EVALUATION OF THE CHEMICAL COMPOSITION OF SOME LOCALLY AVAILABLE ACACIA SEEDS AS ANIMAL FEED IN BOTSWANA

A.A. Aganga[1], C. M. Tsopito[1], S. O. Yeboah[2], C. Mokgoko[1] and S. N. Manne[1].
[1]Department of Animal Science and Production, Botswana College of Agriculture
[2]Department of Chemistry, Faculty of Science, University of Botswana, Gaborone Botswana

ABSTRACT
Two separate studies were conducted using indigenous browse seeds. In the first study, seeds from nine locally available Acacia trees were analysed for proximate composition, fatty acid composition and in vitro dry matter digestibility. Nutrient composition of the seeds varied in crude protein from 12.52% for Acacia robusta to 21.82% for Acacia erubescens. Ash content ranged from 3.20% to 4.75%. The in vitro dry matter digestibility ranged from 46.00% for Acacia rehmanniana to 62.00% for Acacia erubescens. Fatty acids present in the seeds included palmitic, linoleic and oleic acids.

The second study was to evaluate the influence of processing on fibre content and in vitro digestibility of seeds from five browse species using three physical forms of the seeds namely whole seeds, coarsely ground and finely ground. Physical forms of the seeds affected the neutral detergent fibre, acid detergent fibre and dry matter digestibility of all the seeds evaluated.

KEYWORDS
Browse seeds, nutrient composition, digestibility processing

INTRODUCTION
The genus Acacia is a large group of woody species, including shrubs of the family Leguminosae, and belongs to the subfamily Mimosoidae. Many of the Acacia species found in Botswana are the indicators of environmental conditions and many have economic importance like bush encroachment, medicine, browse etc.

Terry, Agbaji and Agbaji (1992) reported that Acacia nilotica's seeds contain 394.0g/kg crude protein and are rich in minerals. Aganga et al. (1994) reported high concentration of proteins and essential minerals in the young twigs and pods but the seeds normally pass undigested through the animal's gut due to the hard covering. Crushing or changing the physical state of the seeds may help in the utilisation of the proteins and other nutrients that are contained in the seeds. The objectives of these studies therefore are to evaluate some locally available browse seeds for nutrient composition, digestibility and influence of processing on the digestibility of some of the seeds.

MATERIALS AND METHODS
Two trials were conducted to evaluate the nutritional value of browse seeds. In Trial 1, the nutrient composition (proximate, minerals and qualitative fatty acid analyses were evaluated while Trial 2 involved fibre analyses and evaluation of browse seeds' processing using three physical forms.

Trial 1
Seeds from nine locally available Acacia species belonging to Mimosodeae subfamily namely *Acacia* (A.) *karro, A. rehmannaiana, A. nigrescens, A. arenaria, A. robusta, A. erubescens* were collected from the savanna and woodlands of Botswana are used in the study.

Analytical methods. Analyses for proximate composition of the seeds were done using the procedures of A.O.A.C. (1990). The mineral composition was determined on ash using atomic absorption spectrophotometer (Varian A A10) after hydrochloric acid digestion and flame photometer for potassium and sodium. Crude protein was determined by the Kjeldahl method using semi-automatic equipment (Bach 323 distillation unit). The fatty acids composition was determined from the methyl esters of the fatty acids in the oil, using thin layer chromatography. The solvent system which gave the best separation was, benzene; ether; acetic acid; ethyl ether (80:10:0.2:10). The spots were identified by spotting the test samples alongside standard methyl esters obtained from SIGMA chemical company (USA).

***In vitro* dry matter digestibility.** This was done using the method of Tilley and Terry (1963) modified by Van Soest (1967).

Trial 2
Seeds from five indigenous Acacia species (subfamily Mimosocleae) namely *Acacia* (A.) *hebeclada, A. leuderitzii, A. erioloba, A. tortilis* and *A. robusta* collected from the savanna and woodlands of Botswana were used in the study. The seeds were randomly assigned into three physical forms, namely:
(a) Whole seeds
(b) Course texture was obtained by grinding the seeds to pass through 1 - 5 mm sieve size.
(c) Fine texture was ground to pass through 0.1 - 0.2 mm sieve size.

Analytical Methods: Seeds were analysed for neutral detergent fibre and Acid detergent fibre using the procedures of Van Soest and Robertson (1980). In vitro dry matter digestibility was done using the procedures developed by Tilley and Terry (1963) and modified by Van Soest (1967).

Data collected were subjected to analysis of variance using the Statistical Analysis Systems (SAS 1994) procedures.

RESULTS AND DISCUSSION
Botswana livestock production is heavily dependent on range land. The country has a well defined short rainy season and a prolonged dry season which lasts for about eight months of the year. It is during the dry season and drought period that browse trees including Acacia trees are very important to livestock nutrition. Crude protein (CP) content of the Acacia seeds ranged from 12.52% for a A. robusta to 21.8% for a A. erubescens (Table 1). The dry matter digestibility (DMD) ranged from 46% for A. rehmanniana to 62% for A. erubescens which are similar to DMD values obtained for some Nigerian browses reported by Aganga and Boudib (1993). The ash contents of the Acacia nilotica seeds is slightly lower than the 5.5% value reported for the same specie by Terry et. al. (1992). Solvent extractable fat levels varied from 2.29% to 5.42% for a A. robusta and A. karoo respectively while A. nilotica contained 4.04% fat which is slightly lower than the 5.0% reported by Gohl (1981) for the same specie. Thus, the extractable fat levels of these seeds could substantially benefit ruminants. The main saturated fatty acids present are: (hexadecanoic) palmitic (16:0), (octadecanoic) stearic (18:0) and ceiocosamic) arachidic (20:0) while the unsaturated fatty acids include: (octadecenoic oleic (18:1) and (octadeca dienoic) linoleic (18:2)

The Ca content for all the evaluated seeds are lower than those reported by Terry et. al. (1992) while the Mg contents fall within adequate levels reported by McDowell (1985) for normal growth of beef cattle (Table 1). The Acacia seeds contained low levels of Na and appreciable levels of the trace minerals evaluated.

Table 2 shows that physical forms of Acacia seeds evaluated influenced the in vitro dry matter digestibility (IVDMD), neutral detergent fibre (NDF) and acid detergent fibre (ADF). Acacia tortilis is the most abundant browse in Botswana range lands thus readily available and accessible to grazing ruminants. When the seeds are crushed, the digestibility improved from 12.0% for whole seeds to 53.7% for finely ground seeds. Neutral detergent fibre (readily digestible carbohydrate) was highest for coarsely ground A. tortilis seeds with 47.8% digestibility. The grazing animals on the range swallow these seeds whole which means that the seeds pass through the gut poorly digested and the animal derives minimal benefit from the seeds. This can be attributed to the fact that the whole seeds have hard outer covering hence microbial activities in the rumen

could not fully utilize the inner seed contents like in crushed seeds. Crushing resulted in reduction in particle size which led to increase in dry matter digestibility. The study showed that Acacia seeds could provide part of the solution to shortage of energy and protein feedstuffs during the dry season to supplement low quality forage grazed by ruminant livestock. The digestibility of the seeds could be improved by coarsely crushing them if used as supplementary feed.

REFERENCES

Aganga, A.A. and S. Boudib. 1993. Contribution of Browse to the nutrition of ruminants in semi-arid Northern Nigeria. Thai. J. Agric. Sci. **26**:207-213.

Aganga, A.A., J.S. Kiazolu and C.M. Tsopito. 1994. Browse plants as feed resource for ruminants in Botswana. 1. Browse in hardveld vegetational zone of Botswana. Bull. Anim. Hlth. Prod. Afr. **42**:117-123.

A.O.A.C. 1990. Association of Official Analytical Chemists. 15th edition. Arlington, Virginia.

McDowell, L.R. 1985. Nutrition of grazing ruminants in warm climates. Academic Press Ltd. San Diego.

SAS. 1994. Statistical Analysis system procedures.

Terry, D.lE., Agbaji, A.S. and Agbaji, E.B. 1992. Proximate composition of the seeds of Acacia nilotica and extraction of its protein. Trop. Sci. **32**:263-268.

Tilley, J.M. and Terry, R.A. 1963. A two stage technique for the in vitro digestion of forage crops. J. Br. Grassld soc. **18**:104-111.

Van Soest, P.J. 1967. Development of a comprehensive system of feed analyses and its application to forages. J. Animal Sci. **26**:119-128.

Van Soest, P.J. and Robertson, J.B. 1980. Systems of analysis for evaluating fibrous feeds. In: W.J. Pidgen, C.C. Balch and M. Graham (eds), Standardization of analytical methodology for feeds. Proceedings of a workshop held at the International Development

Table 1

In Vitro dry matter digestibility (DMD) and nutrient composition (on dry matter basis) of the seeds of some indigenous Acacias in Botswana

	(in g/100g)					(Macrominerals ing/100g DM)					(Microminerals in mg/kgDM)			
SPECIES	DM	DMD	ASH	CP	Extractable fat	CA	P	K	Na	Mg	Cu	Fe	Mn	Zn
A. tortilis	90.90	56.17	4.50	20.16	2.86	0.60	0.25	1.32	0.05	0.22	53.00	70.00	13.00	45.00
A. robusta	90.70	48.49	4.20	12.52	2.29	0.80	0.18	0.94	0.06	0.24	37.00	90.00	26.00	33.00
A. nilotica	91.95	50.20	4.15	17.64	4.04	0.57	0.41	1.60	0.04	0.27	27.00	92.00	27.00	87.00
A. arenaria	92.55	53.13	4.05	19.93	5.00	0.37	0.48	1.39	0.05	0.20	21.00	77.00	9.00	54.00
A. erioloba	91.10	51.81	3.20	18.88	3.67	0.27	0.35	1.76	0.06	0.24	20.00	27.00	1.00	39.00
A. nigrescens	91.90	58.42	3.40	17.14	4.16	0.52	0.29	0.99	0.04	0.40	21.00	40.00	20.00	37.00
A. karoo	91.75	55.99	4.20	13.67	5.42	0.66	0.33	1.32	0.08	0.30	24.00	50.00	21.00	20.00
A. rehmanniana	92.00	46.00	4.75	12.74	4.19	0.88	0.32	1.10	0.02	0.29	28.00	57.00	13.00	24.00
A. erubescens	91.55	62.04	4.10	21.80	4.84	0.91	0.37	0.94	0.07	0.37	42.00	50.00	20.00	21.00

Table 2

Influence of physical forms on in vitro dry matter digestibility, neutral detergent fibre and acid detergent fibre (in g/100 g DM) of five Acacia species[1] seeds in Botswana

		Physical Seed Forms			
Species	Parameters	Whole	Coarse	Fine	SEM[z]
A. erioloba	IVDMD	11.8	46.6	51.8	3.5
	NDF	18.4	47.1	31.7	2.8
	ADF	11.3	25.1	22.61	1.7
A. hebeclada	IVDMD	19.8	57.4	55.0	2.7
	NDF	9.38	59.4	33.3	1.2
	ADF	7.72	31.5	21.8	1.6
A. leuderitzii	IVDMD	18.9	54.9	52.7	5.4
	NDF	11.1	40.3	38.6	2.5
	ADF	12.3	25.7	18.2	1.5
A. robusta	IVDMD	8.4	44.6	47.5	3.7
	NDF	11.4	47.8	38.3	2.4
	ADF	9.7	36.9	17.2	3.2
A. tortilis	IVDMD	12.0	47.8	53.7	2.3
	NDF	16.1	43.3	31.7	3.1
	ADF	11.7	25.3	26.5	2.1

[z]standard error of the mean (8 observations per mean).
[abc]values on the same line with different superscripts are different, P<0.05.