BROWSE QUALITY AFFECTED BY PINE SITE PREPARATION IN EAST TEXAS

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ABSTRACT

An east Texas pine-hardwood forest was clearcut in 1972, and selected sites were burned, chopped, KG bladed, or left untreated in the winter of 1973-1974. Crude protein, calcium, and phosphorus content in leaves and twigs of four browse species were measured in April, September, and November after site preparation. Among site treatments, burning usually resulted in highest nutrient contents, followed by chopping, control, and KG blading. The levels of crude protein and phosphorus in all browse were highest in April, but declined in deciduous plants as the seasons advanced; evergreens held fairly constant levels through September and November. Calcium was low in spring but increased toward fall. Leaves contained more of the measured nutrients than twigs.

If wildlife is to coexist with timber production in intensively managed southern pine forests, it is important to learn how silviculture affects habitat quality. The objective of this study was to determine how different methods of site preparation for planting pine affected crude protein, calcium, and phosphorus in leaves and twigs of deciduous and evergreen browse species on a clearcut site in east Texas. Leaves and twigs of four browse species were sampled during the spring, summer, and fall after site treatments were applied.

MATERIALS AND METHODS

The study area is a nearly level to gently sloping forest tract in Jasper County, Texas (Stransky 1976). The site has never been cleared for agriculture, but it was probably grazed by livestock in years past.

The pine species on the area were loblolly (*Pinus taeda* L.) and shortleaf (*Pinus echinata* Mill.). Principal species of deciduous trees were southern red oak (*Quercus falcata* Michx.), post oak (*Quercus stellata* Wang.), water oak (*Quercus nigra* L.), sweetgum (*Liquidambar styraciflua* L.), and blackgum (*Nyssa sylvatica* Marsh.).

Prominent shrubs were American beautyberry (*Callicarpa americana* L.), yaupon (*Ilex vomitoria* Ait.), blackberry (*Rubus* spp.) and southern bayberry (*Myrica cerifera* L.). The most prevalent vines were yellow jessamine (*Gelsemium sempervirens* (L.) Ait. f.), muscadine grape (*Vitis rotundifolia* Michx.) and greenbriars (*Smilax* spp.).

After all the merchantable wood had been removed in September 1972, the following site preparation treatments were applied in the winter of 1973-1974:

(1) No site preparation (control)—all stems greater than 2.5 centimeters in diameter at breast height (dbh) were cut.

(2) All stems greater than 2.5 centimeters dbh were cut and burned with the logging slash.

(3) Logging slash and all stems were cut with a chopper and burned.

(4) All stems were cut with a KG blade, and the logging slash was raked off the plots.

The chopper resembles a huge lawn roller equipped with cutting blades parallel to the long axis of the cylinder. The chopper prepares the site for planting pine seedlings by cutting non-merchantable trees and shrubs into small chunks and incorporating the debris into the surface soil.

The KG blade resembles a straight razor and is mounted at an angle on the front of a large tractor (D-6 or D-8). It shears off all stems in its path, and in the cutting process greatly churns up the soil surface. Felled trees are raked into windrows off the planting site and burned. Inevitably, some litter and topsoil are pushed off the planting site.

[1]Maintained in cooperation with Stephen F. Austin State University, School of Forestry, Nacogdoches, Texas.

Due to inclement rainy weather in the winter, burning was delayed till March 6, 1974 when fuel moisture was low. Fanned by a steady wind of about 20 kilometers per hour, the head fire consumed the tops of all herbaceous plants, nearly all the leaf litter, most shrubs and small trees, and all but the large branches of the logging slash.

Species selected for sampling were: American beautyberry, a deciduous shrub; muscadine grape, a deciduous woody vine; yaupon, an evergreen shrub; and yellow jessamine, an evergreen vine. All are important to wildlife, especially white-tailed deer (Lay 1957b, Halls and Ripley 1961).

In mid-April, early September, and late November 1974 a combined leaf-twig sample of 100 grams freshweight was collected from each species from each 0.6 hectare study plot. Twig tips about 5 cm long were clipped from the shrubs, and twigs about 10 cm long from the vines. There were three to five samples per species X site treatment X plant part combination. Yaupon and yellow jessamine which were severely reduced by some site treatments, yielded only enough material for two samples at times.

Leaves and twigs were analyzed separately for crude protein, calcium and phosphorus by standard procedures (Association of Official Agricultural Chemists 1960). Each sample was processed in triplicate by the Forestry Laboratories at Texas A & M University, College Station.

The study had a randomized block design with three replications of each treatment. The data were tested by analysis of variance for factorial design with unequal cell sizes. Significant differences between site treatments and between species were analyzed by Duncan's multiple range test. All testing was at the .05 level of significance.

RESULTS AND DISCUSSION

Crude Protein

Site treatments did not significantly affect the protein content of leaves or twigs at any season. On the average, however, the burned plots were highest and KG plots lowest (Table 1). At all seasons, leaves contained significantly more crude protein than twigs.

Differences between species were seasonally significant. In April, deciduous species were higher than evergreens, but in September the evergreen yaupon was higher than all other species. No species comparison was made in November because the deciduous leaves had fallen.

Generally, the leaves and twigs of all species were highest in crude protein in April. The content was much higher than the 6-7 percent maintenance level required by deer (French *et al.* 1955). Even though crude protein in leaves of all species declined after spring, the summer protein level in evergreen leaves remained about the same through November.

Calcium

In April, no significant difference existed in calcium levels among site treatments nor between leaves and twigs. Deciduous species had a significantly higher calcium content than evergreens (Table 2).

In September, the calcium content of browse was significantly higher on burned and chopped plots than on the KG and control treatments. Deciduous plants had significantly higher calcium than evergreens. Leaves of all species increased in calcium from April to September. The increase in deciduous leaves was greater than in evergreens.

In November, the calcium content of plants on KG plots was significantly lower than on the other treatments. Twigs of deciduous plants contained more than evergreens. Calcium levels of evergreens were about the same as they had been in September.

Phosphorus

In April, the phosphorus content of leaves was highest on burned plots for all species (Table 3). Hilmon and Hughes (1965) also found high phosphorus content in plants growing on burned plots in spring. Differences between leaves and twigs were not significant. Leaves and twigs of deciduous plants had a higher percentage of phosphorus than the evergreens.

In September, no significant differences existed among treatments or species in phosphorus content of leaves and twigs. However, phosphorus content of leaves was significantly higher than that of twigs.

Table 1. Percent crude protein in the leaves and twigs of four browse species.

Site	April		September		November	
Treatment	Leaves	Twigs	Leaves	Twigs	Leaves	Twigs
			AMERICAN BEAUTYBERRY			
Control	21.21	15.36	9.68	4.52	—[1]	4.29
Burn	27.05	13.77	10.88	3.88	—	3.99
Chop	24.45	18.28	10.22	4.65	—	5.29
KG	20.91	14.70	10.03	4.48	—	5.71
Mean	23.40	15.53	10.20	4.38	—	4.82
			MUSCADINE GRAPE			
Control	18.96	10.44	10.55	3.60	—[1]	4.27
Burn	20.22	13.63	10.44	3.46	—	5.26
Chop	18.61	12.29	9.94	3.59	—	5.77
KG	15.68	9.42	11.25	3.68	—	5.75
Mean	18.37	11.44	10.54	3.54	—	5.26
			YAUPON			
Control	16.24	10.09	10.89	3.89	11.40	3.32
Burn	16.80[2]	9.44[2]	12.84	5.12	13.05	4.05
Chop	19.11[2]	12.51[2]	11.82	3.54	12.20	3.85
KG	14.64	8.42	13.64	4.92	11.31[2]	3.72[2]
Mean	16.69	10.11	12.30	4.39	11.99	3.73
			YELLOW JESSAMINE			
Control	11.23	7.18	9.20	4.51	10.48	6.30
Burn	15.92	10.31	8.80	4.31	9.10	4.90
Chop	12.38	7.47	9.95	4.52	10.19	5.94
KG	11.25	7.02	11.47[2]	3.84	10.18	5.93[2]
Mean	12.69	7.99	9.85	4.29	9.99	5.77

[1]No leaves in November.
[2]Based upon two samples.

In November, browse on KG plots was significantly lower in phosphorus than on the other site treatments. The content of deciduous plants was significantly lower than that of evergreens.

Phosphorus content was highest for all species and treatments in the spring, but by September, it had declined considerably and remained at low levels in November. Site treatments had a significant effect on phosphorus levels in the fall, but not in spring or summer.

CONCLUSIONS

Even though not always statistically significant, the results of the present investigation confirm other studies which show that crude protein and phosphorus content of forage is increased by burning (Lay 1957a, Hilmon and Hughes 1965, Wells 1971, and Odum *et al.* 1974).

The seasonal data for crude protein, calcium, and phosphorus are in good agreement with the work of Blair and Epps (1969), Blair and Halls (1968), and Lay (1957b).

Deciduous plants provided nutritious succulent browse in spring. As leaves aged and died, however, the crude protein and phosphorus contents of deciduous species declined,

Table 2. Percent of calcium in the leaves and twigs of four browse species.

Site	April		September		November	
Treatment	Leaves	Twigs	Leaves	Twigs	Leaves	Twigs
			AMERICAN BEAUTYBERRY			
Control	.534	.598	1.287	.703	—[1]	.582
Burn	.660	.667	1.270	.653	—	.556
Chop	.688	.656	1.234	.652	—	.570
KG	.605	.660	1.160	.670	—	.585
Mean	.622	.645	1.238	.669	—	.573
			MUSCADINE GRAPE			
Control	.748	.700	1.200	.572	—[1]	.685
Burn	.770	.670	1.320	.720	—	.813
Chop	.860	.794	1.490	.850	—	.724
KG	.670	.790	1.435	.775	—	.780
Mean	.762	.738	1.361	.729	—	.750
			YAUPON			
Control	.272	.350	.392	.232	.408	.216
Burn	.320[2]	.500[2]	.477	.307	.407	.217
Chop	.290[2]	.350[2]	.414	.270	.360	.224
KG	.370	.623	.323	.187	.400	.245
Mean	.313	.456	.401	.249	.394	.225
			YELLOW JESSAMINE			
Control	.334	.236	.606	.340	.534	.370
Burn	.277	.220	.553	.363	.537	.353
Chop	.318	.260	.562	.328	.587	.402
KG	.310	.263	.510	.275	.555	.355
Mean	.310	.245	.558	.326	.553	.370

[1]No leaves in November.
[2]Based upon two samples.

while calcium increased. The importance of evergreens lies primarily in that they supply relatively high levels of crude protein, phosphorus, and calcium throughout the year. When deciduous shrubs and vines lose their foliage and when herbaceous food becomes scarce during fall and winter, evergreens provide a good source of nutritious browse for wildlife.

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Table 3. Percent of phosphorus in the leaves and twigs of four browse species.

Site	*April*		*September*		*November*	
Treatment	*Leaves*	*Twigs*	*Leaves*	*Twigs*	*Leaves*	*Twigs*
			AMERICAN BEAUTYBERRY			
Control	.24	.26	.09	.05	—[1]	.07
Burn	.32	.28	.16	.07	—	.09
Chop	.28	.29	.14	.06	—	.08
KG	.19	.18	.11	.07	—	.06
Mean	.26	.25	.12	.06	—	.07
			MUSCADINE GRAPE			
Control	.29	.22	.10	.05	—[1]	.07
Burn	.37	.35	.11	.07	—	.09
Chop	.26	.25	.11	.06	—	.10
KG	.21	.17	.10	.05	—	.09
Mean	.28	.25	.10	.06	—	.09
			YAUPON			
Control	.17	.14	.08	.06	.07	.04
Burn	.21[2]	.16[2]	.08	.05	.10	.05
Chop	.19	.17	.09	.06	.08	.05
KG	.14	.13	.09	.07	.06	.04
Mean	.18	.15	.08	.06	.08	.04
			YELLOW JESSAMINE			
Control	.11	.11	.07	.05	.08	.07
Burn	.16	.14	.08	.04	.08	.06
Chop	.11	.11	.08	.06	.08	.06
KG	.09	.10	.08	.05	.08	.07
Mean	.12	.11	.08	.05	.08	.06

[1]No leaves in November.
[2]Based upon two samples.

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