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Effect of strategic supplementary feeding on ewe productivity under range conditions in North Kordofan, Sudan

F.M. El-Hag*, B. Fadlalla, M.A. Elmadih

Agricultural Research Corporation, El-Obeid Research Station, Box 429, El-Obeid, Sudan

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Abstract

Strategic supplementary feeding practices were imposed on ewes prior to mating (flushing) and during late pregnancy (steaming-up) at two locations in North Kordofan, Sudan. The objective was to improve ewe reproductive performance and increase lamb birth weight. A completely randomized block design was used and the results analyzed from the economic point of view. Strategic supplementary feeding of ewes increased conception and lambing rates ($P<0.01$), reduced abortions ($P<0.01$), and resulted in higher lamb birth weights ($P<0.05$). The treatment also reduced ewe weight loss ($P<0.05$) and caused no ewe mortality. Respective lambing rates for the supplemented and control ewes were 91.7 and 41.7%. Strategic supplementary feeding was economically more advantageous and could accrue up to 382540 additional Sudanese pounds (US $273.24) in returns. It was concluded that steaming-up and flushing are essential for improving ewe reproductive performance, increasing lamb birth weights, and minimizing pregnancy stress of ewes. Hence, the practice is recommended in similar ecological zones to improve productivity of desert sheep. © 1998 Elsevier Science B.V. All rights reserved.

Keywords: Flushing; Steaming-up; Reproductive performance

1. Introduction

Sudan desert sheep can mate throughout the year, and in North Kordofan they are raised under open rangelands. Nonetheless, defining breeding seasons is common among sheep producers. The breeding season is usually planned for January–March to match lambing with the wet season and, therefore, more nutritious grazing (Mukhtar, 1985). However, mating coincides with the dry season (February–June) when rangelands are at their lowest nutritional quality (El-Hag, 1992).

Nutrition is one of the environmental cues that affect reproduction in domestic animals (Tatman et al., 1990). Direct effects of poor nutrition are reflected in reduced conception, embryonic losses, reduced lambing rates (Diskin and Niswender, 1989) and high ewe mortality (Yoder et al., 1990). Low lambing rates represent a major obstacle to sheep production (Schoenian and Burfening, 1990). Low lambing rates of 64–70% have been reported for sheep in North Kordofan (Mukhtar, 1985).

This study was undertaken to evaluate the effects of strategic supplementary feeding prior to mating

*Corresponding author. Tel.: 00249 81 3000; fax: 00249 11 472814.

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(Flushing) and at late pregnancy (Steaming-up) on ewe productivity in North Kordofan. The ultimate goal was to improve Sudan desert sheep productivity in North Kordofan and similar ecological areas.

2. Materials and methods

2.1. Study area

The study was conducted at two locations, Kazgail and Arifa in Sheikan Province in Sudanese North Kordofan (latitudes 11°:15' to 16°:30'N, and longitudes 27 to 32°E). Average maximum temperature varies between 30 and 35°C during most of the year, with peaks of above 40°C during April, May and June prior to the rainy season which extends from July to October and reaches its peak in August. Rainfall average is ca. 280 mm per annum. Soil types vary from sandy (Goz) which is the dominant type in North Kordofan, through loamy sands (Gardud) to clays. The dominant vegetation is a varying mixture of grasses and herbs with scattered scrub bushes intersected with bare areas (Technoserve, 1987).

2.2. Experimental animals and treatments

At each location, 24 mature Sudan desert ewes (2–4 years old) were selected, ear-tagged, drenched with an anthelmintic (Ivomec®) and weighed. Ewes were then divided into two equal groups based on initial body weight and age. One group was randomly assigned as a control, while the other group was supplemented with groundnut (*Arachis hypogea* L.) seed cake (GNSC) prior to mating and at late pregnancy.

Ewes in the flushed group were supplemented on a daily basis with 150 g of GNSC (Chemical composition, nutritive value and nutrients are shown in Table 1). Supplement provision was constantly supplied every three days, at the same time as watering. Flushing period was 45 days prior to the breeding season (January–March).

Thereafter, ewes at both locations were monitored for signs of behavioral estrus and those detected were serviced. Ewes were monitored for return to estrus and those returning were serviced again until conception. Supplement provision was again resumed for the treated group for 45 days during the last trimester of gestation.

To eliminate ram effect, only one ram bred all the ewes at each location. The rams were supplemented with the same amount of groundnut seed cake (GNSC) (150 g/day), but only prior to mating.

Data recorded were: initial body weight, number of serviced ewes, conception rate, number of abortions and abortion rate, lambing rate, ewe weight at lambing, ewe mortality and lamb birth weights.

Data were analyzed as a completely randomized block design (Snedecor and Cochran, 1982) for each location, then combined in a factorial arrangement to study location effect. Ewes were blocked on the basis of initial body weight and age to reduce ewe-to-ewe variation. Rates and percentages were transformed using Arc Sin. MSTATC software program was used for the statistical analyses.

2.3. Economic analysis

Profitability of the strategic supplementary feeding practice was evaluated using prevailing market prices

Table 1
Groundnut seed cake chemical composition (%DM-basis), nutritive value, and nutrients provided in 150 g of the supplement

Item	GNSC	Calculated nutrient in 150 g of GNSC (g)
Dry matter (%)	95.3	143
Organic matter (%)	91.2	137
Ash (%)	4.4	7
Crude fiber (%)	14.8	22
Crude protein (%)	25.7	39
Energy density (Mcal DE/kg DM)	2.8	0.420
In vitro OM digestibility (%)	65.4	—

Chemical composition and energy density were done according to Horowitz (1980), while in vitro OM digestibility was carried out according to Tilley and Terry (1963).

of ewes, lambs and GNSC supplement to calculate net benefits. Added return from market value of lambs and ewes at the end of the trial in excess of that produced by the control group was then calculated as a percentage of the added cost.

3. Results and discussion

3.1. Reproductive performance

The effects of supplementary feeding during mating and at late pregnancy on the ewes reproductive performance at the Kazgail and Arifa locations indicated that supplemented ewes had higher ($P<0.05$) conception rates, higher ($P<0.05$) lambing rates, lower ($P<0.01$) abortion rates and lower mortality rate ($P<0.05$) compared to the control ones (Table 2).

The combined analysis showed similar results, i.e. higher ($P<0.01$) conception rates, reduced ($P<0.01$) abortions and no ewe mortality. Respective lambing rates ($P<0.01$) for supplemented and control ewes were 91.67 and 41.67%. However, none of the ewes gave birth to twins. It was observed that a minimum of 30 kg ewe body weight was required for successful service and conception. The findings are in line with Mukhtar and Fadlalla (1988) who found that supplementary feeding had resulted in a 17.0% increase in lambing percentage and a 21.0% decrease in abortion rate.

Supplemented ewes had significantly ($P<0.05$) heavier lambs at birth than controls. Average lamb birth weights were 3.9 and 3.5 kg, respectively (Table 2). Reese et al. (1990) reported that energy supplementation had resulted in a significant ($P<0.01$) effect on lamb birth weight.

According to Diskin and Niswender (1989) and Yoder et al. (1990), the effects of pregnancy stress on ewes are manifested in increased abortions, weight loss and mortality. It was observed that control ewes were often serviced 2–3 times during the breeding season as a result of repeated failure to conceive and that eight ewes aborted. Supplemented ewes, on the other hand, had lower ($P<0.05$) weight loss, reduced frequency of abortions and recorded none dead, compared to the control ewes. Respective weight losses during pregnancy for the two groups were 0.7 and 3.4 kg/ewe.

3.2. Economic analysis

Table 3 presents combined partial budgeting results for strategic supplementary feeding of ewes over the common farmer practice. Supplementation had shown superiority over the farmer practice in terms of number of lambs born, ewe condition and survival. Accordingly, this practice could accrue up to 382540 additional Sudanese pounds (US $ 273.24) in return over the farmer's practice. Reese et al. (1990) supplemented ewes with different energy levels during

Table 2
Effects of strategic supplementary feeding on ewe productivity at two locations in Sheikan Province, North Kordofan, Sudan

Parameter	Kazgail		Arifa		Both locations		SE
	treated group	control group	treated group	control group	treated group	control group	
No. of ewes	12	12	12	12	24	24	
Av. service weight (kg)	33.5	32.9	39.7	42.2	36.6	37.5	0.86
Conception rate (%) [a]	91.7a	58.3b	100.0c	75.0d	95.8c	66.7d	2.21
Abortion Rate (%) [b]	9.1c	42.9d	8.3c	55.6d	8.7c	50.0d	2.06
Av. lambing weight (kg)	36.2a	31.3b	35.6	36.8	35.9	34.1	0.81
Av. ewe weight change (kg)	2.7a	−1.6b	−4.1	−5.3	−0.7a	−3.4b	1.17
Ewe mortality rate (%)	0.0a	16.7b	0.0c	16.7d	0.0c	12.5d	0.78
Lambing rate (%) [c]	91.7a	33.3b	97.7c	50.0d	91.7c	41.7d	2.83
Av. lamb birth weight (kg)	3.33	2.93	4.42	3.98	3.9a	3.5b	0.14

[a] (No. of pregnant ewes/No. of serviced ewes)×100.
[b] (No. of aborted ewes/No. of pregnant ewes)×100.
[c] No. of lambs born/No. of ewes serviced)×100 (Schoenian and Burfening, 1990).
a,b=Significantly different ($P<0.05$), and c,d=significantly different ($P<0.01$).

Table 3
Combined complete budget and partial budget for strategically supplemented and control ewes (prices in Sudanese pounds)

Parameter	Farmer practice	Improved practice
Initial number of ewes	24	24
Number died	3	0
Final number of ewes	21	24
Male lambs number	5	18
Female lambs number	5	5
Ewes costs	923,520	923,520
Groundnut seed cake cost	0.0	64,400
Total costs	923,520	987,920
Ewes returns	808,080	923,520
Male lambs returns	127,500	459,000
Female lambs returns	120,000	120,000
Total returns	1,055,580	1,502,520

Partial budget for the combined lot

	Combined
Reduced costs	923,520
Added returns	1,502,520
Benefit (B)	2,426,040
Added costs	987,920
Reduced returns	1,055,580
Cost (C)	2,043,500
Net benefits (B-C)	382,540
Added returns: added costs ratio	1.52 (152%)

1 US dollar=1400 Sudanese pounds.
Note: Ewe price=38480, Male lamb price=25500, Female lamb price=24000 and Groundnut seed cake price=0.20 per kg.

late pregnancy and lamb weaning periods. They found that only the high energy level was profitable and that the added return from lamb sales was 120% of the added cost of supplementing the ewes until all the lambs were weaned. In this study, added return were 152% of the added costs (Table 3).

4. Conclusions and recommendations

The results clearly indicate that flushing and steaming-up are essential to improve ewe reproductive performance in the geographical areas studied. Flushing improved the conception rate and reduced abortions, while steaming-up resulted in higher lamb birth weights, improved ewe condition and minimized pregnancy stresses.

To improve Sudan desert sheep productivity under rangelands condition in North Kordofan, and similar ecological areas in Sudan and other countries, it is recommended to flush breeding ewes and rams and steaming-up ewes at late pregnancy. An amount of 150 g/ewe/day of groundnut seed cake or a similar oilseed cake for 45 days flushing period and 45 days steaming-up period can markedly improve the conception, reduce abortions and increase lambing rate and lamb birth weights.

Adoption of such practice by farmers, especially that the oilseed cake needed is available in the area and the amounts required are small and inexpensive, would improve sheep reproductive performance and lamb birth weights. Further studies on ewe supplementation during lactation and post-weaning nutrition effects on lamb growth and survival are needed.

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