

EFFECT OF GROWTH AND DEVELOPMENT ON THE QUALITATIVE ATTRIBUTES OF *LASIURUS SINDICUS* HENR.

ASHOK K. GUPTA ¹

Central Arid Zone Research Institute, Jodhpur-342003

ABSTRACT

Variations in the qualitative attributes of *Lasiurus indicus* Henr. with the plant growth were studied. Cell wall constituents viz. NDF, ADF, lignin, cellulose, hemicellulose and silica content increased significantly with plant growth while crude protein and in vitro dry matter digestibility decreased significantly in all the three years of study. NDF, ADF, lignin and cellulose were positively and significantly inter-correlated. However, they showed negative correlation with protein content and digestibility. Fodder quality, in terms of digestibility, was best correlated with crude protein and its prediction value was maximum ($R^2 = 0.9322$) with crude protein as a single factor.

INTRODUCTION

'Sewan' grass (*Lasiurus indicus* Henr.) survives even under extreme arid conditions and it has got the highest carrying capacity (Das, 1973). Little information is available on the variations in its qualitative attributes during plant growth and development. Studies were, therefore, undertaken to assess the changes in the qualitative attributes at different growth stages of *L. indicus*.

MATERIAL AND METHODS

A plant-growth-rhythm experiment on *Lasiurus indicus* cv CAZRI 319 was conducted in July, 1977 at CAZRI Farm, Jodhpur in 1977. The experimental area (0.5 ha) was divided into 10 m x 5 m plots. During the growth season, from July 1987 onwards, samples were taken at 15-day interval for 120 days in four replicates from 4 m² plots at 5 cm height above the ground level. The samplings were done for three consecutive years. The grass was uniformly cut prior to the commencement of growing season to record the growth rate.

Samples were oven dried at 60°C, ground and analysed for crude protein (C. P.) content, in vitro dry matter digestibility (IVDMD), neutral detergent fibre (NDF), acid detergent fibre (ADF), cellulose and silica as per methodologies already reported by Gupta et al. (1986).

¹ Scientist S-2 (Biochemistry), National Research Centre on Equines, Hisar 125001

The difference between NDF and ADF provided an estimate of hemicellulose content (Van Soest and Moore, 1965).

The data were subjected to analysis of variance. Simple correlation coefficient of different components and their multiple regression analysis were carried out (Snedecor and Cochran, 1967) on the pooled data of three years of study.

RESULTS AND DISCUSSION

Crude protein (C.P.)

Data (Table 1) revealed that crude protein content of *L. sindicus* decreased with increase in growth period. Decrease was significant till 75 days of plant growth in all the three years of studies and, thereafter, it was on a par. These results are in line with those of Das et al. (1978) and Grant and Campbell (1978). Further, the variations in crude protein content at the same harvesting intervals in different years were not appreciable, and thus the fodder quality for protein was not much affected by the ageing of the root stock.

In vitro dry matter digestibility (IVDMD)

Grass was highly digestible (70.37 – 71.62%) at the first harvesting stage in all the three years of study (Table 1). But thereafter, per cent digestibility decreased significantly till 60 days of plant growth. Decrease in digestibility with plant growth, in general, may be due to decrease in the proportion of cell content and the digestibility of cell wall (Wilman et al., 1977). Further, the year to year variations in digestibility values at the same harvesting intervals were not appreciable. Grant and Campbell

Table 1. Changes in levels of crude protein and in vitro dry matter digestibilities (IVDMD) of *Lasiurus sindicus* with growth and development

Period of cutting	Crude protein (%)			IVDMD (%)		
	1978	1979	1980	1978	1979	1980
15 days	14.52	12.38	12.51	71.62	70.37	71.62
30 days	13.52	9.05	10.15	65.00	67.75	65.00
45 days	8.75	8.70	9.91	59.87	60.00	61.25
60 days	7.91	6.37	8.01	57.62	55.25	56.50
75 days	6.30	3.80	4.08	54.25	53.87	54.62
90 days	4.96	3.63	3.21	52.50	52.00	50.87
105 days	5.77	3.76	4.55	55.37	53.62	53.50
120 days	3.85	4.53	5.38	51.87	54.25	53.75
SEm $\pm$	0.46	0.40	0.35	0.78	0.86	1.16
CD (5%)	1.35	1.18	1.03	2.29	2.53	3.41
CD (1%)	1.84	1.60	1.40	3.12	3.44	4.64

(1978) also reported little variations in digestibility value of different plant species at the same harvesting stage in different years.

Neutral detergent fibre (NDF)

NDF increased significantly till 60 days of plant growth during 1978 and 1979 upto 45 days in 1980 (Table 2). The changes in fibre content were significant except in the year 1978 when NDF decreased significantly during latter stages of growth. Further, the year to year variations in digestibility, at the same cutting intervals were appreciable. NDF content was maximum during 1980.

Acid detergent fibre (ADF)

ADF increased with the advancement of growth in all the three years. Fibre contents were maximum at 75, 105 and 60 days of plant growth during 1979 and 1980 respectively (Table 2). ADF content increased significantly till 45 days of growth during 1978 and 1979 while only upto 30 days in 1980. Further, year to year variations at the same harvesting were quite appreciable as fibre content increased differentially in different years. Increase in fibre content of different plant species with advancement of growth had also been reported by Das and Arora (1976) and Willms et al. (1980).

Lignin

A significant increase in lignin content was observed in 1978 and 1979 as the plants matured. The increase in lignin content was, however, non-significant in 1980. Maximum lignin contents were obtained at the last harvesting stage. Rapid increase in lignin content during latter stages of growth in 1978 may be responsible for significant decrease in IVDMD. Negative relationship of lignification with digestibility is well known (Van Soest and Jones, 1968).

Hemicellulose

When herbage were cut at regular interval, hemicellulose content varied significantly but without any specific trend (Table 3). Such variation has also been reported by Das and Arora, 1976. Jarrige and Minson (1964), however, found hemicellulose content to increase with plant maturity.

Cellulose

Cellulose content increased with the advancement of maturity in all the three years. After 30 days of plant growth, cellulose content went on increasing but the variations were not statistically significant. The increase in cellulose content with plant maturity, in general, is in agreement with the findings of Das and Arora (1976) and Rakkiyappan and Krishnamoorty (1981). Further, cellulose content at the same

Table 2. Changes in levels of NDF, ADF and lignin contents of *Lasurus indicus* with growth and development

Period of cutting	Neutral detergent fibre (%)		Acid detergent fibre (%)		Lignin (%)	
	1978	1979	1978	1979	1978	1979
15 days	58.40	61.15	27.15	29.41	33.50	4.58
30 days	59.10	65.65	34.75	32.41	39.41	5.50
45 days	68.45	65.85	38.60	35.99	41.33	5.99
60 days	71.75	70.31	40.35	37.66	43.33	4.83
75 days	71.50	71.90	43.00	40.91	41.16	6.16
90 days	73.55	68.16	41.40	41.08	40.91	7.16
105 days	67.75	71.33	39.64	45.00	40.16	10.52
120 days	67.10	72.74	38.95	43.33	41.66	9.84
S _{Em} ±	1.22	1.23	1.08	1.12	0.73	0.59
CD (5%)	3.59	3.62	3.17	3.29	2.15	1.73
CD (1%)	4.88	4.92	4.32	4.48	2.92	2.36
						ns

Table 3. Changes in levels of hemicellulose and silica contents of *Lasiurus sindicus* with growth and development

Period of cutting	Hemicellulose (%)			Cellulose (%)			Silica (%)		
	1978	1979	1980	1978	1979	1980	1978	1979	1980
15 days	31.25	31.73	30.08	21.15	21.49	21.33	2.25	3.34	3.34
30 days	24.35	33.23	30.00	25.45	23.83	24.00	4.00	3.08	3.42
45 days	29.85	29.85	34.14	26.70	25.66	26.33	4.60	4.33	2.84
60 days	29.85	32.65	32.75	28.71	29.08	27.91	5.47	3.95	3.34
75 days	31.40	30.73	35.16	28.15	30.25	26.26	5.90	4.50	2.91
90 days	32.15	27.08	31.00	28.45	29.41	25.75	4.55	4.51	3.06
105 days	28.11	26.33	28.83	24.30	31.58	26.33	4.82	4.18	2.09
120 days	27.46	29.42	31.08	24.20	28.11	26.33	2.20	5.34	2.50
SEm $\pm$	1.46	0.80	1.05	1.09	0.81	0.87	0.56	0.42	0.22
CD (5%)	4.29	2.35	3.09	3.20	2.38	2.56	1.65	1.23	0.65
CD (1%)	5.84	3.20	4.20	4.36	3.24	3.48	2.24	1.68	0.88

harvesting intervals upto 60 days of growth in different years remained almost constant but later on varied appreciably.

Silica

With plant growth, silica content showed an increasing trend in 1978 and 1979, while during 1980 it varied significantly at different harvesting stages and there was no specific trend. At the same harvesting intervals in different years, silica content also varied differentially. Like lignin content, silica also reduces the digestibility of the fodder and is negatively related with digestibility value.

Simple correlation and multiple regression studies among different qualitative attributes

Various nutritional properties were taken as independent variables and their associations were studied by simple correlation coefficients (Table 4). Structural constituents such as NDF, ADF, lignin and cellulose were significantly ($P=0.01$) and positively inter-correlated with each other but these characters showed a significant and negative correlation with IVDMD and crude protein. Crude protein, on the other hand, was positively and highly correlated ($r = 0.935$) with IVDMD.

Table 4 : Simple correlation coefficients of different quality attributes.

Parameters	NDF	ADF	Lignin	Cellulose	Silica	IVDMD
Crude protein	-0.683**	-0.773**	-0.466*	-0.670**	-0.171	0.935**
NDF		0.862**	0.626**	0.652**	0.173	-0.686**
ADF			0.642**	0.789**	0.351	-0.829**
Lignin				0.077	-0.311	-0.483*
Cellulose					0.523**	-0.726**
Silica						-0.221

** Significant at 1% level.

* Significant at 5% level.

To find out the exact relationship between dependent and independent variables, the multiple regression analysis was done for different qualitative attributes. The regression with single factor predicted the IVDMD value from R^2 0.0758 to R^2 0.0322 (Table 5). The best regression equation obtained was with crude protein:

$$Y = 44.9389 + 1.8325 b_1 (R^2 = 0.9322) \dots \quad (i)$$

Only a slight improvement was observed in prediction value of IVDMD with the addition of ADF and NDF. The equations are :

$$Y = 63.3355 + 1.4314 b_1 - 0.3986 b_3 \quad (R^2 = 0.9453) \quad \dots \quad (ii)$$

$$Y = 55.8848 + 1.443 b_1 + 0.2186 b_2 - 0.5985 b_3 \quad (R^2 = 0.9465) \quad \dots (iii)$$

Thus for qualitative evaluation of *Lasiurus indicus*, in terms of digestibility, a complete chemical analysis may not be required. Crude protein, with R^2 value as high as 0.9322, could easily be used for this purpose.

Table 5 : Simple and multiple regression coefficients for IVDMD of different constituents

	C.P.	NDF	ADF	LIGNIN	Cellulose	Silica	R^2
(a)	-(b ₁)	(b ₂)	(b ₃)	(b ₄)	(b ₅)	(b ₆)	
63.6007	—	—	—	—	—	(—)1.3930	0.0758
67.9516	—	—	—	(—)1.1026	—	—	0.4450
123.1204	—	(—)0.9369	—	—	—	—	0.6681
104.7927	—	—	—	—	(—)1.7673	—	0.7111
106.7791	—	—	(—)1.2484	—	—	—	0.8209
44.9389	(+)1.8325	—	—	—	—	—	0.9322
63.3355	(+)1.4314	—	(—)0.3986	—	—	—	0.9453
55.8848	(+)1.4443	(+)0.2186	(—)0.5985	—	—	—	0.9465

ACKNOWLEDGEMENTS

The Author is grateful to the Director, Central Arid Zone Research Institute, Jodhpur for providing necessary facilities for this study. Thanks are due also to Dr. K. R. Solanki and Dr. P. C. Mali for their valuable suggestions in preparing the manuscript.

REFERENCES

- Das, R. B. 1973. Managing pastures in arid areas. *Indian Farming*. 23 : 30-31.
- Das, B. and Arora, S. K. 1976. Changes in cell wall carbohydrates, in vitro dry matter digestibility, bulk density and hydration capacity of *Pennisetum pedicellatum* grass as affected by growth stage. *Forage Research*. 2 : 113-9.
- Das, R. B., Bhati, G. N. and Joshi, V. D. 1978. Plant growth rhythm and protein status of desert forage grass *Cenchrus ciliaris* Linn. and *Panicum antidotale* Retz. *Forage Research*. 4 : 97-9.
- Grant, S. A. and Campbell, D. R. 1978. Seasonal variation in in-vitro digestibility and structural carbohydrate content of some commonly grazed plants of blanket bog. *Journal of the British Grassland Society*. 33 : 167-73.

- Gupta, A. K., Jindal., S. K., Solanki, K. R. and Kackar, N. L. 1986. Variability for cell wall constituents, crude protein and IVDMD in different cultivars of *Leucaena leucocephala* Annals of Arid Zone. 25(4) : 277-282.
- Jarrige, R. and Minson, D.J. 1964. Digestibility of the constituents of S 24 perennial rye grass and S 37 Cocksfoot, with special reference to the carbohydrates. Annales de Zootechnie. 13 : 117-50.
- Rakkiyappan, P., and Krishnamoorthy, K. K. 1981. Effect of stage of harvest on forage quality of Guinea grass. Livestock Advances. 6 : 37-42.
- Snedecor, G. W. and Cochran, W. G. 1967. Statistical methods. 6th Ed. Oxford and IBH publishing Company, New Delhi.
- Van Soest, P. J. and Moore, L.A. 1965. New chemical methods for analysis of forages for the puposes of predicting nutritive value. *Proceedings of the IX International Grassland Congress, Sao Paulo (Brazil)* : 783-9.
- Willms, W., Mclean. A and Kalnin, C. 1980. Nutritive characteristics of grasses on springs range in South Central Bristish Columbia in relation to time, habitat and fall grazing. Canadian Journal of Plant Sciences 60 : 130. 7.
- Wilman, D., Koocheki, A., Lwoga, A. B. and Samaanik, S.F. 1977. Digestion in vitro of Italian and perennial ryegrass, red clover, white clover and leucerne. Journal of the British Grassland Society 32 : 13-24.
- Van Soest, P. J. and Jones, L. H. P. 1968. Effect of silica in forages upon digestibility. Journal of Dairy Science 51 : 1644-48.