THE INFLUENCE OF FRAME SIZE/BREED AND STOCKING RATE ON THE REPRODUCTION AND PRODUCTION OF BEEF CATTLE PRELIMINARY RESULTS

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ABSTRACT

In an ongoing trial at Sandveld Research Station, the influence of frame size (two frame sizes) and stocking rate (four fixed stocking rates) on reproduction, pre- and post weaning growth and carcass characteristics are being investigated. With-in frame size there is a decrease in calving- and weaning percentages, birth-, weaning-, 12- month and 18-month weights as the stocking rate increases. Rainfall, through its influence on available grazing, has had an effect on reproduction and production with-in the herds over years.

INTRODUCTION

Namibia is primarily an extensive animal production country and Agriculture is responsible for 20 percent of the Gross Domestic Product (GDP). Due to the importance of livestock production, it is important that high priority should be given to the efficiency of production. Increased production should be achieved through increased efficiency of production, thus, production per unit area should be increased. Ludeman (1981) stated that too much stress is placed on increasing individual aspects of beef production, and not enough emphasis is placed on production per unit area.

Venter (1982) is of the opinion that stocking rate is the all-important factor that in the end determines the condition of the veld and thus the productivity and profitability of the farming enterprize. Another factor related to efficiency is that of frame size. Klosterman (1972) stated that the size of beef cattle as related to feed efficiency is of less importance. Other than developing small cow lines to minimize maintenance requirements, there appears to be no advantage to any one size of cattle. Meissner (1985) stated that large animals tend to be economically more efficient in spite of equal or less biological efficiency, and that there is no specific frame size for cows which would improve cow efficiency universally. However, there may be optimal frame sizes with-in specific production systems, and more so with-in stress environments.

The above summary indicates that no definite answer is available, much less for Namibia where small and large frame size cattle exist side by side. A research project is currently being conducted at Sandveld Research Station to address the issue. The main objectives of the project are to investigate beef production with four fixed stocking rates and two frame sizes/cattle types and to determine the optimum stocking rate for sustained optimum animal production under varying climatic and economic conditions.

MATERIALS AND METHODS

Small framed cattle (indigenous Sanga cattle) are compared with large framed cattle (Afrikaner X Simmentaler), each at four fixed stocking rates, namely 15, 25, 35 and 45kg live mass per hectare. Each treatment is allocated six camps which is grazed in an open rotational grazing system. Replacement heifers are mated at 18-months of age and all oxen and heifers are reared under the same stocking rate as the one to which they were born.

Frame size	Stocking rate (kg/ha)	Number of cows	Number of camps	Total grazing area (ha)
Large frame (LF)	15	15	6	686
	25	28	6	689
	35	40	6	692
	45	52	6	697
Small frame (SF)	15	25	6	694
	25	42	6	684
	35	60	6	687
	45	72	6	687

RESULTS AND DISCUSSION

Table 1 is a summary of the calving and weaning percentages of the different treatments for the period October 1987 till July 1998. The same tendencies are found for both frame sizes; calving and weaning percentages decrease with an increase in stocking rate. The small framed animals performed better than the large framed animals. This is supported by the work of Morgan (1998).

Els (1997), working with Afrikaner and Santa Gertrudis cattle, found similar results between small and large framed animals with-in breed. During the drought of 1994/95 the calving percentages of the LF 35 and LF 45 groups dropped to 57% and 69% respectively, indicating that these two treatments experienced stress during

Table 1. Average calving and weaning percentages for the period October 1987 to July 1998

	LF 15	SF 15	LF 25	SF 25	LF 35	SF 35	LF 45	SF 45
Calving %	92.7 ± 7	97.5 ± 2.5	91.7 ± 8	96.1 ± 3	89.8 ± 5	92.2 ± 4	86.7 ± 8	92.5 ± 5
Weaning %	89.8 ± 5	93.9 ± 7	90.9 ± 5	93.8 ± 5	88.7 ± 5	90.4 ± 3	83.5 ± 4	90.5 ± 4

Table 2. Average birth masses of the bull (M) and heifer (F) calves born between 1987 and 1998

Year	LF 15		LF 25		LF 35		LF 45		SF 15		SF 25		SF 35		SF 45	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1987	49	47	44	41	42	39	46	44	35	27	29	28	31	29	29	29
1988	43	40	43	41	41	37	42	39	35	28	30	30	32	30	29	29
1989	41	38	40	41	42	37	39	37	29	29	28	26	27	25	27	27
1990	40	36	40	39	39	35	42	37	30	28	28	28	31	27	27	26
1991	43	43	41	42	41	40	40	40	34	32	33	30	34	33	31	28
1992	44	41	41	39	42	35	40	36	29	29	30	26	31	29	30	28
1993	42	39	44	40	39	39	41	36	33	30	31	29	33	31	30	29
1994	44	39	45	42	44	37	39	36	32	29	31	30	31	30	30	28
1995	41	39	43	37	37	36	37	36	32	28	29	26	27	26	25	24
1996	42	38	40	38	39	33	37	37	28	27	29	25	27	24	27	25
1997	42	38	40	38	39	37	37	33	28	27	29	25	27	24	27	25
Average	43	40	42	40	40	37	40	37	31	29	30	28	30	28	28	27

Table 3. Average weaning masses of the bull (M) and heifer (F) calves born between 1987 and 1998

Year	LF 15		LF 25		LF 35		LF 45		SF 15		SF 25		SF 35		SF 45	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1987	267	233	253	250	232	223	223	210	187	155	170	152	169	154	151	154
1988	247	220	218	214	225	203	204	197	181	140	153	146	163	139	153	148
1989	257	222	252	241	242	214	220	205	174	144	169	155	166	142	154	139
1990	230	202	218	206	207	191	201	187	160	138	141	141	151	129	136	127
1991	245	215	229	216	218	193	213	195	168	153	155	144	154	145	151	132
1992	278	234	241	223	218	197	210	181	176	153	166	143	158	145	155	132
1993	238	219	240	223	217	216	223	207	153	148	164	142	159	145	156	142
1994	237	223	244	229	195	179	185	170	152	142	156	143	149	139	143	132
1995	253	209	238	207	210	197	193	182	166	145	162	138	142	139	148	135
1996	276	230	258	258	243	219	248	220	165	159	168	157	154	146	161	151
1997	273	233	256	240	250	219	249	222	185	155	166	153	180	162	169	155
Average	255	222	241	208	223	205	215	198	170	148	161	148	159	144	152	141

the drought. The calving percentage recovered during 1996, indicating the inherent high fertility of the animals in the project. Birth mass is a very important contributing factor in the occurrence of difficulties during calving. The incidence of abortions and difficulties during calving is very low, mainly due to the use of bulls that sire calves with low birth masses.

From Table 2 it can be seen that as stocking rate increased, the average birth masses of both sexes decreased. This is especially evident during years of drought (1995), where the birth masses of the calves born to the heavier stocking rates were much lower than those of the lighter stocking rates. Fluctuations with-in treatments did occur and could possibly be due to the availability of grazing and the body condition of the cows.

Weaning mass of the calves is the determining factor of the efficiency of production of the cow herds. Due to the fact that the standard measurement of determining cow efficiency (weaning mass of the calf/mass of cow at weaning) is biased towards the smaller type of cow, the ratio of weaning mass of the calf/100kg cow mass mated, is used to express herd efficiency.

Table 3 presents the average weaning masses of the calves born between 1987 and 1998 and Table 4 the average production performance of the different treatments.

The same numerical decreases are found for weaning mass as for birth mass; as stocking rate increases the weaning mass decreases. Fluctuations with-in treatments, over years, are due to climatic conditions. The effect that the drought of 1994/95 had on the calving percentages of the LF 35 and LF 45, are also reflected in their weaning masses.

From Table 4 it can be seen that for both frame sizes, the weaning mass/100kg cow mass mated and total mass

Table 4. Production performance of the cow herds for the period 1987 to 1997

	LF 15	SF 15	LF 25	SF 25	LF 35	SF 35	LF 45	SF 45
Weaning mass/100kg cow mass mated	46.4	48.7	44.0	43.5	44.6	43.2	40.2	43.0
Total mass/100kg cow mass mated	51.6	54.3	49.5	50.2	47.8	46.8	43.6	47.1
Average 205-day mass production (kg/ha)	4.65	4.77	7.29	7.59	9.67	10.01	11.01	12.60
Total herd production (kg /ha)	5.18	5.34	8.21	8.74	10.63	10.98	11.98	13.91

Table 5. Average 365-day masses of the oxen (M) and heifers (F) born between 1987 and 1996

Year	LF 15		LF 25		LF 35		LF 45		SF 15		SF 25		SF 35		SF 45	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1987	271	253	262	256	240	234	236	232	196	184	181	170	157	155	175	172
1988	268	236	232	247	246	224	238	215	198	151	169	158	185	158	175	162
1989	293	268	282	285	254	215	225	210	186	157	182	165	167	151	158	147
1990	274	241	266	257	241	223	244	227	188	169	187	176	170	153	165	155
1991	284	256	265	244	249	219	228	202	220	181	204	178	184	167	165	149
1992	298	244	268	239	245	215	228	197	192	169	183	167	179	158	173	154
1993	265	238	262	246	240	229	240	219	164	159	187	164	176	159	168	150
1994	255	230	254	241	201	191	193	186	165	158	169	150	158	146	149	136
1995	285	235	255	219	222	205	207	203	184	163	176	153	154	143	153	134
1996	345	290	331	324	302	288	314	297	206	203	215	210	195	189	207	200
Average	284	249	268	256	244	224	235	219	190	169	185	169	173	158	169	156

(weaning mass of calves and the weight gained by the cows) produced per 100kg cow mass mated, decreased with an increase in stocking rate. In terms of production per ha, the expected increase in production with an increase in stocking rate was realized. Interesting though, is the fact that at the same stocking rate, the small framed group outperformed the large framed group. This is directly related to the higher calving and weaning percentages of the small frame groups.

Those heifers and oxen selected at weaning to remain in the project till the age of ±21-months, when the oxen and heifers not used for replacement are slaughtered, are reared under the same conditions as those to which they had been born. This is to prevent animals born in the heavier stocking rate groups from experiencing possible compensatory growth, should they be reared under more favourable circumstances.

Table 6. Average 540-day masses of the oxen (M) and heifers (F) born between 1987 and 1996

Year	LF 15		LF 25		LF 35		LF 45		SF 15		SF 25		SF 35		SF 45	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1987	373	366	388	372	357	352	329	330	281	264	281	258	259	251	271	256
1988	385	354	338	347	355	330	336	314	290	239	263	245	273	243	264	244
1989	362	354	370	366	358	320	333	319	277	244	273	248	254	225	236	223
1990	419	385	382	371	350	331	359	335	282	263	286	253	282	248	246	234
1991	385	357	368	349	363	331	339	309	306	254	299	262	270	253	255	232
1992	423	381	387	361	366	328	332	297	288	260	281	253	268	246	259	233
1993	379	343	366	341	313	314	289	277	261	238	271	239	245	231	221	200
1994	378	357	364	350	315	304	291	290	256	236	260	236	240	219	232	213
1995	442	383	398	359	366	244	340	335	307	266	290	256	266	254	256	237
1996	458	404	441	423	422	397	417	392	298	283	310	293	286	265	289	270
Average	400	368	380	364	357	325	337	320	285	255	281	254	264	244	253	234

Tables 5 and 6 represent the 365-day and 540-day masses (corrected for age) of the oxen and heifers born in the different treatments between 1987 and 1996. An increase in stocking rate resulted in a decrease in mass for both sexes and both frame size groups. The decreases are, for both sexes, more pronounced in the large framed treatments than in the small framed treatments.

The effect of rainfall on the available grazing, and thus on the animals, can clearly be seen in Table 5. During the period 1995/96, when the rainfall was poor, the animals that were born during 1993 and 1994 recorded lower masses, while the good rainfall of 1997/98 resulted in the above average masses recorded for animals born during 1996.

The same numerical decreases in Table 5 are found in Table 6 where mass decreases as stocking rate increases. This is very noticeable in the LF 35 and LF 45 treatments, and to a lesser degree in the SF 35 and SF 45 treatments.

Even though the small framed animals, on a per animal basis, weigh less than the large framed animals at the same stocking rate, the difference in numbers and the higher calving percentages of the small framed treatments enables these treatments to outperform the larger framed groups. Only the LF 15 was able to produce a higher income than the SF 15. This is due to the small difference in number of cows per breeding herd, and the heavy carcass weights of the LF 15 group. This is reflected in Table 7, which is a summary of the average incomes of the different groups for the period 1993 to 1997.

Table 7. Average annual income (N$) of the different groups for the period 1993 to 1997

	15 kg/ha	25 kg/ha	35kg/ha	45 kg/ha
Large frame	18 270	25 626	30 995	36 611
Small frame	15 819	26 499	34 057	44 206

Table 8. Average winter and summer lick consumption (g/day/cow) for the different treatments for the period 1987 to 1996

	LF 15	LF 25	LF 35	LF 45	SF 15	SF 25	SF 35	SF 45
Summer lick	243	241	246	226	152	159	155	153
Winter lick	318	348	315	256	203	191	191	169

The profitability of the enterprize is dependent on the inputs and the outputs. One of the largest inputs in extensive beef production is supplementary feeding (licks). Table 8 presents the winter and summer lick consumption of the different treatments. Lick consumption did not, as one would presume, increase with an increase in stocking rate. The heaviest stocking rates had the lowest lick consumption. These results correspond to those of Labuschagne (1995), who found that in the first few years of this project, year ($P<0.05$), frame size ($P<0.01$) and stocking rate ($P<0.05$) had significant influences on lick consumption. Stocking rate had a significant influence ($P<0.05$) on winter lick consumption for both groups, but no effect on summer lick consumption.

Year had a significant effect ($P<0.0003$) on the winter lick consumption for both groups and a significant effect ($P<0.05$) on the summer lick consumption of the small frame cattle. The small frame cattle consumed significantly less lick per animal unit as well as per metabolic mass unit, compared to large frame cattle. This applies to both the summer and the winter licks.

CONCLUSIONS

As stocking rate increases there is a decrease in calving percentage, birth-, weaning-, 365-day and 540-day mass for both frame size groups. The general better performance of the small framed groups is due to the fact that at the same stocking rate, their higher numbers and better calving percentages enable them to produce more. Small frame size cattle consume significantly less lick per animal and per metabolic mass unit, compared to large frame cattle.

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