded that the mortality rate of calves tended to increase when either Hereford or Africander bulls were used.

Table 3.

Calving Percentages.

BREED	LOCATION	CALVING %	DATA and SOURCE
AFRICANDER (pedigree)	Matopos	58, 7-78	av. for 1959-69. Matopos Res. Sta. Ann Rep. 1969/70
AFRICANDER (grade)		69, 2-84	
Africander	Omatjenne	77,7	av. for 16 yrs. Omatjenne Ann Rep. 1967
AFRICANDER	"	71,2	av. for 5 yrs. Borstlap 1969
"	Mara	81,4	Joubert. 1959
"		64,0	for 62 ♀♀. Harwin *et al.* 1967
NGUNI	Mpisi	73,0	2609 Calvings. Mahadevan. 1964
BAPEDI		78,0	Hamburger, (1973).
LANDIM	Chobela	73,6	361 ♀♀ (1 yr av) Ribeiro 1969
		68,7	data for 1129 ♀♀ in 11 yrs. Do Amaral e Paiva, 1970
NKONE		78-90	Rhod. Fmr. 1970
	Tjolotjo	83-90	3 yrs av. at Tjolotjo. Matopos Res. St. Ann Reps 1967/68-190-71.
MASHONA	Chipero	74-91	1968-72 av. Holness 1973
TULI	Tuli	90-91	1950-59 herd av. Rose 1961
ANGONI	Mazabuka Zambia	82 (77-88)	5 yr av. 7th Ann Rep. C.R.S. Mazabuka Zambia.
BAROTSE		78 (58-90)	
BORAN		78 (69-82)	
ANGONI	Chalimbana ranch, Zambia	88 (84-94)	Zambia Anim. Prod. Res. Team Technical Repts 1968-69.
AFRICANDER		75.5 (61-89)	
MASHONA		84,3 (78-90)	
MALAWI ZEBU	Mikolongue	93,6	1 yr 79 ♀♀. Vet. Dep. Ann Rep. 1966.

Table 4.

Calving and Rearing Data among Rhodesian Crossbred cattle.

BREED. ♂ ♀	*Calving percentage of* Foundation ♀♀	"F_1" ♀♀	*Percentage reared from birth to 3 yrs* "F_1" calves	"F_2" calves
NN. Native x Native	59,7	60,9	87,7	82,1
AN. Afric, x Native	63,5	57,3	82,3	73,4
XN. crossbred x Native	63,0	64,0	81,6	74,6
AE. Afric. x European	61,3	60,0	81,2	73,2
HE Hereford x European	61,6	61,0	72,6	45,4
XE crossbred x European	59,0	57,2	74,2	61,4

In Table 5, I have summarised the calving and mortality data for some of the breeds reported by Borstlap (1969) for the Omatjenne experiment. As these data cover a period of not less than 9 years they must be among the most comprehensive obtained anywhere in Africa. Although the mortality data apparently include that of cows I have calculated the approx, percentage of calves reared (presumably to weaning but the author does not state up to what age his mortality data refer).

Hereford have the best record here, followed by 2 other European breeds but it is somewhat surprising that the Bonsmara and the Brahman x Africander are among those with the lowest rearing percentages.

Calf survival rate.

The importance of rearing a high proportion of calves born is obvious but few reports on the performances of a breed or herd state what percentage of the calves born are reared to weaning age and beyond. In order to be able to evaluate breed/herd performance in economic terms it would be convenient if all reports stated, in addition to calving and weaning percentages, the proportion of calves weaned as a percentage of all breeding cows in the herd, and also the survival rate of females to 3 years. I have only come across one example of the former; this was in the Annual Report of Makoholi Experimental Station in Rhodesia, in a study of beef cow productivity on veld grazing. In 3 successive calving seasons in one particular group the ratio of calves weaned to cows mated was 75,8, 72,6 and 71,6. (Rhodesia, Makoholi Exp., Station, Ann. Reps 1969/70, 1970/71 and 1971/72).

This expression, "percentage of calves weaned to cows mated" combines fertility, calf losses at birth and up to weaning, mothering ability and nutrition of the cow and so gives the most realistic figure on which to judge the success or otherwise of a beef enterprise.

Lactation stress

This is a conditon, more commonly found in zebu than in exotic breeds. A detailed study of reproductive per-

Table 5.

Average Calving and Mortality Rates at Omatjenne, S.W.A.

BREED	No. of Years In Average	Calving %	Mortality %	Reared %
Africander	16	77,7	1,9	76,0
Bonsmara	11	68,9	1,7	67,6
Brown Swiss	14	79,2	2,8	77,0
Brahman x Afr.	9	70,8	2,8	69,0
Hereford	16	85,7	3,6	82,6
Sussex	14	74,8	4,0	72,0
Simmental	16	84,1	2,7	82,0

Source: Ann. Rept. Omatjenne 1967.

formance in Africander and Sussex cows was made by Harwin, Lamb and Bisschop (1967), using data from a number of herds (including those at Armoedsvlakte and Kimberley research stations) over a long period and comprising roughly 5000 calvings. These data highlighted the better general performance of the Sussex cows and the proneness of the Africander to suffer from lactation anoestrus or stress, which almost invariably resulted in a low calving rate with the following pregnancy. The calving rate of lactating Africander cows was 61% *v* 84% for non-lactating cows whereas for Sussex cows the figures was 78 and 79% resp. This phenomenon has been reported by several other people in Southern Africa and by some researchers working with Brahman and other zebu cattle (e.g. Koger, Reynolds, Kirk, Peacock and Warnick 1962, Warnick, Meade and Koger 1960). This failure among some Bos indicus breeds and especially, so far as Southern Africa, is concerned, in the Africander, is obviously of considerable importance, and as the authors say is something requiring more research. In this connection, I think it is worth mentioning that in Queensland, Australia where Africander x British, Brahman x British crossbreds and crosses of Hereford x Shorthorn have been compared, the Africander x British crossbeds had the highest fertility rating and formed the basis of a new breed – the Belmont Red (Rural Research in CSIRO, 1970).

Harwin, Lamb and Bisschop (1967) showed the importance of breeding cows to calve at the optimum season which is in the spring and summer (*i.e.* from the end of October to end of January). Not only was the birth rate significantly higher than for cows calving in the winter but the calves born in spring and early summer developed faster. Similar results were obtained by Bonsmara and Skinner (1969).

The advantages of feeding supplementary protein to breeding cows have been demonstrated many times and can result in a markedly higher calving rate: e.g. at Matopos, over a period of 12-13 yrs. supplemented Africander cows had a calving rate of 81% v 68,3 for non-supplemented cows. (Matopos Res. Sta. Ann. Rep. 1970/71).

A characteristic of many Bos indicus breeds is that puberty is much later than in European breeds and heifers are often not mated until 3 and sometimes 4 years of age. Penzhorn and Meintzes (1968) showed that a medium to high level of feeding resulted in the first oestrus in Africander heifers occurring at 14-17 months v 22-26 months for heifers on a low to medium level; the weight of the heifers was almost the same (260-270 kg). A group of Africander x Hereford heifers on a fairly high level of feeding reached puberty at an average of 12,5 months when they weighed 260 kg v 13,8 months and 245 kg for a comparable group of Africander heifers.

I would like to round off this section by quoting from a report by McDowell (1966) of Cornell University, on the problems of cattle production in tropical countries. Among the many interesting calculations he gives, is one of the estimated requirements, in numbers of animals and hectares of pasture, to produce 50 saleable animals a year weighing 400 kg under 3 systems of management and assuming different calving and mortality rates.

I have reproduced his table for it illustrates perfectly the improvements in numbers of breeding cows and amounts of forage required when calving rate is doubled (from 35 to 70%) and calf mortality is reduced from 20% to 5%. Nothing I can add illustrates the overriding importance of obtaining the highest possible production of calves per breeding cow.

Weaning Weight.

One of the difficulties encountered in comparing weights is the fact that there is so much variation in the age at weaning both within and between herds. With calving taking place over a period of 3 months, if all calves are weaned on the same day they will vary in age from approx. 5 to 8 months at weaning. Early born calves are therefore at a considerable advantage. Despite the fairly numerous records of weaning weights in individual herds there are few studies giving comparative figures for weaning weights of two or more indigenous breeds or of indigenous and European breeds or crosses I have summarised some of the data in Tables 7 and 8. Where the Africander has been compared with European breeds *e.g.* at Omatjenne, or with crossbreds, as in Bosman and Harwin's (1967) data, the European breeds (with the exception of the Hereford) are heavier at weaning. Preliminary results at Vaalhartz indicate similar results. (Sievers, 1973).

The Mazabuka data for 2 Zambian breeds (Angoni and Barotse), the East African Boran and the Africander are of interest (see Table 9). These data, which are for 4 years show, firstly, the variation that occurs between years and secondly that in the 2 years when data for Africanders were included this breed was surpassed by the Boran, which had the highest weaning weight in 3 out of the 4 years. Although the Boran is the heaviest breed in East Africa it is not, I think, quite as large as the Africander; nevertheless its performance in Zambia could be of particular interest of breeders in Southern Africa.

I would also like to draw attention to the data from Mpisi in Swaziland in Table 9: they show that the weaning weights of Africanders were about the same as those of the Ngunis which are much smaller; this clearly reflects the Africander's unsuitability for the more humid climate in the low veld area of Swaziland.

There are several factors, apart from breed, which can influence weaning weight and which illustrate the importance of management in a breeding herd. Niemann and Heydenrych (1965) in the Orange Free State region found that weaning weight of Africander-type calves decreased by 2,9 kg/day for each week that a calf was born after October 1st and also that 6 to 8 year old cows produced the heaviest weaners.

Vorster (1964) obtained similar results in his long term experiment; with both native and crossbred cows weaning weights of calves decreased progressively from a peak for calves born in December and they also began to decline after the cows reached 7 years of age. Vorster also obtained a significant difference (of nearly 9 kg) in the weaning weight of calves whose dams calved for the first time at 5 years compared with those of cows calving at 4 years, though he did not suggest that this advantage outweighed other factors in deciding when to mate heifers.

The importance of the dam's milk supply is obvious; Heyns (1960) showed that Africander cows calving early in

Table 6.

Estimated requirements to produce 50 saleable animals per year under 3 levels of breeding efficiency and calf mortality.

	Systems		
	1	2	3
Cows (3 years and over)	350	160	90
Animals 4-5 years	78	61	56
3-4 years	80	63	56
2-3 years	83	64	56
1-2 years	85	65	57
8 months - 1 year	90	66	58
0-8 months	98	68	60
Total number calves born/year	122	80	63
Total number animals 8 months +	766	479	373
Total all ages	864	547	433
Cow replacements required	25	11	6
No. ha. forage required	2300	1440	1120
Gross income/year ($)	7200	7200	7200
Extraction rate (%)	6,5	10,4	13,4
Assumptions used in calculations.			
Calving percent/year	35	50	70
Calf mortality 0-3 months (%)	20	15	5
Animal losses 3 month-sale (%)	20	10	5
Cow losses/year (%)	10	7	7
Ha. req./animal 8 months +	3,0	3,0	3,0
Average age at sale (month)	55	55	55
Average weight at sale (Kg.)	400	400	400
Average price/Kg. ($)	0,35	0,35	0,35

Source: R.E. McDowell (1966) Problems of Cattle Production in Tropical Countries. Cornell, International Agricultural Development Mineograph, No. 17.

the season had a higher yield of milk than later calving cows (6,3 kg/day *v* 4,5 kg/day) and that the calf's gain in weight was significantly correlated with the dam's milk yield.

Several reports have stressed the benefits of protein and bone meal supplements to beef cows grazing on veld, both in terms of total weight of calf weaned per cow and in subsequent conception rate; e.g. Ward (1968) quotes an increase in 32% in weight of calf at weaning in the Makoholi Mashona herd and a conception rate of 76% *v* 38% for cows not receiving supplements. He also makes the observation that there is a critical "mating" weight range for Mashona cows of approx. 270-290 kg – below and above which they did not conceive. One other experiment is relevant for it shows that a high weaning weight is not necessarily essential for economic meat production. In a trial with Hereford x Africander crosses, groups of steer calves were reared on 3 levels of feeding such that they weighed 92, 136 and 191 kg respectively at weaning; thereafter the 3 groups were fed the same ration and were slaughtered at 28 to 32 months. It was found that the group reared on the low ration recovered so well after weaning that by the time they were slaughtered there was practically no difference between the groups; in fact the 2 groups lightest at weaning had the best feed conversion and carcass weights. The 'high' group graded better and was ready for slaughter 3,8 months before the low group. (Penzhorn and Von La Chevallerie, 1969).

In both South Africa and S.W. Africa and in Rhodesia, on-the-farm recording schemes have been in operation for a number of years. In South Africa over 80,000 records of 205-day weights of weaner calves of 16 breeds were obtained in 1967-70. Average daily gain from birth to 205 days and 205-day weight for 10 breeds and similar data for Rhodesia are given in Table 10.

Table 7.

Birth and Weaning Weights (kg) of Indigenous breeds

BREED	BIRTH WT. ♀	BIRTH WT. ♂	WEANING WT. ♀	WEANING WT. ♂	AGE (days)	LWG to Weaning	Reference
Africander	– 33,5 –						Heyns 1960
	– 31,0 ± 3,2		176		(210?)	0,69	Niemann and Heydenrych 1965
	31,0-33,5		159	172	210	0,61-0,66	Sievers 1972
	32,5		179 *				Joubert 1959
Bonsmara	34,0		206 *				
						0,64-0,8	Bonsma and Skinner 1969
Bapedi			143	150			
Nguni (Swazi type)	25	27	125	133	180	0,50	Mahadevan 1964
" (Bartlow combine)			150	165	180?	0,6-0,7	Hamburger 1973
" Landin	24,1	25,6	124,4	139,8	180	0,55	DoAmaral 1970
Nkone (Tjolojo)			185	186	180-200		Rhod. Agr. J. 1967
Nkone (mlezu)			171 *		205	0,83	Richardson 1973
Mashona	22-23 (♂ + ♀)		145	147	205	0,6	Makoholi Ann. Repts.
	23.5		113		230		Oliver, 1966
	–		132	154	–	–	Holness 1973
Angoni	22	24	135	155	270	0,4-0,5	Zambia Ann. Rep. Res. Branch. Cruikshank 1972
			122	128		0,6	Walker 1964
Malawi Zebu	20	21	103	109	180	0,46-0,49	Malawi Vet Dep. Rep. 1966
Barotse	25	27	156	185	270	0,6 0,7	Zambia Ann Rep. Res. Branch 1969-70 Cruikshank 1970
Tuli	32,7		218	255	270	0,7-0,9	Rose 1961

Note* = Weights corrected for sex.

As one would expect, the Charolais has the highest ADG in South Africa but not in Rhodesia. I would draw attention to the good performance of the Drakensberger in South Africa and of the Bonsmara (but only 10 calves) in Rhodesia. The 463 Drakensberger calves had a daily gain of 0,9 kg (almost 2 lb) and a 205-day weight of 214 kg.

On the other hand, the Africander's growth rate is not as good as those of the Brahman and the Bonsmara.

The Rhodesian figures are not up to date, so that the data for the Nkone and Tuli, which are disappointing, may well have improved in the last 3 years.

Post Weaning Growth.

Performance Test Data.

Performance tests have become the accepted method of evaluating beef bulls on their post weaning growth and are now being carried out in Botswana, Malawi and Zambia as well as in Rhodesia and South Africa. They have the obvious merit of comparing individual bulls of different breeds under standard, controlled, conditions of feeding and management. Although pen feeding is the usual method employed, it could be argued that for bulls which are likely to sire cattle to be reared for slaughter mainly, if not entirely, on veld grazing the bulls should be tested on grazing, or on simulated grazing, rather than on pen feeding. So far as I know only in Zambia had this been done, on a very small scale. Table 11 shows the number of bulls tested at central testing stations in South Africa, Zambia, and Malawi since testing began, up to 1970/71, In Rhodesia, Station testing of individual breeds is carried out at separate centres for each breed: *i.e.* 280 Mashona bulls have been tested at Makoholi between 1966 and 1972, and 143 Nkone bulls have been tested at Mlezu since 1966. Details are given in Table 12. Table 13 gives the results of performance tests of 4 indigenous and 4 (out of 12 tested) exotic breeds obtained at Irene for 2 separate periods, 1963-68 and 1969-71. In the first period bulls were 6-9 months of age when accepted and were given a 42-day settling-in period to accustom them to test conditions; the test lasted for 140 days. Since 1969 age at entry has been increased to 7-10 months with a 70-day settling-in period, so that bulls were 9-12 months old at the start.

Unfortunately, apart from the Africander, the number of bulls of the other indigenous breeds were hardly sufficient to make a reasonable judgement of their performance compared with that of bulls of the exotic breeds, but, of the indigenous breeds, both the Bonsmara and the Drakensberger had higher live weight gains and better feed

Table 8.

Comparative Weaning Weights (kg.) of Indigenous & Exotic Breeds

BREEDS	Weaning Weight	Age at Weaning days	Source
Africander (1 Herd)	154	210	Bosman and Harwin 1967
Crossbreds (6 Herds)	162 - 187		
Africander	179,1		
Bonsmara	206,8	240	Joubert 1959
Hereford	176,8		(Data from Mara Res. Station)
Africander	184	240	Omatjenne data for 10 yrs. (Borstlap 1967)
Bonsmara	196		
Hereford	184		
Brown Swiss	225		
Simmental	227		
Angoni	140 - 163	210 - 240	C.R.S. Mazabuka data for 4 yrs. (Zambia Dept. Agr. Ann. Reps. Res. Branch 1969, 1970)
Barotse	156 - 185		
Boran	167 - 180		
Africander	159 - 170		
Africander	172 159	210	Vaalhartz Res. Station Sievers, 1972.
Brahman x Africander	199 179		
Hereford x Africander	192 187		
Simmental x Africander	201 185		
Charolais x Africander	203 199		
Nguni	152 135	–	At Mpisi, Swaziland John, 1973
Africander x Nguni	148 139		
¾ Africander x ¼ Nguni	157 150		
Africander	152 140		

Table 9.

Weaning Weights (kg) over a 4 yr period at Mazabuka, Zambia.

Breed	Year Born and Date Weaned			
	1967 11/6/68	1968 11/6/69	1969 11/6/70	1970 11/6/71
ANGONI	144,6	163,5	146,0	140,8
BAROTSE	169,8	184,7	155,6	165,4
BORAN	166,6	180,6	171,0	171,2
AFRICANDER	159,3	–	169,8	–

Source: Zambia Dept. of Agriculture Ann. Rep. Research Branch, 1970.

Table 10.

On-the-farm breed records for A.D.G. and 205 day Weights (kg)

Breed	South Africa 1967-70						Rhodesia 1967-69		
	No. ♂♂ Tested	ADG* kg/ day	205 day Wt.	No. ♀♀ Tested	ADG*	205 day Wt.	No. Tested	ADG* kg/ day	205 day Wt.
Africander	4684	0,73	184	4908	0,65	167	80	0,70	176
Aberdeen Angus	131	0,69	174	106	0,64	162	20	0,78	183
Bonsmara	2603	0,81	201	2703	0,74	186	10	0,85	200
Brahman	348	0,81	202	366	0,70	177	–	–	–
Charolais	56	1,04	253	50	1,01	246	37	0,82	209
Drakensberger	463	0,88	214	427	0,80	198	–	–	–
Hereford	1011	0,77	191	1092	0,68	172	265	0,77	190
Mashona	–			–			44	0,63	152
Nguni	506	0,59	147	556	0,53	132	–		
Nkone	–			–			3	0,78	183
Simmental	2026	0,82	204	2159	0,75	189	–		
Sussex	358	0,91	220	263	0,81	198	86	0,82	202
Tuli	–			–			21	0,71	178

Source:– D.J. Bosman, Personal Communication.

NOTE: A.D.G. = Av. daily gain from birth to 205 days.

conversion than the Africander. However, the range in average daily gain in both periods suggests that there is scope for selection; the top Bonsmara bull gained 1,75 kg/day compared with 2,06 kg/day for the top Simmental bull. Nguni bulls were much the lightest of the indigenous breeds.

The Zambian Performance Tests

These differ from others reported in Southern Africa in that the 121 bulls of 4 breeds (41 Angoni, 31 Barotse, 42 Boran and 7 Hereford) selected for testing have been subjected to 4 consecutive tests, as follows:–

P.T.1. July-Oct. 1967 in pens on ad lib feeding (110 days)
P.T.2. Dec. 1967-April 1968 on veld (105 days)
P.T.3. July-Oct. 1968 in pens on ad lib feeding (110 days)
P.T.4. Nov. 1968-Mar. 1969 on veld (121 days)

The bulls were all born in Sept-Dec 1966 and at the start of the 1st test were approx. 7-9 months old and at the end of the 4th test, about $2\frac{1}{2}$ years old. Their weaning weights and liveweight gains in each test are given in Table 14. The main conclusion drawn from these results was that pen feeding tests will not select the best bulls for use on veld grazing. Herefords will outgain the African breeds on pen feeding but are inferior when tested on grazing alone; in fact they lost weight in the 4th test when the other breeds all gained slightly in weight. Of the 3 African breeds, the Barotse is shown to be later maturing than the other two but the Boran compared very favourably with the both Zambian breeds, being about equal to the Barotse and better than the Angoni. The results are given in Table 14. The latest report of this experiment (Zambia; Dept. Agric., Annual Rept. Research Branch 1970; Cruikshank, 1972) gives correlations between the weights at different tests and

Table 11

Numbers and Breeds of Bulls tested at Progeny Testing Stations, 1963 - 1971

BREED	Numbers tested by period					
At IRENE, SOUTH AFRICA				**1963 - 68**	**1969 - 71**	**Total**
AFRICANDER				436	200	636
BONSMARA				4	136	140
DRAKENSBERGER				6	2	8
NGUNI				–	25	25
BRAHMAN				44	3	47
EXOTIC BREEDS				490	564	1054
Totals				980	930	1910
At MAZABUKA, ZAMBIA			**1967 - 69***	**1970 - 72+**	**1971 - 72°**	**Total**
ANGONI			43	76	51	170
BAROTSE			34	57	25	116
BORAN			43	50	40	133
HEREFORD			12	–	–	12
OTHERS			12	–	29	41
Totals			144	183	145	472
At CHITEDZE, MALAWI	**1966**	**1967**	**1968**	**1969**	**1970**	**Total**
MALAWI ZEBU	59	82	71	94	82	388

NOTE: * 4 Tests - 2 on Veld 2 in Pens
+ Tested on Veld only
° Tested on Veld 1971/72
in Pens 1972
On Veld 1972 - 74

between liveweight gains over the different periods. The correlation between weaning weight (180 days) and weights at the end of each test was highest for the Angoni, closely followed by the Boran; it was much less for the Barotse. The repeatability of liveweight at weaning was high. The weights at the end of the first veld test are correlated with those in the first feed-lot test (PT2) only in the Angonis, indicating that only Angonis could be selected on the basis of a feed lot test.

Walker (1964), who worked with the Angoni at Mazabuka, concluded that it had a high potential for meat production and that steers reached their optimum weight and condition, under well-managed natural environmental conditions, at about 3 years. Both the Zambian Angoni and the Malawi Zebu – which is of Angoni type – though smaller than the other Zambian breeds have given a good account of themselves in performance tests.

Malawi Performance Tests.

These began in 1966 and data for 5 years are available. Each test runs for 120 days and bulls are about a year old at the end of the test. The top bulls in each test have subsequently been progeny tested.

The results for the 5 years show that the average daily gain on test varied between years from 0,82 kg/day to 0,98 kg/day and corrected 165-day weight from 216 kg to 245 kg. (Malawi. Min. of Agric. and Nat. Resources, 1971).

In Botswana, comparisons of 4 purebreeds – Tswana, Tuli, Brahman and Africander – have shown only small differences in weight at 1 year, Tuli being the heaviest at 193 kg and Africander the lighest at 181 kg, a difference of 12 kg which was significant (Botswana, Min. Agric., 1973).

I should like to make one observation on bull evaluation. In Britain the main criterion of a bull's evaluation is his 400-day weight; his relative performance is the difference between this weight and the mean 400-day weight of all bulls on test. Daily gain on test and from birth to end of test are also given. This is an extremely convenient and easy way of comparing bulls and I wonder whether a similar standard age at which to compare bulls' performance might not be an advantage in Southern Africa.

Growth from 1 to 3 Years.

Much of the information on the weights of indigenous breeds from the age of 1 year is scattered in numerous reports and I have not attempted to deal with this in any detail. However, there is one experiment I must mention, as it concerned 3 indigenous breeds, Angoni, Mashona and Africander plus Hereford and commercial cattle; This was carried out by the Zambian Animal Productivity Research team and is described in the NCSR report for 1970-71.

Among the conclusions were the following:–
Although the larger breeds, Africander, Hereford and Commercial (which were South Devon x Africander crossbreds) made the largest overall gains from 9 to 18 months whether

Table 12.

Summary of Rhodesian performance test results.

BREED	YEAR	No. Bulls Tested	ADG kg/day	Av. Wt. at end of Test yr. kg	Range in Final Wts. kg	Feed Conversion
MASHONA	1966	24	1,00	302	270 - 353	6,81
	1967	29	0,96	270	207 - 320	7,70
	1968	43	1,00	290	203 - 365	-
	1969	41	0,74	261	219 - 319	-
	1970	41	0,87	279	195 - 384	-
	1971	51	0,88	299	236 - 364	-
	1972	51	0,86	292	236 - 368	-
NKONE	1966	26	1,08	325	274 - 383	7,12
	1967	25	1,08	291	198 - 341	6,34
	1968	25	1,13	305	238 - 348	6,42
	1969	27	1,06	317	236 - 430	7,00
	1970	16	1,02	312	280 - 370	7,30
	1971	24	1,07	319	274 - 345	7,03

Source: NKONE Data from MLEZU (F.D. Richardson, personal communication)

MASHONA Data from MAKOHOLI (Makoholi Exp. Station Annual Reports and Ward, 1972).

Table 13

Performance tests at Irene, South Africa
For (1) 1963-68 (2) 1969-71

BREED		Number of bulls	A.D.G. kg/day	Final Wt.* kg (1)	(2)	A.D.A. kg	Feed Conversion	Range in A.D.G.
Africander	(1)	436	0,96	359		0,80	8,22	0,42 - 1,39
	(2)	200	1,08		410	0,81	7,56	0,78 - 1,44
Bonsmara	(1)	4	1,43	460		0,97	6,19	1,38 - 1,52
	(2)	136	1,27		481	0,97	7,47	0,92 - 1,75
Drakensberger	(1)	6	1,12	416		0,93	7,20	0,89 - 1,23
	(2)	2	1,13		546	0,99	7,44	1,04 - 1,22
Nguni	(2)	25	0,99		367	0,70	7,53	0,81 - 1,21
Hereford	(1)	188	1,20	416		0,93	7,68	0,74 - 1,54
	(2)	94	1,13		546	1,00	7,35	1,06 - 1,64
Sussex	(1)	86	1,16	431		1,10	7,14	0,60 - 1,63
	(2)	28	1,26		513	1,02	8,11	0,86 - 1,50
Simmental	(1)	146	1,42	488		0,97	7,72	0,59 - 2,06
	(2)	228	1,49		567	1,14	7,42	0,87 - 1,95
Charolais	(1)	4	1,45	518		1,18	7,01	1,65 - 1,69
	(2)	41	1,58		654	1,32	7,36	1,23 - 1,97

* Final Wt. (1) 1963-68 at 436 days
(2) 1969-71 at 479 days

NOTE: In the Series 1 (1963-68) bulls were 180 - 270 days of age on arrival and in Series 2 (1969-71) they were 210 - 300 days of age on arrival.

A.D.A. = Av. daily gain per day of age.

Source: D.J. Bosman, Personal Communication 1973.

Table 14

Liveweight gains during 4 performance tests of the same Bulls

(All weights in kg/day)

TEST	BREED		ANGONI	BAROTSE	BORAN	HEREFORD
	No. bulls tested		41	31	42	7
	Weaning Wt. (180 days) kg		135	158	163	195
	TYPE OF FEEDING & DAYS ON TEST		L.W.G./DAY			
PT 1	Pen.	110 days	0,91	1,08	1,03	1,40
PT 2	Veld	105 days	0,41	0,44	0,50	0,29
PT 3	Pen. adlib.	110 days	1,16	1,30	1,33	1,80
PT 4	On veld	121 days	0,28	0,40	0,28	- 1,04

Source: Cruikshank 1972, Zambia, Ann. Rep. Res. Branch 1970.

The results for the whole period from 9-30 months for heifers only are summarised below:–

Table 15

Breed gains in live weight from 9 to 30 mths (kg).

Breed	Initial L.W. (I.L.W.)	LW at 18 mth	A.D.G. 9-18 mth	gain/45 kg of I.L.W.	LW 30 mth	A.D.G. 9-30 m (638 days)	gain/45 kg of I.L.W. 9-30 m
Angoni	152	257	0,39	31,5	326	0,24	49,1
Mashona	158	257	0,37	28,8	326	0,23	45,6
Africander	170	285	0,42	30,8	369	0,31	53,1
Hereford	190	323	0,46	28,7	407	0,33	46,0
Commercial	194	323	0,47	30,3	398	0,33	46,0

Source: N.C.S.R. Zambia, 1970-71.

on grazing alone or with supplementary feed, when the breeds are compared on the basis of gain per unit of body weight, then the differences are very small; the same is true for the period from 18 to 30 months, with the Angoni having a small advantage over all the other breeds; the Mashona had the poorest results.

This shows that on the basis of gains per unit of initial weight the Africander gave the best results followed by the Angoni; the Africander responded better to winter supplementation than the Angoni.

Feeding indigenous cattle for slaughter: Age at slaughter.

The usual practice is probably to sell indigenous cattle straight off the veld with either no supplementary feeding or at best only small amounts, at about $3\frac{1}{2}$ to $4\frac{1}{2}$ years of age or more.

There are a number of experiments which show that a finishing ration fed for about 3 months enables cattle to be slaughtered at a younger age than would otherwise be possible. A typical example is provided by the work of Matopos Research Station, where supplementary feeding of Africander steers during the summer of 1969 and 1970 enabled them to be sold at 30 months of age, whereas other steers not fed in this way were not slaughtered until they were over 4 years, and although they produced slightly heavier carcasses they did not grade nearly as well.

It would be impossible for me to try to summarise all the experiments concerned with the effect of feeding on age at slaughter, carcass weight and quality and the economics of feeding, though I realise that this is extremely important. However, there are some points I wish to emphasize. The Omatjenne work involving some 10 breeds including Africander and Bonsmara showed two things:

1. That the dual-purpose breeds, such as the Simmental and Brown Swiss were outstanding in weight and quality of carcass and, with the Hereford, were more profitable than the Africander and Bonsmara though these breeds had the highest muscle/bone ratio at 30 months of age. Later when the Santa Gertruidis was introduced it surpassed all the breeds in profitability. (Venter and Luitingh, 1967; Borstlap 1969.)

2. That it was more profitable to finish cattle (both bulls and steers) at just under 2 years (± 22 mths.) than to feed them cheaply until they were $2\frac{3}{4}$ years and then finish them for slaughter or keep then on veld grazing until they were $3\frac{3}{4}$ years. Some of the data for carcass weights of steers at these ages are given in Table 16.

Von La Chevallerie (1969a) made a detailed compari- of 5 breeds, Africander, Drankensberger, Hereford, Brown Swiss and Friesland, under both intensive and semi-intensive regimes and found that the Africander grew more slowly than the other breeds. They required more feed per kg carcass gain but they produced as good as carcass as the Hereford and had a better dressing percentage. The Drakensberger had by far the heaviest carcass and graded better than the Brown Swiss which had the second heaviest carcass. The author commented that the Africander's poor performance when intensively fed is a cuase of concern because of its widespread use. In carcass grade the Africander was outstandingly good, comparing very favourably in fat covering over the longissimus dorsi muscle with the Hereford.

These results were confirmed in a second experiment (Von La Chevallerie 1969b) in which he compared Africanders with Friesian and Brown Swiss on 2 treatments – one in which steers were fed to 454 kg on simulated veld grazing + concentrates and the other in which steers were kept on veld grazing for 2 years and then given a finishing ration for 90 days before being slaughtered at 32 months. The results are summarised in Table 17.

The author points out that more attention should be paid to the selection of Africander bulls with a high rate of gain and better feed conversion.

However, despite the Drakensberger's merits in the first of these experiments, it is generally the case that when indigenous breeds are fed intensively they do not put on weight as fast as exotic breeds or crossbreds, which tend to produce better quality carcasses in a shorter time. This has been demonstrated in Kenya with Borans and Herefords; the latter having a much higher feed intake than the Borans and being twice as efficient in converting feed into liveweight gain (Rogerson, Ledger and Freeman 1968, and Ledger, Rogerson and Freeman, 1970).

Table 16.

Carcass weights & food conversion for steers slaughtered at 3 ages (kg)

Breed	22-Mth-old Steers			2¾ yr-old Steers			3¾ yr-old Steers
	ADG	Carcass Wt.	Food Conv.	ADG	Carcass Wt.	Food Conv	(Grazing only) Carcass Wtg.
Africander	0,63	211	11,6	0,64	240	15,1	231
Bonsmara	0,81	230	10,2	0,71	257	14,3	243
¾ Brahman x Afr.	0,60	203	11,2	0,67	248	14,3	235
Hereford	0,75	228	9,7	0,8	233	11,6	258
Simmental	0,88	232	10,2	0,82	271	12,2	273
Sussex	0,82	206	8,8	0,8	227	11,4	244

Source:– Annual Report, Omatjenne Experimental Station, 1967.

NOTE: In the 1st Group steers were stall fed for 120 at the rate of 0,45 kg per 45 kg L.W. plus hay.

The 2nd Group were stall fed for 94 days on 0,45 kg maize meal per 45 kg L.W. plus hay.

Table 17.

A comparison of 3 breeds on 2 systems of feeding.

	Treatment 1 (Intensive)			**Treatment 2** (Extensive + 90 days in feed lot)		
	A.	F.	BS	A.	F.	BS
Daily Gain (Kg/day)	0,43	0,6	0,63	0,7	0,94	0,9
Days to reach 454 Kg	672	518	509			
Total gain, weaning to Slaughter (Kg)				249	305	297
Carcass Weight (Kg)	250	238	239	233	240	251
Dressing %	54,6	51,9	52,3	55,1	54,6	55,2
Carcass grade (Max. 20 pts)	16,6	10,1	12,1	14,7	13,2	14,7
Total fat %	22,7	17,0	16,9	25,3	22,6	20,9
Total bone %	15,7	20,6	18,9	14,9	18,7	17,7
Total meat %	60,8	61,5	63,0	58,8	57,0	60,7

NOTE: A = Africander, F = Friesland, BS = Brown Swiss.

Source: Von la Chevallerie, 1969.

The possibilities of finishing indigenous cattle on high energy diets so that they can be slaughtered at around 2 years after a short feeding period has hardly been exploited. There are certainly difficulties involved, such as the fact that the indigenous breeds will not always consume all their concentrate ration. A serious disadvantage to the feeding of high-concentrate diets – that is diets with less than 25% roughage in them – has been enountered in Rhodesia. Elliott (1973) has found that a high proportion of both Africander and Mashona cattle on such diets develop laminitis, and besides going lame they also go off their feed; this condition is evidently uncommon in European breeds and crossbreds, but as Elliott points out is does suggest that the indigenous breeds cannot be used in intensive feed-lot systems of production unless some selection is undertaken to eliminate this trait.

The question of profitability is closely linked with that of carcass quality or finish, for the large European breeds which mature slowly can take longer and require more food to reach market condition than does tha Africander. Lombard has sent me a report of an experiment designed to compare carcass quality and optimum slaughter weight in 3 types of cattle when fed intensively. The 3 breeds he compared were Africander, Simmental (representing the dual purpose breeds) and Hereford (representing beef breeds). Groups of 5 steers of each breed were slaughtered at 340, 430 and 455 kg and the Simmental also at 545 kg. The Africander and Hereford breeds were fed for 130 days by which time they had reached 455 kg live weight but the Simmentals, because they mature more slowly, were fed for a further 70 days, a total of 200 days, by which time they had reached 545 kg. Although the Simmentals grew faster and were more efficient converters of feed, either on a liveweight or carcass weight basis, the longer period of feeding required to produce a satisfactory carcass meant that the profit margin was less. Herefords reached their maximum profit at ± 400 kg, Africanders at ± 425 kg and Simmentals at ± 545 kg. In assessing the results obtained from these 3 types of cattle Lombard drew attention to the fact that ability to convert feed into live or carcass weight is only one aspect of the economics of fattening; dressing percentage (highest in the Africanders), cost of feed, length of fattening period and value per kg of the carcass are equally important. In this trial the Africanders, partly because they were older and in good condition at the start, compared very favourably with the Herefords but this is not necessarily always the case. (Lombard 1970.)

This brings me to some extremely interesting work with the Boran which is being carried out in Kenya by Dr M.J. Creek and an FAO team in a large feed lot project. (Creek, 1971, 1972.)

They have developed a system of feeding Boran cattle that will produce a well-finished beast with a carcass of 180-200 kg after a 10 week period in the feed lot. They found that this is possible by adapting the ration to meet the particular metabolic requirements of the Boran; these cattle not only react differently to crossbred cattle in the feed lot, in that they can use a ration with more roughage and less concentrates (33/67) to better advantage than the usual ration of 67% concentrates and 33% roughage, but they also have the ability to put on fat at any age and in a much shorter time. Thus after 10 weeks in the feed lot the Boran yields a carcass with 24% fat, whereas the crossbreds, continue to grow bone and take longer to produce a carcass with the same finish as the Borans.

This is shown in the following figures:

	BORAN	CROSS-BRED
Days on feed	68	101
Maize grain in ration	39%	53%
Total gain in L.W. (kg)	76	143.5
Conversion ratio	5,7:1	7,5:1
Carcass weight (kg)	180	238
Fat % in carcass	24,9	26,0
Total quantity maize fed (kg)	170	569
kg maize/kg carcass	0,94	2,39

Dr Creek has compared both the unimproved Boran (obtained in N.E. Kenya) and the improved Boran from Kenya raches with large crossbreds (Charolais, Devon or Fiesian ♂♂ x Boran ♀♀) and small crossbreds (Hereford or Angus x Boran), over short (10 week) and long (16 week) periods in the feedlot and both the Boran groups consistently graded well after the short feeding period.

The importance of this work is that if other indigenous breeds react in the same way as the Boran, then provided the feed costs are not prohibitive, many more cattle could be finished at much younger ages, after a short feedlot period thereby increasing the quality of carcasses marketed and at the same time reducing the strain on the grazing land.

Creek estimated that if only 25% of the annual offtake in Kenya was to pass through a feedlot it would increase the offtake from 13 to 17% which with the heavier carcasses of improved quality would be worth over $ 60 million annually.

Crossbreeding.

I have been struck by the absence of any recent work to compare the performance of crosses between indigenous and European breeds, despite the fact that such crossbreeding is widely carried out commercially. Some work is in progress at Neudam in S.W. Africa and at Vaalhartz Research Station but few results are available from either station. Some indication of the liveweight at weaning (205-days) and at 1 year can be obtained from the On-farm records obtained in South Africa and South West Africa for crosses of exotic, Brahman and Africander bulls on Africander-type cows. For example, Simmental-sired heifers are heaviest (221 and 265 kg respectively for S. Africa and S.W. Africa), followed by Brahman-sired heifers (209 and 228 kg respectively). Crossbred Africander-sired heifers averaged 191 and 232 kg respectively and purebred Africanders average 205 and 196 kg respectively.

Crossbreeding between indigenous breeds is in progress at Mazabuka in Zambia, where Angoni, Barotse and East African Borans have been crossed with each other. Latest results are given in the Annual Report of the Research Branch of the Department of Agriculture for 1970. The amount of heterosis obtained in the crossbreds has

not been large – about 1,4% at birth, 2,5% in weaning weight and 4% in liveweight at 22 years. Almost certainly the amount of heterosis is less between two Bos indicus breeds than between a cross of a European and an indigenous breed.

In another crossbreeding experiment at Mazabuka, Angoni, Barotse, Boran and Africander cows are being bred to Hereford and Friesian bulls. The first crossbred calves were born in Oct.-Dec. 1970 and were weaned in June 1971. Weaning weights of steer and heifer calves are shown in Table 18. In all cases the crossbreds outweighed the indigenous parent breeds and one point of particular interest is that the Friesian crossbreds were heavier than the Hereford crossbreeds. In Botswana, crosses are being made between Africander, Brahman and Tuli bulls on Tswana cows and these will be compared with purebred Tswanas (Trail and Fisher, 1970). When crosses of Brahman, Bonsmara, Tuli and Simmental bulls with Tswana cows were compared with purebred Tswanas, weight at 1 year were respectively 213, 212, 193 and 241 kg v 190 for Tswanas.

At the Central Breeding Station in Mozambique, Herefords have been crossed with Landim cattle with some success; both the F_1 and the 3/4 Hereford were heavier than Landims at 1 and 3 years of age. F_1 males weighed 517 and females 356 kg at 3 years v 416 and 291 kg for Landims (Ribeiro 1969). Do Amaral e Paiva (1970) gave slightly lower figures for 3/8 Herefords and Landims.

Cartwright (1971) of Texas A & M has drawn attention to the importance of efficiency of production in determining maximum profitability. He says "one basic consideration is to recognise that each producer has a different set of production conditions and market needs and the same cattle do not perform equally profitably for all productive conditions". He then goes on to point out that size of cow is important when considering maintenance requirements: for instance a 550 kg cow required 35% more T.D.N. for maintenance alone than a 370 kg cow or, put another way, grazing sufficient for 65 large cows, would maintain 100 small cows. Cartwright suggests using a small crossbred (F1) cow with high fertility, early puberty, good milking qualities and a long breeding life and breeding her to a bull of a larger breed with the required ability to sire calves which will put on weight and give the right type of carcass. An obvious advantage in using a crossbred cow is the increased hybrid vigour that is obtained. Mason (1966) showed that in crossbreeding experiments between Brahman and British breeds in Southern USA, the advantage of the crosses in weaning weight was 10-16% but the full benefit of crossing was not reached until the F_1 cow was used for breeding, when the advantage over the purebred was 10-30% in weaning rate and 10-15% in calf weaning weight making a total advantage of 25-35% in weight of calf weaned per cow mated. This situation could, I suggest, be exploited here by using F_1 crosses, which so far as I know is seldom practised. I had in mind such crosses as, for example, Angoni, Mashona or Nguni cows crossed with Red Poll or Simmental bull and then mating the crossbred cow to a Charolais, or possibly a Sussex bull. These are, of course not the only possibilities. Crossbred cows were used in the formation of new breeds, *e.g.* the Bonsmara, the Holmonger in S.W. Africa and the Tauricus in Natal, a project which has recently been described by Lombard (1973). The value of the Brahman in crossbreeding projects should not be overlooked; it has been used widely and with some success in the USA, mainly for crosses with British breeds; it might possibly be used in the same way in Southern Africa by crossing with Shorthorn, Angus or Hereford cows and mating the F_1 cow to either Simmental, Charolais or Sussex bulls. It is also perhaps pertinent to draw attention to the fact that besides their contribution to the formation of the Bonsmara breed in South Africa, the Africander has been used in the formation of new breeds outside South Africa, *e.g.* in the Belmont Red in Australia (Rural Research in C.S.I.R.O. 1970) and in the Barzona in the United States (Rouse 1970).

Table 18.

Weaning weights (kg) of crossbred Hereford and Friesian calves at Mazabuka, Zambia

CROSS	Weaning Weight		Indigenous Parent	
	Steers	Heifers	Steers	Heifers
Hereford x Angoni	171	170	150	135
Friesian x Angoni	165	158		
Hereford x Barotse	181	169	162	162
Friesian x Barotse	198	199		
Hereford x Boran	185	185	175	159
Friesian x Boran	189,5	186		
Friesian x Africander	208,4	182,7		
All Hereford Crosses	184			
All Friesian Crosses	178			

Source: Zambia, Dept. Agric. Ann. Rep. Research Branch 1971.

Brahmans have been crossed with Africanders at Neudam (Sievers and Kemp, 1971) where the progeny showed about 3% advantage over Africanders in liveweight at 20 mth v 9,8% for Hereford, and 15,2 for Charolais, crosses. They have also been crossed with Ngunis in Swaziland and with Malawi Zebus in Malawi; in both cases the crossbreds were heavier than the purebred indigenous breed, but not as heavy as comparable crosses between Friesians and the local breed. In the Neudam experiment the carcass yeild of Brahman x Africander crosses was better than that of Africanders.

Because of the differences the exist between different cattle raising regions in Southern Africa and the comparative success achieved in some areas, there must be room for several types of cattle in the formation of new breeds and I believe there must be plenty of scope for individual breeders or groups of breeders to attempt this, as is already being done by a few people. My belief is that there is ample scope for developing more new crossbred types of cattle to meet particular conditions in many parts of the sub-tropics, and so far as Southern Africa is concerned you have a wealth of indigenous breeds which have by no means been fully exploited for producing profitable beef cattle.

Conclusion

In attempting to sum up this review I am conscious of the fact that I have not been able to refer to many aspects of the performance of indigenous breeds – such as work on age at which calves are weaned; the dams milk production and Steenkamp's work on dentition (Steenkamp, 1969). Much of this is contained in the reports of individual research stations. Nor have I dealt with many aspects of the effects of nutrition on performance and carcass composition. However, I have tried to highlight those aspects which to my mind are basic in considering the role of the indigenous breeds in the future.

Let me say at once that I am certain there is a very definite role for most of the indigenous breeds in the future and that even though the larger European breeds and crossbreds often hit the headlines, because of their ability to put on weight quickly and give larger carcasses, they do not necessarily produce the most economical carcasses. I was immensely impressed by the Kenya feedlot project and I am sure this is a pointer to further research with your own breeds. In the report of the Animal Productivity Research & Team in Zambia, it was stated that Angoni and Mashona carcasses had more sub-cutaneous fat than had Herefords, Africanders and commercial cattle and higher dressing out percentages, and it was noted that both breeds would have graded choice at lower weights at 1½ and 2½ years.

In a recent Malawi report of stall feeding experiments it is stated that the "feeder" cattle, were fed for 200 days and though they produced top quality carcasses (of about 200 kg) the margin over feed costs was small. Perhaps the Kenya experience could be applied here to produce a smaller carcass in a shorter period with a larger margin of profit (Malawi 1972).

Although the Africander is slower growing and does not produce as heavy a carcass as do the European breeds at comparable ages, it has a high dressing percentage and usually a higher grading, but it is unfortunate that there are so few data on Africander crossbreds; Sievers' interim results at Vaalhartz (Sievers, personal communication 1973) suggest that crossbreds surpass the Africander in carcass grade.

Cartwright's ideas on the small F_1 cow are, I suggest, worth investigating; the few data on the crossbreds at Mazabuka indicate the sort of increases in growth to expect, though this experiment does not, so far as I know, intend to use the F_1 females for breeding – though I may be wrong.

I suggest that crosses between breeds such as the Mashona, Nkone and Tuli with bulls of two or possibly three exotic breeds should be compared with each other and with the pure breeds to ascertain how these crosses perform. This could be more rewarding than attempting to create new breeds which requires great skill and patience on the part of the breeder. On the other hand, planned crossbreeding using 2 or 3 breeds gives considerable scope to the breeder to produce a desired type for a particular market and can exploit the desired characters in both the indigenous and exotic breeds. So far, of the indigenous breeds, only the Africander appears to have been used in this way to any extent.

I have been impressed by some of the crosses with the Boran now being tried in Kenya. First crosses with both Charolais and Friesian bulls are extremely promising and could be a pointer to similar crosses with the indigenous Tuli and Nkone. Crosses with Simmental in S.W. Africa have also been very promising.

Finally, I believe this survey has shown that not enough research has been done to exploit the indigenous breeds in crossbreeding schemes. I have attempted to give an over all picture of the usefulness of some of these breeds for beef production. I am sure that as purebreeds they must continue to provide the basis for much of the beef cattle breeding in the less favourable areas of Southern Africa.

References

BORSTLAP, C.W.R.Z., 1964. A comparative study of the growth potential, slaughter weight, carcass measurements and economical value of 10 breeds of cattle on the Omatjenne Experiment Station. *Dept. Agric. Sth W. Africa*, 86 pp. [mimeograph].

BORSTLAP, C.W.R.Z., 1969. A comparative study of the growth potentiality, slaughter weight, carcass measurements and economic value of 10 breeds of cattle at Omatjenne Experimental Station. *Proc. 2nd Wld Conf. Anim. Prod.*, College Park, Md, 1968 :303. (Reprinted as mimeograph).

BONSMA, J.C., & SKINNER, J.D. 1969. Factors influencing birth date, birth weight and preweaning growth rate of Afrikaner, Bonsmara and Hereford cattle in the sub-tropies. *Proc. S. Afr. Soc. Anim. Prod.* 8, 161.

BOSMAN, D.J., 1973. Performance test data: Personal communication.
BOSMAN, D.J., & HARWIN, G.O. 1967. Variation between herds in respect of the influence of year, sex, season and age of cow on weaning weight of cow on weaning weight of beef calves. *Proc. S. Afr. Soc. Anim. Prod.* 6, 213.
BOTSWANA, MINISTRY OF AGRICULTURE, ANIMAL PRODUCTION RESEARCH UNIT, 1973. Review of beef cattle production research in Botswana, 1970-1972. 58 pp.
BOYENS, R.W., 1964. General report on the numbers of livestock, their productivity and importance to the African economy. *1st FAO Regional meeting on Animal Production and Health.* Addis Ababa, 9-18 March, 1964.
BROWN, D.L., 1959. The Nguni breed of cattle. I. A descriptive review. II. Mortality, grazing behaviour, and beef production. *Emp. J. exp. Agric.* 27, 276 and 28, 44.
CARTWRIGHT, T.C., 1971. Comparison of F_1 cows to purebred and other crosses. Paper presented to the Beef Cattle Short Course Gainesville, Florida, 5-8th May, 1971.
CREEK, M.J., 1972. The Kenya feedlot project. *World Animal Review,* No. 3, 23.
CREEK, M.J., 1971. A zebu feedlot in Kenya. *Span* 14, (3).
CRUIKSHANK, D.K.R., 1972. Seventh Annual report of the Animal Husbandry Research Division, Department of Agriculture, Central Research Station, Mazabuka, 1st Oct. 1970-30th Sept. 1971.
DE PINHO MORGADO, F., 1961 a. Subsidies for the study of cattle breeds in Mozambique. I. Landim cattle. *An Serv. Vet. Industr. Anim. Mozambique* No. 6 (1953-54) : 433.
DE PINHO MORGADO. F., 1961 b. Level of meat and milk production in the Central Zootechnical Station. in Mozambique. *An Serv. Vet. Mozambique,* No. 7 (1955-59) : 301.
DO AMARAL E PAIVA, J., 1970. The performance of Landim cattle in the Chebela Zootechnical Station. *Veterinária Mozamb.,* 3, 41. (Eng. summ).
ELLIOTT, R.C., 1973. Personal communication.
HAMBURGER, H., 1973. Personal communication.
HARWIN, G.O., LAMB, R.D., & BISSCHOP, J.H.R. 1967. Some factors affecting reproductive performance in beef females. *S. Afr. Soc. Anim. Prod.* 6, 171.
HEYNS, H., 1960. The growth of the Afrikaner calf in relation to the production and composition of the milk of its dam. II. Milk production of the dam and growth of the calf. *S. Afr. J. agric. Sci.,* 3, 517.
HIRZEL, R., 1968. Aspects of meat production in South Africa. *Proc. S. Afr. Soc. Anim. Prod.* 1968, 7, 49.
HOLNESS, D.H., 1973. Personal communication.
JOHN, R.A., 1973. Personal communication.
JOUBERT, D.M., 1959. [Breeding of cattle for subtropical regions of South Africa.] *Zuchtungskunde,* 31, 193; 337.
JOUBERT, D.M. & BOYAZOGLU, J.G., 1971. The place of Animal production in the Agricultural Economy of South Africa: Results and formulae for the future. *Options Méditerranenness,* 7, 112. (Reprint).
KOGER, M., REYNOLDS, W.L., KIRK, W.G., PEACOCK, F.M. & WARNICK, A.C., 1962. Reproductive performance of crossbred and straightbred cattle on different pasture programs in Florida. *J. Anim. Sci.,* 21, 14.
LEDGER, H.P., ROGERSON, A. & FREEMAN, G.H., 1970. Further studies on the voluntary food intake of *Bos indicus, Bos taurus* and crossbred cattle. *Anim. Prod.,* 12, 425.
LOMBARD, J.H., 1970. Optimum slaughter weight for different beef type oxen finished intensively. Feedlot project: results of trial 9. Stock owners co-operative Co. Ltd., Pietermaritzburg, 18 pp. [Mimeograph].
LOMBARD, J.H., 1972. Taurius beef cattle. *Farmers Weekly, Bloemfontein,* 11th Oct. 1972. (Typescript).
McDOWELL, R.E. 1966. Problems of cattle production in tropical countries. Cornell Int. Agric. Dev. Mimeogr., No. 17. Ithaca, N.Y.: New York State College of Agriculture, Cornell University. 24 pp.
MAHADEVAN, P., 1964. A report on the herd of Nguni cattle at Mpisi, Swaziland, 10 pp. [Mimeograph].
MALAWI, DEPARTMENT OF AGRICULTURE. 1972. Annual Report (Animal Husbandry Research, 1968-69).
MALAWI, MINISTRY OF NATURAL RESOURCES, DEPARTMENT OF VETERINARY SERVICES AND ANIMAL INDUSTRY. Annual Reports, 1966. 1967 and 1968.
MALAWI, MINISTRY OF AGRICULTURE AND NATURAL RESOURCES, 1971. I. Zebu breeding improvement and its role in the improvement of livestock in Malawi. 6 pp. (mineograph) II. Summary of first five years of Malawi zebu performance testing – Chiredze Agricultural Research Station. 5 pp. [Mimeograph].
MANSVELT, P.R. & SKINNER, J.D., 1962. The cattle of the Bavenda. *Dept. Agric. Tech. Serv. Tech. Comm.* No. 6. 21 pp.
MASON, I.L., 1966. Hybrid vigour in beef cattle. *Anim. Breed. Abstr.* 34. No. 4.
MASON, I.L. & MAULE, J.P., 1960. *The indigenous livestock of Eastern and Southern Africa.* Commonwealth Agricultural Bureaux., xv + 151 pp.
MEYN, K., 1970. Beef production in East Africa. (With a comprehensive bibliography on cattle breeding in East Africa). IFO-Institut für Wirtschaftsforschung, Afrika-Studienstelle, Munich. Munich: Weltforum-Verlag. 227 pp.
MORAIS GRADIL, J., 1970. Analysis of development of cattle resources in the province of Mozambique. *Anais. Serv. Vet. Mozamb.* No. 16 (1968) : 27.
NIEMANN, P.J. & HEYDENRYCH, H.J., 1965. Some environmental and physiological factors affecting birth and weaning weights of beef calves. *Dept. Agric. Tech. Serv. S. Africa, Tech. Comm.* No. 51. 11 pp.
OLIVER, J., 1966. The productivity of Mashona cattle in Rhodesia. *Exptal Agric.* 2, 119.

PENZHORN, E.J. & MEINTZES, J.P., 1968. Preliminary results with regard to early reproduction in Afrikaner heifers. *Proc. S. Afr. Soc. Anim. Prod.*, 1968. 7, 155.

PENZHORN, E.J. & VON LA CHEVALLERIE, M.K.S.L., 1969. Influence of weaning weight on efficiency of beef production I. *Agroanimalia* 1, 13.

RHODESIA AGRICULTURAL JOURNAL. 1967. The improvement of the Manguni breed of cattle. *Rhodesia agric. J.*, 64, 3.

RHODESIA: MINISTRY OF AGRICULTURE: DEPARTMENT OF RESEARCH AND SPECIALIST SERVICES. Matopos Research Station: Annual Reports, 1967/68, 1968/69, 1969/70, 1970/71.

RHODESIA: MINISTRY OF AGRICULTURE: DEPARTMENT OF RESEARCH AND SPECIALIST SERVICES. Makoholi Experiment Station, Annual Reports, 1966/67, 1968/69, 1970/71.

RHODESIAN FARMER. 1970. The Nkone – an old breed with a new name. *Rhod. Fmr.* 40 (34) : 13, 19.

RIBEIRO, J.A., 1969. The Hereford breed and improvement of Landim cattle. *Anais Serv. Vet. Mozamb.*, No. 15, 135.

RICHARDSON, F.D., 1969. Milk production in beef cows. *Proc. 1st Symp. Anim. Prod.* Salisbury, 1968. pp. 9-16.

RICHARDSON, F.D., 1973. Personal communication.

ROGERSON, A., LEDGER, H.P. & FREEMAN, G.H. 1968. Feed intake and liveweight gain comparisons of *Bos indicus* and *Bos taurus* steers on a high plane of nutrition. *Anim. Prod.* 10, 373.

ROSE, C.J., 1961a. Native cattle in Southern Rhodesia. Dept. of Native Agriculture and Lands, Southern Rhodesia 25 pp. [Mimeograph].

ROSE, C.J., 1961b. Report on Tuli Breeding Station and Pasture Sub-Station. Dept. of Native Agriculture and Lands, Southern Rhodesia, 17 pp. [Mimeograph].

ROUSE, J.E., 1970. *World cattle.* Vol. 2. University of Oklahoma Press.

RURAL RESEARCH IN CSIRO. 1970. Beef cattle for the tropics. Rur. Res. in C.S.I.R.O., 69, 18.

SIEVERS, C.F., 1972. Africander crossbreeding project. [Mimeograph.] 1 page.

SIEVERS, C.F., 1973. Personal communication.

SIEVERS, C.F. & KEMP. J., 1971. Crossing of bulls of various breeds with Africander cows in order to increase beef protion in South West Africa. *Tierzüchter*, 23, 314.

SOUTH WEST AFRICA: ADMINISTRATION AGRICULTURE BRANCH. 1970. Progress report on agricultural research in South West Africa, 1967. *Windhoek.* 36 pp. [Also, mimeograph of the 1967 Annual Report, Omatjenne Experimental Station].

STEENKAMP, J.D.G., 1969. Effect of brittle hardness and abrasive hardness of enamel on degree of attrition of deciduous teeth of representative breeds of *Bos indicus* and *Bos taurus* cattle. *Agroanimalia*, 1, 23.

TRAIL, J.C.M. & FISHER, I.L., 1970. Beef cattle breeding research by the Ministry of Agriculture, Botswana. Animal Production Research Unit, Division of Animal Production, Ministry of Agriculture, Botswana 30 pp. [Mimeograph].

TRAIL, J.C.M. SACKER, G.D. & FISHER, I.L., 1971. Crossbreeding beef cattle in Western Uganda. [6 papers]. *Anim. Prod.*, 13, 127.

TURNER, HELEN N., 1967. Genetic aspects of charactersitics to be considered in the evaluation and utilization of indigenous livestock. *Wld. Rev. Anim. Prod.*, 3 (12), 17.

VENTER, J.P, & LUITINGH, H.C., 1967. A carcass and meat quality evaluation of eleven beef and dual purpose breeds in South West Africa. *Proc. S. Afr. Soc. Anim. Prod.*, 6, 165.

VON LA CHEVALLERIE, M.K.S.L., 1969a. Beef production by steers of five breeds. I. Growth feed conversion and carcass grade. II. Carcass composition and meat quality. *Agroanimalia*, 1, 183. 2, 11.

VON LA CHEVALLERIE, M.K.S.L., 1969b. Growth and carcass quality of three cattle breeds. *Proc. S. Afr. Soc. Anim.* Prod., 1969, 8, 195.

VORSTER, T.H., 1964. Factors influencing the growth, production and reproduction of different breeds of beef cattle under range conditions in Southern Rhodesia. *S. Rhod. Agric. Res. Bull.* No. 1.

WALKER, C.A., 1964. The growth and development of the beef qualities of Angoni cattle. Part I. Live weight. Park II. Linear growth and carcass qualities. *J. agric. Sci., Camb.* 63, 235.

WARD, H.K., 1968. Supplementation of beef cows grazing on veld. *Rhod. J. agric. Res.*, 6, 93.

WARD, H.K., 1972. Personal communication.

WARNICK, A.C., MEADE, J.H. & KOGER, M., 1960. Factors influencing pregnancy rates in Florida beef cattle. *Bull. Fla. Agric. Exp. Sta.*, No. 623. 10 pp.

ZAMBIA: NATIONAL COUNCIL FOR SCIENTIFIC RESEARCH. Animal productivity research team. 1972. Technical reports 1968-1969, 1970-71.

ZAMBIA REPUBLIC OF: MINISTRY OF RURAL DEVELOPMENT. 1969. Department of Agriculture Annual Report of the Research Branch 1970, 163 pp.

ZAMBIA REPUBLIC OF: MINISTRY OF RURAL DEVELOPMENT. 1971. Department of Agriculture. Annual Report of the Research Branch 1969, 143 pp.