ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 07, Issue, 08, pp.14224-14226, August, 2017

ORIGINAL RESEARCH ARTICLE Open Access

A CHEMICAL COMPARISON OF TWO NATURALLY OCCURRING PODS AS POTENTIAL ANIMAL FEED RESOURCES

***Matekenya Tendai, D., Tabarirwa Isaac and Makiwa Priscilla**

Henderson Research Institute, P. Bag 2004, Mazowe, Zimbabwe

ARTICLE INFO

Article History:
Received 19th May, 2017
Received in revised form
25th June, 2017
Accepted 16th July, 2017
Published online 30th August, 2017

Keywords:

Dichrostachys cinerea
and *Acacia sieberiana*,
Chemical composition,
Animal feed.

ABSTRACT

Virtual disappearance of nutritious grass in the dry season in Zimbabwe is compensated by trees and shrubs which make an essential part of livestock rearing systems in smallholder farming communities. Appetite is shown to naturally occurring tree pods, *Acacia sieberiana* and *Dichrostachys cinerea* whose pods and leaves are highly palatable to cattle. The experiment compared and determined the chemical composition of these two species of pods as animal feed. Pods from *Dichrostachys cinerea* and *Acacia sieberiana* were randomly selected and collected from Seke communal area in Zimbabwe during the dry season. Proximate chemical analysis was carried on the samples. Results showed that *Acacia sieberiana* pods had a significantly ($P<0.05$) higher dry matter (DM), ash, neutral detergent fibre (ADF) and crude protein (CP) than *Dichrostachys cinerea.* Pods from *Dichrostachys cinerea* contained more ($P<0.05$) condensed tannins, total phenolics and nitrogen free extracts than *Acacia sieberiana* pods. The ether extract (EE), crude fibre (CF), phosphorus (P) and calcium (Ca) content of these pods were the same ($P>0.05$). In conclusion, considerable variations and similarities in chemical composition were observed in the two species of pods. These chemical variations can be correlated to the nutritive value and intake by cattle.

****Corresponding author:***

Citation: Matekenya Tendai, D., Tabarirwa Isaac and Makiwa Priscilla, 2017. "A chemical comparison of two naturally occurring pods as potential animal feed resources", *International Journal of Development Research*, 7, (08), 14224-14226.

INTRODUCTION

In the communal areas of Zimbabwe, cattle are left to graze freely away from the vleis into fields that have crop residues from the previous planting season. This period marks the dry season in Zimbabwe and is characterized by deterioration in forage quality. Virtual disappearance of nutritious grass in the dry season is compensated by trees and shrubs which make an essential part of livestock rearing systems in the small holder farming communities of Southern Africa (Nherera, 1999).Of great interest is the appetite shown by cattle to naturally occurring pods found on the fields. These are pods from *Acacia sieberiana* and *Dichrostachys* cinerea trees whose pods and leaves are highly palatable to cattle (Anderson and Drummond, 1981; Nherera, 1999). These pods grow in summer and become ripe when cattle are left to graze in the fields during the dry season. However, the major constraint is the accessibility of these pods to the animals; tree height being the major determinant. Cattle can only access the ripened pods when they fall to the ground either by natural forces such as wind or through the assistance of farmers harvesting (*laborious task*). This might imply under-utilization of these valuable resources. Indigenous knowledge systems of the area indicate that there is a measure of preference in the consumption of these two pods. It is speculated that *Dichrostachys cinerea* is preferred to *Acacia sieberiana* by cattle. Another concern stems from the underutilization of seeds from the ripened dry pods which are passed undigested when fed to animals. This raises questions on the best harvesting time for the pods. Therefore, the present study sought to establish and compare the chemical composition of *Acacia sieberiana and Dichrostachys cinerea* pods.

MATERIALS AND METHODS

Description of study site: Samples of *Acacia sieberiana* and *Dichrostachys cinerea* pods were collected from Seke communal area, (Dema village) in Zimbabwe. The area is in

Mashonaland East province located in natural ecological region II and III with an average annual rainfall of 650-1000mm. The study site was selected because of the high density of trees therein**.**

Sample collection: Samples from *Acacia sieberiana* and *Dichrostachys cinerea* pods were collected once in the dry season (autumn). The pods were randomly collected from the available trees to give a representative sample. The pods were taken for laboratory analysis.

Drying of samples: Samples of*Acacia sieberiana* and *Dichrostachys cinerea* pods were oven dried for 24 hours at a temperature of 105°C before they were ground. Samples were milled on a 2mm sieve and taken for a chemical analysis.

Chemical Analyses: Homogenized ground samples of *Acacia sieberiana* and *Dichrostachys cinerea* pods were analysed by proximate procedures to determine the dry matter content (DM), crude protein (CP), ether extract (EE), ash, nitrogen free extracts (NFE) according to the method of Association of Official Analytical Chemists (1995). Neutral detergent fibre (NDF), acid detergent fibre (ADP) was analysed using Van Soest method (1967). Phosphorus (P), calcium (Ca) was analysed using Wet chemistry AOAC (1995). Condensed tannins (proanthocyanidins) and total phenolics were analysed according to the method of Porter *et al,* (1986) and Folin-Ciocalteu method respectively.

Data Analysis: The General Linear Model procedure of SAS (1996), was used to analyse the data. The process employed the following model:

Statistical Model

$Y_i = \mu + t_i + e_i$

where; Y_i=dependent variable (response) i.e. (DM, Ash, EE, CF, NDF, ADF, CP, P, Ca, Condtan and Totphen).

μ = Overall mean of all observations on the species
t_i = species effect (*Acacia*; *Dichro*.)
e_l = residual error

RESULTS AND DISCUSSION

Comparison of the Chemical Composition of *Dichrostachys cinerea* and *Acacia sieberiana*

Results of the chemical composition of *Dichrostachys cinerea* and *Acacia sieberiana* pods are shown in Table 1.

Dry matter and Ash content

Dichrostachys cinerea had a significant (P<0.05) lower DM and Ash content than *Acacia sieberiana*. The result agreed with those of (Ncube and Mpofu, 1994) who found similar findings. A slightly higher DM content in *A. sieberiana* could imply high carbohydrate content in the latter (McDonalds *et al*., 1995) since carbohydrates form the major component of DM in all plants and many seeds. This could mean a higher metabolisable energy (ME) for *Acacia sieberiana* than *Dichrostachys. cinerea*.

Ether Extract (EE) and Crude Fibre (CF) content

Dichrostachys cinerea and *Acacia sieberiana* did not vary (P>0.05) in their EE and CF content. The results are in contrast to findings of Gohl (1981) who reported that *Dichrostachys cinerea* had a higher EE and CF content than *Acacia sieberiana*. Variations in the chemical composition of biological systems over space and time could offer an explanation for these differences.

Neutral Detergent Fibre (NDF) content

Acacia sieberiana pods had a significantly (P<0.05) higher NDF content than *Dichrostachys cinerea* pods Similar results were confirmed in the study (Ncube and Mpofu, 1994).

Crude Protein (CP) content

The two pods varied significantly (P<0.05) in their CP content. *Acacia* species had a higher CP content than *Dichrostachys* species. However, Gohl (1981) found that *Acacia sieberiana* was lower in CP content than *Dichrostachys cinerea*. This difference could be attributed to wide differences in the chemical composition within and among species growing under the same climate and edaphic conditions (Nherera, 1999). Also the age of the tree at sampling has an effect on its CP content (McDonald *et al.,* 1995). Both pods *Dichrostachys cinerea* and *Acacia sieberiana* had high CP contents of 11.3 % and 16.6% respectively making them ideal feed resources in the dry season. Hence these pods are valuable protein sources when compared with mature grasses, whose CP levels can fall to 3-4% or less in the dry season, well below 7% which is suggested as a lower limit for fibre digestion in cattle (Van-Soest, 1982). However, for comparison, *A. sieberiana* had a higher CP content than *Dichrostachys*. The data gained from this study did not compare the nutritive value of the CP from these two pods in terms of their digestible crude protein (DCP). But digestibility trails carried out in the study (Ncube and Mpofu, 1994) showed that *Dichrostachys* had a higher in-vitro dry matter digestibility than another Acacia species *(A. rehmanniana*).

Phosphorus and Calcium levels

The two species of pods had the same (P>0.05) Phosphorus and Calcium levels. Likewise, Gohl (1981) reported similar results. Low levels of Ca and P for both species could be explained by the fact that the pods were sampled from the same area, which had inherently low levels of these nutrients in the soil (Nherera, 1999).

Nitrogen Free Extract (NFE) content

Dichrostachys cinerea had a significantly (P<0.05) higher NFE content than *Acacia sieberiana*. The higher nitrogen free extract (NFE) amounts in *Dichrostachys* confirmed that this species was rich in the following components: cellulose, hemicellulose, lignin, sugars, pigments and water-soluble vitamins (McDonald *et al*., 1995).The carbohydrate component of the feed is the main source of energy for ruminants and is contained in two fractions, the crude fibre and nitrogen free extractives (McDonalds *et al.*, 1995). Both pods had high CF contents. However, high fibre content might lower the digestibility and hence the nutritive value of the feed. On the other end, this high CF content during the dry spell could provide energy sources for the efficient utilization of digestible crude protein (DCP) and maintenance of gut fill, which in turn may prevent metabolic disorders such as displaced 0020 abomasums, making these pods good supplements during this time.

Table 1. Least square means for the Comparison of the chemical composition of *Dichrostachys cenerea* and *Acacia sieberiana*

Species	DM (g/kg)	ASH (g/kg)	EE (g/kg)	CF (g/kg)	NDF (g/kg)	CP (g/kg)	PHOSH (g/kg)	Ca (g/kg)	NFE (g/kg)	CONDTAN (g/kg)	TOTAL PHENOLIC (g/kg)
Dichro. cinerea	901.3[a]	52[a]	18[a]	183.0[a]	310.0[a]	113.0[a]	21.0[a]	1.3[a]	634.3[a]	11.5[a]	204.0[a]
Acacia sieberiana	904.0[b]	80[b]	22.6[a]	193.0[a]	459.3[b]	166.3[b]	24.7[a]	2.3[a]	538.0[b]	7.5[b]	87.5[b]

KEY:
[a,b]Means in the same column with different superscripts are significantly different (P<0.05).

DM = Dry matter NDF = Neutral detergent fibre NFE = Nitrogen Free Extract
EE = Ether Extract CP = Crude Protein Condtan = Condensed tannins
CF = Crude fibre Phosh = Phosphorus Totalphen = Total phenolic

Condensed tannins and total phenolics

A significantly (P<0.05) higher proportion of condensed tannins and total phenolics was found in *Dichrostachys cinerea* than in *Acacia sieberiana*. Higher levels of condensed tannins and total phenolics in *Dichrostachys cinerea* could mean a decrease in the degradability of these pods as compared to *A.sieberiana*. This could invalidate earlier speculations by the local people from the sampling area who postulated that *Dichrostachys* were the most preferred pods by the cattle. This is so because condensed tannins have been known to complex with proteins resulting in reduced feed intake and digestibility (McNoughton, 1987). Even so, there were relatively high levels of tannins in *A.Sieberiana* (Bennison and Peterson, 1993). Total phenolics are mainly composed of cellulose, hemicellulose and lignin. When P-linked carbohydrates are associated with lignin they are resistant to rumen microbial attack and this can reduce intake and digestibility. This therefore implies that a cautious approach is needed when harvesting these pods as feed supplements in the dry season as both contained anti-nutritional compounds (Bennison and Paterson, 1993). This is particularly important in periods of extreme feed scarcity or in situations where the opportunity for feed selection is reduced as in stall feeding and cut and carry system. There is need for proper rationing when fed as supplements. However, Bennison and Paterson (1993) reported that in the natural ecosystem they are consumed as part of a wider diet and the effect of anti-nutritive factors is diluted.

Conclusion

The two species of pods varied in their chemical composition. *Acacia sieberiana* pods had higher DM, Ash, NDF and CP content than *Dichrostachys cinerea* pods. On the other hand, Dichrostachys cinerea pods contained higher levels of NFE, condensed tannins and total phenolics than *Acacia sieberiana* pods. Similarities were found in the EE, CF, P and Ca content levels of the two pods. The higher CP content in both pods supports earlier findings that these species are a good source of protein in the dry season**.** Further research could involve digestibility trails to compare the nutritive value of these two species.

Acknowledgements

Appreciation is extended to Rockerfeller Foundation for funding the entire project. Profound gratitude to I.D.T. Mpofu and O. Nyoni for the technical support. The assistance of Nutritional Biochemistry Laboratory technicians at the University of Zimbabwe, Department of Animal Science is appreciated.

REFERENCES

Anderson, O. and Drummond, R. B. 1981. Common Trees of the Central Watershed Woodlands of Zimbabwe. Department of Natural Resources. Salisbury, Zimbabwe.

Association of Official Analytical Chemists (AOAC). 1995. Official methods of analysis. Trends Food Science and Technology, 6: 382-383

Bennison, J.J and Paterson, R.T. 1993. Use of Trees by Livestock 2: Acacia.Natural Resources Institute. Chatham, UK.

Gohl, B. 1981. Tropical Feeds: Feed information Summaries and Nutritive Values. FAO Animal Production and Health Series No. 12. Rome, Italy.

Mcdonald, P., Edward, R.A. and Greenhalgh J.F.D. 1995. Animal Nutrition. 5th Ed. Longman Group Ltd. England.UK

McNaughton, S.J.1987. Adaption of herbivores to season changes in nutrient supply. In: Nutrition of Herbivores. Hacker, J.B. and Ternmouth, J.H. (ed). Academic Press. Sydney, Australia.pp. 391-408

Ncube, S. and Mpofu, D. 1994. The nutritive value of wild fruits and their use as supplements to veld hay. Zimbabwe Journal of Agriculture Research, 32(1): 71-77.

Nherera, F. 1999. Instructional material for a course in Agroforestry-Browse in Agroforestry. IES special report No. 15. University of Zimbabwe & University of Alberta.

Porter, L.J., Hrstich, L.N. and Chan B.G. 1986. Phytochemisty, 25: 223-230.

SAS Institute. 1996. SAS/STAT user's guide. 9th Edition. SAS Institute, Cary, NC, USA.

Van Soest P.J. 1967. Developments of a comprehensive systems of food analysisand its application toforages. J. Animal Science: 26-119.

Van Soest, P.J. 1982. Nutritional Ecology of the Ruminant. O & B Books, Corvallis, Oregon, USA.

****