Asian Journal of Chemistry Vol. 15, No. 1 (2003), 225–228

Variation of Chemical Constituents and Relative Nutritive Value with Plant Maturity in *Chrysopogon gryllus* (Linn.) Trin and *Eragrostis nigra* Nees of Kumaun Hills

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Chemical investigation of indigenous fodder grasses, *viz.*, *Chrysopogon gryllus* (Linn) Trin and *Eragrostis nigra* Nees of Naintial was carried out at different stages of plant maturity from July to October to assess their relative nutritive value because these grasses are commonly used as green fodder by local people during monsoon season and also stored as hay for feeding the cattle during dry winter and summer seasons. These grasses were found to contain sufficiently high level of chemical ingredients, *viz.*, protein, ether extract (crude fat), sugars, ash and minerals and hence are assessed as good quality fodders.

Key Words: *Chrysopogon gryllus* (Linn) Trin, *Eragrostis nigra* Nees, Chemical investigation, Kumaun Hills.

INTRODUCTION

Kumaun Hill region consists of mountainous terrains with poor farming conditions due to limited irrigation facilities and slopy terraces of agricultural land. Hence the output from the crops is low as compared to the cost involved in growing them. Therefore, the farmers and dairy workers of this region are mostly dependent on the animals and animal based production. To increase the lactation and strength of the ruminants, a balanced and nutritious diet must be provided to them for which a proper and systematic selection of fodder is essential. During monsoon season green grasses are used as the principal fodder for the cattle by the local people. *Chrysopogon gryllus* and *Eragrostis nigra* are common fodder grasses used as cattle feed which grow abundantly in the natural grasslands of north-west Himalayas from 1,000 to 2,700 m altitude. Therefore, it was considered of interest to analyse these fodder grasses for their chemical constituents and assess their relative nutritive value at different stages of growth.

EXPERIMENTAL

The samples of *C. gryllus* and *E. nigra* were collected from various locations around Nainital (1,900–2,100 m altitude) in the middle of every month from July to October in 1999–2000. Fresh forage samples were dried at 60–70°C in an electric oven and ground to powder. The powdered samples were stored in a refrigerator in polythene bags. These samples were analysed in the chemical laboratories at D.S.B. Campus, Kumaun University, Nainital for protein, free

amino acids, ether extract (crude fat), total available carbohydrates, total soluble carbohydrates, starch, cellulose, free sugars, total ash, soluble ash, minerals like Ca, P, Na, K and Fe and crude fibre. The *in-vivo* digestibility of the samples was determined at IVRI, Bareilly.

Protein, ether extract (crude fat) and crude fibre of the samples were determined employing the methods of A.O.A.C.[1] The protein percentages of total nitrogen and non-protein nitrogen were evaluated by Kjeldahl's method and with these parameters percentage of protein was calculated. Free amino acids were detected, characterised and determined according to the method of Heathoote *et al.*[2] Total available carbohydrates were estimated by the method of Murphy[3] and total soluble carbohydrates were evaluated by using the technique of Johnson *et al.*[4] Free sugars were detected and characterised by paper chromotography[5]. For estimating starch, Stoddart's anthrone reagent method[6] was employed. Cellulose was determined by Colin's method.[7]

Ash and minerals were evaluated by the methods of Misra[6], Paech and Tracey[8]. *In-vivo* digestibility was estimated by nylon bag technique of Neathrey[9].

RESULTS AND DISCUSSION

The findings of chemical investigation of *C. gryllus* and *E. nigra* recorded at monthly intervals during the growing season are reported in Table-1.

TABLE-1
CHEMICAL CONSTITUENTS OF *CHRYSOPOGON GRYLLUS* AND *ERAGROSTIS NIGRA* IN DIFFERENT SAMPLING MONTHS (g/100 g DRY MATTER)

Chemical constituents	*C. gryllus*				*E. nigra*			
	Jul	Aug	Sep	Oct	Jul	Aug	Sep	Oct
Total nitrogen	2.20	1.61	1.02	0.79	1.90	2.10	1.91	1.20
Non-protein nitrogen	0.42	0.39	0.24	0.11	.83	0.59	0.38	0.26
Protein	11.12	9.50	4.87	4.27	12.94	9.43	9.42	6.25
Ether extract (crude fat)	1.56	1.20	1.01	0.75	2.58	2.10	1.10	0.85
Total available carbohydrate	5.62	4.48	6.65	9.26	7.25	6.10	10.20	13.01
Water soluble carbohydrate	3.11	2.95	3.21	4.12	2.81	2.09	2.89	3.75
Starch	2.21	3.42	4.46	5.84	2.96	3.24	4.16	4.88
Cellulose	26.12	28.21	31.28	32.60	24.20	25.10	31.02	32.10
Total ash	10.23	9.20	11.10	6.20	12.75	13.10	14.10	11.20
Soluble ash	6.50	5.90	8.01	4.02	7.20	9.10	11.10	6.20
Ca	0.62	0.63	0.81	0.50	0.85	0.92	1.02	0.86
P	0.15	0.18	0.19	0.16	0.19	0.21	0.25	0.21
Na	0.11	0.12	0.09	0.06	0.15	0.19	0.12	0.08
K	1.12	1.25	1.06	1.00	1.35	1.50	1.01	0.98
Fe	0.098	0.072	0.07	0.052	0.076	0.052	0.058	0.048
Crude fibre	28.56	27.18	29.12	30.32	28.60	29.86	30.18	32.12
In-vivo digestibility	72.42	60.01	52.80	46.20	73.20	67.30	54.50	50.20

In *C. gryllus*, total nitrogen (2.20–0.79%), non-protein nitrogen (0.42–0.11%) and protein (11.2–4.27%) contents were found to decrease continuously from July to October with a sharp decline in all the parameters in September. Total nitrogen in *E. nigra* showed an increase from July to August (1.90–2.10%) and then decreased up to the last cut (2.10–1.20%). Non-protein nitrogen (0.83–0.26%) and protein percentage (12.94–6.25%) of this fodder were recorded to have a declining trend with plant maturity. Chromotographic analysis of the ethanolic water extracts of the samples of these fodders visualised fourteen and thirteen ninhydrin positive spots out of which only eleven amino acids in both of them were identified and characterised. In *C. gryllus* aspartic acid, serine, glycine and threonine were found in fairly good quantities, α-alanine and lysine in low amounts and cystine, glutamic acid, isoleucine, valine and α-amino butyric acid were present in trace amounts only. In *E. nigra* aspartic acid, α-alanine, α-aminobutyric acid, glutamic acid and isoleucine were found to occur in appreciable amounts, glycine, serine, threonine and valine were present in fairly low quantities and cystine and lysine were recorded in very low amounts respectively. The concentration of all the amino acids was found to decrease with advancing maturity.

Ether extract (crude fat) was found highest in July (1.56 and 2.58%) and lowest in October (0.75 and 0.85%) in both the grasses chosen for investigation.

Total available carbohydrates and water soluble carbohydrates showed a decreasing trend from July to August and then increased up to October in both the grasses. Minimum values of total available carbohydrates and water-soluble carbohydrates in *C. gryllus* were 4.48 and 2.95% and in *C. nigra* the values were 6.10 and 2.09% respectively. The maximum values of the above parameters were found to be 9.26, 4.12 and 13.01 and 3.75% in the two fodders. Starch and cellulose contents were recorded in the increasing trend with advancing maturity in both the fodders. Total variation of starch in *C. gryllus* was found in between 2.21 and 58.40% and in *E. nigra* it was between 2.96 and 4.88% respectively. Amount of cellulose varied from 26.12 to 32.60% in *C. gryllus* and 24.20 to 32.10% in *E. nigra*. Maltose, sucrose, glucose, arabinose, fructose and xylose were the main free sugars detected chromatographically in both the grasses analysed.

Total ash and soluble ash were observed to have an irregular trend in *C. gryllus* from the first to the las‘ cut which first decreased form July to August and then increased in September and again decreased in October as is evident from the Table-1. In *E. nigra*, the values of the above parameters increased up to September (total ash: 12.75–14.10%, soluble ash: 7.20–11.10%) and decreased in October. Amount of calcium was found to increase up to September in both the fodders (*C. gryllus*: 0.62–0.81% and *E. nigra*: 0.85–1.02%) and decreased in October. The percentage of phosphorus was recorded highest in September and lowest in July in both the grasses but the amounts of sodium and potassium were found lowest in October and highest in August. Fe was found to have a regular decreasing trend with maturity.

Crude fibre in both the fodders showed an increasing trend reaching at the highest level in October (*C. gryllus*: 28.56–30.32%; *E. nigra*: 28.60–32.12%).

In-vivo digestibility in rumen suspension for 72 h was found to decrease regularly in the samples of the grasses from July to October (*C. gryllus*: 72.42–46.28% and *E. nigra*: 73.20–50.20%).

Adequate amount of minerals is essential for the growth of animals, production of milk and to protect them from various diseases. N.R.C. (U.S.A., 1971)[10] has given minimum requirement level of minerals as follows:

Ca 0.20 to 0.25%, P 0.20%, Fe – 100 ppm.

The amount of these minerals in the grasses analysed has been found much higher than the required level.

It is concluded that *C. gryllus* and *E. nigra* contained sufficient amounts of all chemical ingredients necessary for cattle. The digestibility data reveal that these grasses may serve as good quality fodders if selectively fed to the ruminants. These may be used as fresh fodder up to October and stored as hay for feeding the animals during dry winter and summer seasons.

REFERENCES

1. A.O.A.C., Official Methods of Analysis, 11th Edn., Association of Official Agricultural Chemists, Washington, DC (1970).
2. J.G. Heathoote and R.J. Washington, *Analyst*, **92**, 627 (1967).
3. R.P. Murphy, *J. Sci. Fd. & Agric.*, **9**, 714 (1958).
4. R.R. Johnson, T.L. Balwani and L.J. Johnson, *J. Anim., Sci.*, **25**, 617 (1966).
5. I.M. Hais and K. Macek, Paper Chromatography, Academic Press, New York (1963).
6. R. Misra, Ecology Work Book, Oxford & IBH Publishing Co., New Delhi (1968).
7. S.C. Colin, *J. Sci. Food & Agric.*, **24**, 381 (1973).
8. K. Paech and M.V. Tracey, Modern Methods of Plant Analysis, Vol. 1, Springer-Verlag, Berlin-Heidelberg (1956).
9. N.W. Neathrey, *J. Dairy Sci.*, **52**, 74 (1969).
10. N.R.C., National Research Council, 4th Edn., National Academy of Sciences, Washington, DC.

(*Received*: 12 June 2002; *Accepted:* 19 August 2002) AJC-2822