Practical Approaches for Improving Utilization of Feed Resources under an Extensive Production System in Sinai

El Shaer H.

in

Rubino R. (ed.), Morand-Fehr P. (ed.).
Systems of sheep and goat production: Organization of husbandry and role of extension services

Zaragoza : CIHEAM
Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 38

1999
pages 207-213

Practical approaches for improving utilization of feed resources under an extensive production system in Sinai

H.M. EL Shaer
Desert Research Centre, P.O. Box 11753, Mataria, Cairo, Egypt

SUMMARY - Range vegetation is considered the basic resource for animal feeding in the Egyptian desert. It has been deteriorated as a result of poor management and environmental impacts. The fresh biomass produced from the native ranges in Sinai, particularly in dry seasons, may not sustain the nutritional requirements of the large population of livestock in this region. It was of interest to define proper approaches for improving feed resources availability under the conditions of extensive production system in Sinai. The practical approaches which had already been applied are presented in this article. They included processing of minor and non-palatable shrubs to improve their utilization as good quality fodders; cultivation of salt- and drought-tolerant shrubs and utilization of local organic wastes as feed ingredients.

Key words: Range vegetation, sheep, goat, camel, animal feed, production system.

RESUME - *"Approches pratiques pour améliorer l'utilisation des ressources alimentaires dans un système de production intensive au Sinaï". La végétation des parcours est considérée comme la ressource de base de l'alimentation animale dans le désert égyptien. Ils ont été dégradés comme résultat d'une mauvaise gestion et des impacts sur l'environnement. La biomasse fraîche produite à partir des parcours autochtones du Sinaï, particulièrement pendant les saisons sèches, peuvent ne pas être suffisants pour les besoins nutritionnels des grandes populations animales de cette région. Il était donc d'intérêt de définir des approches adéquates pour améliorer la disponibilité en ressources alimentaires sous les conditions des systèmes de production extensifs du Sinaï. Les approches pratiques qui avaient déjà été appliquées sont présentées dans cet article. Elles comprenaient une transformation des arbustes peu et pas appétents afin d'améliorer leur utilisation en tant que fourrages de bonne qualité ; et la culture d'arbustes tolérants à la salinité et la sécheresse ainsi que l'utilisation de résidus organiques locaux comme ingrédients alimentaires.*

Mots-clés : *Végétation des parcours, ovins, caprins, camélidés, aliment animal, système de production.*

Introduction

The rapidly growing demand for animal products in Egypt and a parallel increase in livestock and imports of feed grains have drawn the attention towards the need for intensification of efforts to develop the indigenous livestock and feed resources, particularly in the newly reclaimed and desert areas. Animal production (mainly from sheep, goats and camels), based on grazing natural range grazing, is one of the main source of income for most of the population in Sinai peninsula (60,000 km^2). The production system of small ruminants is mostly an extensive system, so called nomadic or transhuman herding system. Because of the low seasonal erratic rainfall (30-180 mm/year) forage resources are considerably seasonal, fluctuate greatly in and quantity quality (El Shaer, 1981). Shortage feedstuff is considered the main constraint to increasing animal productivity ranges in Sinai peninsula. It was of interest to overcome such constraints, using local resources. Therefore, this article focused on some approaches for improving the indigenous feed resources which had been applied among Bedouins in Sinai for many years.

Characteristics of the indigenous range

The native natural range, as described by El Shaer and Gihad (1994), is an open shrub vegetation; most likely salt and/or drought tolerant plant species. They vary in their green biomass production, distribution, and nutritive value from year to year due to environmental changes especially the amount of rainfall and its distribution. The less palatable and unpalatable species are dominant and widley distributed such as *Haloxylon salicornicum, Salsola tetrandra, Tamarix aphylla, Zygophyllum* spp., etc.

The palatable and good quality species are always deteriorated because of overgrazing (El-Shaer, 1981 and 1996). Data in Table 1 summarize the overall chemical constituents and palatability index of most dominant plant species in Sinai peninsula allover the year. The common forage species varied widely in their chemical and mineral contents and palatability as well. Most of such shrubs contained moderate level of crude protein and high contents of ash, fiber constituents and silica. Shrub production, palatability and nutritive value vary from area to area and among seasons of the year, particularly during the prolonged dry periods. Bedouins move their flocks from area to area to take advantage of grazing and/or browsing the most palatable forages such as *Suaeda fruticosa, Nitraria retusa,* etc. (El Shaer, 1996). The nutritive value and green biomass yield of the native ranges reached their peaks in the spring season and were minimal in the mid-summer season (Hassan *et al.*, 1980; El Shaer, 1981; El Shaer, 1996). Sheep and goats were not able to maintain efficiently their productive performance even when the native ranges reached their best conditions (Hassan *et al.*, 1982). Supplementary feeding practices were recommended to support the essential nutritional requirements for various animal productivity (El Shaer, 1981; El Shaer *et al.*, 1986). Several practical approaches had been done to increase the feed resources availability for livestock on ranges. Such approaches were: (i) processing of less-palatable and non-palatable shrubs to improving their quality and quantity; (ii) cultivating some salt and drought tolerant shrubs; and (iii) utilization of local organic wastes as feed ingredients, e.g., crop-residues, agro-industrial by-products and organic wastes from kitchen, resturant and the wholesale markets of vegetables and fruit.

Table 1. Mean values (±SD) of chemical and mineral composition and palatability rate of most common plant species in Sinai (%, on DM basis)[†]

	AM	AH	AL	HS	NR	SF	ST	TM	ZA
DM	44.0 ±1.41	35.0 ±1.34	32.1 ±1.10	30.1 ±1.22	38.1 ±2.32	24.1 ±1.84	38.0 ±2.11	42.1 ±1.53	25.3 ±1.08
Ash	25.9 ±1.35	23.1 ±1.79	25.3 ±1.71	40.1 ±1.98	30.2 ±1.22	14.2 ±1.11	36.1 ±1.63	25.2 ±1.51	24.7 ±0.94
CP	9.46 ±1.12	13.2 ±1.09	15.2 ±1.13	6.92 ±1.16	11.3 ±1.08	12.1 ±1.43	6.77 ±1.33	8.15 ±0.93	6.22 ±0.87
NDF	68.5 ±1.41	65.3 ±1.13	68.1 ±1.11	63.4 ±1.36	35.2 ±1.54	38.2 ±1.01	39.1 ±1.32	44.1 ±1.51	40.5 ±1.44
ADL	10.1 ±1.10	11.9 ±0.82	13.1 ±0.75	9.12 ±0.99	6.51 ±1.11	7.10 ±0.78	10.8 ±0.54	11.0 ±1.14	7.35 ±1.28
Ca	1.75 ±0.53	1.69 ±0.05	1.80 ±0.40	3.70 ±0.14	1.96 ±0.08	3.98 ±0.09	2.11 ±0.03	3.11 ±0.11	2.26 ±0.09
Na	3.44 ±0.85	3.91 ±0.71	2.99 ±0.81	3.56 ±0.32	5.35 ±0.30	5.65 ±0.42	4.06 ±0.31	2.45 ±0.23	2.89 ±0.045
Zn ppm	75 ±2.11	64 ±2.43	70 ±2.20	70 ±2.61	32 ±1.98	44 ±1.84	55 ±2.22	32 ±1.61	41 ±1.23
Cu ppm	8.0 ±0.88	10 ±0.94	9.90 ±0.71	12 ±0.99	11 ±0.11	8.88 ±0.84	13 ±1.32	13 ±1.07	7.75 ±0.94
P. rate[††]	PP	FP	FP	NP	HP	HP	FP	PP	NP

[†]AH: *A. halimus;* HS: *H. strobilaceum;* NR: *N. retusa;* SF: *S. fruticosa;* ST: *S. tetrandra;* TM: *T. mannifera;* ZA: *Z. album;* AM: *A. maurorum;* AL: *A. leucoclada*
[††]P. rate: highly palatable (HP); fairly palatable (FP); poorly palatable (PP); non-palatable (NP)
Source: El Shaer (1981) and El Shaer and Gihad (1994)

Processing of the natural ranges

Processing of unpalatable or less-palatable shrubs to produce improved feeds and upgrade their palatability and feeding value were carried out in early nineties (El Shaer *et al.*, 1990). Data on dry matter intake of common halophytic species, in Southern Sinai, in the fresh, air-aried and ensiled states showed that animals fed the fresh shrubs were not able to maintain themselves since voluntary intake of each shrub was rather small.

The poor intake of the fresh and air - dried halophytic species could be attributed to main four factors: (i) high Na, Ca and silica contents; (ii) higher levels of ADL and NDF; and (iii) many of shrubs contained higher levels of plant secondary metabolites (Abd El Rahman, 1996).

Ensiling of less or unpalatable halophytes with other feed ingredients would improve forage acceptability; therefore, forage intake would be increased. Molasses, barely grains, and ground date seeds could be mixed as energy sources. Broiler litter, and urea could be used as protein sources. Dry matter intake of shrubs ensiled with broiler litter and molasses at proportions of 46, 51, 3%, respectively on DM basis, differed among plant species but did not vary between animal species (Table 2). Maximum silage intakes were recorded for sheep and goats fed both *A. halimus* and *H. strobilceum* silages (approximately 59 g/d/kg $W^{0.75)}$. It seems, therefore, animals were able to cover their maintenance requirements (Kearl, 1982). It is of interest to make good quality fodder from unpalatable forages such as *Tamarix* spp. *and Z. album* since their silage intakes were greatly improved. Voluntary Intake was increased significantly ($P<0.05$) by ensiling a mixture of halophytic species, i.e., *A. halimus*, *H. strobilaceum*, *T. mannifera* and *Z. album* with ground date seeds (GDS) as shown in Table 2 (Abd El Rahman, 1996).

Table 2. Mean values of intake (g/day/kg $W^{0.75}$) of some halophytic species in different conditions (fresh, air-dried, ensiled) by sheep and goats

	Sheep (S)	Goat (G)	S/G ratio
Fresh state			
A. Halimus (AH)	19.4	15.8	1.23
H. strobilaceum (HS)	18.2	14.2	1.28
T. mannifera (TM)	10.9	10.3	1.06
Z. album (ZA)	2.12	2.94	0.72
Air - dried state			
A. Halimus	13.2	21.0	0.63
H. strobilaceum	9.45	8.23	1.15
T. mannifera	5.12	4.75	1.08
Z. album (ZA)	0.00	0.00	0.00
Silage state			
AH + BL + MO[†]	59.9	59.7	1.00
HS + BL + MO	58.2	59.4	0.98
TM + BL + MO	46.5	42.9	1.08
ZA + BL + MO	24.5	22.5	1.09
Shrubs mixture + GDS + Urea	42.4	30.9	1.37

[†]BL: broiler litters; MO: molasses; GDS: ground date seeds
Source: El Shaer *et al.* (1990) and Abd El Rahman (1996)

Cultivation of salt/drought to lerant forages

Rehabilitation of rangelands with proper shrubs, perennial grasses, forbs and trees can considerably add to feed resources of animals, and will also stop erosion, degradation and desertification of soils. *Atriplex, Acacia* and *Sorghum* species represent groups of plant well adapted to drought and salt stress. Table 3. summarized the overall means of chemical constituents and nutritive value of some introduced legumes and grasses species that were successfully cultivated in Sinai. Several salt tolerant grasses, legumes as well as saltbushes are promising in saline soils due to their high productivity, rapid growth palatability and suitable nutritive value (El Shaer, 1995). Mixing of legumes with grasses or with saltbushes is an acceptable practice to have more advantages of the stand. It leads to improving the nutritive value, physical and physiological feeding properties of the forages. Such mixtures could be successfully applied and practiced in the newly - reclaimed areas. The agricultural extension services started to teach Bedouins in the desert and farmers in the newly -reclaimed lands to grow the most common and adaptable grasses, legumes and saltbushes. About one million seedlings of *Acacia saligna* and *Atriplex nummularia* had already been distributed and transplanted along the northern coastal zone of Egypt.

Table 3. Overall means of nutritive value of some introduced grasses and legumes

Parameter (%)	Bule panic	Green panic	Rhodes grasses	Sulla	Acacia Saligna	Sanfoin-common	Saltbush
DM	23.0	28.0	29.8	18.3	29.9	24.4	2.17
Ash	15.1	11.0	14.0	15.2	10.6	7.71	26.7
CP	11.0	12.8	11.2	15.8	12.9	14.5	13.3
ADL	6.15	8.11	5.51	8.12	7.20	8.05	8.10
NDF	47.1	47.0	50.4	41.1	45.2	42.1	52.8
DMD	59.4	60.5	51.2	60.9	55.5	57.0	57.2
DCP	7.45	8.90	7.86	11.7	8.71	10.2	10.3
TDN	59.7	62.0	56.2	61.2	63.0	66.6	47.9

Source: El Shaer *et al.* (1984)

Utilization of organic wastes as feed ingredients

There is a growing interest in the use of organic wastes, particularly agricultural wastes, agro-industrial by-products, as a low-cost alternative feed source for animals. Sizeable amounts of organic wastes are produced annually but some of these organic wastes are being used at small scale in animal feeding (El Shaer *et al.*, 1986; Abd El Gawad *et al.*, 1994). The potential contribution and utilization of agro-industrial by-products and other organic wastes in animal feeding had been studied in Egypt (El Shaer *et al.*, 1986). Bedouins grow rainfed barely as well as olive pulp and date - palm plantations which produce sizable quantities of by-products. Such agro-industrial by-products have been used successfully as untraditional feed supplements for grazing sheep and goats. It considerably reduces the feeding costs and increases the net gain compared to utilization of the traditional feed supplements (El Shaer *et al.*, 1986). The feeding values and utilization of feed supplements non conventional (organic wastes feed mixture, OWFM) by sheep and goats were evaluated (Table 4) in Sinai (El Shaer *et al.*, 1996). All feed ingredients and rations were free of aflatoxins and bacterial toxins; no digestive disorders occurred. Animals fed the OWFM diet (S2 and G2) utilized and digested the nutrients more efficiently and retained more N (379 and 317 mg/kgW$^{0.75}$, respectively) than those fed the conventional concentrate feed mixture (CFM) diet (S1 and G1).

Table 4. Dry matter intake, digestibilities, nitrogen retention and nutritive value

Items	Sheep		Goats		±SE
	S1	S2	G1	G2	
Digestion coefficients (%)					
Dry matter	60.0^{b}	63.1^{a}	63.1^{a}	62.3^{a}	0.39
Crude protein	59.8^{b}	68.4^{a}	61.9^{b}	70.4^{a}	1.36
DM intakes (g/kgW$^{0.75}$)					
Barly straw	5.26^{c}	6.20^{c}	10.1^{a}	8.1^{b}	0.56
Supplement	108^{a}	106^{ab}	80.5^{c}	98.0^{b}	3.36
N retention (mg/kgW$^{0.75}$)	335^{ab}	379^{a}	202^{c}	317^{b}	19.5
TDN intake (g/kgW$^{0.75}$)	58.9^{c}	73.1^{a}	49.2^{d}	68.1^{b}	1.45
DCP intake (g/kgW$^{0.75}$)	7.08^{b}	8.80^{a}	5.45^{c}	8.30^{a}	0.35
GOT (IU/L)	20.5^{d}	23.7^{c}	26.2^{b}	30.2^{a}	1.01
GGT (IU/L)	15.5^{c}	21.1^{b}	19.1^{bc}	24.7^{a}	1.53

a,b,c,d: Values with different superscripts on the same line differ at P<0.01
Source: El Shaer *et al.* (1996)

The nutritive values of the OWFM diet were much better in terms of TDN and DCP. Values of GPT and GGT enzymes were in normal ranges. Such results recommended that the nonconventional feed supplements (OWFM) could be efficiently used as nutritious, palatable and low-cost feed for small ruminants in Egypt.

References

Abd El-Gawad, A.M., Abd El Malik, W.H., Allam, M.S. and El Sayed, I.M. (1994). Utilization of banana, tomato and potato by-products by sheep. *Egyptian J. Anim. Prod.*, 31(Suppl.): 215-230.

Abd El Rahman, H.M. (1996). *Utilization of desert range poor quality feeds by sheep and goats.* M.Sc. Thesis, Fac. Agric., Cairo University, Egypt.

El Shaer, H.M. (1981). *Comparative nutrition studies on sheep and goats grazing southern Sinai desert range with supplements.* PhD. Thesis, Fac. Agric., Ain Shams University, Egypt.

El Shaer, H.M. (1995). Potential use of cultivated range plants as animal feed in the Mediterranean costal zone of Egypt. In: *Proc. the 8th Meeting of FAO working group on Mediterranean pastures and fodder crops. Sylvopastoral System, Environmental, Agricultural and Economic Sustainability,* Avignon, France, 29 May - 2 June, 1995.

El Shaer, H.M. (1996). Rangelands as feed resources in the Egyptian desert: Management and improvement. In: *Proc. of the Inter. Conf. on Desert Development in the Arab Gulf countries,* State of Kuwait, 23-26 March, 1996.

El Shaer, H.M. and Gihad, E.A. (1994). Halophytes as animal feeds in Egyptian deserts. *Halophytes as are source for livestock and for rehabilitation of degraded lambs,* Squires, V.R. and Ayoub, A.T. (eds). pp. 281-284.

El Shaer, H.M., Kandil, H.M. and Farid, M.F.A. (1986). The use of agro-industrial by-products in the supplementary feeding of pregnant and lactating sheep and goats. In: *Proc. of the 2nd Egyptian - British Conf. on Animal and Poultry Production,* Bangor, Gwynedd, UK, August 26-28, 1986.

El Shaer, H.M., Kandil, H.M., Khamis, H.S. and Abou El Nasr, H.M. (1996). Alternative feed supplement resources for sheep and goats in Egypt. In: *Proc. of Seminar on Recent Advances in Small Ruminants Nutrition,* Rabat, Morocco, Oct. 24-26, 1996.

El Shaer, H.M., Salem, O.A., Khamis, H.S., Shalaby, A.S. and Farid, M.F.A. (1990). Nutritional comparison studies of goats and sheep fed broiler litters ensiled with desert shrubs in Sinai. Proc. Inter, Goat Production Symp., Oct. 22-26, Tallahassee, FL, USA, pp. 70-74.

El Shaer, H.M., Tag El Din, S.S. and Kandil, H.M. (1984). Nutritive evaluation of some introduced pasture plants in North Sinai. In: *Proc. of the 1st Egyptian - British Conf. on Animal Production,* Zagazig, Egypt, Sept. 11-13, 1984.

Hassan, N.I., El Serafy, A.M. and Farid, M.F.A. (1980). Studies on pasture indigenous to south Sinai. 1-Chemical composition and *in vitro* digestibility. *J. Anim. Sci.,* 51(Suppl. 1) 239.

Hassan, N.I., El Shaer, H.M. and Kandil, H.M. (1982). Lambs performance on pasture supplemented with concentrates. *World Rev. Anim. Prod.,* 18: 70-73.

Kearl, L.C. (1982). *Nutrient requirements of ruminants in developing countries.* Utah Agricultural Experimental Station, Logan, Utah, USA.