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Original Article

The Effect of Drying Methods on Chemical Composition and Digestibility of *Leucaena Leucocephala* Leaves

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ABSTRACT

On average *Leucaena leucocephala* leaves contained 222.2 g/kg DM crude proteins, 315.7 g/kg DM neutral detergent fiber concentration, 234.1 g/kg DM acid detergent fiber concentration, 1.85% Ca, 0.198% P, 23.4 g/kg tannin concentrations and 54.9% digestibility. It was concluded the *L. leucocephala* leaves contain adequate amount of nutrients to support microbial growth and to feed animals. Method of drying samples (air-dried, sun-dried and soaked plus sun-dried) showed that sun-drying and soaking plus sun-drying slightly increased the level of dry matter, organic matter, neutral detergent fiber and acid detergent fiber. However, the levels of tannin concentration were reduced in sun-dried and soaked samples compared to air dried samples.

Keywords: Dry matter, In vitro-digestible, Tannin, *Leucaena leucocephala*.

INTRODUCTION

The chemical composition of a feed is one of the indicators of the potential nutritive value of feedstuff, which shows at a glance whether the feedstuff has the capacity to provide adequate and balanced quantity of nutrients for maintenance, growth and reproduction of an animal (Norton and Poppi, 1995). The property of a feed stuff depends on the composition of each of the components which make up the feedstuff. Hence, the composition of a feedstuff varies according to the type of plant species; the plant parts; the age of the plant; the inclusion rate in the feed stuff; the climate and soils on which the plants grew (Norton, 1994); the state of hydration (Fresh, wilted or dry) (Palmer and Schlink, 1992) and drying procedure used (Dzowela *et al.*, 1995*). Leucaena leucocephala*, belongs to the Leguminosae family and is

one of the fastest-growing leguminous trees. It is an important crop encouraged under the social forestry schemes in drought-prone and semi-arid areas and it provides useful timber as well as leaves for fuel and energy and feed purposes (Sethi, and kulkarni, 1995). Leucaena species grow well on well-drained fertile soils from the sea level to 1500 meters above sea level (Hughes, 1998). Aletor and Omodara (1994) evaluated tree forages in terms of chemical composition. Among them Leucaena, Gliricidia and Cajanus were included. When these tree forages are in season, they can provide adequate crude protein, vitamins and minerals. Karachi (1998) observed the nitrogen content in Leucaema species differed between species and between leaves and stems. Therefore, it is always necessary to determine the chemical composition of a feedstuff in order to ascertain the quality of feedstuff and the quantity of each nutrient that goes into feed formulation. This experiment was conducted to determine the content of dry matter, organic matter, ash, crude protein, phosphorus, calcium, neutral detergent fiber, acid detergent fiber, in vitro-digestible organic matter and tannin content in air-dried, sun-dried and soaked plus sun-dried *Leucaena leucocephala* leaves.

MATERIALS AND METHODS

Freshly cut samples of *Leucaena leucocephala* leaves were placed on a bench in the laboratory to dry (air-dried), on mats outside (sun-dried) and freshly soaked 48 hours plus sun dried and milled through a 1mm diameter sieve. Triplicate samples were analyzed for dry matter, ash, organic matter, P, Ca and crude protein as described by AOAC (1990). The cell wall content was determined as by Van Soest and Wine (1967); the in vitro digestible organic matter by Tilley and Terry methods (Tilley and Terry, 1963). Quantitative estimation of tannin was carried out using the modified method of vanillin-Hcl in methanol (Price *et al.*, 1978). The data were analyzed assuming a Completely Randomized Design (CRD) Duncan's Multiple Range Test was used to detect significant differences between treatment means.

RESULTS AND DISCUSSION

The comparison between air-dried, sun-dried and soaked plus sun-dried samples showed that sun-drying and soaking plus sun-drying slightly increased the level of dry matter, organic matter, neutral detergent fiber and acid detergent fiber (Table 1, 2, 3, 4). However, the levels of tannin concentration were reduced in sun-dried and soaked samples compared to air dried samples. Chemical composition alone is not an accurate predictor of the nutritive value of feedstuff, but it is a good indication of the potential availability of nutrients in the forage (Norton and Poppi, 1995). Drying of leaves decreases the level of tannin and improves feed intake, nitrogen and fiber digestibility (Kumar and DMello, 1995). Sun-drying and soaking plus sun-drying of samples represented typical farm conditions, under which *Leucaena leucocephala* leaves are usually prepared, while air drying of samples represented typical laboratory conditions. In this study the in vitro DOM, CP, NDF and tannin concentration ranged between 539 and 557 g. kg DM for DOM, 214 and 236 g. kg DM for CP, 250 and 332 g. kg DM for NDF, and 11.68-23.47 g.kg DM for tannin. As a general rule, feedstuff which have 550 and 650 g. kg DM and 11-13% CP are capable of supplying adequate protein for maintenance and growth (Poppi and Mclennan,.1995), while feedstuffs with low NDF (20 - 35 %) are more digestible than those with more than 35% NDF (Norton,.1994). On the other hand, feedstuffs have low to moderate tannin (<3 % DM) are bloat-free with more rumen undegradable protein, which can supply adequate dietary protein for post ruminal digestion and absorption in the small intestine (Lowry *et al.*, 1996). It has been shown that legumes that contain moderate tannin are a more effective source of available protein than those without tannins, and therefore, inclusion of *leucaena* is highly desirable. According to Norton and Poppi (1995) moderate tannins may protect plant protein from excessive degradation in the

rumen, in order to provide the host animal with a significant source of additional protein for absorption and utilization.

Table 1: Chemical composition of air-dried browse forage

Parameter	*Leucaena leucocephala*	*Gliricidia sepium*	*Cajanus cajan*
Dry matter (%)	90.63	86.37	93.05
Crude protein (%)	25.27	21.92	18.56
Calcium (%)	1.48	0.74	2.71
Sodium (%)	2.66	6.23	3.78
Potassium (%)	1.06	2.49	0.58
Phosphorus (%)	0.28	0.43	0.51
Magnesium (%)	0.23	0.44	0.49
Manganese (g.kgDM^{-1})	55.16	46.31	42.99
Iron (mg.kgDM^{-1})	187.58	231.56	290.17
Copper (mg.kgDM^{-1})	22.07	11.58	21.49
Zinc (mg.kgDM^{-1})	308.95	393.66	333.15
Oxalate (mg.kgDM^{-1})	0.882	0.909	0.286
Phytin (mg.kgDM^{-1})	19.26	16.18	11.67
Phytin – P (mg.kgDM^{-1})	2.89	4.55	3.29

Source: Aletor and Omodara (1994)

Table 2: Chemical composition of *Leucaeena leucocephala* leaf and stem

Sample		N (%)	P (%)	K (%)	Ca (%)	Mg (%)	ADF (%)	ADL (%)	IVDMD (%)
Leaf	Mean	4.0	0.22	1.6	0.9	0.4	27.2	15.9	58.7
	Max.	4.2	0.25	1.7	1.2	0.5	31.8	17.5	63.3
	Min.	3.4	0.21	1.5	0.7	.2	23.8	14.1	53.0
Stem	Mean	2.1	0.20	1.8	0.5	0.3	51.5	18.5	36.0
	Max.	2.5	0.21	2.1	0.6	0.4	55.3	23.2	38.1
	Min.	1.9	0.18	1.6	0.4	0.2	46.3	16.8	34.7

Source: Karachi (1998)

Table 3: Chemical composition of *Leucaena leucocephala* leaves

Trait	Mean ± SE
Dry matter (g kg DM^{-1})	885.377±0.14
Ash (g kg DM^{-1})	6.149±0.003
Organic matter (g kg DM^{-1})	823.97±0.137
Nitrogen %	3.56±0.004
Crude protein (g kg DM^{-1})	22.226±0.024
Neutral detergent fibre (g kg DM^{-1})	315.746±0.07
Acid detergent fibre (g kg DM^{-1})	234.19±0.128
Calcium %	1.8 ± 0.001
Phosphorus %	0.2 ± 0.003
Tannin (g kg DM^{-1})	18.05±0.243
Two stage digestibility (g kg DM^{-1})	54.94±0.040

Values are means of 3 replicates
SE: Standard error of the means.

Table 4: chemical composition of *Leucaena leucocephala* leaves as affected by method of drying

Trait	Air-dried Mean ± SE	Sun-dried Mean ± SE	Soaked Mean ± SE
Dry matter (g kg DM^{-1})	859.57^{c}±0.245	903.07^{a}±0.245	893.45^{b}±0.245
Ash (g kg DM^{-1})	6.2^{a} ± 0.01	6.13^{a} ± 0.01	6.09^{a} ± 0.01
Organic matter (g kg DM^{-1})	797.57^{c}±0.24	841.73^{a}±0.24	832.6^{b}±0.24
Nitrogen %	3.78^{a} ± 0.01	3.46^{b} ± 0.01	3.43^{b} ± 0.01
Crude protein (g kg DM^{-1})	23.62^{a}±0.041	21.62^{b}±0.041	21.42^{b}±0.041
Neutral detergent fibre (g kg DM^{-1})	287.86^{a}±0.121	327.1^{c}±0.121	332.27^{b}±0.121
Acid detergent fibre (g kg DM^{-1})	202.23^{c}±0.21	249.5^{b}±0.21	250.57^{a}±0.21
Calcium	1.8^{a} ± 0.001	1.8^{a} ± 0.001	1.8^{a} ± 0.001
Phosphorus	0.2^{a} ± 0.003	0.2^{a} ± 0.003	0.2^{a} ± 0.003
Tannin (g .kg DM^{-1})	23.47^{a}±0.42	19.01^{b}±0.42	11.68^{c}±0.42
Two stage digestibility In-vivo-DOM (g kg DM^{-1})	55.8^{a} ± 0.069	53.9^{b} ± 0.069	55.1^{a} ± 0.069

1. Values are means of 3 replicates per treatment.
2. Means with different superscripts in the same raw were significantly different (P ≤ 0.05).
3. SE: Standard error of the means.

These results are comparable with those obtained by various workers in other parts of the world (Jones, 1979; Shelton and Brewbaker, 1994; Norton and Poppi, 1995; Devendra 1995; Garcia *et al.*, 1996; Dzowela *et al.*, 1997 and Larbi *et al.*, 1998). In Australia, Jones (1979) obtained 3.04-4.2 % nitrogen; 11% ash; 2.4% Ca; 0.2% P; 204 g. kg acid detergent fiber; 10.15 mg. g condensed tannins and 50-71% dry matter digestibility. Similar values were reported by Shelton and Brewbaker (1994).

CONCLUSION

It was concluded that *leucaena* has adequate potential nutrients capable of supporting microbial growth and subsequently allowing higher animal performance.

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