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Chemical Composition and Digestion of Shurbs Browsed by White-Tailed Deer (*Odocoileus virginianus* Texanus)

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Abstract: The aim of the study was to determine, seasonally, the nutritional value of the native shrubs: *Acacia amentacea*, *Castela erecta*, *Celtis pallida*, *Croton cortesianus*, *Forestiera angustifolia*, *Karwinskia humboldtiana*, *Lantana macropoda*, *Leucophyllum frutescens*, *Prosopis laevigata*, *Syderoxylon celastrinum* and *Zanthoxylum fagara*. Leave samples were collected seasonally during 2 years from Summer 2004 to Spring 2006 in three county sites: China, Linares and Los Ramones in the state Nuevo Leon, Mexico and evaluated for the content of their Crude Protein (CP), Neutral Detergent Fiber (NDF) and Acid Detergent Lignin (ADL). Dry Matter Digestibility (DMD) was also estimated. The CP content (range of total means = 13-22% dry matter) in most plants significantly varied among sites and seasons and between years. The same pattern occurred for NDF (40-55), ADL (8-22) and DMD (48-73). *Celtis pallida* had the highest nutritional value. However, due to their high CP and DMD and low NDF and ADL all studied plants in all sites, most seasons and years may be considered as good food sources for white-tailed deer.

Key words: Native shrubs, chemical composition, dry matter digestibility, CP, NDF, ADL

INTRODUCTION

The major kind of semiarid vegetation in Northeastern Mexico is the Tamaulipan thornscrub that is composed by shrubs and trees dense and thorny; they are distinguished by their wide rank of taxonomic groups showing different development patterns, foliar longevity, growing dynamics and phenological development (Garcia-Hernandez and Jurado, 2008). The foliage from small trees and shrubs is extensively utilized as a food for range small ruminants such as white-tailed deer (Ramirez *et al*., 1997). These range plants keep their green foliage and at the same time with a relatively high nutrient content all year round (Ramirez-Lozano and Gonzalez-Rodriguez, 2010) are of low cost and give diet diversity to range ruminants (Kokten *et al*., 2012), consequently native shrubs are a potential option to be used in range ruminant productions systems (Azim *et al*., 2011).

It has been documented that the annual diet of the white-tailed deer is high in browse plants (85%) from the semiarid region of Northeastern Mexico (Ramirez *et al*., 1997). However, diet and nutrition of the white-tailed deer is affected mainly by availability (quantity and accessibility) and quality (nutritive counting and digestibility) of plants (Ramirez-Lozano, 2012). Additionally, the seasonal changes influence the plant abundance, their growing state and nutritive features (Richardson, 1999). Thus, this study was conducted with the objectives to determine and compare, seasonally in three sampling sites during 2 consecutive years, the chemical composition and dry matter digestion of 11 native shrubs growing in the Northeastern Mexico Objectives were developed from the hypothesis that browse plants, growing in Northeastern Mexico are good nutritional quality to adult range white-tailed deer.

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MATERIALS AND METHODS

Collection of leave plants was carried out in the vegetation called Tamaulipan Thornscrub or Subtropical Thornscrub that is located at Northeastern Mexico (Everitt *et al*., 2002). Three sampling county sites were situated in the state of Nuevo Leon. The first site was located at Zaragoza ranch in China county (25°31'N; 99°16'W). It has an elevation also of 200 m. The second site was located at the Campus of the Facultad de Ciencias Forestales, Universidad Autonoma de Nuevo Leon, located at Linares county (24°47'N; 99°32'W); it has an elevation of 350 m. The third site was located at El Abuelo ranch in Los Ramones county (25°40'N; 99°27'W) with an elevation of 200 m.

In general, the three sites chosen in this study are grouped under a similar climatic pattern (subtropical and semiarid with warm Summer) with an annual precipitation that ranges from 650-800 mm with a bimodal distribution (peaks rainfall are observed in May, June, August and September). Monthly mean air temperature of the region ranges from 14.7°C in January to 22.3°C in August although, daily high temperatures of 45°C are common during Summer (Gonzailez *et al*., 2004). Los Ramones and China sites have not registered livestock activities in the last 5 years and Linares since the last 25 years. The main type of vegetation of the area is known as the Tamaulipan Thornscrub or Subtropical Thornscrub Woodlands. Dominant soils are deep, dark-gray, lime-gray, lime-clay vertisols with montmorillonite which shrink and swell noticeably in response to changes in soil moisture content (INEGI, 2000).

Studied shrub species were *Acacia amentacea* DC. (Fabaceae), *Castela erecta* Turp. ssp. *texana* Torr. and A. Gray Cronquist (Simaroubaceae), *Celtis pallida* Torr (Ulmaceae), *Croton cortesianus* Kunth (Euphorbiaceae), *Forestiera angustifolia* Torr (Oleaceae), *Karwinskia humboldtiana* Roem. Et Schult (Zucc.) (Rhamnaceae), *Lantana macropoda* Torr. (Verbenaceae), *Leucophyllum frutescens* (Berl.) I.M. Jhonst. (Scrophulariaceae), *Prosopis laevigata* (Humb. and Bonpl. Ex Willd.) M.C. Jhonston. (Fabaceae), *Syderoxylon celastrinum* (Kunth) (Sapoteceae) and *Zanthoxylum fagara* (L.) Sarg. (Rutaceae). These species are representative of the native vegetation of the Northeastern Mexico and the subtropical savanna ecosystems of southern Texas, USA (Everitt *et al*., 2002) and are consumed by range ruminates and white-tailed deer (Ramirez-Lozano, 2012). At browsing height (about 1.5 m), terminal shoots with fully expanded leaves were randomly chosen from a 50×50 m representative and undisturbed plot located in each site. Collections were undertaken, seasonally during 2 consecutive years: Summer 2004 (August, 28); fall 2004 (December, 1); Winter 2005 (March 1); Spring 2005 (May, 28); Summer 2005 (September, 1); fall 2005 (November, 28); Winter 2006 (February, 27) and Spring 2006 (May, 28). Shoots were excised and sampled (about 800 g) from the middle side of three plants of each species. Leaves were placed into paper bags and stored. Thereafter, samples were transferred to the laboratory for analyses.

Partial Dry Matter (DM) was established by drying samples in an oven at 55°C during 72 h then grounded in a Wiley mill (1 mm) and stored in plastic containers for further analyses. By triplicate, samples were analyzed for dry matter, Crude Protein (CP) (AOAC, 1997). Neutral Detergent Fiber (NDF) and Acid Detergent Lignin (ADL) were performed according to the procedures described by Van Soest *et al*. (1991). Although, the value of accurate digestibility data is unbiased, obtaining actual data is time consuming, expensive and requires large amounts of the forage samples that was not feasible in this study then Dry Matter Digestibility (DMD) was estimated using the formula developed by Oddy *et al*. (1987):

$$\text{DMD} = 83.58-0.824\ \text{ADF}\%+2.626\ \text{N}\%$$

Predictive equations derived in this study could be used in estimating nutrient digestibility if relevant chemical composition is known without doing expensive feeding trials (Appiah *et al*., 2012). Data were statistically analyzed using a completely random design with factorial arrangement. The factors were years (A), sampling sites (B) and seasons (C). Simple linear regression analyses were carried out between chemical composition and DMD (Steel and Torrie, 1980).

RESULTS AND DISCUSSION

The CP content of in most shrubs was significantly different between years and among sites and seasons. The double and triple interaction were also significant (Table 1). The highest total mean concentration of CP resulted in *C. pallida* and *P. laevigata* and in the Spring and Summer seasons most plants had the highest values. Similar pattern was reported by Parlak *et al*. (2011) and Lopez-Perez *et al*. (2012) they mentioned that during Spring and Summer the CP content increases and decline during Winter months. They also mentioned that protein synthesis is stimulated as the plants starts to grow in the spring, the number of young cells increase and the physiological events are induced. In this study, the overall mean of CP of all species was 16%. Similar values were reported by Moya-Rodriguez *et al*. (2002) and Dominguez-Gomez *et al*. (2011) in browse plants growing in Northeastern Mexico and they founded that these

Table 1: Seasonal means of crude protein (%) in native shrubs from Northeastern Mexico

		Shrub species										
County sites	Seasons and years	A. ame	C. ere	C. pal	C. cor	F. ang	K. hum	L. fru	L. mac	S. cel	P. lae	Z. fag
China	Summer 2004	15	12	21	24	11	17	11	18	12	19	14
	Autumn 2004	17	10	22	16	13	18	13	17	14	25	17
	Winter 2005	15	13	20	21	-	15	16	19	13	33	15
	Spring 2005	16	14	23	18	-	18	13	17	14	19	17
	Summer 2005	17	14	24	15	17	16	13	13	15	19	18
	Autumn 2005	16	14	20	18	13	17	11	14	15	17	20
	Winter 2006	14	12	19	16	11	15	14	14	15	24	12
	Spring 2006	16	13	25	19	14	18	14	19	12	21	25
Linares	Summer 2004	16	11	18	16	-	14	10	14	13	18	15
	Autumn 2004	18	12	21	17	-	17	14	17	13	-	14
	Winter 2005	21	13	24	17	15	16	12	20	14	-	13
	Spring 2005	16	10	20	20	11	18	11	16	14	21	16
	Summer 2005	16	15	21	17	16	18	13	18	18	21	19
	Autumn 2005	16	15	19	19	14	15	15	14	17	19	18
	Winter 2006	13	15	22	16	12	17	14	16	14	17	13
	Spring 2006	16	13	26	19	13	18	15	18	16	22	16
Los Ramones	Summer 2004	14	14	22	16	13	15	11	15	12	20	14
	Autumn 2004	13	14	17	17	12	15	11	14	13	21	15
	Winter 2005	18	12	30	19	12	17	16	17	14	20	16
	Spring 2005	15	11	20	19	13	18	18	19	14	18	16
	Summer 2005	19	14	24	17	14	17	14	17	12	20	16
	Autumn 2005	15	13	21	14	11	14	11	16	18	19	16
	Winter 2006	16	12	17	15	12	12	12	19	13	29	14
	Spring 2006	16	16	24	19	15	18	15	18	16	22	22
	Grand mean	16	13	22	18	13	16	13	17	14	21	16
	SEM	0.2	0.2	0.4	0.3	0.2	0.2	0.2	0.2	0.2	0.5	0.4
		p	p	p	p	p	p	p	p	p	p	p
Factors	Year (A)	0.006	0.001	0.322	0.001	0.013	0.009	0.001	0.001	0.001	0.989	0.001
	Sites (B)	0.001	0.047	0.139	0.001	0.042	0.001	0.024	0.013	0.001	0.001	0.001
	Seasons (C)	0.198	0.547	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	A×B	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	A×C	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	B×C	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	A×B×C	0.001	0.001	0.001	0.001	0.009	0.001	0.001	0.001	0.001	0.001	0.001

SEM = Standard Error of the Mean; P = Probability; A. ame = *Acacia amentacea*; C. ere = *Castela erecta*; C. pal = *Celtis pallida*; C. cor = *Croton cortesianus*; F. ang = *Forestiera angustifolia*; K. hum = *Karwinskia humboldtiana*; L. fru = *Leucophyllum frutescens*; L. mac = *Lantana macropoda*; S. cel = *Sideroxylon celastrinum*; P. lae = *Prosopis laevigata*; Z. fag = *Zanthoxylum fagara*

species may be considered as good protein supplements for range ruminants, especially during Winter season. A CP content of 7-8% is required to maintain rumen microbial activity (Elahi and Rouzbehan, 2008). In this study, all plants in all seasons and years had CP values to fulfill maintenance requirements for adult white-tailed deer (NRC, 2007).

The NDF content in all shrub species was significant different among sites and seasons and between years. The double and triple interactions were also significant (Table 2). Low (in Summer) and high NDF (in Winter) values were obtained in *C. pallida*, *F. angustifolia* and *A. amentacea*, respectively. Minson (1990) reported that forage plants with low cell wall content are rich in soluble non structural carbohydrates. Moreover, Gomez-Castro *et al*. (2006) determined that forages with >50% NDF are associated with less nutrient consumption in ruminants and this might indicate low quality forage. In addition, Sosa-Rubio *et al*. (2004) that analyzed vegetative material of small trees, determined that NDF values from 20-35% had high levels of digestibility. Thus because all studied shrubs except *A. amentacea* had low NDF values they may be considered suitable for white-tailed deer nutrition.

The ADL content in all shrubs had similar spatio-temporal variations as NDF. *Celtis pallida, C. cortesianus* and *Z. fagara* had the lowest ADL values and *L. frutescens* and *A. amentacea* were highest (Table 3). It has been determined (Van Soest, 1994) that the amount of ADL is positively associated with the maturity of plants and with low dry matter digestibility and consequently it turns in a reduced consumption of forage by ruminants (Moya-Rodriguez *et al*., 2002).

The DMD of all plant species was significantly different among sites and seasons and between years. The double and the triple interactions were also significant (Table 4). In general, *A. amentacea* and *L. frutescens* had the lowest values (total mean) and *C. pallida* and *Z. fagara* were highest. The DMD is one of the main factors determining the nutritive value of forage and those forages with DMD values >50% are considered of good nutritional quality for ruminants

Table 2: Seasonal means of neutral detergent fiber (%) in native shrubs from Northeastern Mexico

		Shrub species										
County sites	Seasons and years	A. ame	C. ere	C. pal	C. cor	F. ang	K. hum	L. fru	L. mac	S. cel	P. lae	Z. fag
China	Summer 2004	56	38	34	48	40	50	58	46	49	47	30
	Autumn 2004	61	36	38	42	40	67	48	45	42	57	53
	Winter 2005	58	41	38	57	-	60	59	55	39	33	40
	Spring 2005	55	45	42	48	-	41	49	52	44	50	56
	Summer 2005	51	45	35	51	43	46	47	38	46	47	72
	Autumn 2005	53	42	37	46	38	46	44	47	42	50	37
	Winter 2006	47	47	37	52	51	38	51	50	37	43	34
	Spring 2006	51	40	36	47	36	39	44	46	40	44	51
Linares	Summer 2004	61	47	32	50	na	48	49	61	43	59	46
	Autumn 2004	62	47	45	48	na	66	42	61	43	-	45
	Winter 2005	63	48	58	53	45	57	47	61	43	-	43
	Spring 2005	54	51	42	38	39	44	45	53	45	53	54
	Summer 2005	55	42	38	51	41	47	48	46	49	55	68
	Autumn 2005	57	35	41	51	46	51	42	30	49	51	39
	Winter 2006	51	40	41	47	40	41	36	43	42	55	31
	Spring 2006	56	44	42	50	32	44	44	46	42	51	33
Los Ramones	Summer 2004	60	39	35	44	39	45	52	-	47	48	39
	Autumn 2004	55	42	36	44	36	46	47	41	45	53	34
	Winter 2005	63	43	38	60	39	46	53	48	40	53	40
	Spring 2005	55	44	40	49	42	45	55	54	41	54	46
	Summer 2005	49	45	58	45	44	47	55	52	42	46	65
	Autumn 2005	51	39	36	42	33	45	45	46	39	47	33
	Winter 2006	46	43	46	46	36	41	46	39	34	36	40
	Spring 2006	59	37	40	53	42	43	48	-	39	46	58
	Grand mean	55	43	40	48	40	48	48	48	42	49	45
	SEM	0.59	0.48	0.77	0.57	0.58	0.90	0.63	0.94	0.45	0.77	1.40
		p	p	p	p	p	p	p	p	p	p	p
Factors	Year (A)	0.001	0.001	0.038	0.514	0.000	0.000	0.001	0.001	0.001	0.001	0.001
	Sites (B)	0.001	0.001	0.001	0.025	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Seasons (C)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	A×B	0.050	0.001	0.001	0.001	0.003	0.001	0.001	0.001	0.001	0.001	0.001
	A×C	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.011	0.001	0.001
	B×C	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	A×B×C	0.001	0.001	0.001	0.001	0.051	0.001	0.001	0.001	0.001	0.001	0.001

SEM= Standard Error of the Mean; p = Probability; A. ame = *Acacia amentacea*; C. ere = *Castela erecta*; C. pal = *Celtis pallida*; C. cor = *Croton cortesianus*; F. ang = *Forestiera angustifolia*; K. hum = *Karwinskia humboldtiana*; L. fru = *Leucophyllum frutescens*; L. mac = *Lantana macropoda*; S. cel = *Sideroxylon celastrinum*; P. lae = *Prosopis laevigata*; Z. fag = *Zanthoxylum fagara*

Table 3: Seasonal means of Lignin (%) in native shrubs from Northeastern Mexico

		Shrub species										
County sites	Seasons and years	A. ame	C. ere	C. pal	C. cor	F. ang	K. hum	L. fru	L. mac	S. cel	P. lae	Z. fag
China	Summer 2004	22.00	14.00	6.00	7.00	11.00	16.00	26.00	10.00	19.00	16.00	6.00
	Autumn 2004	23.00	13.00	5.00	6.00	11.00	21.00	22.00	8.00	14.00	16.00	7.00
	Winter 2005	26.00	15.00	8.00	10.00	-	21.00	26.00	12.00	15.00	7.00	9.00
	Spring 2005	23.00	17.00	9.00	10.00	-	13.00	23.00	12.00	15.00	18.00	8.00
	Summer 2005	20.00	17.00	6.00	7.00	8.00	14.00	18.00	10.00	16.00	17.00	7.00
	Autumn 2005	22.00	17.00	6.00	9.00	14.00	18.00	20.00	11.00	15.00	18.00	6.00
	Winter 2006	20.00	20.00	6.00	10.00	13.00	11.00	26.00	12.00	13.00	12.00	6.00
	Spring 2006	21.00	16.00	6.00	8.00	9.00	13.00	20.00	12.00	16.00	18.00	5.00
Linares	Summer 2004	26.00	16.00	5.00	9.00	-	17.00	21.00	15.00	16.00	16.00	9.00
	Autumn 2004	30.00	16.00	10.00	7.00	-	20.00	21.00	14.00	15.00	-	8.00
	Winter 2005	33.00	16.00	15.00	9.00	13.00	19.00	18.00	13.00	15.00	-	7.00
	Spring 2005	20.00	18.00	8.00	7.00	14.00	13.00	20.00	19.00	13.00	19.00	8.00
	Summer 2005	23.00	17.00	7.00	11.00	11.00	13.00	20.00	9.00	16.00	18.00	7.00
	Autumn 2005	25.00	7.00	10.00	8.00	17.00	13.00	19.00	4.00	15.00	18.00	9.00
	Winter 2006	22.00	15.00	9.00	7.00	12.00	12.00	16.00	10.00	15.00	18.00	7.00
	Spring 2006	25.00	16.00	8.00	9.00	9.00	14.00	22.00	12.00	13.00	18.00	7.00
Los Ramones	Summer 2004	28.00	13.00	7.00	8.00	11.00	15.00	28.00	-	19.00	16.00	8.00
	Autumn 2004	20.00	14.00	5.00	6.00	10.00	16.00	22.00	9.00	14.00	14.00	6.00
	Winter 2005	34.00	15.00	6.00	10.00	10.00	15.00	22.00	11.00	16.00	16.00	7.00
	Spring 2005	23.00	15.00	7.00	10.00	11.00	14.00	20.00	13.00	14.00	19.00	7.00
	Summer 2005	23.00	17.00	10.00	9.00	13.00	20.00	30.00	13.00	21.00	19.00	8.00
	Autumn 2005	21.00	16.00	8.00	8.00	13.00	13.00	21.00	12.00	16.00	16.00	8.00
	Winter 2006	19.00	18.00	12.00	6.00	10.00	14.00	23.00	10.00	11.00	10.00	13.00
	Spring 2006	25.00	14.00	9.00	8.00	11.00	13.00	22.00	-	14.00	15.00	7.00
	Grand mean	24.00	15.00	8.00	8.00	12.00	15.00	22.00	11.00	15.00	16.00	8.00
	SEM	0.48	0.29	0.33	0.18	0.28	0.36	0.39	0.37	0.26	0.36	0.19

Table 3: Continue

		Shrub species										
County sites	Seasons and years	A. ame	C. ere	C. pal	C. cor	F. ang	K. hum	L. fru	L. mac	S. cel	P. lae	Z. fag
		p	p	p	p	p	p	p	p	p	p	p
Factors	Year (A)	0.001	0.003	0.156	0.279	0.044	0.001	0.001	0.001	0.008	0.011	0.380
	Sites (B)	0.001	0.001	0.001	0.091	0.001	0.001	0.001	0.010	0.002	0.001	0.001
	Seasons (C)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	A×B	0.055	0.001	0.001	0.002	0.001	0.001	0.001	0.001	0.060	0.001	0.001
	A×C	0.001	0.001	0.039	0.001	0.001	0.001	0.002	0.487	0.001	0.001	0.001
	B×C	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	A×B×C	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

Table 4: Seasonal means of dry matter digestibility (%) in native shrubs from Northeastern Mexico

		Shrub species										
County sites	Seasons and years	A. ame	C. ere	C. pal	C. cor	F. ang	K. hum	L. fru	L. mac	S. cel	P. lae	Z. fag
China	Summer 2004	50	63	77	68	66	61	58	64	54	59	73
	Autumn 2004	47	64	77	66	68	50	48	65	63	60	70
	Winter 2005	45	61	73	58	-	54	59	59	62	78	68
	Spring 2005	49	57	73	61	-	69	49	57	61	55	71
	Summer 2005	54	59	78	61	69	64	47	67	58	59	74
	Autumn 2005	49	59	76	61	64	60	44	55	61	56	77
	Winter 2006	56	56	76	57	59	69	51	54	65	67	72
	Spring 2006	55	62	79	64	74	69	44	63	61	63	79
Linares	Summer 2004	44	57	76	59	-	59	49	48	60	52	66
	Autumn 2004	43	57	67	65	-	53	42	51	60	-	67
	Winter 2005	43	57	59	59	63	55	47	54	60	-	69
	Spring 2005	53	53	72	70	65	68	45	54	62	56	66
	Summer 2005	49	61	75	59	68	65	48	63	60	57	74
	Autumn 2005	44	70	64	59	58	57	42	60	58	56	63
	Winter 2006	53	64	69	62	66	68	36	62	65	55	74
	Spring 2006	48	61	74	62	73	65	44	62	64	58	72
Los Ramones	Summer 2004	44	65	76	63	69	63	52		55	58	68
	Autumn 2004	52	60	77	65	71	62	47	63	62	58	73
	Winter 2005	41	59	81	65	67	64	53	59	61	55	73
	Spring 2005	49	58	74	61	64	67	56	56	61	52	72
	Summer 2005	52	58	73	62	62	58	55	55	54	55	71
	Autumn 2005	52	61	74	63	67	63	45	58	64	58	73
	Winter 2006	59	58	61	61	68	64	46	65	68	74	64
	Spring 2006	48	66	73	60	68	67	48		66	63	72
	Grand mean	49	60	73	62	66	62	48	59	61	59	71
	SEM	0.98	0.79	1.14	0.62	0.98	1.18	1.18	1.09	0.70	1.37	0.79
		p	p	p	p	p	p	p	p	p	p	p
Factors	Year (A)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	Sites (B)	0.001	0.017	0.001	0.002	0.001	0.001	0.001	0.001	0.060	0.001	0.001
	Seasons (C)	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.583	0.001	0.001	0.001
	A×B	0.001	0.001	0.001	0.073	0.001	0.001	0.001	0.001	0.067	0.001	0.001
	A×C	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	B×C	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
	A×B×C	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

SEM = Standard Error of the Mean; p = Probability. A. ame = *Acacia amentacea*; C. ere = *Castela erecta*; C. pal = *Celtis pallida*; C. cor = *Croton cortesianus*; F. ang = *Forestiera angustifolia*; K. hum = *Karwinskia humboldtiana*; L. fru = *Leucophyllum frutescens*; L. mac = *Lantana macropoda*; S. cel = *Sideroxylon celastrinum*; P. lae = *Prosopis laevigata*; Z. fag = *Zanthoxylum fagara*

(McDonald *et al*., 1995). Van Soest (1994) proposed that the DMD parameter is similar to Digestible Energy (DE) and DMD may be a good indicator of DE. Thus except *A. amentacea* and *L. frutescens*, all studied species had DMD values >50% and could be considered as good sources of energy for white-tailed deer.

CONCLUSION

Results show that in all seasons, all shrubs may be considered as good protein supplements for white-tailed deer. Moreover, due to the highest CP and DMD and the lowest NDF and ADL, *Celtis pallida* had the best nutritional value. Deer browsing these plants may obtain diet diversity which is a key factor in nutrient contribution of shrubs consumed by range ruminants In addition, these shrubs have different developing cycle thorough year, even during drought periods allowing access to animals for energy and CP all year round. Thus, both diversity and chemical composition show a great potential of native forages as food in northeast Mexico and consequently to a good productivity of deer.

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