SMALL STOCK PROJECT X0254

MILK PRODUCTION FROM THE INDIGENOUS MALAWI GOAT

FINAL REPORT

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Summary

These trials aimed to achieve four objectives:

a) To examine the milk production potential of the indigenous Malawi goat.

b) To evaluate the effects of removing milk for human consumption on the liveweight and reproductive performance of the lactating doe.

c) To develop an improved feeding regime for lactating goats using locally available feed by-products.

d) To compare the performance of indigenous and Saanen x indigenous does under similar management regimes.

ii) From 21±3 days (4 days for Saanen x) does were separated from their kids at housing and hand milked every morning before turnout.

iii) Feeding was unimproved "bush" grazing. Where supplementation was used, 250±10g maize bran was fed each evening.

iv) Mean milk yield in supplemented (MS) does was higher in 1993-94 (29.2±18.3 litres) than in 1994-95 (27.9±15.2 litres) but differences were not significant (P=0.67)

v) Mean yield in unsupplemented (MNS) animals was 15.0±8.6 litres in 1993-94 and 20.2±12.6 litres in 1994-95 but this difference was not significant (P=0.22)

vi) In 1993-94 supplementation produced a significant yield response (P<0.01) in each of the first 20 weeks of lactation. In 1994-95 the response was only significant in week 4 (P<0.05)

vii) Post-partum wight loss averaged 1.9±0.59kg in supplemented animals, 0.7±0.54kg in unsupplemented and 1.5±0.69kg in unmilked (C) controls. Kidding weights had been regained by weeks 17, 14 and 12 respectively.

viii) Litter sizes, in litters produced following treatment, were 1.9±0.7, .4±0.5 and 1.7±0.5 in MS, MNS and C does, respectively.

ix) Most mortality in control kids occurred in the first week (60%). In the milked groups mortality occurred after the initiation of hand milking.

x) Kid mortality over the two years was 53%, 45% and 33% for MS, MNS and C respectively (X^2=3.67, P>0.1). In 1993-4 mortality was higher in kids from milked does (P<0.01) but in 1994-5 there were no differences between treatment.

xi) There were no effects of treatment on the number of days from kidding to conception. Figures for MS, MNS and C were 155±49.8, 144±83 and 165±91 days in 1993-94 and 171±62, 164±86 and 176±47 days in 1994-95.

xii) Cross-bred does produced 35.7±27.3 litres in 145±103 days.

xiii) With cross-bred does milked from day 4, kid mortality was high at 9/14 at a mean age of 16 days.

xiv) Crossbred does lost weight post kidding, an average of 1.9±1.6kg, but had all regained it by week 10 (cv week 17 for MS does). Mean kidding to conception interval, at 168±119 days was similar to that of MS animals.

xv) It is concluded that:

a) the indigenous Malawi goat is capable of producing usable amounts of milk (>150ml/day) for extended periods (12-20 weeks).

b) Supplementation with 250±10g maize bran produces a yield response but this response is variable between years.

c) Milking indigenous goats does not produce unacceptable adverse effects on the does.

d) In some years, removal of milk from does can lead to significantly higher kid mortality.

e) Fully milking out cross-bred does leaves insufficient residual milk for their kids. If milk off take were to be restricted - say to 250ml/day, the yield advantage of the cross-bred would be largely negated.

FINAL REPORT
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PROJECT NO. X0254

Collaborating Institutions

Seale-Hayne Faculty of Agriculture, Food and Land Use, Newton Abbot, Devon, TQ12 6NQ, England. (Dr Alan Cooper)

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Programme Area: Livestock Production

Introduction

It has been estimated that in some areas of Malawi the incidence of malnutrition in children under the age of 5 may be as high as 70%. The problem is particularly severe in children who have been weaned off breast milk. Milk is seen as being of special benefit to such children and in many parts of the world the source of that milk would be the goat. Estimates of the number of goats in Malawi vary between 1.0m and 1.5m and yet, with the exception of a few localised areas, those goats are not milked. There does not appear to be any custom or taboo prohibiting the consumption of goats milk. Indeed, in a survey, Banda (1992_a) showed that goats' milk was acceptable to many people and was even preferred to that of the sheep or cow. The aim of this project was therefore to examine the milking potential of the indigenous Malawi goat to determine the feasibility of producing goat's milk in subsistence-farming situations.

Objectives:

i. To examine the milk production potential of the indigenous Malawi goat.

ii. To evaluate the effects of removing milk for human consumption on the liveweight and reproductive performance of the lactating doe.

iii. To develop an improved feeding regime for lactating goats using locally-available feed by-products.

iv. To compare the production and performance of indigenous and Saanen x indigenous does under similar management regimes.

The original finish date for this project was 31st March 1995. Following delays in obtaining Saanen x does permission was sought for an extension to 31st September 1995 at no additional cost. That extension allowed the collection of data on completed cross-bred lactations. All the above objectives have therefore been achieved.

Materials and Methods

This project was undertaken at Bunda College, University of Malawi (14°S, 33°E). All does grazed indigenous pastures by day (7am to 4pm) (Plate 1), with access to maize gardens during the dry season (May to October), and were housed at dusk. Housing, in groups of 10-15 was in a blue-gum pole and chain-link fence 'khola' with concrete floor and corrugated iron roof (Plate 2). Pens were not bedded and were cleaned out weekly. The kids of does being milked were removed from their dams at housing, penned in an adjacent pen and returned to their dams at turnout the following morning. Supplemented does received a feed of maize bran (250 ± 10g/head) each evening. Proximate analysis of the bran is given in Appendix 1.

Initially, indigenous does were allocated sequentially at kidding to one of four treatment groups:

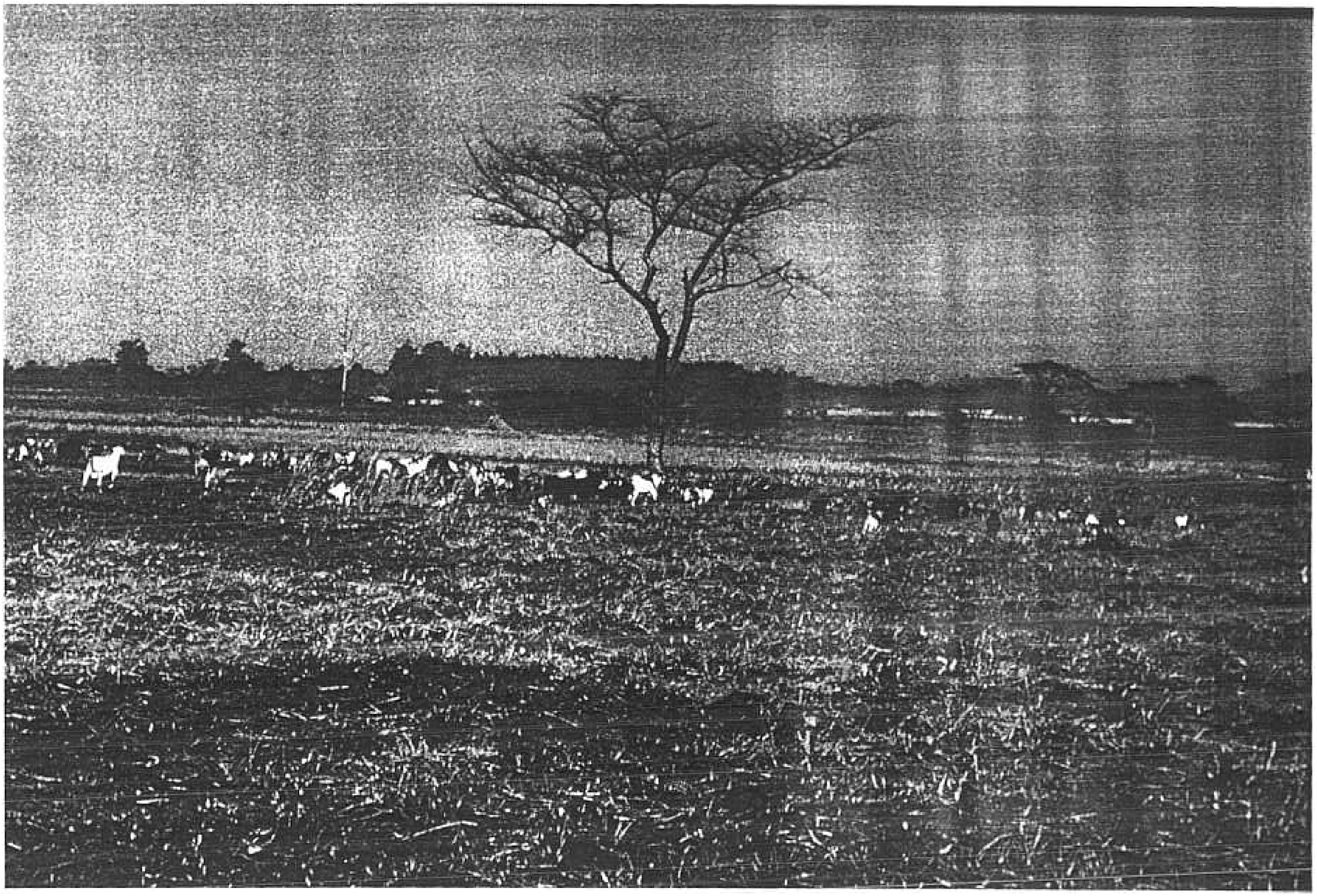
Milked, supplemented (MS)
Milked, unsupplemented (MNS)
Unmilked, supplemented (NMS)
Unmilked, unsupplemented (NMNS)

At the suggestion of the Programme Advisory Committee of NRI, the NMS treatment was dropped and a single unmilked, unsupplemented group created as the control group (C). A total of 57 "milked" and 30 "unmilked" lactations were recorded during the programme.

A separate, cross-bred group of does was also established during 1994 (n=15). Indigenous does were of varying ages. In order to improve comparability of data, when the Saanen x Indigenous does were acquired, an attempt was made to find animals with an equivalent age spread (as estimated from incisor teeth). Three yearlings and four each with 4, 6 and 8 permanent incisor teeth were found.

Milking took place once daily, immediately before turnout. Individual yields were measured with a measuring cylinder and the bulked quantity sent to the College's 'under-fives' clinic. Milking of indigenous does commenced 21 ± 3 days after kidding but, in expectation of higher yields, the Saanen x does were milked from day 4. Milking ceased when production dropped below 50ml. on three consecutive days. Kids continued to run with their dams after hand milking ceased and were allowed to wean naturally. Does and kids were weighed on the day after kidding and fortnightly thereafter until milking was stopped (monthly in 1993). Oestrus was determined from the behaviour of the does. Males were housed separately and oestrous does were hand mated at each oestrus. Routine prophylactic veterinary treatments were not applied. A veterinary assistant was given responsibility for the project in October 1993. Veterinary treatments were given to individual animals, as appropriate, and the cause of all deaths was established where possible.

The indigenous animals used were largely those remaining at the end of a previous trial programme in September 1992 (see final report X0124). In the hope that further funding would be available treatments were applied, as does kidded, from April 1993 onwards. Thus, although the project memorandum for contract X0254 starts on 1 September 1993 the lactation data presented are for the two years April 1993 - March 1994 and April 1994 to March 1995.



P ate 1 nd genous Does At Pasture

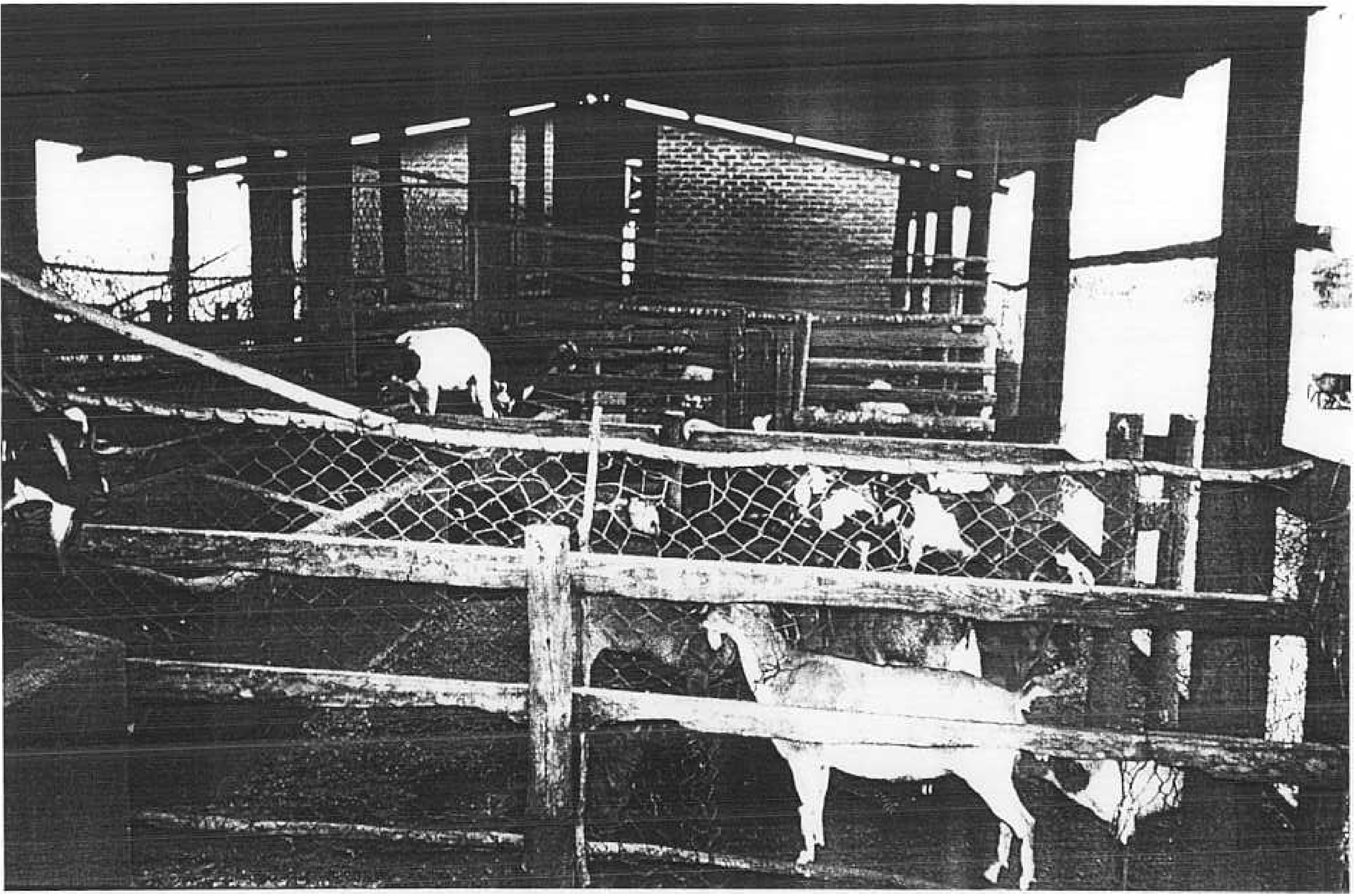


Plate 2 Doe Housing

Results and Discussion

1) Indigenous Does

a. Reproductive Performance

In comparison with previous trials, kidding dates over 1993-4 and 1994-5 were much more consistent. Mean date of kidding was 29th May ±47 days in 1993 (n=50) and 17th May ±49 days in 1994 (n=37).

Patterns of kidding are shown in Table 1. Figures in parentheses indicate does not included in the trials because of other requirements. It can be seen that the spread of kidding was such that comparisons between periods are difficult since in some months numbers on any one treatment are small.

Table 1
Kiddings by month

	A	M	J	J	A	S	O	N	D	J	F	M
1993-4	18	8	1	7	2	8				6	(5)	(2)
1994-5	25	1	1		8	1		1		(5)	(0)	(12)

From these data it is evident that the majority of conceptions occurred during the December - January period. This would be the middle of the rainy season and would coincide with the period of maximum feed availability. Mean dates of conception are calculated as 3rd January 1993 and 21st December 1993 for kiddings in 1993-4 and 1994-5 respectively.

Reproductive data are given in Table 2. In both years supplementation led to a marked, though not significant increase in litter size. MNS animals had the smallest litters, despite the fact that they had lost the least liveweight during early lactation. In both years the data appear 'perverse' in that the milked, unsupplemented (MNS) does returned to oestrus faster than supplemented (MS) or unmilked (C) does, when it might have been expected that these animals, being under greater nutritional stress, would have been slower. An examination of the litter size data shows that in both years the MNS group had a similar litter size to that of other groups in the kidding prior to treatment and the earlier return cannot be explained in terms of a reduced sucking stimulus in that group.

Table 2
Effect of Treatment on reproductive performance (mean±SD)

	Year	Treatment		
		MS	MNS	C
Litter size	1993-94	1.9±0.8[a]	1.3±0.5[a]	1.7±0.5[a]
	1994-95	1.9±0.7[a]	1.4±0.5[a]	1.6±0.5[a]
Kidding to Conception (Days)	1993-94	155±49.8[a]	143.7±83.0[a]	164.6±91.4[a]
	1994-95	171±61.6[a]	163.9±86.3[a]	175.9±47.3[a]

Within rows, means with different superscripts differ significantly, P<0.05

Unfortunately a number of does did not have any recorded oestrus/service, yet they managed to kid again! For these animals effective service date has been taken as kidding date minus 147 days. With the exception of does which died, data are available for all but 4 animals in 1993-4 and all but 2 in 1994-5. Because not all services were recorded, data are given as days to presumed conception. It is evident that milking did not adversely affect conception rates once cyclicity was re-established. Nor was there a relationship between milk yield (to hand milking) and days to conception. The regression of days to conception on milk yield (Y) gave the equation $D = 134+0.0039Y$ in 1993-94 ($r^2 = 0.05$). The equivalent equation for 1994-95 was $D = 85+0.0024Y$ ($r^2 = 0.27$). There was no relationship between date of kidding and days to conception or litter size.

b. Kid Mortality

Kid mortalities differed between years (Table 3). In 1993-94 there was significantly higher mortality in the milked groups (P<0.01) with the majority of deaths occurring after hand milking had started. Mean age at death was 66.3±36.7 days, 50.1±38.1 days and 24.6±42.3 days for MS, MNS and C respectively. Three of these deaths followed the death of dams (2MNS, 1C) and 7 occurred during an outbreak of bacterial scour in a 2-week period in early June (3MS, 3MNS, 1C). The figures also include kids which died immediately after birth, an event not related to the treatment of the does.

Most deaths in the control group (60%) occurred in week 1 and all of these were in kids born as twins. For MS and MNS animals the percentage of deaths in kids born as twins was 67% and 59% respectively.

Following the appointment of a Veterinary Assistant to take responsibility for the goats (as required by the project memorandum) mortalities reduced. In the year 1994-5 there were no differences between treatment in terms either of numbers dying or mean age at death (54.4±56.1 days, 60.8±48.9 days and 84.8±50.5 days for MS, MNS and C respectively). Again, the majority of deaths was among kids born as twins or triplets (75%, 67% and 83% for MS, MNS and C). "Scours" (11 deaths) and pasteurella pneumonia (5 deaths) were identified as the main problems. In both years the main "season" for deaths was the period May to July (26 in 1993, 12 in 1994) but this is seen as a reflection of mean kidding date rather than of a climatic effect.

When mortality data for the two years are amalgamated, overall deaths were 53%, 45% and 33% for MS, MNS and C respectively. These differences were not significant ($X^2=3.67$, $P>0.1$).

Table 3
Kid mortality by year and treatment (No. and [%])

	Treatment		
	MS	**MNS**	**C**
1993-94	17 [63]^{a}	14[58]^{a}	6[20]^{b}
1994-95	8 [40]^{a}	6 [30]^{a}	6 [36]^{a}

Within row, means with different superscripts differ significantly, $P<0.01$.

c. Kid Liveweights

In 1993 only kids from does being handmilked were weighed monthly. Their weights are shown in Table 4. There were no differences between MS and MNS animals until week 14, when MNS kids were significantly lighter. ($P<0.05$). By week 18, this difference had been made good, but it must be remembered that mortalities in these groups were high and thus numbers were decreased making interpretation of the data difficult since it was usually the smaller kids which died.

Table 4

Kid liveweights 1993 (kg±SD)

Age (wks)	MNS		MS	
Birth	1.78±0.33	(n=24)	2.00±0.37	(n=27)
2	3.20±0.76		3.78±0.75	
6	5.30±0.91	(n=14)	4.95±1.30	(n=14)
10	6.90±1.50		6.70±1.96	
14	7.64±1.75	(n=11)	8.68±2.20	(n=10)
18	9.25±1.19	(n=10)	9.13±2.33	

In 1994-5 all kids were weighed fortnightly. (Table 5) There were no differences between treatments until 14 weeks, at which age kids from MS does were significantly lighter than others (P<0.05). At 16 weeks the differences were even greater (P<0.01) with MS kids not putting on any weight during the previous 14 days. By week 18 however growth had been re-established and differences were no longer significant although MS kids remained lighter. Mean liveweight at any age was not affected by season of birth.

Table 5

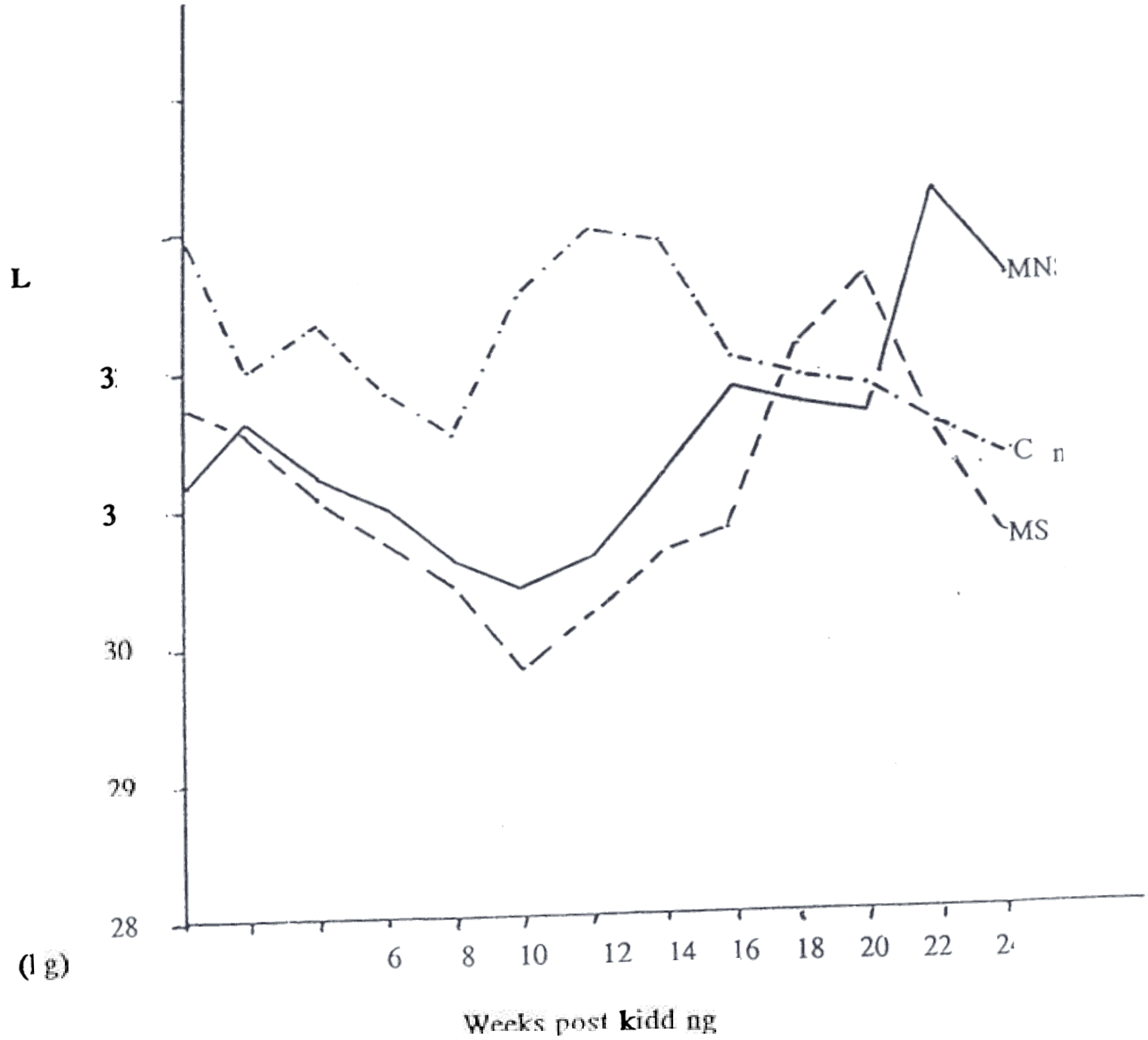
Liveweights of kids 1994-95 (kg±SD)

Age(wks)	MS (n=21)	MNS (n=18)	C (n=24)	SIG
BIRTH	1.86±0.63	1.86±0.33	2.22±0.59	NS
2	3.69±0.97	3.64±0.82	3.78±0.73	NS
4	5.03±1.47	5.10±1.42	4.75±1.14	NS
6	6.32±1.86	5.78±1.43	5.45±1.67	NS
8	6.85±1.69	6.97±1.34	6.65±1.90	NS
10	7.38±1.93	8.28±1.91	7.12±1.82	P<0.05
12	7.35±2.13	9.33±1.89	9.45±1.91	P<0.01
14	7.92±2.05	10.72±2.14	10.06±1.64	NS
16	8.86±2.63	10.86±1.99	10.33±2.25	NS
18	9.36±2.40	11.04±1.89	10.25±1.99	NS
20	10.1±2.44	11.4±2.07		NS
22	10.7±2.70	12.3±1.73		NS
24	11.5±2.82	12.8±1.50		NS

Figu

Patterns of Doe Livewei Cha ge Indigenous Does

994 95



d. <u>Doe Liveweight</u>

Control group does were slightly heavier at kidding (33.0 ± 7.0 kg) than MS (31.7 ± 6.9kg) or MNS (31.1 ± 5.9kg). Patterns of weight change are shown in Figure 1. Mean weight loss was not great, averaging 1.9±0.59kg in MS, 1.5±0.69kg in C and 0.7±0.54kg in MNS animals. Thus those animals under the greatest potential nutritional stress lost the least. Minimum body weight (29.8 ± 7.3 kg) was reached in week 10 in MS animals. Comparative figures were 30.4 ± 5.3kg in week 10 and 31.5 ± 5.4kg in week 8 for groups MNS and C respectively. Control group animals had regained their kidding weight after 12 weeks, MNS animals took 14 weeks and MS animals 17 weeks. There was no relationship between milk yield and weight loss. The correlation co-efficients were 0.101 for MNS and 0.239 for MS.

e. <u>Milk yields and lactation lengths</u>

In January 1994 the trial site was hit by a hurricane and the roof was completely blown off the goat unit. During this event the lactation data for the previous 6 weeks were destroyed. These were largely for the September kidding does. Milking continued after the accident. Thus lactation lengths are available for all animals but accurate lactation yields are not. For these animals (MNS = 3, MS = 2) total lactation data have been excluded from the following analyses.

Yield details for 1993-4 and 1994-5 are given in Tables 6 and 7. Overall, supplemented animals produced significantly more than unsupplemented ones (30.7±17.0 l vs 17.5±10.5 l, $P<0.01$) but between years there were no differences within treatment. Mean lactation length was not significantly different between years (1993=132.1±47.4 days, 1994=159±64.6 days) but within treatment, between years supplemented animals had a significantly longer lactation in 1994-5 (183.7±53.3 vs 139.5±42.0 days, $P<0.05$).

Figure 2

Mean Weekly Milk Yields 1993-94 (ml)

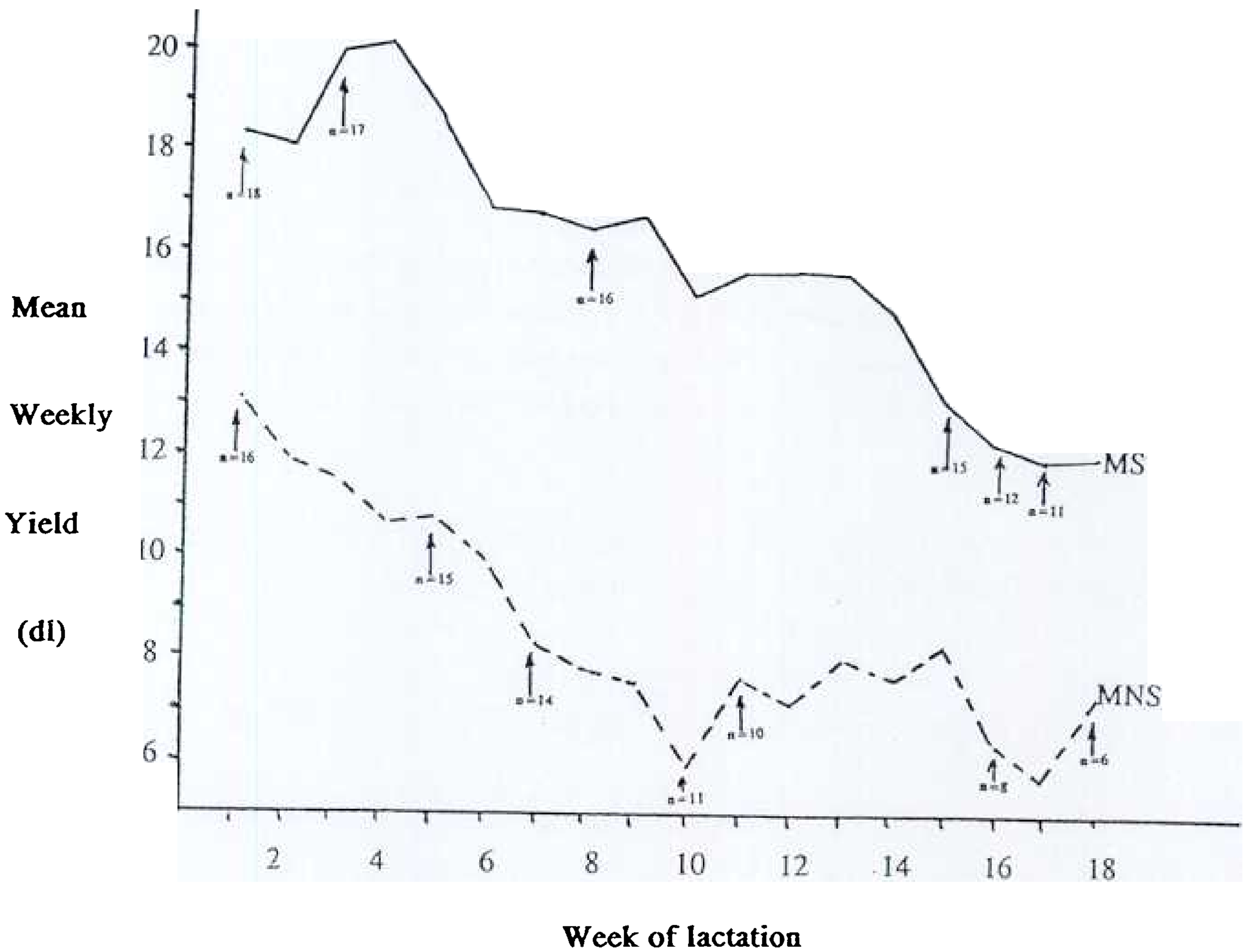


Table 6

Mean weekly yield at monthly intervals. 1993-94 (ml)

		Week					
		1	**4**	**8**	**12**	**16**	
MS	Mean	1935^{a}	2109^{c}	1746^{e}	1767^{c}	1306^{a}	
	SD	689	962	710	727	643	
	n	18	17	17	14	12	6
MNS	Mean	1404^{b}	1176^{d}	893^{f}	829^{d}	748^{b}	886
	SD	524	582	406	307	319	131
	n	16	16	13	10	8	3

Column means with different subscripts differ significantly:

a,b $P<0.05$ *c,d* $P<0.01$ *e,f* $P<0.001$

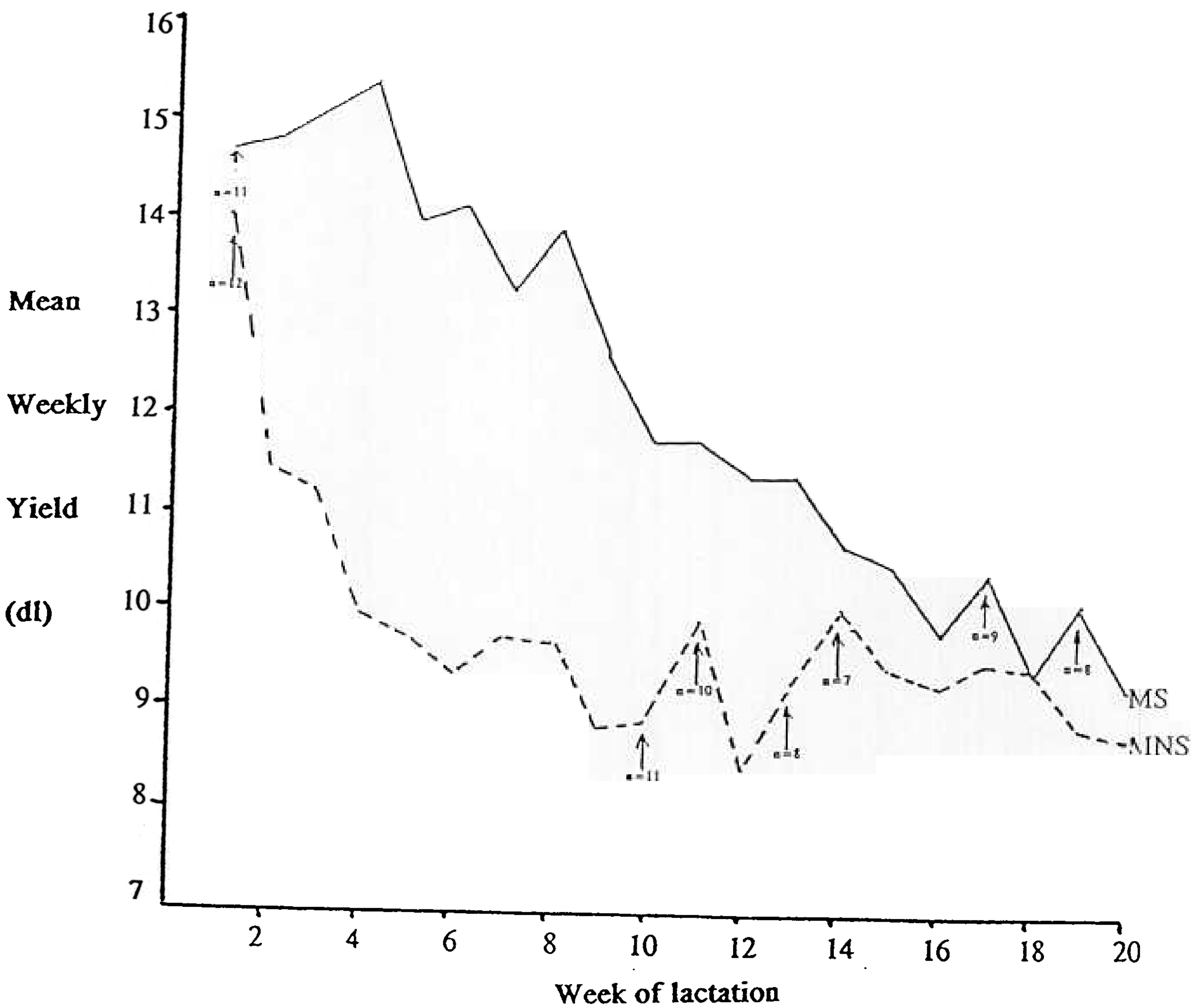
i 1993-94

Mean production data are given in Table 6. Lactation lengths were variable at 19 to 236 days (mean 117.4±56.8) and 25 to 285 days (mean 129.2±48.4) for MNS and MS respectively. From Figure 2 the differences in both mean weekly yield and lactation length are obvious. With the exception of one doe which fell sick and dried off in week 2, the majority of April-kidding MS does (8/9) were still lactating in week 16 whilst the figure for MNS animals was 5/8. It will be noted that as low yielders dropped out of the records the mean yield for the remaining animals showed a short-term improvement. When all lactations are included by week 17 11/18 MS does were still lactating whilst the figure for MNS was 7/16.

Total milk yields varied between 2.59 and 36.66 litres in MNS does and 2.34 and 85.24 litres in MS animals. In each case the lowest yield was associated with a doe which fell sick and dried off. If these two animals are excluded then the lowest yields were 6.35 and 10.74 litres for MNS and MS does respectively. Overall mean yields were significantly higher for MS does (29.2 ± 18.3 litres vs 15.0 ± 8.6 litres, P<0.01) with mean weekly yields significantly higher at every stage up to week 20 (Table 6).

Figure 3

Mean Weekly Milk Yields 1994-95 (ml)



ii. 1994-95

Lactation length was again very variable, ranging from 63 to 273 days in MNS (mean 155.2 ± 70.3 days) and from 118 to 266 days in MS (mean 194.4 ± 55.6 days). As in 1993-94 there was a marked tendency for more does to dry off 'early' in the MNS group (Figure 3). Only 7/12 does were still milking in week 16 compared to 11/11 for MS. Total milk yields were equally variable. The mean yield for MNS does was 20.2 ± 12.64 litres (range 5.2 to 51.5 litres) whilst for MS it was 27.9 ± 15.18 litres (range 14.2 to 64.5 litres) (Table 7).

Table 7

Mean weekly yield at monthly intervals - 1994-95 (ml)

		1	4	8	12	16	20	24	28
	Mean	1466	1535[a]	1392	1140	977	930	875	877
MS	SD	566	568	592	514	612	435	346	465
	n	11	11	11	11	11	8	7	6
	Mean	1398	997[b]	968	845	929	857	797	752
MNS	SD	496	384	421	412	456	418	320	367
	n	12	12	12	10	7	7	6	5

Column means with different superscripts differ significantly, P<0.05

Compared with 1993-94 overall yields were lower, with the difference for MS animals being particularly marked. Treatment differences were only significant in week 4 (P<0.05). Thus supplementation produced a smaller yield response in 1994/95 than it did in 1993 (Table 8).

Table 8

Differences in weekly yields 1993 - 94 and 1994-95 [MS-MNS](ml)

	Week							
	1	4	8	12	16	20	24	28
1993-94	531	933	853	834	578	465		
1994-95	68	538	424	295	48	73	78	125

Kidding patterns were similar in the two years, with a majority of does kidding in April and May. This would coincide with a reduction in herbage availability following cessation of rains. However, in both years rainfall patterns were similar and cannot be used to explain these differences.

2. Crossbred Does

a. Reproductive Performance

Thirteen does of the 15 acquired kidded in 1994. With only one doe producing twins, mean litter size was low at 1.07. Five does subsequently kidded again before the completion of the trial and again litter size was low at 1.00. Kid mortality was high with 9/14 kids dying at a mean age of 16 days. Unlike the indigenous does, which were allowed to suckle their kids for 21 ± 3 days before being milked by hand, crossbred does were milked from day 4. With hindsight this policy was almost certainly detrimental. A subsequent small-scale observation on indigenous does, when oxytocin injections were used to determine levels of residual milk following hand milking, (Table 9) suggested that the residual milk averaged 48.7%.

Table 9

Levels of milk in indigenous does milked with or without oxytocin (ml).

	Week						
Oxytocin	**1**	**2**	**3**	**4**	**5**	**6**	**7**
	16.3	15.5	16.7	14.7	16.1	8.2	8.6
+	23.2	24.7	22.8	20.8	17.1	19.8	13.8

This amount would be enough to provide some nutrients for the young kids. If cross-bred goats have a 'better' let-down reflex then it is likely that milking from day 4 did not leave adequate feed for the kids.

Rebreeding performance was very variable. Mean kidding to conception interval was 167.6 ± 118.5 days and predicted mean kidding index 308.4 ± 127.6 days. These means were not dissimilar to those for the indigenous does (Table 2) though the ranges were greater. There was no correlation between rebreeding and milk yield ($D=140+0.0014Y$, $r^2=0.097$).

Figur

Patterns of Doe Liveweight Change-Cross-Bred Does

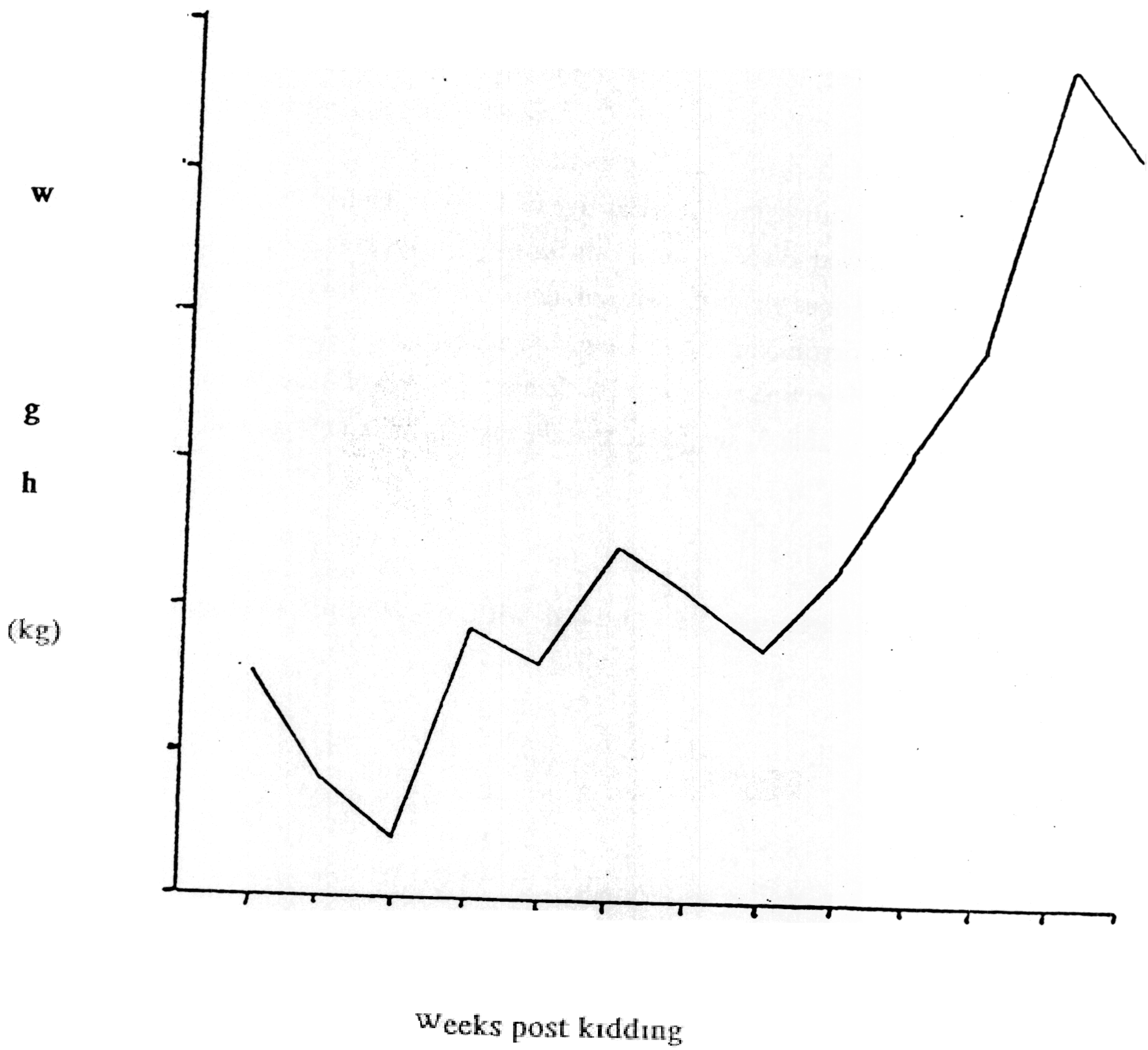
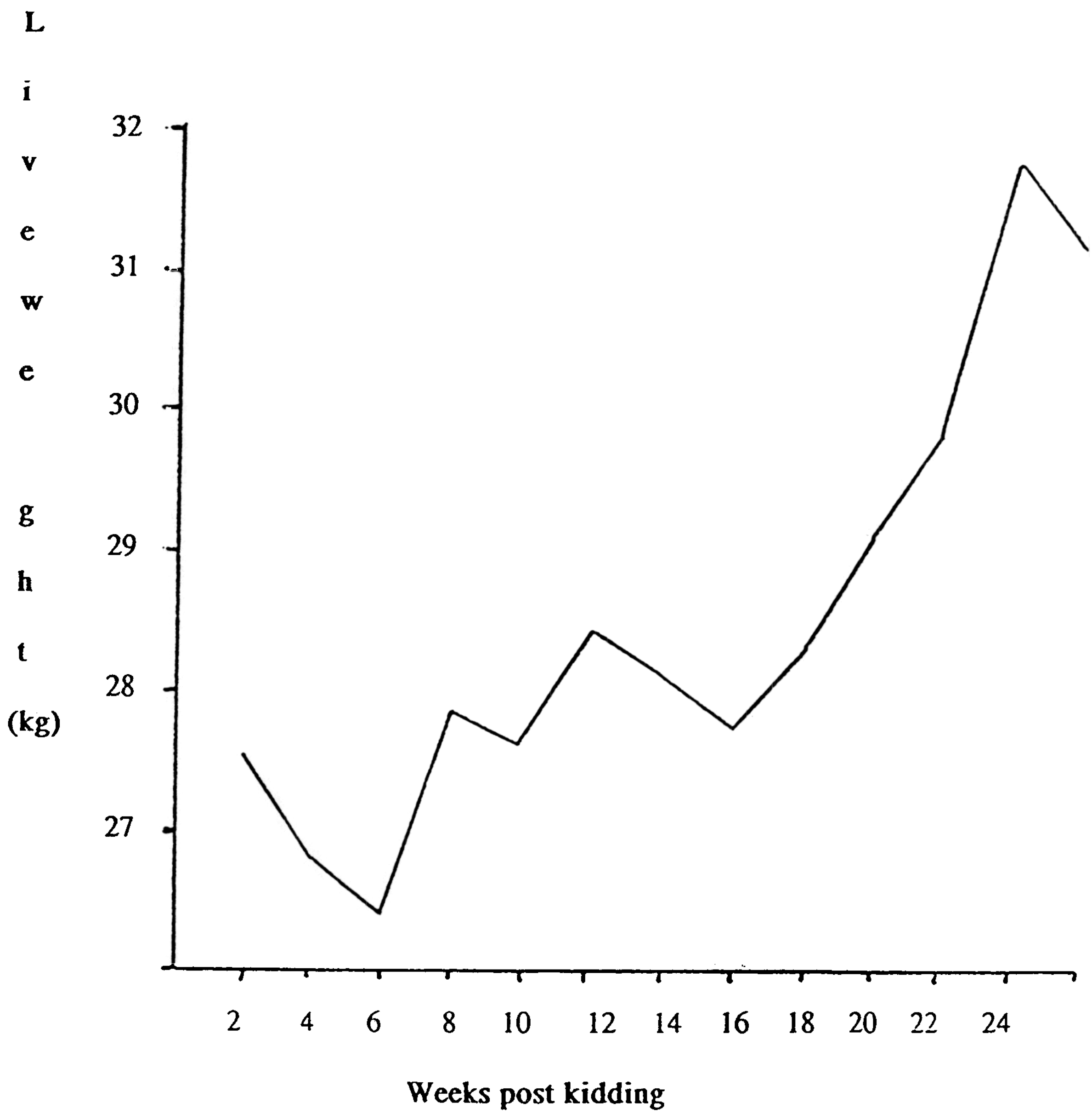


Figure 4

Patterns of Doe Liveweight Change-Cross-Bred Does



b. Doe Liveweight

With a mean liveweight at kidding of 27.6 ± 6.7 kg crossbred does were slightly lighter than indigenous animals, though the range of weights was similar. Weight loss was also similar at 1.9 ± 1.6 kg. Interestingly, minimum weight was reached more quickly in the cross-breds, with 75% of does in a weight gain situation by week 6 and all of them by week 10. It is likely that this was a reflection of low body fat levels at kidding. Mean weight gain continued (Figure 4) so that by 26 weeks post-kidding does were similar in weight to the indigenous MS animals (31.3 ± 5.9lkg vs 31.3 ± 7.1kg). As with indigenous does, there was no correlation between yield and weight loss (Corr coeff. 0.050).

c. Milk Yields

One doe failed to give any milk to hand milking and attempts were discontinued. For the remaining 12 lactations mean yield was 35.7 ± 27.3 litres in 144.8 ± 102.8 days. Yield patterns are shown in Table 10 and Figure 5.

Table 10

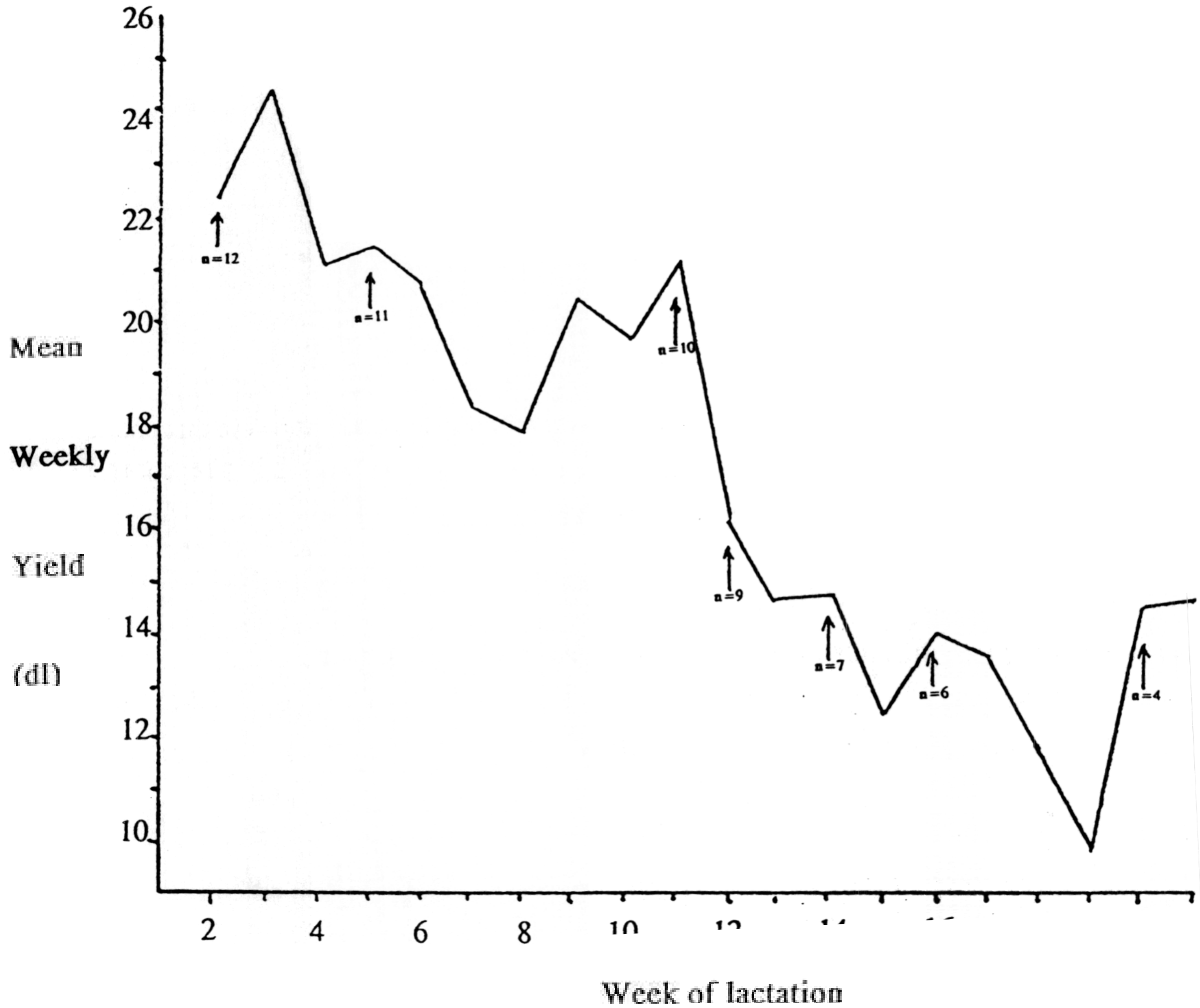
Mean weekly yield at monthly intervals - crossbred does (ml).

			Week			
	1	**4**	**8**	**12**	**16**	**20**
Mean	2241	2145	2045	1469	1353	1471
SD	1072	927	1050	761	485	522
n	12	11	10	9	6	4

When yields are recalculated from day 21, to make them more comparable to those of indigenous does, then the mean yield becomes 31.8 ± 25.4 litres, a figure very similar to the 27.9 ± 15.2 litres achieved by MS animals in the same year. The range of yields (5.6 to 93.1 litres) which led to the large Standard Deviation, does indicate the increased potential in at least some cross-bred animals, but equally it is clear that crossbreds do not demonstrate an obvious superiority under low-input conditions. Given the number of does drying off early, there may well be scope for a selection programme designed to identify persistency of lactation but such an approach could increase the cost of animals and this would run counter to the minimum-cost philosophy necessary if milk is to be consumed rather than sold.

Figure

Mean Weekly Milk Yields Cross- Bred Does



Discussion

The data generated here largely support earlier findings in terms both of the magnitude of parameters measured and of the between-year variability demonstrated. Over five years of trials, supplementation has consistently produced a yield response, but that response has varied according to month of kidding (project X0124) and even with similar kidding patterns (project X0254). In a uni-modal rainfall situation a month-of-kidding effect was to be expected and may be explained in terms of availability of forage at critical times. Between-year variation, when kidding dates were similar, is more difficult to explain, particularly when rainfall patterns were apparently similar in both years.

If the milk taken from indigenous does is to be useful then daily production needs to be in excess of 150ml. The compositional quality of this milk has been shown to be high with 53g prot/kg. (Banda 1992_b) Two hundred millilitres can thus provide a child with over 10g high quality protein (50% of RDA) as well as valuable amounts of Calcium and Vitamin A. In these trials supplemented animals sustained these production levels for an average of 20 weeks in 1993-94 and 12 weeks in 1994. The lower production of unsupplemented animals would still make a contribution to the diets of small children but would be unlikely to justify the effort involved.

However, any such production will only be acceptable if it does not prejudice other outputs and outcomes. Where does were milked but not supplemented kidding was 130%. This figure is not high, in view of the perception of the goat as a fecund animal, but it is better than the 109% reported by Reynolds (1979) and the 107% of Karua (1988). It is clear that supplementation in the period leading up to service improved ovulation rate and hence litter size, as would be expected. Kid mortality is clearly a potential problem, though variations between years have been shown to be considerable. Of the 5 years covered by projects X0124 and X0254 four have not produced any treatment effects. Over that period overall kid mortality has averaged 38%. The 60% mortality experienced in kids from milked does in 1993 was thus both distressing and unexpected and the outbreak of bacterial scour aside, not easily explained. In terms of growth the 9.18±1.64 kg at 18 weeks attained by those surviving to that age was higher than those attained in the earlier trials and in line with those reported by Renolds (1979), for kids from unmilked does, which averaged 8.2±2.0kg at 12 wks and 11.9±2.7kg at 24 weeks. Malnutrition does not therefore appear to have been a problem, in surviving kids at least!

It is normally expected that lactating females lose weight in early lactation and this weight loss may be associated with delays in re-establishment of oestrus and/or poor conception rates, especially if it exceeds 5% of bodyweight. All three trial groups lost weight, as expected, but losses were within the acceptable range and did not affect subsequent reproductive performance. It is therefore suggested that the handmilking of does is a practice which may be undertaken without detriment to the doe or to her production. It is clear, however that kid mortality may be substantial and that the benefits of having milk available will need to be weighed against these potential losses. Nonetheless, it is accepted that, despite attempts to mirror subsistence farming conditions, it is possible that in a genuine village situation the impact of the strategy might be greater. It is considered desirable that an evaluation of the technique be carried out under village conditions. Further, given that the routine, daily milking of does with very small teats might be considered tedious, such an evaluation would allow evaluation of the acceptability of the technique and the likelihood of its uptake. In view of the intention to make any milked produced available to the younger children in a family, it is desirable that the woman of the house be the main participant in any such trial.

Proposals

In view of the findings reported here, and those from project X0124 it is proposed that consideration be given to:

i) Establishing a field trial in which these findings may be tested in a subsistence-farming environment and the acceptability of the technique determined.

ii) Extending the project to other countries in the region. Given the widespread occurrence of goats of this type in Mocambique, Zambia and Zimbabwe, and in view of the child malnutrition prevalent in these countries, it is desirable to determine whether similar strategies are capable of providing similar benefits there.

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Karua, S. 1988. Reproductive performance of indigenous Malawi goats under traditional management. Munco, Goat Development Workshop, Bikika, Zimbabwe.

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Appendix I

Proximate analysis of maize bran

	%
Dry Matter	91.0
Crude Protein	10.1
Other Extract	8.8
Crude Fibre	7.0
Ash	6.2
Nitrogen -free extract	59.0
Estimated ME	14.0 MJ/kgDM

SMALL STOCK PROJECT X0254

MILK PRODUCTION, ETC
FINAL ACCOUNT

	1993-94 £	1994-95 £	Total £
Salaries	4850	4850	9700
Overheads	2108	2108	4216
Consumables	1150	1115	2265
Misc Costs	550	50	600
Travel/Subs	3450	3235	6685
Total	12108	11358	23466

I certify that the above expenditure has been wholly and necessarily expended under the grant, in accordance with the terms and conditions of research project X0254.

Alan Cooper

Project Leader