Nutrition diet of grazing sheep and forage supply on natural grassland

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Introduction

Forages are a major asset of any livestock operation and the foundation of most rations in a forage-based livestock system. The available nutrients in a forage influence individual animal production (*e.g.* gain per animal), while the amount of forage produced affects production per hectare. The relationship between voluntary food intake and animal productivity is well recognized. Many studies related to the regulation of food consumption by sheep and cattle have been reported (Provenza 1996). Willoughby (1958) discussed a number of factors which might influence the herbage intake of grazing animals. By contrast, less attention has been given to the nutritional supply which influences the intake of herbage by grazing animals. It is necessary to know about animal daily nutrient requirements for production and forage supply in order to evaluate grazing capacity.

Methods

The experiment was carried out in 2008 at a sandy grassland at Xilingol (latitude 43º46′N and longitude 116º59′E). Three types of sheep were used; Mongolian (M) sheep (Ujimqin breed developed by the Inner Mongolia Academy of Agricultural Sciences), German mutton merino (G) and crossbred (T) sheep (hybrid of German Merino, Polled Dorset, Suffolk and Mongolian sheep). The initial weight of trial sheep was approximately 50 kg.

Bite number, size and composition of the ingested forage was monitored. Rate of intake was determined usually five times per day for 10 minutes at each time. Forage samples, designed to simulate forage ingested by the sheep, was collected. The intake (I) of herbage by the animal was defined as follows: I=IR x W x T, where IR is rate of biting by grazing sheep per unit of time, W is the intake per bite and T is the time spend grazing over the whole day. Forage quality parameters of crude protein (CP), dry matter (DM), ash, ether extract (EE), crude fibre (CF), calcium (Ca) and phosphorus (P) were determined.

Results

The forage nutrient content was 10.9%, 9.5%, 33.1%, 4.1%, 1.5% and 0.1% for ash, CP, CF ,EE, Ca and P, respectively, in August, and 9.3%, 10.2%, 29.0%, 5.1%, 1.8% and 0.2%, respectively, in September. The feed intake of M, G and T sheep were 0.95 kg/d, 1.47 kg/d and 1.20 kg/d, respectively, in August, and 1.34 kg/d, 1.74 kg/d and 1.50 kg/d, respectively, in September (Table 1). The feed intake of G sheep was significantly higher than M ($P < 0.05$) with T intermediate and not different from either.

Grazing sheep mainly ingested leaves of Siberia apricot and Elm, accounting for 34.1% and 18.1% of the total feed intake respectively in August, and mainly ingested leaves of Siberia apricot and Elm piece in September, accounting for 52.0% and 9.5% respectively of the total feed intake.

Discussion

Our data indicated that nutrient composition supplied by natural grassland determined nutrient intakes. The nutrient intake of sheep was much higher when diverse feed sources were supplied rather than single species. Clearly, sheep were unable to obtain sufficient nutrient to satisfy their energy and protein requirements from a single plant species, therefore, sheep must select different feeds with different nutrients that complement each other (Westoby 1978). Diet selection is important for herbivores possibly as a consequence of nutrient balance and detoxification limitation. The nutrient balance hypothesis proposes that dietary diversity allows individuals to balance intake of different nutrients (Westoby 1978). Most importantly, animal performance depends on intake of forage. Overgrazed pastures

Table 1. Grazing behaviour and feed intake for each type of sheep.

Grazing sheep	Month	Grazing time (min)	Ingestion time (min)	Feed intake speed (bite/min)	Intake per bite (g/bite)	Daily intake (kg/d)
M	Aug	510.25 ± 4.52 a	424.50 ± 2.84 a	28.00 ± 2.42 b	0.08 ± 0.00 a	0.95 ± 0.14 b
	Sep.	443.00 ± 22.19 a	400.33 ± 4.88 a	27.83 ± 2.05 b	0.12 ± 0.00 a	1.34 ± 0.00 b
G	Aug	506.00 ± 8.69 a	410.00 ± 30.09 a	39.75 ± 5.22 a	0.09 ± 0.01 a	1.47 ± 0.21 a
	Sep.	438.17 ± 41.05 a	385.00 ± 36.54 a	34.67 ± 4.91 a	0.13 ± 0.02 a	1.74 ± 0.17 a
T	Aug	511.50 ±60.43 a	423.50 ± 3.30 a	31.50 ± 3.66 b	0.09 ± 0.01 a	1.20 ± 0.16 ab
	Sep.	433.50 ±6.38 b	381.83 ± 33.00 a	30.17 ± 3.01 b	0.13 ± 0.02 a	1.50 ± 0.13 ab

Note: Different small letters in the same row mean significant difference at 0.05 level.

Table 2. The weight component of grazing herbage by sheep (g/d).

Plant species	Aug			Sep.		
	M	G	T	M	G	T
Olygonum divaricatum L.	56.53±4.97a	1.45±0.24b	1.29±0.24b	20.63±1.05a	6.20±0.66b	4.66±0.76b
Prunus sibirica L.	340.86±20.15b	443.97±49.16a	447.63±51.96a	737.19±72.99b	771.04±96.04b	921.41±139.36a
Achnatherum sibiricum (L.) Keng	13.23±1.17a	0.00±0.00	0.00±0.00	105.70±11.02a	43.12±6.26b	93.86±16.37ab
Cleistogenes squarrosa (Trin.) Keng	50.49±8.71b	170.52±14.90a	47.54±7.22b	14.28±2.76a	3.19±0.31b	0.00±0.00
Salsola.collina Pall.	29.61±3.28c	131.56±23.37b	183.74±31.16a	42.42±4.63b	79.96±9.13ab	98.22±5.49a
Stipa grandis P. Smirn.	139.58±19.02a	0.00±0.00	0.21±0.03	2.66±0.36c	12.34±1.01a	7.21±0.67b
Kochia prostrata (L.) Schrad.	123.31±7.78b	379.31±36.90a	152.20±11.47b	162.47±29.29b	264.53±17.65a	18.31±3.65c
Ulmus pumila L.	79.91±4.70c	178.13±25.37b	232.33±39.41a	93.59±9.78b	263.79±34.72a	71.27±7.81b
others	117.05±19.53b	161.70±22.66a	135.52±21.31ab	158.64±21.44b	293.63±30.13a	381.98±43.75a
Total	950.58±140.03c	1,466.64±183.10a	1,200.46±151.06b	1,337.58±215.99c	1,737.80±125.24a	1,596.92±241.29b

are generally the result of overstocking, which in turn, diminishes the ability of the animal to select plant species or plant parts of higher nutritive value. Consequently, in overgrazed pasture forage intake declines.

Conclusion

Forage nutrients available on natural grassland are almost sufficient to meet the nutritional needs of grazing sheep in the Aug and Sep. The ash, EE and CF content provided by natural grassland in August were higher than the requirement of grazing sheep and CP could satisfy their need, but Ca and P were insufficient. In September, natural grassland provided greater nutrient intake by grazing sheep. Different sheep breeds had different intake nutrient requirements with G the highest.

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