Effects of Plant Shredding on Nutrient Content of Four South Texas Deer Browse Species

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Abstract

The nutrient content [crude protein (CP), P, Ca, K, and Mg] of the regrowth of shredded and current growth of nonshredded (control) plants was measured for 4 important deer browse species in south Texas. Plants were shredded in February, April, and July of 1980. Plants shredded in February and their controls were sampled for nutrient analyses at 2, 6, and 9 months after shredding. Plants shredded in April and July and their controls were sampled for analyses 2 months after shredding. Two months after shredding, regrowth from plants shredded in February, April, and July generally had higher CP and P than current growth from nonshredded plants. Few differences were detected in CP and P at 6 and 9 months after shredding. These results indicate that CP and P levels could be increased in initial regrowth from plants shredded at various dates during the growing season. Levels of Ca, K, and Mg did not differ between shredded and current growth, or they were slightly lower in the regrowth.

Shredding is one of several techniques that can be used to regenerate stands of browse. The treatment causes shrubs to produce new leader growth which is of enhanced nutrient quality while active growth is occurring (Reynolds and Sampson 1943). Such regenerative treatments should be carefully planned so that large contiguous areas of browse are not shredded at one time. Large treatment areas could cause impacts to the structure of the midstory which might adversely affect wildlife species dependent on this midstory structural component.

The short-term effect of shredding of browse plants is similar to that of clipping of herbaceous plants. Removal of leaves and twigs during the growing season stimulates sprouting and new twig growth (Laycock and Price 1970, Willard and McKell 1978). Powell and Box (1966) thought there was increased use by deer and cattle of brush resprouts after shredding because the resprouts had greater palatability. The present paper reports the changes in concentration of crude protein (CP), P, Ca, K, and Mg in 4 browse plant species from south Texas that were shredded at 3 different seasons.

Materials and Methods

The study was conducted on the H. Yturria Ranch located about 13 km north of Raymondville in Kenedy and Willacy counties, Texas. The ranch has 7,200 ha of native and improved rangeland located in the transition zone between the Coastal Prairies and the South Texas Plains (Gould 1975). The climate, soils, and vegetation of this area were described by Everitt and Gonzalez (1979).

The experimental site was on a tight sandy loam range site with Delfina fine sandy loam soil (Aquic Paleustalfs). The brush had been bulldozed in 1977, but was reinfesting the area. Its regrowth ranged from 1 to 2 m in height. In February 1980, 6 plots, each 30 × 150 m, were established where the vegetation was uniform. These were arranged into 3 pairs, designated A, B, and C. One plot of each pair was shredded with a 1.8-m rotary blade pulled by a tractor and the adjoining plot served as a nonshredded control. The brush was shredded to about a 10-cm stubble height in mid-February for plot pair A, mid-April for pair B, and mid-July for pair C. The site was lightly grazed intermittently by cattle during the study. Deer at a density of 1/7 ha utilized the area throughout the study (Gary Waggerman, Texas Parks and Wildlife Department: personal communication).

Four common browse species were selected for nutrient analyses: bluewood *(Condalia hookeri)*, granjeno *(Celtis pallida)*, lime pricklyash *(Zanthoxylum fagara)*, and lotebush *(Ziziphus obtusifolia)*. These species are important foods of white-tailed deer *(Odocoileus virginianus)* in south Texas (Davis and Winkler 1968, Everitt and Drawe 1974, Everitt and Gonzalez 1979, Arnold and Drawe 1979). For pair A, vegetation samples were collected in 1980 on 3 dates following shredding to determine if nutrient value declined following treatment; mid-monthly in April (2 months after shredding), August (6 months after shredding), and November (9 months after shredding). Lotebush is deciduous, thus November samples were not collected from this species. For plots shredded in mid-April (pair B) and mid-July (pair C), samples were collected 2 months after shredding in mid-June and mid-September, respectively. Vegetation samples were collected only once from these plots to determine if the nutritive content of regrowth of shredded plants varied from current growth of control plants. Plants were handclipped and leaf and stem samples from only the outer 5 cm of new growth were collected. Only unbrowsed plants were sampled for analyses. Ten samples were collected for each species from both nonshredded and shredded plots. Each sample was a composite from at least 4 plants to provide adequate tissue for analyses. Samples were oven dried at 65°C for 48 hours, ground in a Wiley mill through a 1-mm mesh screen, thoroughly mixed, and stored in sealed jars.

Duplicate plant samples were analyzed for CP, P, Ca, K, and Mg, and the results averaged. Total N was determined by the Kjeldahl method (Peech et al. 1947). Percent CP was calculated by N × 6.25. Levels of Ca, K, and Mg were determined by atomic absorption spectrometry (Robison 1966). Lanthanum oxide was added to Ca and Mg samples to reduce interference. Phosphorus was determined by the rapid digestion method (Bolin and Stramberg 1944).

Results

February Shredding

Nutritive content of the 4 browse species from shredded and nonshredded plots on 3 dates during the growing season are given in Table 1. In April, 2 months following shredding, the CP content of granjeno, lime pricklyash, and lotebush regrowth from the

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shredded plants was higher than current growth of plants from the nonshredded plants. In August, 6 months after shredding, only the regrowth from granjeno was higher in CP than that of current growth. There were no differences between treatments in the CP content in November, 9 months after shredding. The P content of regrowth of all species from the shredded plot was significantly higher in April than that of the current growth from the nonshredded plants; however, there were no differences between treatments in August or November, regardless of species.

The Ca content of lotebush samples from the shredded plants was significantly lower in April than that of samples from the nonshredded plants. In August, shredded plants of bluewood, granjeno, and lotebush were lower in Ca than the controls. The Ca content of bluewood, granjeno, and lime pricklyash regrowth from the shredded plants was lower in November than the growth from nonshredded plants.

The K content of bluewood regrowth from the shredded plot was significantly lower than that of control plants on all 3 sampling dates. In November, lime pricklyash from the shredded plot was lower in K than current growth from the nonshredded plot, but no differences were detected on the first 2 sampling dates. The K content of granjeno and lotebush from the shredded and nonshredded plots did not differ on any of the sampling dates.

Magnesium levels of all 4 species from the shredded plot were significantly lower in April than those from the nonshredded plot. In August, the Mg content of shredded plants of bluewood, granjeno, and lime pricklyash was lower than that of nonshredded plants. Bluewood from the shredded plot also had a lower Mg content in November than plants from the nonshredded plot. No differences were detected in the Mg content of the other species in November.

April Shredding

The nutritive content in June (2 months after shredding) of the 4 browse species from shredded and nonshredded plots are presented in Table 2. Treatment differences in the CP and P levels of the 4 species were the same as those of April samples from the February shredding (Table 1). There were no differences in the Ca content of bluewood and granjeno from shredded and nonshredded plots; however, lime pricklyash and lotebush from the shredded plot had lower levels of Ca than plants from the nonshredded plot. Bluewood from the shredded plot had a significantly lower K content than that on the control while other species did not differ between treatments. The Mg content of bluewood, lime pricklyash, and lotebush samples from the shredded plot were lower than those from the nonshredded plot. The Mg content of granjeno was not affected by shredding.

July Shredding

Nutritive content of the leaves and twigs of 4 browse species from shredded and nonshredded plots in September, 2 months following shredding, are presented in Table 3. Regrowth of bluewood, granjeno, and lime pricklyash from the shredded plot was significantly higher in CP than of the current growth of these species on the nonshredded plot. Phosphorus levels of all species from the shredded plot were higher than those from the nonshredded plot; whereas, Ca levels from the shredded plot were lower than those from the control. Bluewood from the shredded plot was lower in K than growth from the nonshredded plot, but there were no differences between treatments in K levels of the other species. All species from the shredded plot had significantly lower levels of Mg than those from the nonshredded plot.

Discussion and Conclusions

Data indicated that CP and P content in regrowth of browse plants shredded on various dates was higher than in current growth from nonshredded plants at 2 months after shredding. As growth matured the CP and P declined and essentially no differences occurred between shredded and nonshredded plants at 6 or 9 months after shredding. Changes in the CP and P content of leaves and stems of woody plants through the growing season have been reported on by several researchers (Price and Laycock 1970, Kozlowski 1971, Kramer and Kozlowski 1979). Their findings indicate that CP and P levels are highest in initial growth in spring or early summer and these nutrients rapidly decline as the foliage matures. Apparently this same cycle occurred in the regrowth from shredded plants. All species from both shredded and nonshredded plots on all sampling dates had levels of CP adequate for the nutrition of white-tailed deer (French et al. 1956, Murphy and Coates 1966). The minimum daily P requirement for white-tailed deer nutrition is in excess of 0.25% of the dry ration (Magruder et al. 1957). At 2

Table 1. Average crude and mineal content of four browse species sampled at three dates during the 1980 growing season from shredded and nonshredded plots on the Yturria Ranch in south Texas. Plots were shredded in February 1980.

Species	Chemical analyses	April		August		November	
		Shredded	Nonshredded	Shredded	Nonshredded	Shredded	Nonshredded
Bluewood	CP[1]	22.39	19.68	17.68	18.94	18.77	17.36
	P	.25*	.15	.15	.17	.18	.17
	Ca	1.48	1.56	.77*	1.25	.97*	1.51
	K	2.66*	3.11	2.46*	3.17	1.95*	2.43
	Mg	.55*	.75	.57*	.82	.66*	.84
Granjeno	CP	28.73*	21.51	27.98*	22.69	22.10	23.32
	P	.26*	.20	.25	.26	.21	.19
	Ca	2.64	2.79	2.47*	3.14	3.11*	3.93
	K	1.91	1.84	2.11	2.14	1.88	1.96
	Mg	.72*	.93	.71*	.99	.88	1.10
Lime pricklyash	CP	22.19*	16.09	16.52	17.42	18.00	16.52
	P	.30*	.19	.19	.21	.20	.18
	Ca	1.01	1.14	1.29	1.37	1.53*	1.94
	K	2.00	1.91	1.71	1.77	1.36*	1.63
	Mg	.30*	.45	.45*	.57	.45	.56
Lotebush	CP	27.20*	19.87	18.34	19.0	—[2]	—
	P	.29*	.19	.22	.21	—	—
	Ca	.66*	.95	.98*	1.32	—	—
	K	2.59	2.85	1.98	1.91	—	—
	Mg	.22*	.25	.40	.41	—	—

*Significantly different from nonshredded at $P<0.05$ level.
[1]CP=Crude protein.
[2]Insufficient plant material for sampling.

Table 2. Average crude protein and mineral content of four browse species sampled from shredded and nonshredded plots on the Yturria Ranch in south Texas. Plots were shredded in april and plant material was collected for analyses in June 1980.

Chemical Analyses	Bluewood		Granjeno		Lime pricklyash		Lotebush	
	Shredded	Nonshredded	Shredded	Nonshredded	Shredded	Nonshredded	Shredded	Nonshredded
CP[1]	19.51	17.28	31.00*	19.42	21.80*	15.68	26.00*	16.98
P	.22*	.16	.31*	.21	.29*	.19	.28*	.17
Ca	1.20	1.23	3.07	3.33	1.01*	1.35	.73*	1.28
K	2.66*	3.58	2.03	2.16	1.70	1.49	2.41	2.42
Mg	.62	.77	.96	1.09	.31*	.52	.35*	.49

*Significantly different from nonshredded at $P<0.05$ level.
[1]CP=Crude Protein.

Table 3. Average crude protein and mineral content of four browse species sampled from shredded and nonshredded plots on the Yturria Ranch in south Texas. Plots were shredded in July and plant material was collected for analyses in September 1980.

Chemical Analyses	Bluewood		Granjeno		Lime pricklyash		Lotebush	
	Shredded	Nonshredded	Shredded	Nonshredded	Shredded	Nonshredded	Shredded	Nonshredded
CP[1]	22.52*	17.30	36.84*	24.60	23.63*	16.14	23.95	22.14
P	.20*	.16	.48*	.26	.34*	.21	.31*	.22
Ca	.73*	1.32	2.43*	3.47	.74*	1.09	.71*	1.23
K	2.56*	3.25	2.00	1.92	2.10	2.07	2.32	2.27
Mg	.44*	.80	.61*	1.04	.29*	.49	.21*	.32

*Significantly different from nonshredded at $P<0.05$ level.
[1]CP=Crude Protein.

months after shredding most of the leaf and twig samples from shredded plants had P levels at or above this minimal level, but as growth matured on shredded and nonshredded plants, P levels were generally inadequate for deer.

Levels of Ca, K, and Mg either did not differ between regrowth from shredded plants and current growth from nonshredded plants or were significantly lower in the regrowth. Similar patterns were observed on all sampling dates. The reason for decreased concentrations of these minerals in some of the regrowth samples is unknown. Everitt and Gonzalez (1981) reported that levels of Ca, K, and Mg remained generally stable from spring through fall in south Texas browse plants. Although these minerals were often lower in the regrowth, they were always above the requirement levels reported for deer and other ruminants (Magruder et al. 1957, Maynard and Loosli 1969).

The study area had droughty conditions during the first 7 months of 1980. The drought was broken in early August by Hurricane Allen when 36 cm of rain fell within 2 days. Prior to this, total rainfall for the year was about 18 cm, 50% below normal. Although droughty conditions prevailed, brush shredded during this period had regrowth. Because rainfall peaks in south Texas occur in May or June and again in Sepember, optimum times for shredding may be in April and July. Shredding in July may have more practical significance than in April, because other deer foods such as forbs and soft mast are not as available in late summer and early fall. Thus, shredding can enhance the probability for providing deer with more succulent nutritious growth.

More deer browsing was noted on the shredded plots than on the nonshredded plots. This observation agrees with that of Powell and Box (1966). Shredding creates nutritious sprouts that are more palatable and readily available because plant height is reduced and restrictions to browsing such as sharp thorns, often prevalent on mature stems, are eliminated.

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