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STUDIES ON FEEDING VALUE FOR FIVE PSAMMOPHYTE SHRUBS IN NINGXIA REGION

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Abstract

A trial was conducted on five psammophyte shrubs -*Caragana intermedia, C. korshinskii, Hedysarum scoparium, H. laeve, Salix psammophylla* in the post-fruit period in Ningxia, China. Chemical composition, palatability and *in vitro* digestibility were studied systematically. The feeding value was evaluated through Fuzzy multifactorial model. According to chemical composition, palatability and *in vitro* digestibility, *C. intermedia*, had the highest feeding value and *C .korshinskii* the lowest.

Keywords: psammophyte shrubs, chemical composition, palatability, *in vitro* digestibility, feeding value

Introduction

Ningxia is in the east of the north -west of China, there are 3,014 millions hm^2 natural grasslands and 63.97 percent of them are semi-desert. Lying in the edge of Maowusu sandland, it has seriously desertificated, sandland area amounts to 16.7268km^2 . Wind protection and sand stablization has become an important link for improving ecological environment.

Psammophyte shrubs, which are well adapted to draught and infertile soil, wind erosion resistant, rapidly growing and have well-developed root have become vanward and major species for stabilizing sands. The shrubs used in sand stabilization in Ningxia region are majorly *Hedysarum scoparium, H. laeve, Caragana intermedia, C. korshinskii, Salix psammophylla* etc.

With the advance of sand stablization, psammophyte shrubs have become dominant species of artificial and half-artificial plants in sandland, and they have high biomass, certain

palatability and nutritive value. These types of plants play an important role in the nutrition of grazing animals during withered season and calamitous year, improve ecological environments in sand area and establish high -quality grasslands. Therefore, evaluating their feeding value are important both in academic and practice

Material and Methods

Natural survey of experiment plot

The experiment plot lies in the south-west edge of Maowusu sand land in Yanchi ,Ningxia,China with an elevation of 1300m, Mean annual temperature is 7.83 ,wind season are mainly in April and May, average wind speed reaches 3-4m/s.Mean annual precipitation are 320.3mm and 70 percent concentrate from July to September, rate of evaporation are 2784mm, frost-free period are 148 days. Vegetable cover belongs to desert-steppe. The major plant species in this area are *Artemisia sphaerocephala, psammochloa villosa, Corispermum tylocarpum, Artemisia ordosica, Sophora alopecuroides, Cynanchum komarovii, Pennisetum centrasiaticum, Setaria viridis, Oxytropis aciphylla, Leymus secalinus, Nitraria tangutorum, Kalidium gracile , Achnatherum splendens*, and so on .In the past few years, with the development of sand stabilization, large areas of artificial and half-artificial grasslands mainly with psammophyte shrubs have been established .

Shrubs

Five major psammophyte shrubs in the locality: *Hedysarum scoparium Fisch.et Mey*., *H. laeve Maxim.-H. fruticosum pall var. laeve(Maxim.)H.C. Fu., Caragana intermedia kuang et H . C. Fu., C. korshinskii Kom., Salix psammophylla C. Wang et C.Y. Yang* .

Animals

Sheep (average 35.2 Kg body weight) three are ram and the others are ewes to determine palatability .

Experimental contents

Study feeding value of esculent twig and leaves of the five shrubs according to nutrient composition, palatability, digestibility and compare with common grasses (*Medicago sativa, Achnatherum splendens*) and cornstalk.

Techniques

Proximate composition were analysed by using the standard procedures (Association of Official Analytical Chemists, 1980) .The method of van soest (1963) was adopted for fiber fractionation.

For determining palatability ,15 sheep were housed in small individual hutch (150×200cm)

and fed twice daily (in the morning and in the afternoon) with equal amounts of twig and leaves of experimental plants putting in the trough with separated lattice at the same time. Half an hour later, recorded the intakes of various plants .Did this every two days and repeated five times, calculated acceptability index (Pi).

$$Pi = \sum_{K=1}^{n} D_{ik} / RA_{ik} / n \quad \text{(Loehle et Rihenhouse , 1982)}$$

D_i is the weight percentage of i plant in eaten plants.

RA_i is the weight percentage of i plant in provided plants

K is experimental times

In vitro Dm and OM digestibility (IVDMD, IVOMD) were determined by the procedures of Tilley and Terry (1963) using rumen fluid

Feeding value were evaluated comprehensively in accordance with chemical composition, palatability and *in vitro* digestibility through Fuzzy multifactorial model.

Results and Discussion

CP content of C*aragana intermedia* is the highest of those of the five shrubs, amounts to 18.70%,only 0.89 % lower than that of M*edicago sativa* ,For *C. korshinskii, Hedysarum scoparium, H. laeve* ,they are equivalent to those of medium quality grasses , the CP content of *salix psammophylla* is much lower ,but significantly higher than that of cornstalk ($P<0.01$).

Fibrous matter contents of the five shrubs are significantly higher than those of *Medicago sativa* ,CF contents are lower or equivalent to those of cornstalk and *Achnatherum splendens*.NDF, ADF contents are obviously lower than those of cornstalk and *A. splendens* and Lignin contents are obviously higher than those of cornstalk and *A. splendens* ($P<0.01$).

It was revealed by investigating that sheep and goats all like eating the five shrubs from late autumn to the next spring.In winter and spring, for sheep,C. *intermedia* and *H.scoparium* are eaten best ,*H. laeve* and *S. psammophylla* are better, but *C. korshinskii* is much worse .

Palatability for the five shrubs in the post-fruit period were also observed. The order of acceptability index was ranked as: *Medicago sativa*. *C. intermedia*, *H. scoparium, S. psammophylla, H. laeve, A. splendens, C. korshinskii and* cornstalk.

IVDMD and IVOMD of *C. intermedia* are higher (68.27%, 68.13% resp),which only slightly exceeded by those of *M. sativa* (75.76%, 76.59%), while those of *C. korshinskii, H. laeve and S. psammophylla* are lower , but they are higher than those of *A.. splendens* and cornstalk.

Considering that it's not comprehensive to evaluate the feeding value of a kind of plant by

using single factor or isolated multiple factors, we applied Fuzzy transformation principle and maximum subordination principle, choosing those factors related to feeding value of the plant and making a comprehensive evaluation in two grades, that is two-graded Fuzzy multifactorial model.

According to table 1, the feeding value for the five shrubs from higher to lower was *C. intermedia, H. scoparium*, *H. laeve*, *S. psammophylla*, *C. korshinskii* in sequence . Especially for *C. intermedia*, the F value (5.57) was only slightly lower than that of *M sativa*. As feed stuffs, the five shrubs are all better than *A. splendens* and cornstalk.

The results indicated that in late autumn, when the shrubs stop growing gradually, that is they are in post-fruit period, they can be used as feed stuffs. Thus, they will solve the imbalance between animal needs and available grasses in withered season and calamitous year while improving ecological environments in sand area.

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Table 1 - Chemical composition, palatability, *in vitro* digestibility and feeding value for the experimental plants.

Components (on DM basis)	*C.intermedia*	*C.korshinskii*	*H.scoparium*	*H.laeve*	*S.psammophylla*	*M.sativa*	*A.splendens*	*cornstalk*
CP (%)	18.70^{b}	13.25^{c}	11.30^{e}	12.88^{d}	7.14^{g}	19.59^{a}	10.48^{f}	3.45^{h}
EE (%)	3.55^{c}	3.56^{c}	3.34^{cd}	5.03^{b}	6.02^{a}	2.99^{d}	3.31^{cd}	0.35^{e}
ASH (%)	7.54^{e}	6.89^{f}	7.63^{de}	7.84^{d}	4.66^{g}	8.69^{a}	8.09^{c}	8.39^{b}
CF (%)	24.65^{cd}	32.83^{b}	32.42^{b}	26.70^{c}	33.64^{b}	22.54^{d}	33.28^{b}	43.17^{a}
NDF (%)	41.89^{d}	52.89^{c}	48.17^{cd}	41.78^{d}	52.77^{c}	32.43^{e}	69.73^{b}	80.90^{a}
ADF (%)	29.61^{e}	40.60^{c}	33.15^{d}	27.29^{f}	42.34^{bc}	21.67^{g}	43.35^{b}	52.34^{a}
Lignin(%)	8.77^{c}	11.14^{b}	9.04^{c}	7.82^{d}	16.57^{a}	7.72^{d}	5.84^{f}	6.69^{e}
Ca (%)	1.51^{ab}	1.23^{b}	1.86^{a}	1.78^{a}	1.12^{bc}	1.02^{c}	0.37^{d}	0.21^{d}
P (%)	0.17^{bc}	0.13^{c}	0.54^{a}	0.22^{b}	0.17^{bc}	0.14^{c}	0.11^{c}	0.10^{c}
Acceptability index	1.26	0.64	1.20	0.96	1.06	1.59	0.82	0.29
IVDMD(%)	68.20	61.41	60.12	55.17	49.27	75.76	44.97	43.74
IVOMD(%)	68.13	62.16	60.00	54.66	50.47	76.59	47.30	42.51
Feeding value	5.57	4.13	4.69	4.51	4.27	6.40	3.95	2.28

Table 2 - Quantitative grade standard for comprehensive evaluation (except upper limit)

Φ i	Acceptability index	Acceptable seasons	CP content	CF content	EE content	IVOMD
Φ 7	>1.50	four seasons	>20%	>25%	>4.5%	>74%
Φ 6	1.25-1.50	four seasons	15-20%	25-29%	3.9-4.5%	65-74%
Φ 5	1.00-1.25	growing seasons	10-15%	25-33%	3.3-3.9%	57-65%
Φ 4	0.75-1.00	growing seasons	6-10%	33-37%	2.7-3.3%	48-57%
Φ 3	0.50-0.75	two seasons	4-6%	37-41%	2.1-2.7%	39-48%
Φ 2	0.25-0.50	one season	3-4%	41-45%	1.5-2.1%	31-39%
Φ 1	<0.25	Less than two months	<3%	>45%	<1.5%	<30%