Technical Notes

Mineral content of guajillo regrowth following roller chopping

TIMOTHY E. FULBRIGHT, J. PAUL REYNOLDS, SAMUEL L. BEASOM, AND STEPHEN DEMARAIS

Abstract

Guajillo (*Acacia berlandieri* Benth.) is browsed by white-tailed deer (*Odocoileus virginianus* Raf.). We determined phosphorus (P), potassium, (K), calcium (Ca), and magnesium (Mg) of browse from roller-chopped (July 1986 and July 1987) and nontreated guajillo. Browse from regrowth was temporarily higher in P than browse from nontreated plants. Potassium was higher in leaves from plants roller chopped in 1987. Calcium and Mg tended to be lower in leaves from roller-chopped plants. Roller chopping temporarily increases P and K, but whether or not browse from roller-chopped guajillo meets P and K requirements for deer is unknown.

Key Words: *Acacia berlandieri,* calcium, macronutrients, magnesium, nutrition, phosphorus, potassium, shrubs, white-tailed deer

Guajillo (*Acacia berlandieri* Benth.) occurs on more than 2.4 million ha in southern Texas (Scifres 1980). The shrub is common on caliche ridges (Scifres 1980) and sometimes occurs in almost pure stands (Smith and Rechenthin 1964). The thornless legume is browsed by white-tailed deer (*Odocoileus virginianus* Raf.) and livestock (Scifres 1980). Varner and Blankenship (1985) found that guajillo averaged 17% of annual white-tailed deer diets and composed 21.1 and 19.0% of cattle diets during summer and fall, respectively, in the northern Rio Grande Plains of Texas.

Browse species in the Rio Grande Plains may be deficient in phosphorus (P) for white-tailed deer most of the year, and only marginally adequate in spring (Barnes et al. 1990). This deficiency may affect deer nutrition because during drought and hot, dry summers when forb availability is low, deer consume primarily browse (Arnold and Drawe 1979, Varner and Blankenship 1987, Barnes et al. 1990). Everitt (1983) found that shredding temporarily increased P of 4 shrub species, but reduced or had no effect on K, Ca, and Mg. Our objective was to determine the effects of roller chopping on bimonthly P, K, Ca, and Mg content of guajillo for 1 and 2 years posttreatment.

Materials and Methods

This study was conducted on the 4,800-ha Esperanza Ranch in Duval County, Texas. The climate of this region is subtropical with mild winters and hot summers. Precipitation is bimodal with peaks in May and September. Mean annual rainfall and temperature in Duval County are 59 cm and 23° C. Monthly rainfall at Freer, Texas, about 16 km from the study area, is representative of study area rainfall patterns for January 1986–July 1988 (Fig. 1).

Predominant soil of the study area was Olmos Loam (SCS, Benavides, Texas, unpublished), a loamy-skeletal, carbonatic, hyperthermic, shallow Petrocalcic Calciustoll (Sanders et al. 1974). Vegetation on the ranch is predominately dense, low-growing brush dominated by guajillo, blackbrush (*Acacia rigidula* Benth.), and honey mesquite *Prosopis glandulosa* Torr.).

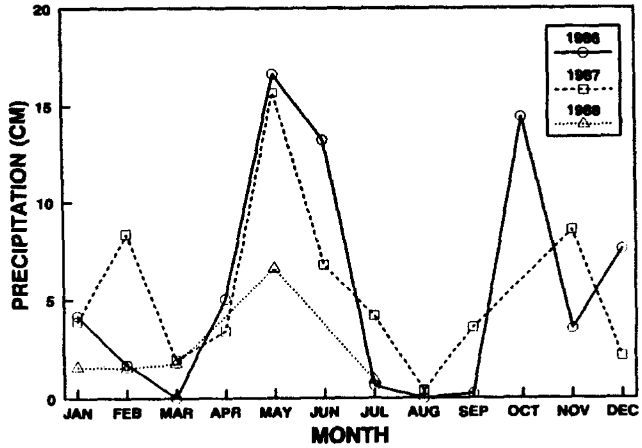

Fig. 1. Monthly rainfall at Freer, Texas during January 1986–July 1988 (NOAA 1986, 1987, 1988).

Parallel strips of brush 40 m wide and 1.6 km long within a 405-ha area were roller chopped in a pattern of alternating roller-chopped and nontreated strips in July 1986 and 1987 using a 6.4-m-wide (about 27,300-kg) roller chopper pulled by a crawler tractor. Strips roller chopped in 1987 were adjacent to those roller chopped in 1986. Roller chopping was done in July to provide sprouts in late summer and fall when deer diets primarily consist of browse (Varner and Blankenship 1987, Barnes et al. 1990).

Leaf and stem samples from the terminal 5 cm of current year's guajillo growth were collected bimonthly from 20 randomly selected unbrowsed plants/treatment/strip on 5 roller-chopped and 5 nontreated strips (each combination of a roller-chopped strip or stips and a nontreated strip was a block in statistical analyses). Samples were dried (initially at 40° C, then to a constant weight at 50° C), separated by hand into leaves and stems, ground in a Wiley mill through a 40-mesh screen, and stored in sealed plastic bags. Samples were analyzed in duplicate to determine % dry matter, P, K, Ca, and Mg. Dry matter was determined by weighing samples, oven drying at 105° C for 24 hours, and reweighing.

Phosphorus was estimated using standard spectrophotometric methods (AOAC 1984). Calcium, Mg, and K were estimated using standard atomic absorption spectrophotometric methods (AOAC 1984). Results are presented on a dry-matter basis.

Data were analyzed using analysis of variance for a complete-block design (Gill 1981:198-203). A complete-block design is appropriate when treatments are not randomized within blocks. Tukey's test was used to separate significantly ($P \leq 0.05$) different means. Data were arcsin transformed for analysis; untransformed means are presented in Figures 2–5. Sampling date × treatment interactions were significant for each mineral, so each sampling date was analyzed separately.

Results and Discussion

Leaves of regrowth following roller chopping were higher in P

Authors are associate professor, graduate research fellow, and director, Caesar Kleberg Wildlife Research Institute, Texas A&I University, Kingsville 78363; and assistant professor, Dep. of Range and Wildlife Management, Texas Tech University, Lubbock 79409. J.P. Reynold's current address is Texas Agricultural Experiment Station, La Copita Research Area, Rt. 1, Box 203, Alice, Texas 78332.

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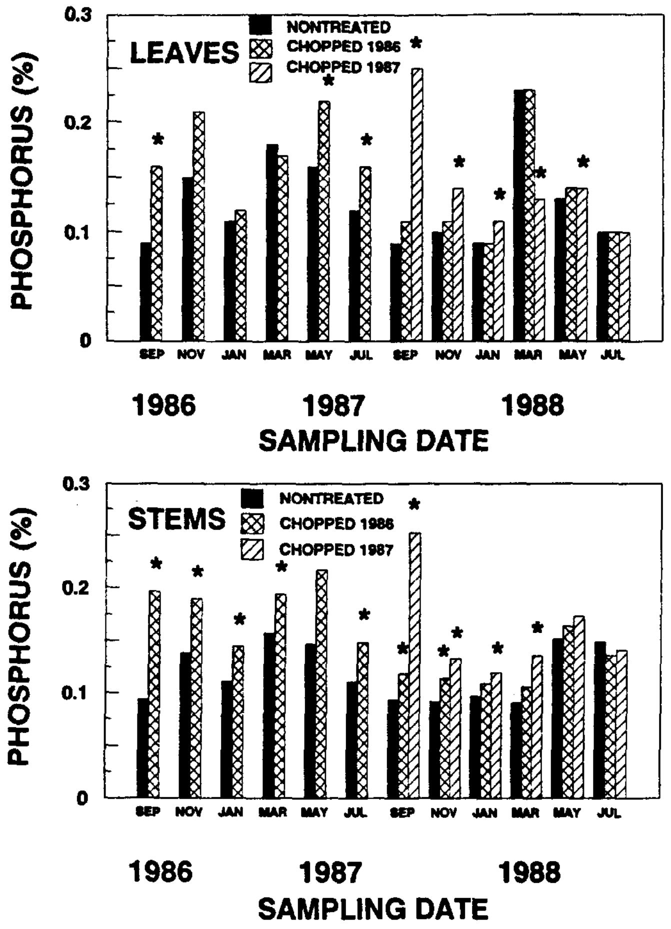

Fig. 2. Phosphorus (% of dry matter) in leaves and stems of nontreated guajillo and of regrowth from guajillo roller chopped in July 1986 or 1987, Duval County, Texas 1986–1988. An asterisk associated with a treatment mean indicates a significant ($P<0.05$) difference from nontreated plants.

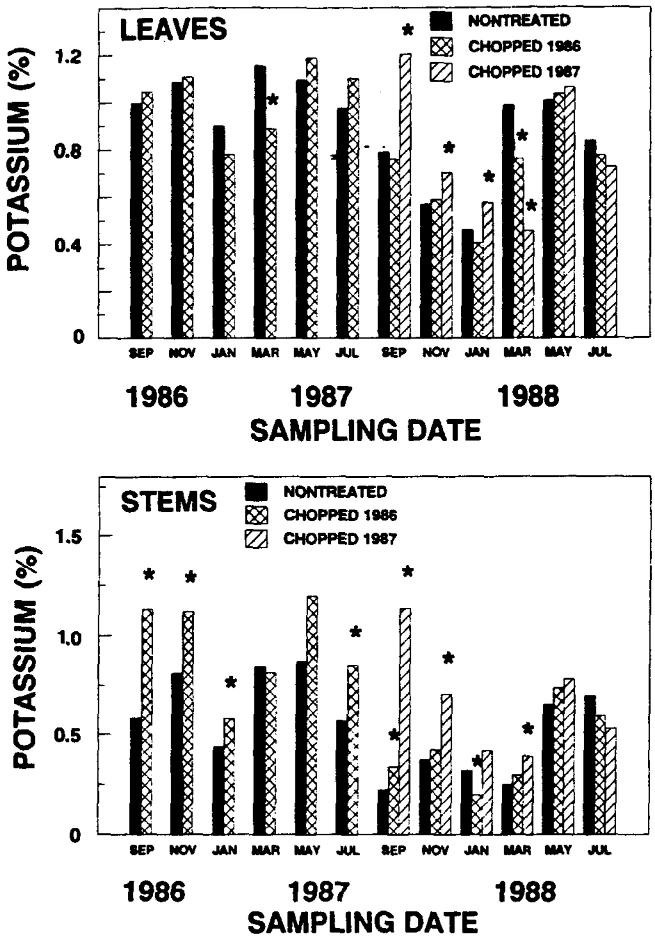

Fig. 3. Potassium (% of dry matter) in leaves and stems of nontreated guajillo and of regrowth from guajillo roller chopped in July 1986 or 1987, Duval County, Texas 1986–1988. An asterisk associated with a treatment mean indicates a significant ($P<0.05$) difference from nontreated plants.

than leaves from nontreated plants 2 months following roller chopping in 1986 and for 6 months following roller chopping in 1987 (Fig. 2). Nontreated plants and plants > 1 year posttreatment were deciduous, with new growth occurring during late February and early March. Regrowth from roller-chopped plants retained leaves during the first posttreatment winter. Consequently, in March P content of leaves from nontreated plants and plants roller chopped in 1986 exceeded that of leaves from regrowth of plants roller chopped in 1987. By May, P content of regrowth from plants roller chopped 10 months earlier exceeded that of nontreated plants. Phosphorus content of stems from regrowth of plants roller chopped in 1986 and 1987 also temporarily exceeded that of stems from nontreated plants.

Guajillo regrowth maintained higher P than nontreated plants longer than regrowth of the 4 shredded shrub species studied by Everitt (1983). Everitt (1983) reported that P content of bluewood (*Condalia obovata* Hook.), spiny hackberry (*Celtis pallida* Torr.), lime pricklyash [*Zanthoxylum fagara* L. (Sarg.)], and lotebush (*Condalia obtusifolia* Hook.) was greater in regrowth from shredded plants than in nontreated plants 2 months posttreatment. By 6 months posttreatment, P was similar in shredded and nonshredded plants.

Potassium in leaves from roller-chopped plants was similar to that of leaves from nontreated plants in 1986 (Fig. 3). In March 1987 and 1988, the higher K of leaves from nontreated plants than K of leaves from roller-chopped plants probably was related to leaf retention by roller-chopped plants during winter. In 1987, K content of leaves from regrowth of plants roller chopped in July 1987 exceeded that of leaves from nontreated plants for 6 months posttreatment. Stems of regrowth were higher in K than stems of nontreated plants for 6 months after the 1986 treatment and for 8 months after the 1987 treatment.

Larger differences in P and K between leaves and stems of nontreated plants and roller-chopped plants occurred in September 1987 than in September 1986, possibly because of greater rainfall during the summer of 1987 than in the summer of 1986 (Fig. 1). Greater moisture availability probably resulted in more rapid growth and consequently greater translocation of P and K to actively growing tissues.

Calcium and Mg of leaves from roller-chopped and nontreated plants followed similar trends (Figs. 4 and 5). Content of both minerals was either lower in leaves from roller-chopped plants, or similar in roller-chopped and nontreated plants. In March 1988, Ca and Mg were greater in leaves from roller-chopped plants because nontreated plants were producing new growth. Calcium and Mg are less mobile in plants than P or K and concentration of these minerals sometimes increases with age in plants (Charley 1977).

Calcium was temporarily lower in guajillo stems from roller-chopped plants than in stems from nontreated plants (Fig. 4). Stems from roller-chopped plants were temporarily higher in Mg (Fig. 5).

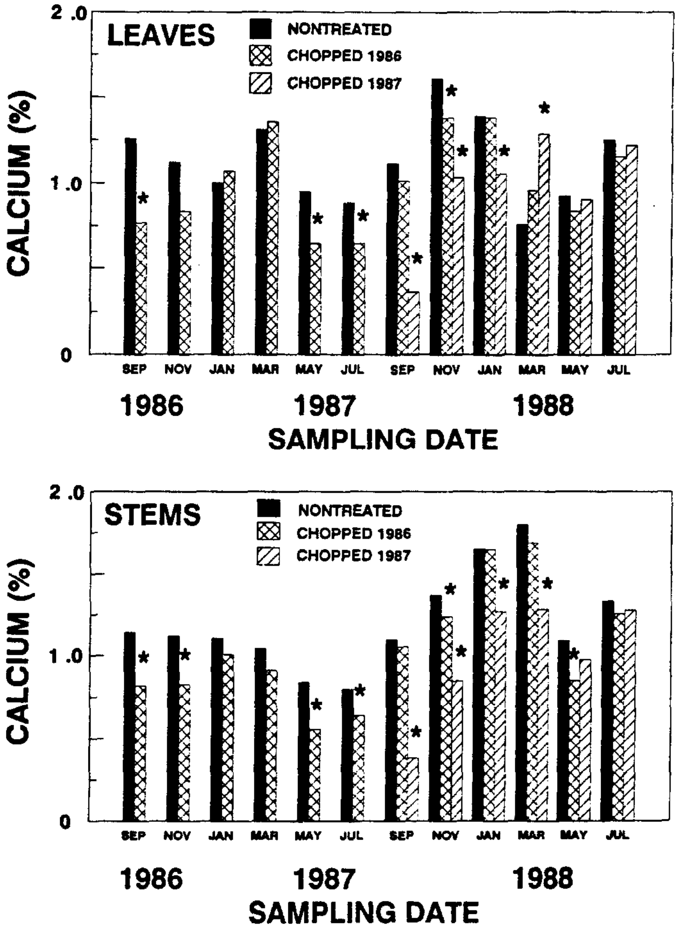

Fig. 4. Calcium (% of dry matter) in leaves and stems of nontreated guajillo and of regrowth from guajillo roller chopped in July 1986 or 1987, Duval County, Texas, 1986–1988. An asterisk associated with a treatment mean indicates a significant ($P \leq 0.05$) difference from nontreated plants.

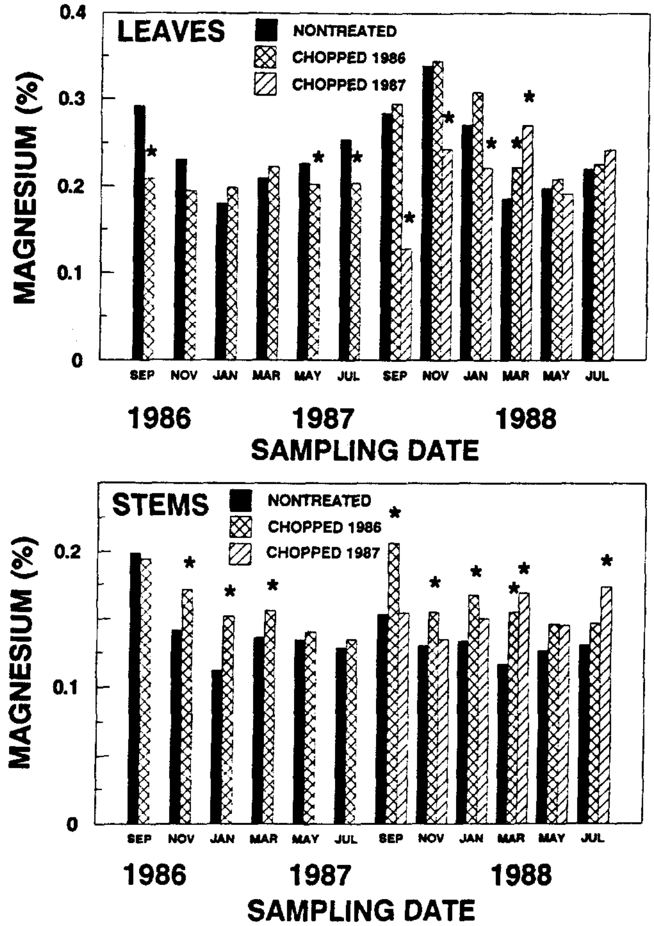

Fig. 5. Magnesium (% of dry matter) in leaves and stems of nontreated guajillo and of regrowth from guajillo roller chopped in July 1986 or 1987, Duval County, Texas, 1986–1988. An asterisk associated with a treatment mean indicates a significant ($P \leq 0.05$) difference from nontreated plants.

Our results indicate that roller chopping guajillo temporarily increased P and K in regrowth browse compared to nontreated plants. Forbs in south Texas provide adequate P for white-tailed deer when available (Barnes et al. 1990). However, forbs may be unavailable during dry, hot summers whereas guajillo readily sprouts following roller chopping in July. Roller chopping guajillo could increase availability of P for deer during periods when forbs are unavailable.

Inferences regarding whether or not roller-chopped guajillo provides adequate P, K, Ca, and Mg for deer should be approached with caution because: (1) animals may select more nutritious plant parts than researchers sampling the plants (Karn and Hofmann 1990); (2) high condensed tannin and lignin levels in guajillo (Barnes et al. 1988) may limit mineral digestibility; and (3) mineral requirements of white-tailed deer are unknown (Davis and Johnson 1984).

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