THE ROLE OF MINERALS IN THE GROWTH AND VIABILITY OF BUNAJI CATTLE RAISED UNDER TRADITIONAL MANAGEMENT IN CENTRAL NIGERIA.

O. A. IKWUEGBU AND D. CAMPBELL

International Livestock Centre for Africa

P. M. B. 2248, Kaduna, Nigeria.

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ABSTRACT

About 400 Bunaji cattle from 12 herds at three sites namely, Kurmin Biri, Madauchi and Ganawuri were used to study the productivity of cattle fed mineral supplements under village conditions. Two herds at each site were allocated at random to each treatment. Mineral blocks containing 10% P and local salt licks containing 96% NaCl which served as control were fed. Supplementation lasted three years. Mineral blocks were put out daily in the *Kraals* and taken in during rains and when the animals went grazing. Births and disposals were recorded. Animals were weighed monthly using portable barlo electronic scales. Animals grazed natural pasture and crop residues after harvest. Data were analysed using general linear models (GLM) procedure of SAS. Analysis were done for birth weights up to 18 months. Models used for analysis involved the fixed effects of location, herds nested within location, year and season of calving, parity, age of dam and sex of calf. The results showed that birth weights were significantly influenced by location ($P < 0.05$), year of birth ($P < 0.05$) and mineral supplementation ($P < 0.05$). The birth weights were 22.4 ± 0.53 , 21.1 ± 0.42 and 18.2 ± 0.40 kg in Ganawuri, Kurmin Biri and Madauchi respectively. Calves born in 1988 were significantly heavier than those born in 1989 and 1990 and weighed 21.1 ± 0.47 , 19.8 ± 0.39 and 20.8 ± 0.48 kg in 1988, 1989 and 1990 respectively. The mineral supplemented calves weighed 21.1 ± 0.38 and 19.9 ± 0.36 kg for phosphate and salt respectively. Using weight as a covariate, it was shown that the growth rate of P supplemented group was

significantly higher than the control group ($P < 0.05$) so that at 18 months the mineral group weighed 165 kg, an improvement of 22%. Calving interval was influenced by location ($P < 0.05$), year of calving ($P < 0.01$) but not significantly by treatment ($P > 0.05$). Calving intervals were 530 ± 62.9 and 503 ± 54.8 days for mineral and salt respectively. Cumulative mortality percentage of calves to 9 and 12 months were not significantly affected by mineral supplementation ($P > 0.05$). These were 11.1 ± 5.00 and 13.4 ± 5.31 and 17.4 ± 5.06 and 24.0 ± 5.43 for mineral and salt respectively. It is concluded that the provision of P-rich mineral blocks to agropastoral herds at strategic periods can improve the productivity of Bunaji cattle.

Key words: Mineral supplementation, Bunaji cattle, growth, calf mortality, calving interval, Central Nigeria.

INTRODUCTION

Malnutrition is a major constraint to animal production in subsaharan Africa particularly during the dry season when available pasture is low in nutrients. This low productivity (Pullan 1979, 1980) has generally been attributed to low energy and N content of the pasture. Attempts to increase productivity by providing agro-industrial byproducts have had beneficial effects but these products are now scarce and expensive and have not been adopted by agropastoralists. In addition the level of improvement was lower than the proven potential of the zebu cattle raised under similar systems in Africa (ILCA 1978, Wagener et al., 1986) suggesting that there may be other nutrient deficiencies

The soil in the subhumid zone, defined ecologically as having 1000 to 1500mm rainfall and 180 to 270 plant growing days, is low in P and N (Mohamed-Saleem, 1986). The pasture is low in N and several minerals (Kapu, 1975). This experiment was designed to measure some productivity parameters for Bunaji cattle raised in the traditional system but fed either a local salt supplement or a phosphorus-rich but complete mineral mixture.

MATERIALS AND METHOD

Animals and Management

About 400 Bunaji cattle from 12 herds in 3 case study areas in the subhumid zone were used. The sites were Kurmin Biri, Madauchi and Ganawuri. The ecology, and soil characteristics had been described by Mohamed-Saleem (1986). Two herds were allocated at random to each treatment. Mineral blocks containing 10% P (Tithebane, Southport, UK) and local salt licks containing about 96% NaCl (Kola and Sons, Ilorin, Nigeria) and serving as control were fed. The blocks weighing between 8 and 10 kg were fed at the rate of one block per 15 animals and were replenished when exhausted. Supplementation lasted 3 years. Herd sizes varied from 12 to 60; there were a total of 207 animals on P-rich mineral supplements and 197 animals on salt.

Animals grazed natural range land or crop residues. Agricultural by products were seldom fed. Mineral blocks were put out daily in the kraals and taken in during rains or when the animals went grazing. Births, deaths and disposals were recorded. Animals were weighed at birth using bath room scales or monthly using portable barlo electronic scales.

Statistical Analysis

Data were analysed using general linear models (GLM) procedure (SAS, 1987). Analyses were done for weights at birth up to 18 months of age. Models used included the fixed effects of location, herds nested within location, year and season of birth, parity, age of dam, sex and the effect of treatment.

RESULTS

Tables 1 & 2 show the weight of calves up to 18 months of age. Table 3 shows the least squares mean cumulative mortality to 18 months and Table 4 the calving intervals as influenced by the variables used in the statistical models. Table 5 shows the chemical composition of the mineral supplements used. Birth weights were significantly influenced by location ($P < 0.05$), year of birth and mineral supplement type ($P < 0.05$). The birth weights (kg) were 22.4 ± 0.53 , 21.1 ± 0.42 and 18.2 ± 0.40 in Ganawuri, Kurmin Biri and Madauchi respectively. Calves born in 1988 were significantly heavier ($P < 0.05$) than those born in 1989 and 1990 and weighed 21.1 ± 0.47 , 19.8 ± 0.39 and 20.8 ± 0.48 kg in 1988, 1989 and 1990 respectively. Dams with access to high P supplement produced significantly heavier calves ($P < 0.05$). There were no significant seasonal differences ($P > 0.05$) in calf weights after 12 months of age. The mortality of calves was influenced by year of birth ($P < 0.05$) so that calves born in 1988 sustained the highest cumulative mortality by 18 months of age. On the other hand calves born in Ganawuri and Madauchi had significantly higher mortality ($P < 0.05$) than calves born in Kurmin Biri. Average mortality at 9 and 12 months were about 17 and 18% respectively.

For the period of study the calving intervals recorded were few (31 records, Table 4). The unadjusted mean calving interval was 483 days. Calving intervals were significantly longer in Ganawuri ($P < 0.05$) and were significantly influenced by year ($P < 0.05$) and season of birth ($P < 0.05$). Average mineral consumption lay between 30 and 50 g/head/day.

DISCUSSION

Average mortality at 1 year of 18% in these herds is less than 22% recorded by Otchere (1986) in similar herds which were provided, whenever available, local salt licks. These licks (Kanwa) are essentially chlorides, sulphates and carbonates of Na and K which

TABLE 1: LEAST-SQUARES MEANS FOR WEIGHT OF CATTLE AT BIRTH AND AT 9 MONTHS (KG) BY SEX AND ENVIRONMENTAL EFFECTS IN THE SUBHUMID ZONE OF NIGERIA.

	Birth			9 months		
Effect	No.	Mean	SE	No.	Mean	SE
Overall	252	20.56	0.19	63	87.83	1.76
Location		***				
Ganawuri	42	22.37 ^a	0.54	7	88.49	6.23
Kurmin Biri	104	21.11 ^a	0.42	37	92.53	3.19
Madauchi	106	18.20 ^b	0.40	19	82.43	4.74
Year of birth		*			*	
1988	88	21.11	0.47	37	80.82 ^a	4.55
1989	103	19.76	0.39	26	94.82 ^b	3.62
1990	61	20.83	0.48			
Season of birth					*	
Feb - April	90	20.04	0.42	12	91.95 ^a	4.55
May - July	31	20.34	0.64	6	70.67 ^b	7.41
Aug - October	36	21.11	0.57	12	96.96 ^a	4.74
Nov - December	95	20.76	0.42	22	91.68 ^a	4.08
Sex						
Female	116	20.45	0.38	27	85.78	3.72
Male	136	20.68	0.33	36	89.88	3.42
Treatment		**			*	
MN	135	21.14 ^a	0.38	38	93.82 ^a	3.98
SL	117	19.98 ^b	0.36	25	81.81 ^b	4.04
Previous parity						
0	120	20.59	0.39	36	84.22	3.94
1	73	20.64	0.42	11	92.02	5.17
2	38	20.78	0.56	16	87.20	5.30
3	21	20.25	0.76			
Age of dam						
≤ 5	32	20.89	0.68	9	86.95	5.98
6	40	21.52	0.61	10	98.05	6.31
7	26	20.86	0.67	4	82.17	8.28
8	35	20.25	0.59	11	85.05	5.64
9	38	19.37	0.56	10	82.71	5.84
10	52	20.69	0.47	19	91.98	4.08
≥ 11	29	20.35	0.68			

*P<0.05 **P<0.01, ***P<0.001

MN = P-rich supplement, SL = Salt.

^{ab} Means in the same column with a different superscript differ significantly (P<0.05).

TABLE 2: LEAST-SQUARES MEANS FOR WEIGHT OF CATTLE AT 12 AND 18 MONTHS (KG) BY SEX, TREATMENT AND ENVIRONMENTAL EFFECTS SUPPLEMENTED WITH MINERALS OR SALT IN THE SUB-HUMID ZONE OF NIGERIA.

Effect	No.	Mean	SE	No.	Mean	SE
Overall	49	102.42	2.13	24	146.90	5.39
Location						
Ganawuri	8	104.19	6.80	5	155.18	19.98
Kurmin Biri	24	107.87	5.00	9	145.30	16.57
Madauchi	17	95.18	6.09	10	140.25	16.70
Year of birth		*				
1988	31	94.76 ^a	5.04	24	146.91	12.45
1989	18	110.07 ^b	5.21	-	-	-
Season of birth						
Aug - October	6	101.11	8.03	2	147.27	24.87
Feb - April	20	97.77	4.92	7	154.22	18.43
May - July	4	100.09	10.19	-	-	-
Nov - December	19	110.69	5.33	15	139.24	11.99
Sex						
Female	20	99.93	4.85	11	145.72	16.22
Male	29	104.90	4.08	13	148.10	13.88
Treatment						
MN	30	107.28	4.83	11	165.15	25.00
SL	19	97.55	5.61	13	128.67	14.66
Age of dam						
≤ 5	7	107.02	7.27	3	181.39	25.00
6	8	104.73	7.69	5	194.23	31.21
7	5	92.31	8.22	2	101.97	25.57
8	5	110.44	8.18	3	164.98	22.84
9	8	97.07	6.63	3	112.15	21.95
10	16			8	126.73	20.48

* $P < 0.05$

MN = P-rich supplement, SL = Salt.

^{ab}Means in the same column with a different superscript differ significantly ($P < 0.05$).

TABLE 3: LEAST-SQUARES MEANS FOR MORTALITY (%) FROM BIRTH TO 9, 12 MONTHS OR 18 MONTHS FOR CATTLE ON MINERALS AND SALT BY SEX AND ENVIRONMENTAL EFFECTS IN THE SUBHUMID ZONE OF NIGERIA.

Effect	9 months			12 months		18 months	
	No.	Mean	SE	Mean	SE	Mean	SE
Overall	134	14.2	2.61	18.7	3.16	18.8	3.06
Location						*	
Ganawuri	24	14.8	7.13	25.9	7.65	26.1 ^a	7.85
Kurmin Biri	54	6.3	5.58	6.9	5.99	6.1 ^b	6.15
Madauchi	56	21.6	5.68	23.4	6.10	24.2 ^a	6.25
Year of birth		*	*		**		
1988	57	26.4 ^a	5.80	38.5 ^a	6.23	38.3 ^a	6.38
1989	49	9.1 ^b	5.35	12.4 ^b	5.75	14.4 ^b	5.89
1990	28	7.3 ^b	6.74	5.3 ^b	7.24	3.9 ^c	7.43
Season of birth							
Feb - April	48	5.1	5.61	14.4	6.03	15.7	6.18
May - July	12	25.3	10.07	28.3	10.82	28.2	11.09
Aug - October	19	13.1	7.95	13.9	8.54	13.3	8.76
Nov - December	55	13.5	5.12	18.4	5.50	18.1	5.63
Sex							
Female	59	15.7	5.25	19.1	5.64	18.5	5.79
Male	75	12.7	4.32	18.4	4.64	19.2	4.76
Treatment [†]						*	
MN	71	11.1	5.00	13.4	5.31	13.0	5.51
SL	63	17.4	5.06	24.0	5.43	24.6	5.57

*P<0.05 **P< 0.01

MN = P-rich supplement SL=Salt.

^{abc}Means in the same column with a different superscript differ significantly (P<0.05).

TABLE 4: LEAST-SQUARES MEANS FOR CALVING INTERVALS (DAYS) BY TREATMENT AND ENVIRONMENTAL EFFECTS FOR CATTLE IN THE SUBHUMID ZONE OF NIGERIA.

Effect	No. of records	Mean	SE
Overall	31	518.4	10.84
Location		*	
Ganawuri	5	632.7 ^a	75.07
Kurmin Biri	22	471.1 ^b	51.4
Madauchi	4	446.8 ^b	69.70
Year of birth		*	
1989	17	414.1 ^a	57.10
1990	14	619.6 ^b	50.90
Season of birth		*	
Jan - April	17	597.0 ^a	30.80
May - August	1	482.0 ^{ab}	116.20
Sep - December	13	471.0 ^b	37.40
Parity			
1	17	551.9	55.56
2	6	559.9	165.23
3	8	438.9	52.48
Dam age			
7	7	522.4	55.56
8	5	492.4	64.60
9	8	521.2	67.40
10	5	491.5	54.50
≥ 11	6	557.1	64.60
Treatment			
MN	22	530.2	62.97
SL	9	503.5	54.89

*P<0.05 **P<0.01, MN = P-rich, SL = Salt.

^{ab}Means in the same column with a different superscript differ significantly (P<0.05)

TABLE 5: CHEMICAL COMPOSITION OF RANDOM SAMPLES OF MINERAL AND SALT BLOCKS USED TO SUPPLEMENT CATTLE IN THE SUBHUMID ZONE OF NIGERIA.

Mineral Block (Phosphorus rich)

Sample	Percentage				mg/kg			
	P	Na	K	Ca	Mg	Zn	Cu	Mn
Sample 1	10.42	19.00	0.14	7.60	0.77	240	240	4000
2	10.18	21.20	0.12	7.80	0.75	190	200	4200

Salt Block

Sample								
1	0.17	37.50	1.04	0.43	0.25	93	420	2300
2	0.15	36.70	0.03	0.40	0.25	53	310	2250

are also rich in trace minerals (Ikwuegbu *et al.*, 1984). The high mortality of calves in the early wet season may be due to diseases mainly pneumonia and diarrhoea. It could also in part be due to the condition of the dams which have not had sufficient time to replete their body reserves. In the mature cow, weight gains begin in May during early rains to November during crop residue grazing. In the present studies, only the growth patterns of young animals were monitored.

Sodium and phosphorus were limiting in range pasture in the subhumid zone (Ikwuegbu, this study, unpublished). McDowell *et al.*, (1983) found that these two elements are the most limiting minerals in the grazing situation in subsaharan Africa. Phosphorous deficiency is the most widespread and important mineral deficiency affecting grazing livestock in the tropics (Underwood, 1981). A requirement for supplementary P is advocated particularly when there is a commensurate increase in energy supply.

Supplementary P in the form of bone meal has been shown to improve weight gains

(McDowell, 1976) and calving percentage (McDowell and Conrad, 1977, Molokwu, *et al.* 1979). The present findings are in agreement with these observations. Calving intervals found in the zone are of the order of 765 days in an ILCA 10-year study (unpublished) of the traditional system. A subset data from this study covering 4 years showed calving intervals of about 757 days (Otchere, 1986).

In the present studies average calving intervals were of the order of 518 days as a result of mineral supplementation. This would increase calving percentage (365/calving interval) from 48 to 70%. Unfortunately the number of records is small but an improvement is indicated which will translate to more calves being produced during the productive life of the cow. Despite the ecological similarities of the case study areas, they differ in land tenure, extent of cultivation and proximity to markets.

The effects of location on calf birth weight and calving intervals are related to the management objectives of the agropastoralists. In Kurmin Biri, the agropastoralists keep cattle as the primary enterprise. They graze

range land containing grasses, browses and crop residues. Madauchi on the other hand is on the outskirts of a rural town, Zonkwa, with high milk offtake for human consumption and smaller quantities left for the calves. In Ganawuri on the other hand, cropping is the major activity and cattle are kept as an investment. Cows are access to abundant crop residues after crop harvest. Cows are often not milked and calves are allowed to suckle for 1 to 2 years leading to long calving intervals. Animal husbandry skills are not as well developed as in agropastoralist herds. So even though animals are born heavier in Ganawuri, poor management results in high calf mortality. Knowledge of local medicinal herbs also appears scanty in the area.

The findings in this experiment suggest that provision of salt and mineral supplements improve several animal production parameters. The provision of P-rich mineral supplements to growing stock does not appear to be very much better than salt alone. When compared to the costs of blocks, the local preparation costs about 20% of the imported material. It would appear that salt supplementation alone is economically adoptable by agropastoralists and the average consumption of 30-50 g/d/hd appears affordable. For lactating animals with greater demand for P and Na, the responses could be higher and more definitive making its incorporation profitable.

A possible trade off could be to incorporate rock phosphate low in fluoride into the local material or in the alternative use about 2% P for growing stock. In the agropastoralists system the lower energy available in pasture will reduce the requirement for N, minerals and indeed other nutrients. provision of non-protein N in the form of urea mixed with salt could well increase energy availability from highly fibrous diet and form a low input nutrition package for adoption.

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