

Seasonal growth and the effect of supplementary feeding on the performance of sheep under range condition of Southern Darfur, Sudan

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Summary

In a study of Sudan desert sheep (fuse ecotype), a natural grazing growth trial was followed by another of dry summer dietary supplementary feeding trial. Trials were carried in Ghazal Gawazat Station, of Southern Darfur (37°, 11' north, 3° 26' east); 360 metres above m.s.l and an annual rainfall 400-600 mm. The sheep on natural range grazing had highest body weight in the cool winter season, than in other season. The rainy season was the worst in sheep performance in spite of abundant-rich pasture, because of unfavorable environmental wet conditions, associated with high humidity and flourishing of irritating biting flies. Dry summer season supplementation increased daily gain compared to cool winter season gains; particularity with groundnut cake or Roselle oilseeds supplements. Nevertheless, supplementation with groundnut haulm (Hay) maintained body weight attained during cool season, without noticeable gain.

Introduction

Desert sheep is the most important sheep breed type in Sudan, which contributes more than 65% of total sheep of the Sudan (Sulieman *et al.*, 1990). They are reared strictly in the semi-desert belt in association with camel; which are raised exclusively by nomadic tribes in the region (Mufarrih, 1985). They exist under migratory rangeland areas with sparse vegetation in search of water and grass as dictated by the seasonal distribution

of rainfall and soil fertility conditions, impose a direct influence on the amount and quality of forage available during the year and indirectly affect animal performance. During the rainy season, range pastures provide adequate feed to pasture animals and allow for satisfactory levels of production, meanwhile in late dry summer season, the available grazing is of low quality and low digestibility (Mohamed and Salih, 1991), and is consumed in quantities less than the animal maintenance requirement.

Eventually the animal loses body weight when kept entirely on dry season grazing, hence the pattern of growth of animal's exhibits a characteristic drop cycles of liveweight followed by compensatory cycles during the rainy season. As such resulting in retarded body development, late maturity, and low reproductive rate. Those animals might benefit from supplementation during dry summer season, from available agricultural crop residues and by-products such as Karkade (Roselle) seeds, groundnut haulms, and groundnut seed cakes are of major importance as annual cash crops eventually planted by sedentary villagers in nearby householding during the rainy season.

The studies of production performance of desert sheep under natural habitat of range conditions were scarce. Therefore this study was conducted on low rainfall Savanna, at Ghazal Gawazat Research Station, Southern Darfur, in order to evaluate the effect of season of the year on growth performance of sheep and to study the effect of different agro-industrial by-products supplementation during the dry season on feed utilization.

Materials and Methods

Study area

The study was carried out at Ghazal Gawazat Research Station, located at about 23km North West Eddaain town, and 160 km east of Nyala town, in Southern Darfur (Western Sudan). It lies at latitude 37°, 11` north, longitude 3° 26` east, and situated on an attitude of 360 metres above mean sea level. It covers an area of 20 square miles (51.8 km²/5180 hectare). The area is classified as low rainfall woodland Savanna on sandy soil (Jackson and Harrison, 1958). However, clay soil (Buta.), and non-cracking clay soil (Nagaa) patches are also found, therefore, various grass, herbs, shrubs and trees formations of the vegetation cover in the station were surveyed, (Ahmed and Ahmed, 1978).

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The climate is characterized by three annual seasons, a dry hot summer (February – May) a wet summer (June – October) and a dry cool winter season (November – January).

Ambient temperature ranges between a maximum of 47°C in dry summer to a minimum, as low as 15°C in the cool season. Annual rainfall ranges between 400-600 mm, the highest precipitation occurring during in August/September; however occasional showers may occur in May.

Experimental treatment:

A fuse ecotype desert sheep (McLeroy 1961^b) flock consisting, of eleven male and nine female lambs, 4-5 months of age, was purchased from a local village market in late cool season, and were kept under the station conditions until the study was started in the following summer season, when they were seven months of age.

The study was carried out in two experiments. The first experiment was an evaluation of the effect of the three seasons of the year on the growth performance of sheep under natural range grazing without supplementation, where only mineral block lick was provided. Body weight was recorded fortnightly. The second experiment was conducted in late summer season, using three dietary supplement treatments; groundnut haulms (GNH), Karkade (Roselle) crushed seed, or locally extracted groundnut cake (GNC). The sheep were blocked into three balanced (weight and sex) groups; where in the treatments (supplements) were assigned to sheep groups in Randomized block arrangement. The sheep were weighed at weekly intervals, during an experimental period of 56 days.

Calculation of energy requirements and utilization was based on the metabolizable energy system used in Britain, published in ARC (1980) and AFRC (1990) Nutrition Abstracts and Reviews, series B, **60 (729-804)**.

Statistical analysis:

Data collected in the study were analysed by analysis of variance (ANOVA) methods. The significant treatment means differences were separated by the Duncan new multiple range

test, while sex differences were tested by the least square test (LST), according to Steel and Torrie (1960).

Results and Discussion

The growth performance of sheep under natural range grazing is shown in **table 1**. In the cool winter season the sheep was higher in body weight than in other two seasons. Moreover male sheep exhibited ($P<0.05$) also higher gain in cool winter than in the summer seasons, while female sheep showed non-

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different gains ($P>0.05$) in dry summer and winter seasons. Lower negative gains ($P<0.05$) were obtained in wet season for both male and female sheep. In general, males were heavier ($P<0.05$) and had better gain than females.

An improvement in growth performance of sheep at early dry season in this study may be attributed to the fact that, animals met their nutrient requirements in early dry summer, when the nutritive value of standing hay is suboptimal; by supplementing their feed from selective browsing (Ahmed and Ahmed, 1978). While in late dry summer (April-June) a decrease in body weight was observed, this is due to deterioration of the available grazing pasture in both quality and quantity, and been consumed in amounts less than the animal maintenance requirement; eventually the animal loses body weight (Crowder, 1977).

Table 1. Seasonal body weight {kg}, and daily weight gain {g} of sheep under natural range grazing conditions in Ghazal Gawazat Station; in experiment 1.

Item	Seasons			SE	Overall Mean
	Dry Summer	Wet Summer	cool Winter		
Number of animals	15	13	13		
Experimental period (month)	4	4	4		
Mean initial weight	33.4	38.1	36.4		
Male	34.3	38.7	33.8		
Female	32.6	37.6	35.1		
Mean final weight					
Male	38.1 ^b	36.4 ^b	43.1 ^a	0.57	-
Female	38.3 ^b	37.8 ^b	46.7 ^a	0.82	40.9 A
SE	37.9 ^a	35.0 ^a	39.4 ^a	0.79	37.5 B
SE	0.94	1.01	1.01	-	-
Mean total gain	+4.7 ^b	-1.7 ^c	+6.6 ^a	0.58	-
Male	+4.0 ^b	-0.9 ^c	+8.9 ^a	0.83	4.0 A
Female	+5.4 ^a	-2.6 ^c	+4.3 ^a	0.80	2.4 B
SE	0.94	1.01	1.01	-	-
Mean daily gain					
Male	+39.0	-14.5	+55.0	4.79	-
Female	+33.3 ^b	-7.6 ^c	+74.3 ^a	6.91	33.3 A
SE	+44.6 ^{ab}	-21.3 ^c	35.7 ^b	6.68	19.7 B
SE	7.93	8.52	8.52	-	-

SE = Standard error of mean.

a, b and c = Means on the same row with different superscripts differ significantly (P<0.05).
 A and B = Means on the same column with different superscripts differ significantly (P<0.05).

At the beginning of the rainy season, when the grasses started growing up; the sheep growth declined, due to shift of sheep from dry pasture to a newly growing grass of low dry matter (DM), crude fibre (CF) and acid detergent (ADF) (Mohamed and Salih, 1991). However after few weeks later when the pasture herbage growth was at maximum thus the sheep body weight improved, due to the fact that, herbage contents of crude protein (CP), ether extract (EE) and nitrogen free extract (NFE) were high concentration (Mohamed and Salih, 1991). Although, in the rainy season the grazing pasture was abundant and adequate to support animal growth; however, the sheep body weights dropped (August/September), this is due to unfavorable environmental conditions created by heavy rain (maximum fall and relative humidity), flourishing irritating insects and insect-blood borne diseases (El Wali and Konopathkin, 1984); these factors led to depression, loss of appetite and decrease in body weight due to lowering intake of grass, subsequently mortality rate (26%) raised. The cool dry winter, was the best sheep growing season abundant in pasture grass, tree browse, optimum ambient temperature, reduction in insect irritation and diseases. The daily gain in body weight (55g/day), in winter season generally is similar to that of long-tailed Ugogo sheep in Tanzania (Wilson, 1976). Males were heavier than females by 30% as were reported; (Sulieman *et al.*, 1990; and Pollot, Ahmed and Mohamed 1978) for Watish sheep. Supplementation of range grazing (**table 2**), improved daily gain, compared with cool winter weights, in previous experiment: particularity with G.N. cake and Karkade (Roselle) seeds supplements. Though differences were not significant (P>0.05); as shown in **table 3**; 133.9g and 129.5g/day respectively.

Improved growth performance, with legume hay (G.N.H), oilseed (Roselle) and cake (G.N.C) supplements would enhance microbial fermentation in the rumen; providing, optimal ammonia nitrogen concentration required for microbial growth, and may subsequently satisfy the animal requirement for protein as well, (Weston, 1967; McDonald *et al.*, 1995); as when an 13% CP concentration in the diet is provided (Satter and Slyter, 1974).

Dietary energy utilization (**table 3**), suggests that supplementation with G.N.C or Roselle (Karkade) seed shall positively increase energy intake from dry summer pasture, to attain reasonable weight gains. Meanwhile G.N.H supplement would only maintain the body weight obtained during the cool winter season, without further noticeable gain.

The daily gains with pasture supplementation were comparable to those reported by Abu-Laziya (1996) for Beija sheep of Sudan (115g/day) and those for Sudan desert sheep fed different supplements, reported by Hassan and Mukhtar (1970).

Table 2. Ingredients (g/DM) of dietary supplements, and intake of dry matter (kg), metabolizable energy (MJ/d), and crude protein (g/d) of sheep, in experiment 2.

Item	Dietary supplement		
	Groundnut cake	Karkade seed	Groundnut haulms {GNH}

	{GNC}	{Roselle}	
Ingredients:			
Groundnut cake	477.0	-	-
Karkade seed	-	475.5	-
Groundnut haulms	623.7	627.7	1247.4
Common salt	11.0	11.0	11.0
Dietary intake:			
Total dry matter	1.112	1.114	1.258
Total metabolizable energy {MJ}	10.70	11.65	9.73
M/D {MJ/kg DM}	9.6	10.5	7.7
Total crude protein {g}	268.4	194.6	101.0
(g/kg DM)	241	175	80

GNC: (ME = 12.23 MJ/kg DM; CP = 457 g/kg DM).

GNH: (ME = 7.8 MJ/kg DM; CP = 81 g/kg DM).

Karkade seed: (ME = 14.21 MJ/kg DM; CP = 303 g/kg DM).

Source: Sulieman Y.R. and Mabrouk Afaf A.R. (1999). The Nutrient composition of Sudanese Animal Feeds – Bulletin III. APRC, Kuku, Khartoum North, Sudan.

Table 3. Growth performance and energy utilization in sheep grazing natural range grass supplemented with groundnut cake, Karkade seed or groundnut haulms during the dry summer season {April-June}, in Ghazal Gawazat Station Southern Darfur in experiment 2.

Item	Dietary supplement			SE
	G.N.C	Karkade	G.N.H	
Growth performance:				
Experimental sheep {N}	4	4	5	-
Experimental period {week}	8	8	8	-
Initial weight {kg}	44.0	44.0	43.8	1.40
Final weight {kg}	51.5	51.3	46.8	1.42
Mean weight {kg}	47.75	47.65	45.30	-
Metabolic weight {W ^{0.75} }/kg	18.2	18.1	17.5	-
Total gain {kg}	7.5	7.3	2.9	0.80
Daily gain {g}	133.9	129.5	52.1	14.30
Feed energy utilization:				
Net energy value of gain {MJ} ⁽¹⁾	2.827	2.730	1.056	-
Metabolizable energy of gain (growth) {MJ} ⁽²⁾	8.672	6.653	3.160	-
Net energy requirement for maintenance {MJ/day} ⁽³⁾	4.209	4.202	4.042	-
Metabolizable energy requirement for maintenance {MJ/day} ⁽⁴⁾	6.145	5.977	6.218	-
Metabolizable energy intake for maintenance and growth {MJ}	14.817	12.030	9.378	-
Metabolizable intake from supplement {MJ}	10.700	11.650	9.730	-

Metabolizable energy intake from pasture {MJ}	+ 4.112	+ 0.380	- 0.352	-
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$W = \text{mean body weight [kg]; } qm = M/D \div 18.4.$

(1) $\text{Energy value of gain [Evg], MJ NE/kg} = 4.4 + 0.25W \text{ [castrate / sheep].}$

(2) $\text{Metabolizable energy of gain [MJ]} = (\text{Evg} \times \text{daily gain}) \div Kf \text{ [gain].}$

(3) $\text{Net energy requirement for maintenance [sheep], MJ/day} = 0.226 \{W^{0.75}\} + 0.007W.$

(4) $\text{Metabolizable energy requirement for maintenance [MJ/day]} = NE \text{ [maintenance]} \div Kf \text{ [maintenance].}$

Source: McDonald, Edwards, Green holgh, Morgan (1995). Animal Nutrition; 5th edition Pp. 270, 322-336. Prentice Hall, Harlow, England.

Conclusion

Late wet summer and winter seasons are most favourable seasons for growing sheep, in Ghazal Gawazat-like areas, in Southern Darfur. The decline in body weight in the dry season can be avoided by supplementary protein feeding using available low cost agricultural by-products remaining from locally planted oilseed crops, during the rainy season.

References

Abu Laziya, M. (1996). Sheep animal resources and animal production in the Sudan, Khartoum University Press, University of Khartoum. **63-90** {Arabic publication}.

AFRC (1990). Nutrition Abstracts and Reviews, series B, **60, 729-804.**

ARC (1980). Agricultural Research Council, the nutrient requirements of Ruminant Livestock. Commonwealth Agricultural Bateaux, Slough, England.

Ahmed, F.A. and Ahmed, A.E. (1978). Plant cover, nutritive value and carrying capacity of a range pasture in low rainfall woodland savanna of Western Sudan. E. Afr. Agric. For J. **43: (3), 238-245.**

Crowder, L.V. (1977). Potential of Tropical Zone Cultivated forages. In potential of the world's forages for ruminant animal production. Winrock Int. Livestock Trg. Center, Arkansas: **49-78.**

El Wali, A.A. and Konopathkin, A.A. (1984). The effect of metro-logic factors on the seasonal dynamics of cattle leptospirosis in the Sudan. Sudan J. Vet. Res. **6: 9-14.**

Hassan, M.H. and Mukhtar, A.M.S. (1970). Digestibility trials and feedlot performance of Sudan desert sheep. Trop. Agric. Trinidad, **47: 325-330.**

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- Jackson, J.K. and Harrison, M.N. (1958).** Ecological classification of vegetation of the Sudan. Forest Bulletin, New Series 2. Khartoum.
- Mc Donlad, P., Edwards, R.A.; Greenhalph, J.F.D, and Morgan (1995).** Animal Nutrition 5th edition, Prentice Hall, Harlow, England.
- Mc Leroy, B.B. (1961^b).** The sheep of the Sudan, 2. Ecotype and tribal Breeds. Sudan J. Vet. Science and Anim. Husb. **2: 101-151.**
- Mohamed, T.A. and Salih, F.E. (1991).** Effect of stage of maturity on the nutritive value of low rainfall woodland savanna pasture. Sudan J. Anim. Prod. **4: 23-36.**
- Mufarrih, M.E. (1985).** Sudan desert sheep, their origin, ecology and production potential. <http://www.fao.org/doc rep/t8600t/t8600 top.htm>.
- Pollot, G.E.; Ahmed, F.A. and Mohamed, D.M. (1978).** The effect of weaning age on the growth of Watish {Sudan desert type} lambs under feedlot condition. Um Banein Livestock Research, Bulletin No. **2.**
- Satter, L.D. and Slyter, L.L. (1974).** Effect of rumen ammonia concentration on rumen microbial production in vitro. British J. Nutrition, **34: 199-208.**
- Steel, R.G.D. and Torrie, J.H. (1960).** Priceless and procedures of Statistics; McGraw-Hill Inc., New York.
- Sulieman, Y.R. and Mabrouk, Afaf. (1999).** The Nutrient composition of Sudanese Animal Feeds – Bulletin III, APRC, Kuku, Khartoum North, Sudan.
- Sulieman, A.H.; Sayers, A.R. and Wilson, R.T. (1990).** Evaluation of Shugor, Dubasi and Watish subtypes of Sudan desert sheep at El Huda National Sheep Research Station, Gezira Province, Sudan, ILCA, Addis Ababa, Ethiopia.
- Weston, R.H. (1967).** Factors limiting the intake of feed by sheep. II. Studies with wheaten hay. Aust. J. Agric. Res. **18: 983-1003.**
- Wilson, R.T. (1976).** Studies on the livestock of Southern Darfur, Sudan III Production traits in sheep. Trop. Anim. Helth. and Prod. **8: 103-114.**

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**النمو الموسمي وأثر التغذية التكميلية في المراعي علي الأغنام
في جنوب دارفور - السودان
عبدالله إبراهيم عبدالله ، يوسف رزق الله سليمان وفيصل عوض أحمد**

المخلص:

في دراسة علي الأغنام السودانية الصحراوية ، أجريت تجربة علي النمو في المراعي الطبيعية ، تبعها تجربة أخرى علي التغذية التكميلية في فصل الصيف. وذلك في محطة الغزاليه جاوزت بجنوب دارفور (11 ثانية 37 درجة

شمال ، 26 ثانية 3 درجات شرق ، وعلـي ارتفاع 360 متر فوق سطح البحر) تتراوح فيها الأمطار السنوية والتي تسقط في فصل الصيف بين 400-600 ملمـيتر.

سجلت الأغنام أعلى وزن لها في فصل الشتاء المعتدل ، دونه في الفصول الأخرى. وقد كان الفصل المطير (الخريف) أسوأ الفصول لنمو الأغنام بالرغم من وفرة المرعي الغني ، ويرجع ذلك إلى الأحوال البيئية المشبعة بالرطوبة غير الملائمة لها وكثرة الذباب اللاسع علي الأغنام. التغذية في الصيف الجاف أدت إلي زيادة الكسب في الوزن اليومي للأغنام مقارنة بكسب موسم الشتاء المعتدل، خاصة عند التغذية بكسب الفول السوداني وبذور الكركدي الزيتية. أما التغذية بتبن الفول السوداني فقد حافظت علي الوزن الذي أكتسبته الأغنام خلال الفصل المعتدل وبدون أي زيادة ملحوظة.