Paper ID: 550
Theme 2. Grassland production and utilization
Sub-theme 2.2. Integration of plant protection to optimise production

Chemical composition of woody species at browsed Caatinga under different forage allowance

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Keywords: Native rangelands, Nutritive values, Plant chemical composition

Introduction

Native rangelands are essential for Brazilian livestock production in the northeast Caatinga because they are abundant and inexpensive. Greater knowledge of nutritive values of these native plants is a needed because they fit well in prevailing edapho-climatic conditions. The chemical composition of plants, however, may differ according to ontogeny, elevation, soil, climate, plant community and human actions. Caatinga plants usually have high crude protein (CP) although some of this is fiber-bound (Santos *et al*., 2009). Browse can therefore become a key livestock diet component.

Condensed tannins (CT) in browse can provide benefits, including anthelmintic activity greater amino acid absorption, synthesis of microbiological protein and reduction in methane emission when consumed at 20 to 50 g kg^{-1} dry matter (DM) (Littlefield *et al*., 2011; Muir, 2011). Above those levels, animals may suffer negative consequences because of the strong linkage with enzymes, metal ions and carbohydrates although browsers can neutralize CT via salivary proline (Naumann *et al*., 2013). The objective of this study was to estimate the chemical composition of commonly browsed Caatinga woody species in four forage allowances.

Materials and Methods

Browse samples were collected in Serra Talhada, Pernambuco (7°59'7''S, 38°17'34''W) with undulating relief, shallow, well-drained, medium to high fertility Luvisols, at 429-m altitude. The climate is Tropical semiarid, mean annual temperature is 25.7°C and mean annual rainfall is 432 mm. The vegetation is mainly hyperxerophile species, consisting of shrub land, thorn forest and deciduous forest.

The collection area covered 0.72 ha of partially cleared Caatinga enriched with mororó (*Bauhinia cheilantha* Steud.) and buffalo-grass (*Urochloa mosambicensis* Hack.) planted by seed in 1980, and orelha-de-onça (*Macropitilium martii* Benth.) was present in the rainy season. Over the years the area was grazed by cattle. The assay design was a randomized block design with three replications. Each experimental unit consisted of 30 x 20 m in which we tested the effect of four forage allowances (2.0, 2.5, 3.0 and 3.5 kg DM/kg LW).

Browses from arboreal and shrubby species (*B. cheilantha*, *Caesalpinia pyramidalis* Tul., *Capparis flexuosa* L., *Senna pendula* Willd., *Ziziphus joazeiro* Mart., *Anadenanthera macrocarpa* Benth., *Mimosa tenuiflora* Willd., *Myracrodruon urundeuva* All., *C. ferrea* Mart. ex Tul.) were cut up to 6 mm and up to 1.5 m height before sheep initiated grazing during the rainy season in March, 2013. *M. martii* leaves and stems were cut close to the ground. The samples were oven dried at 55 °C until weight became constant and then ground through a Wiley Mill using a 1-mm sieve.

Ash, ether extract (EE), total nitrogen (N), neutral detergent fiber (NDF), acid detergent fiber (ADF), acid detergent lignin (ADL), total carbohydrates [(TC = 100 - (CP + EE + Ash)], non-fiber carbohydrates (NFC = 100 - (CP + NDF + EE + Ash), CT and total phenolics (TP) were analyzed. Statistical analysis consisted of regression and comparison of means by Tukey test at 5% of probability using SISVAR version 5.3.

Results and Discussion

Forage allowance did not affect chemical composition of woody plants, except that the lowest offer presented greater ADF and ADL ($P \leq 0.05$) (Table 1), probably due to advanced maturity and low animal consumption. Forage chemical composition was adequate for ruminant nutrition, with hemicellulose averaging 187 g kg^{-1} DM and NFC averaging 319 g kg^{-1} DM. Plant CP was greater than 70 g kg^{-1} DM (Table 1), the minimum amount needed for rumen fermentation. Part of CP, however, may be linked to the fiber and unavailable to the animal (Santos *et al*., 2009). Ash concentration was similar

to values found in the literature and averaged 79.5 g kg^{-1} DM. Only the EE showed levels above that recommended (60 g kg^{-1} DM) for ruminants. Animals in high temperature environments with reduced DM intake should ingest more fat. Condensed tannin and TP showed a weak quadratic response: as grazing pressure increased, plants tended to accumulate secondary compounds up to 2.5 kg DM/kg LW^{-1} (Table 1). Condensed tannin concentration varies according to the plant tissues ontogeny and anatomical origin (leaf, stem, fruits, seeds) as well as biotic and abiotic factors (Muir, 2011).

Table 1. Chemical composition (g kg^{-1} DM) of woody species in thinned and over-seeded Caatinga rangeland four different forage allowances

Variables	Forage allowance (kg DM/kg LW)				CV %	*P* value
	2.0	**2.5**	**3.0**	**3.5**		
Ash	83.8	80.2	73.9	80.2	12.5	0.69
Ether extract	57.7	58.0	53.2	54.4	19.1	0.92
Crude protein	92.1	105.7	116.1	101.1	11.4	0.19
Neutral detergent fiber	496.1	428.2	427.2	415.2	10.2	0.21
Acid detergent fiber[1]	296.7 a	265.5 ab	238.3 b	218.3 b	7.8	0.013
Acid detergent lignin	188.0 a	174.0 ab	148.7 ab	130.9 b	12.7	0.05
Total carbohydrates	766.4	756.2	756.8	764.3	2.8	0.91
Non-fiber carbohydrates	270.3	327.9	329.7	349.0	11.7	0.16
Condensed tannins	25.8	36.5	42.4	29.2	50.9	0.65
Total phenolics	108.3	186.3	151.3	147.4	41.7	0.54

[1]Means followed by same low cases letters are statistic equals by test Tukey at 5% of probability.

There was a weak quadratic effect for CT (*P*=0.67) and TP (*P*=0.84) concentration for *B. cheilantha* at different forage allowances (Fig. 1). When *B. cheilantha* plants were subjected to greater grazing pressure, from 2,8 to 2,0 kg DM/kg LW, there was an increase of CT and TP, as response to protect their against herbivory. However, when they were subjected to lower grazing pasture there was an increase again, possibly for precaution. Adams *et al.* (2013) found that *Juniperus ashei* Buch consumed by goats and deer had greater CT than not browsed which synthetized more terpenoids. The concentration of CT does not always define biological activities (Littlefield *et al.*, 2011) since molecular weights, and therefore reactivity, may vary (Muir, 2011).

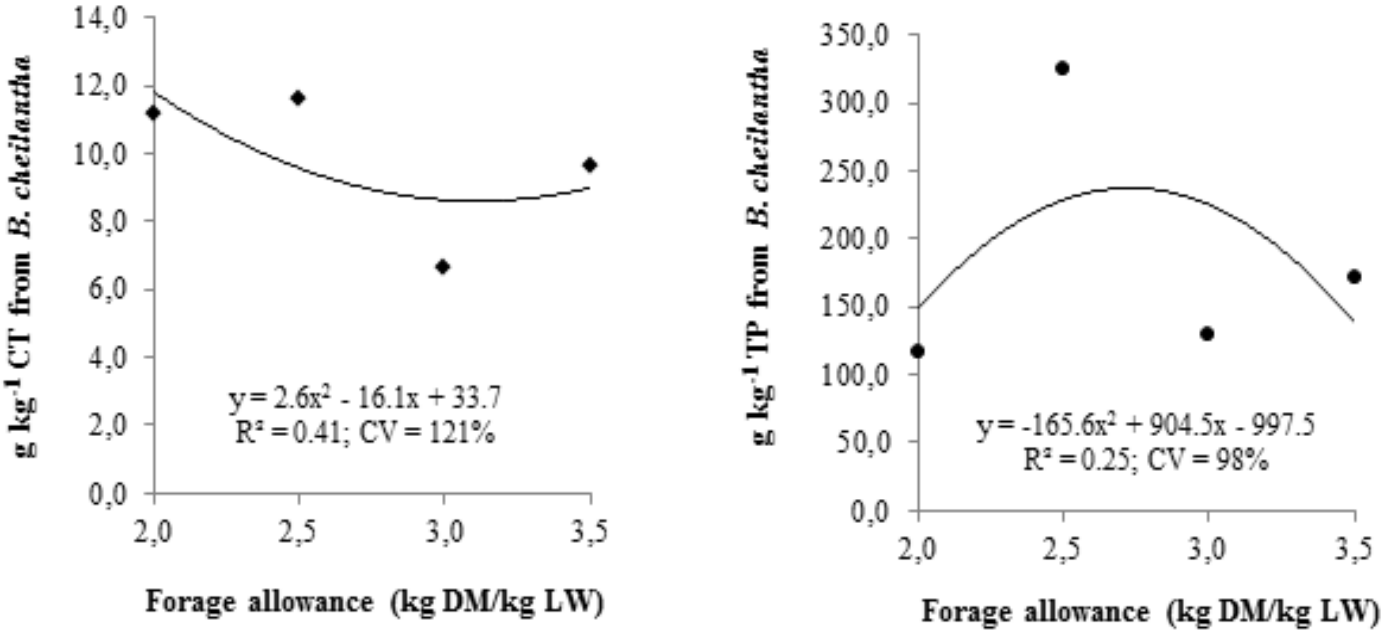

Fig. 1: Range of condensed tannins (CT) and total phenolics (TP) in *B. cheilantha* browse under different forage allowance.

Conclusion

Except for ADF and ADL concentration, the chemical composition of plants did not change among different forage allowances. However, the increase in CP and NFC, and decrease in NDF, CT and TP concentrations which will likely have biological significance.

References

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Acknowledgement

Capes and Texas A & M Agrilife Research for providing support to this research.