Quality of Native Plant Forage Species Important to White-tailed Deer and Goats in South Central Oklahoma

The Noble Foundation • Ardmore, Oklahoma

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INTRODUCTION

Many landowners managing a wildlife production enterprise focus on white-tailed deer, and producing quality or trophy bucks are common objectives. Age, nutrition and genetics are the building blocks for quality or trophy buck management.

In our world of increased commercialization, producers are often led to believe that supplementation in the form of feed or plantings is the most important aspect of habitat management. This is in spite of the fact that many native or natural habitats have substantial forb and woody components, and, if properly managed, can provide excellent nutrition for white-tailed deer. Since native habitat cannot be sold, its importance is minimized and certainly not advertised. Unfortunately, this has led many landowners to manage deer habitat "intensively" through food plots and feeding programs rather than "extensively" through manipulation of native plant communities with tools such as burning, grazing, cutting, etc.

Stocking goats is a common choice for producers wanting to diversify their livestock enterprise. In many areas, forb and woody plant communities can provide good forage for goats. As with other livestock enterprises, providing proper nutrition is important for production and profitability.

Studies have demonstrated that white-tailed deer and goats consume a variety of plants depending on quality, season, availability, preference, familiarity and a range of physiological conditions. Habitats supporting an abundance of forb and browse species best meet the nutrient requirements of white-tailed deer. White-tailed deer diets in south central Oklahoma are predominantly forbs and browse (Table 1).

Table 1. Percent of Overall use of Forage Classes (Gee et. al. 1994)

Forage class	Percent use
Forbs	44%
Browse (acorns)	41% (8%)
Grasses & Grasslikes	13%
Others	1%

Plant diversity is a goal of habitat management for many species of wildlife, including white-tailed deer. Feeders and food plots may have a place in some management scenarios, but they do not constitute complete habitat management nor can they easily replace the overall nutrition provided by native plants.

Goats utilize many woody plants and forbs. They are also able to utilize many species of grasses and can subsist on properly managed grass monocultures. Nevertheless, for most goat production systems, diverse high-quality woody and herbaceous plant communities are necessary to meet nutritional needs.

OBJECTIVES

This project was undertaken to provide a better understanding of the potential nutrient quality of native plants available to white-tailed deer and goat during the growing season in south central Oklahoma.

STUDY SITE

The study was conducted five miles west of Marietta, Okla., on the Noble Foundation's Coffey Ranch. The ranch is located in the Cross Timbers and Prairies ecological region with dominant woody plants consisting of oak (*Quercus* spp.), elm (*Ulmus* spp.), hackberry (*Celtis* spp.), juniper (*Juniperus* spp.) greenbrier (*Smilax* spp.) and sumac (*Rhus* spp.). Most open herbaceous plant communities are best characterized as "go-back" native rangeland, with the exception of the herbaceous plant communities on rocky limestone outcrops where soils were not plowed. Average annual precipitation is 35 inches; however, drought occurred during the three years (1998, 1999 and 2000) of the study (Figure 1). Consequently, May, July, August and September experienced lower rainfall and higher temperatures during the three-year sampling period as compared to the 30-year average.

Figure 1. Average Rainfall and Average Temperatures for the 1998-2000 Growing Seasons Compared with the 30-Year Average, Love County, Oklahoma

Source of 1998-2000 data: Oklahoma Mesonet station in Burneyville, Oklahoma, located approximately 3 miles southwest of the study site.

METHODS

Thirteen woody and 12 forb species (Table 2) known to be deer foods and common in the Cross Timbers were sampled. The woody species were sampled during 1998, 1999 and 2000, and the forb species were sampled during 1999 and 2000. Plants analyzed in this report are not all-inclusive of what white-tailed deer or goats may use in south central Oklahoma or other areas.

Table 2.

WOODY	FORB
Smooth sumac – *Rhus glabra*	**Western ragweed** – *Ambrosia psilostachya*
Poison ivy – *Toxicodendron radicans*	**Giant ragweed** – *Ambrosia trifida*
Coralberry – *Symphoricarpos orbiculatas*	**Mare's tail** – *Conyza canadensis*
Roughleaf dogwood – *Cornus drummondii*	**Three-seeded mercury** – *Acalypha virginica*
Black oak – *Quercus velutina*	**Tropic croton** – *Croton glandulosus*
Post oak – *Quercus stellata*	**Illinois bundleflower** - *Desmanthus illinoensis*
Greenbrier - *Smilax bona-nox*	**Partridge pea** – *Chamaecrista fasciculata*
Osage orange - *Maclura pomifera*	**Tick clover** – *Desmodium canescens, D. sessilifolium & D. marilandicum*
Chickasaw plum – *Prunus angustifolia*	**Lespedeza** – *Lespedeza repens, L. virginica & L. stipulacea*
Chittamwood – *Sideroxylon lanuginosum*	**Trailing wild bean** – *Strophostyles helvola*
Winged elm – *Ulmus alata*	**Carolina snailseed** – *Cocculus carolinus*
Hackberry – *Celtis laevigata*	**Yellow wood sorrel** – *Oxalis dillenii*
Texas prickly ash – *Zanthoxylum hirsutum*	

Hand-grab samples of woody species were taken every two weeks while forbs were sampled every month. Collection began at the initiation of plant growth (early April) and ended in late October or early November when leaves were dropped due to decreasing photoperiod or frost. Samples were randomly collected on Loamy Prairie and Blackclay Prairie range sites with 1 to 8 percent slopes. In an attempt to mimic browsing by deer and goats, only the most succulent parts of the plant were sampled.

Samples were oven dried and prepared for analysis. Analyses were performed by Ward Laboratories in Kearney, Nebraska, and included crude protein (CP), total digestible nutrients (TDN), potassium (K), phosphorus (P), calcium (Ca) and magnesium (Mg).

Of the woody or woody plant complexes sampled, Gee, et. al., (1994) indicated deer use of at least 1% frequency in diet in one or more seasons of all but chittamwood, hack-

berry and Texas prickly ash (not present on their study site) (Table 3). Chittamwood and hackberry were listed as desirable deer food plants by Bidwell, et. al. (1999) while Texas prickly ash was included based upon personal observation of deer use. Note that the sumac-poison ivy complex, oaks and Osage orange were listed as important deer foods in sout central Oklahoma during all seasons by Gee, et. al. (1994).

Table 3.

	Spring	Summer	Fall	Winter
Sumac-poison ivy complex	X	X	X	X
Coralberry		X	X	X
Dogwoods	X	X		
Oaks	X	X	X	X
Greenbrier			X	X
Osage orange	X	X	X	X
Plums		X		
Chittamwood				
Winged elm	X			
Hackberry				
Texas prickly ash				

Of the forb or forb complexes sampled, Gee, et. al. (1994) indicated deer use of at least 1% frequency in diet in one or more seasons of all but Illinois bundleflower (Table 4) and that forbs comprised the major component of deer diets in the spring and summer. Three-seeded mercuries were listed as important during the summer, fall and winter and were preferred during the summer and fall. Interestingly, Illinois bundleflower did not appear in deer diets during the study by Gee, et. al. (1994), however, Bidwell, et. al. (1999) listed it as a desirable food plant for deer. It is important to keep in mind that availability and preference are major factors that influence animal diets.

Table 4.

	Spring	Summer	Fall	Winter
Western ragweed	X	X		
Giant ragweed	X	X		
Mare's tail		X		
Three-seeded mercury	X	X	X	
Tropic croton		X		
Illinois bundleflower				
Partridge pea		X		
Tick clovers		X		
Lespedezas		X		
Trailing wild bean	X	X		
Carolina snailseed	X	X		
Yellow wood sorrel		X		

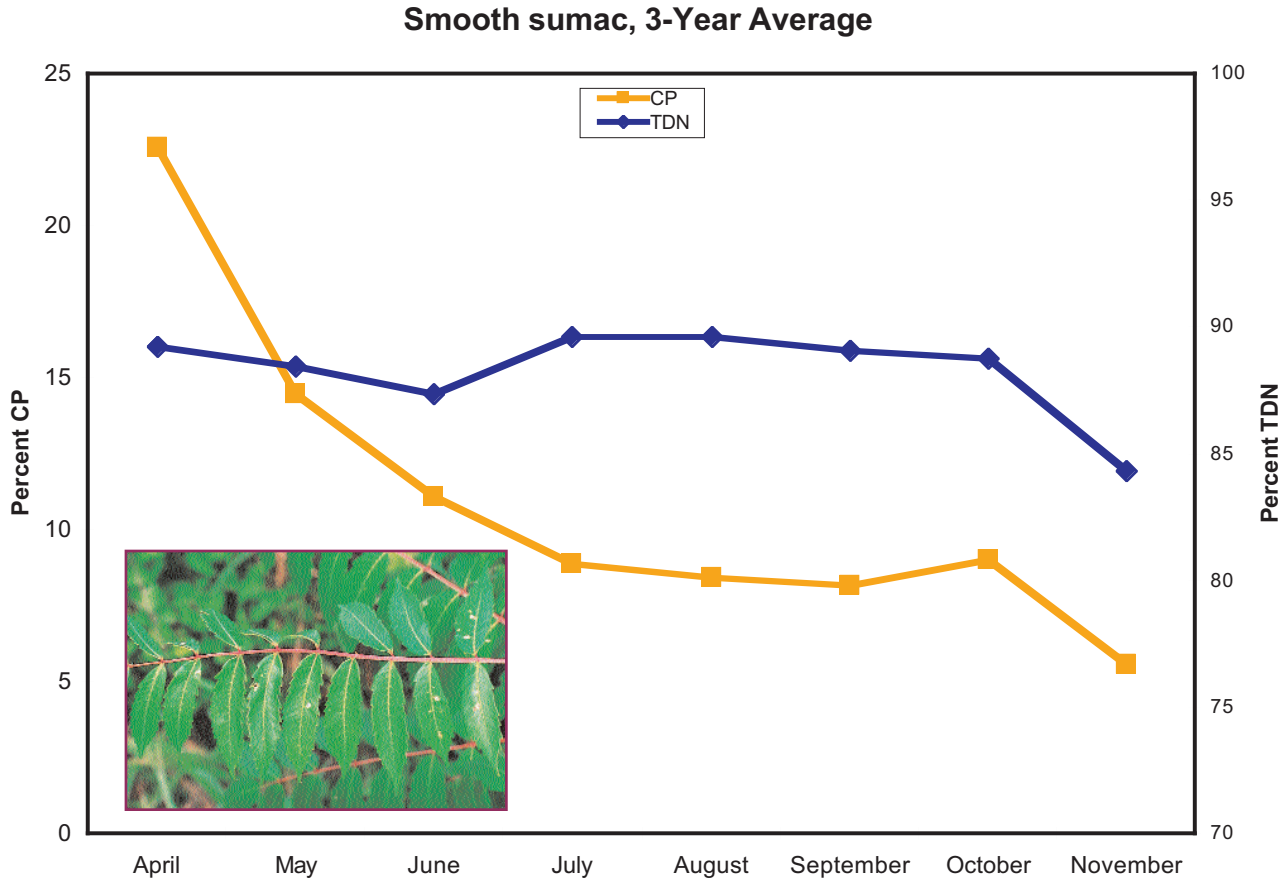
RESULTS AND DISCUSSION

Some forbs were not available in sufficient amounts for sampling during some time periods due to drought conditions, frost or decreasing photoperiods (Appendix Table 2). The following figures depict the CP and TDN monthly three-year average for woody plants and the monthly two-year average for forbs, accompanied by a photograph of a leaf for each plant.

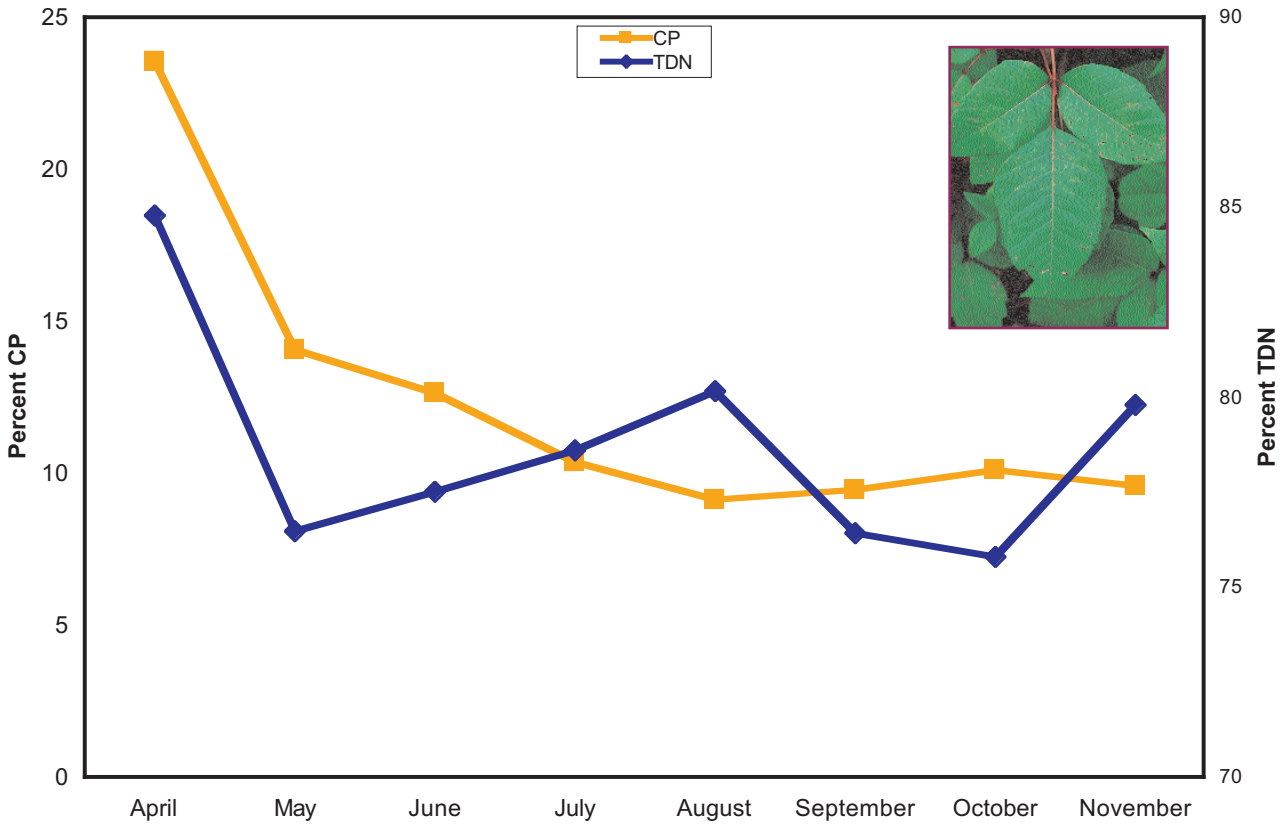
Average CP and TDN for woody and forb plants are depicted for April and May, June, July and August, and September, October and November during 1998–2000 (Figures 2, 3 and 4, respectively). Average plant CP and TDN, and CP and TDN requirements for deer antler growth, lactation, pre-rut and rut and goat lactation and yearling growth are illustrated for comparison (Klein, 1999). CP values for hackberry, roughleaf dogwood, greenbrier and coralberry in this study were similar to those found by Bogle et. al. (1989).

Appendix Tables 1 and 2 represent monthly CP, TDN, P, Ca, K and Mg for each plant sampled. Drought conditions during the growing season eliminated some forbs or limited our ability to sample them during some months.

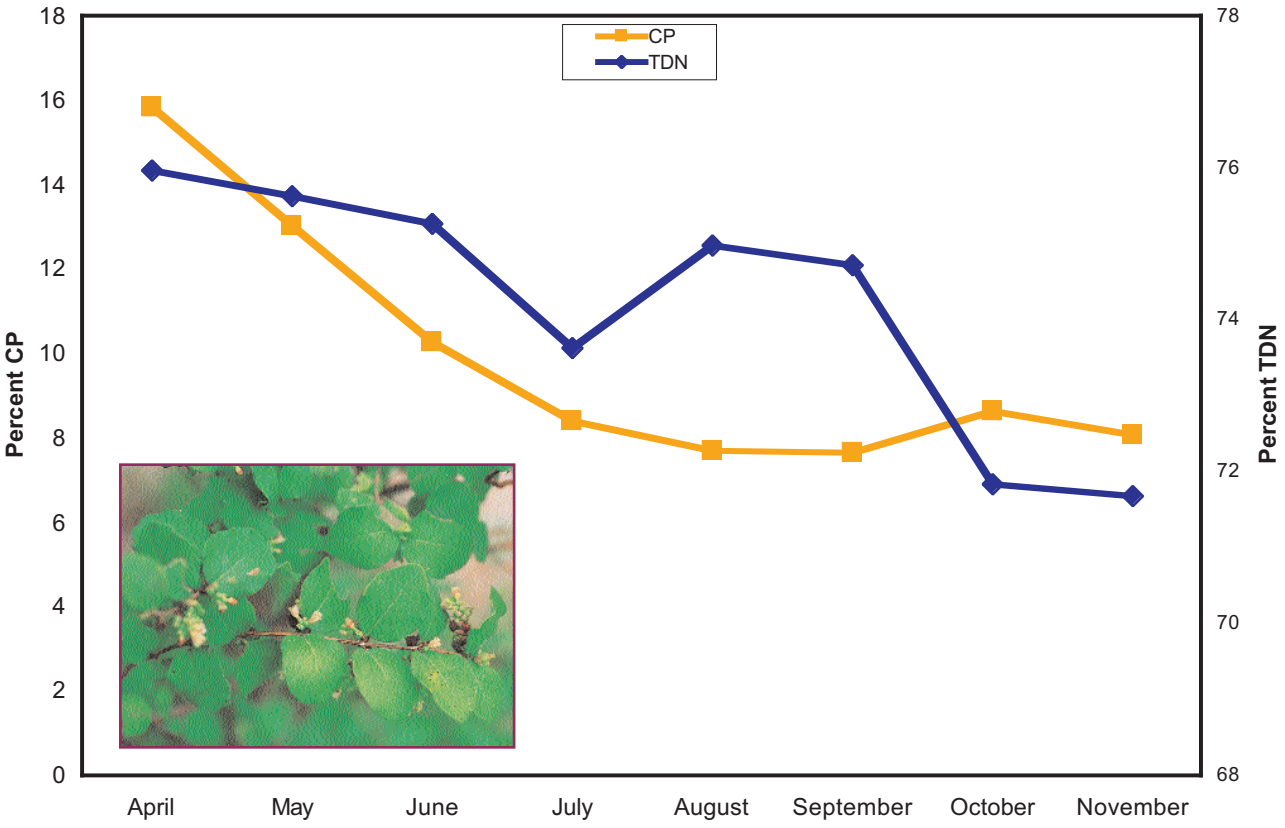
CP and TDN Monthly Three-year Average for Woody Plants



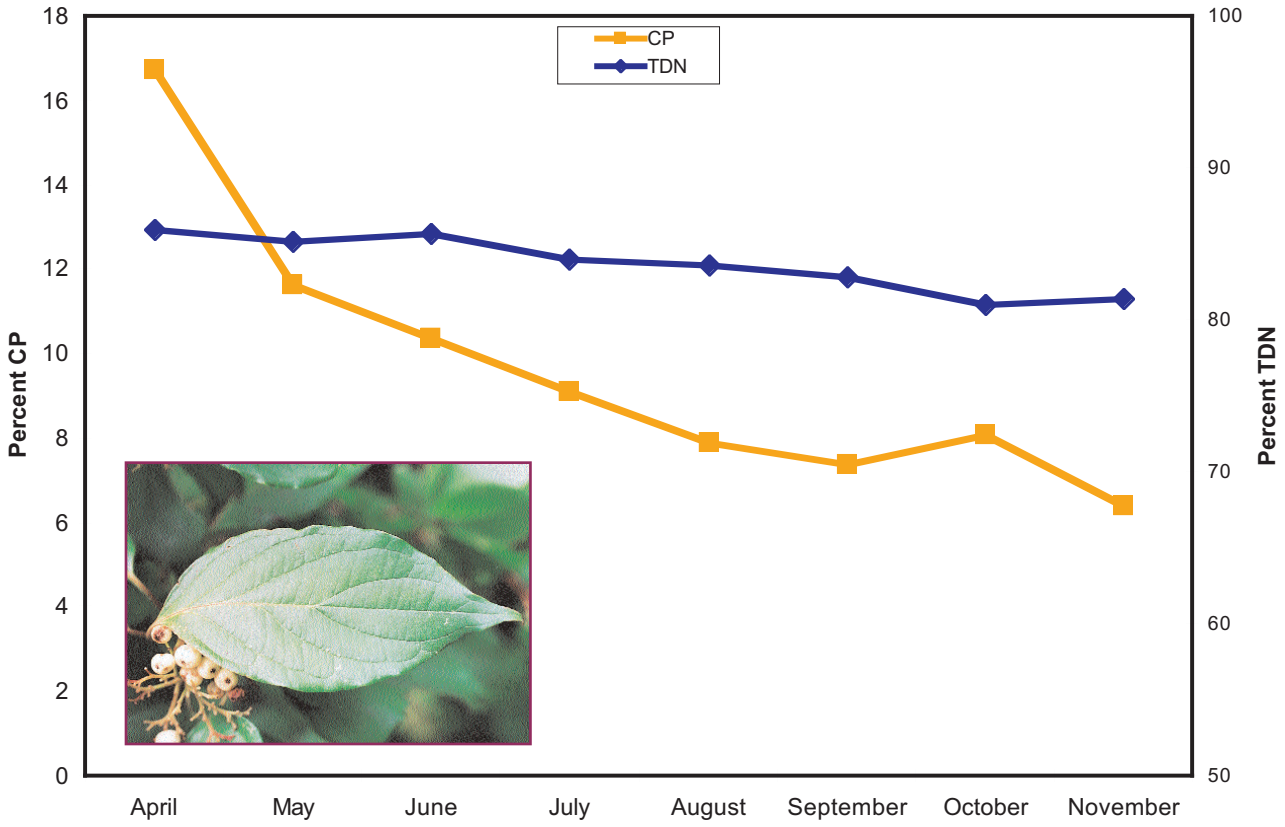
Poison ivy, 3-Year Average



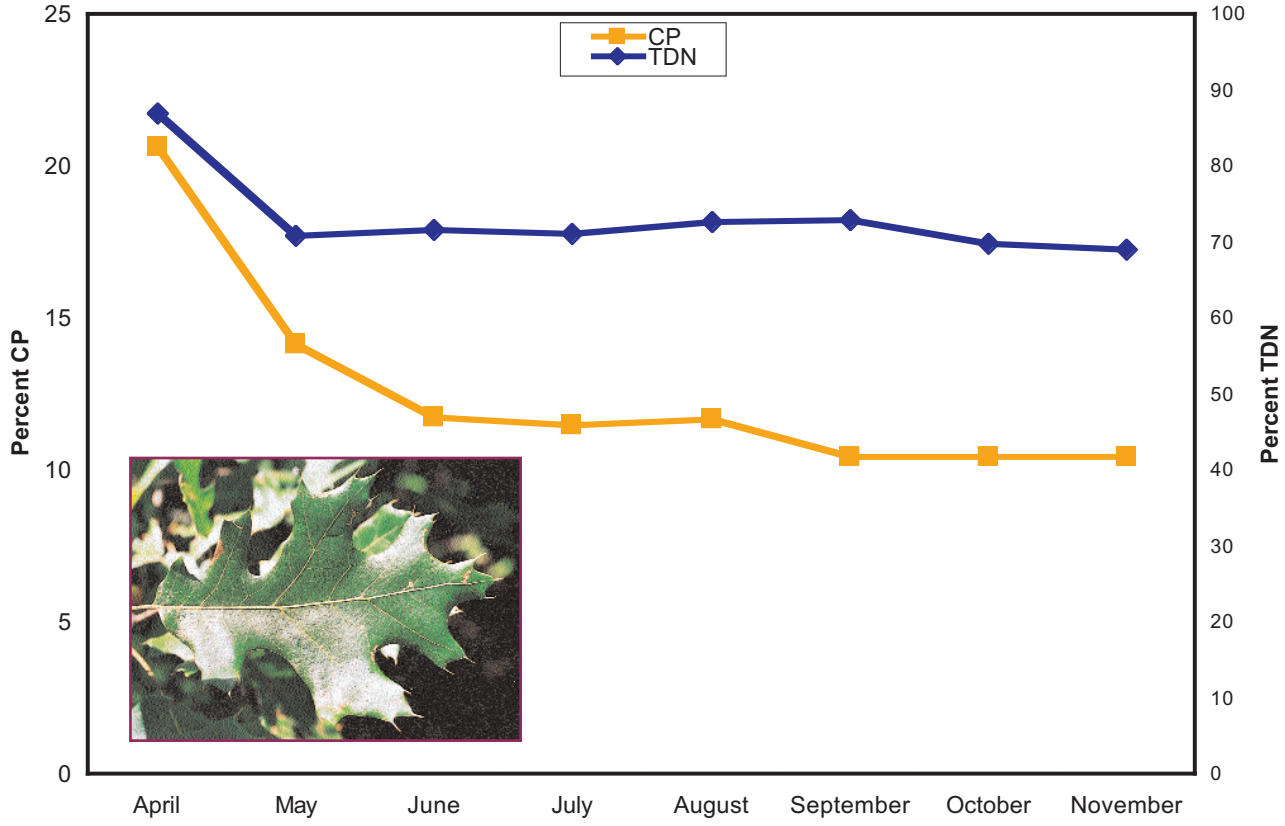
Coralberry, 3-Year Average



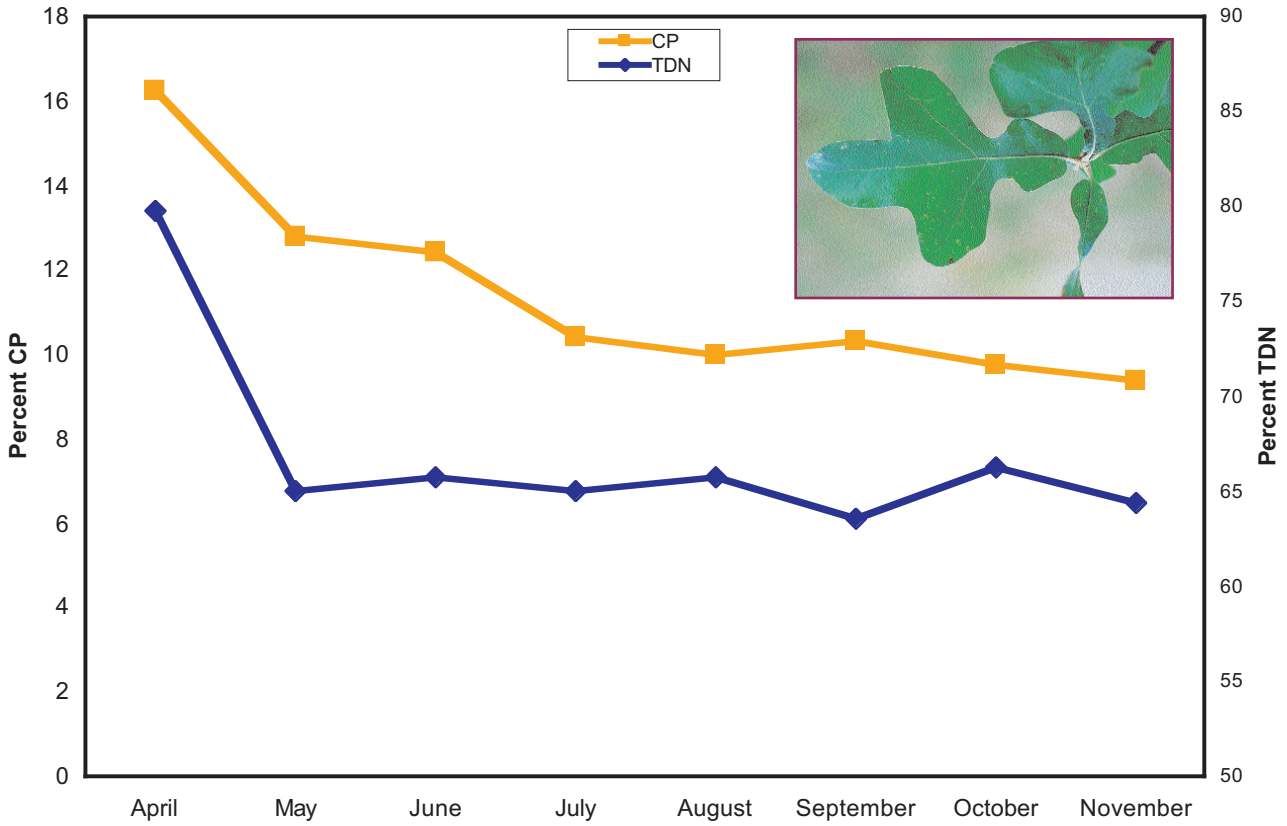
Roughleaf dogwood, 3-Year Average



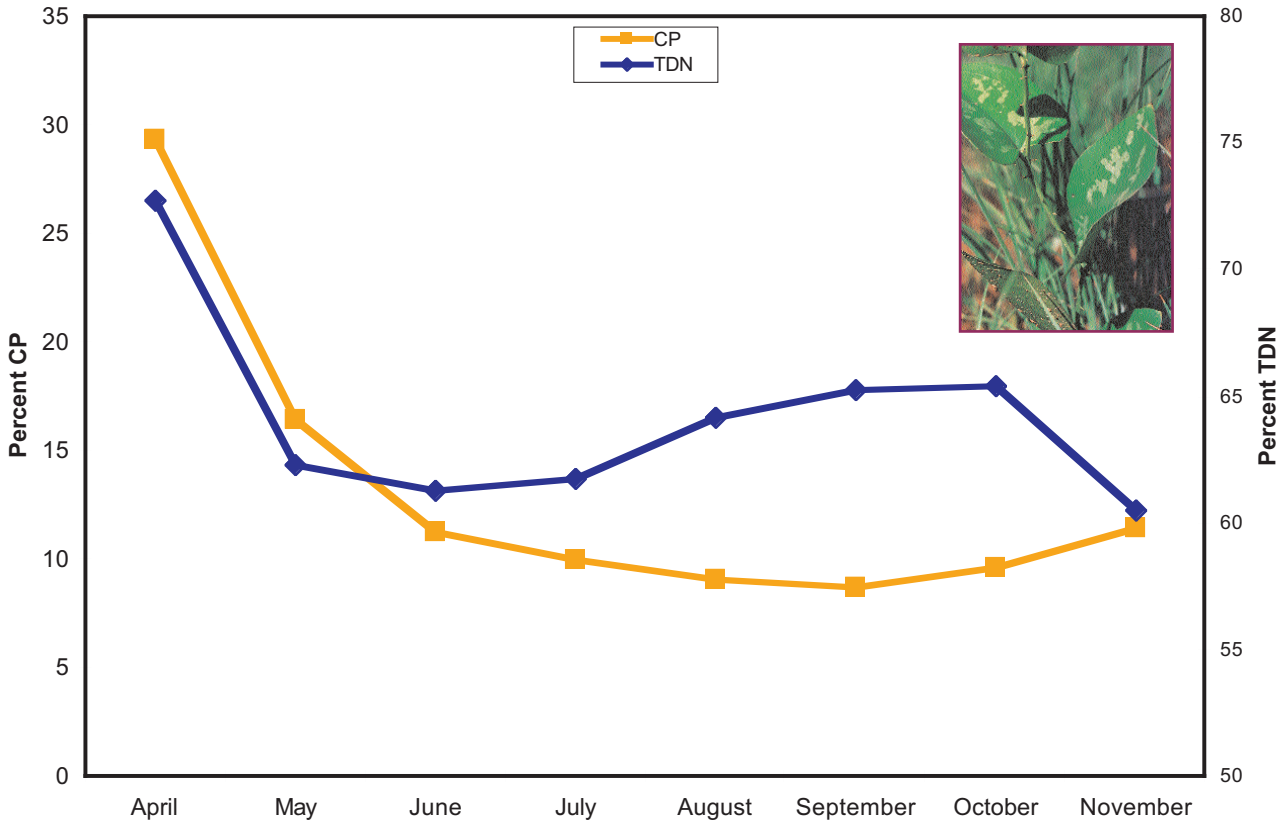
Black oak, 3-Year Average



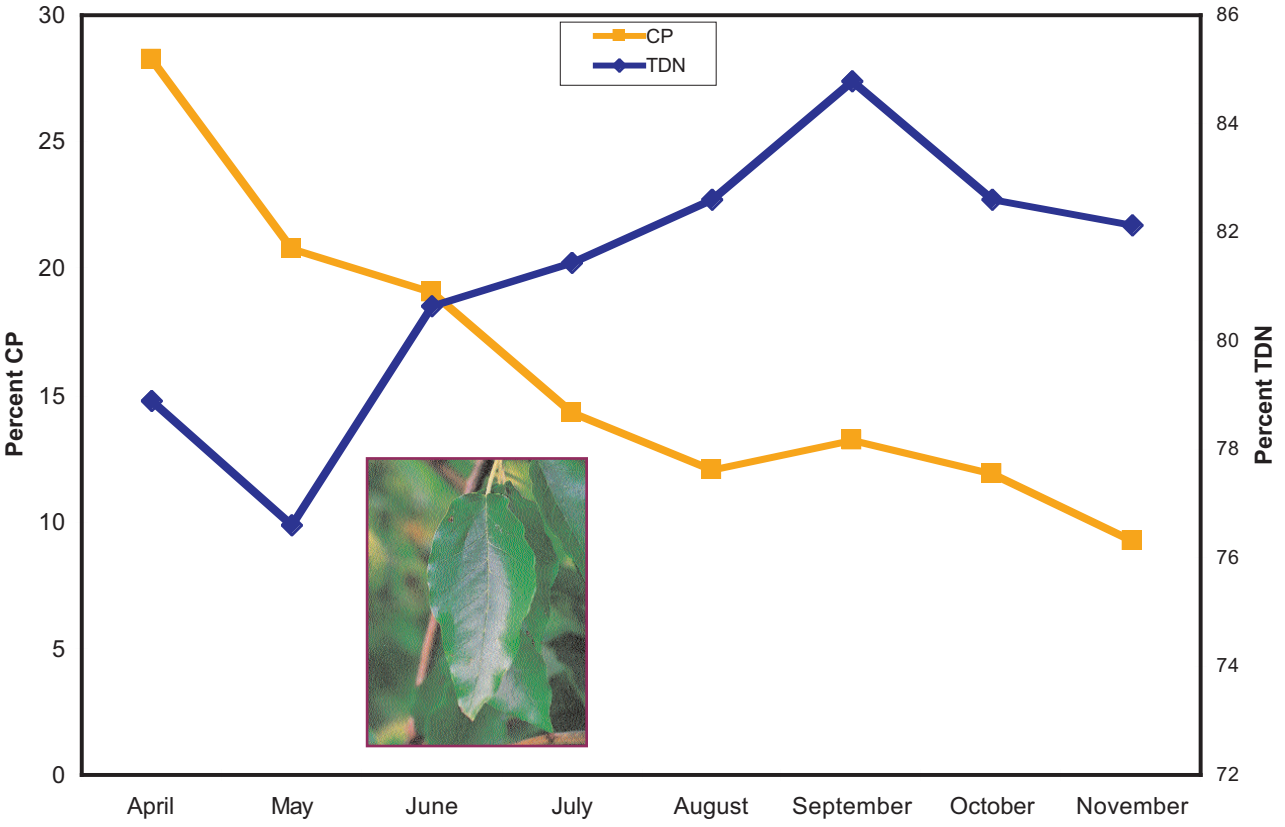
Post oak, 3-Year Average



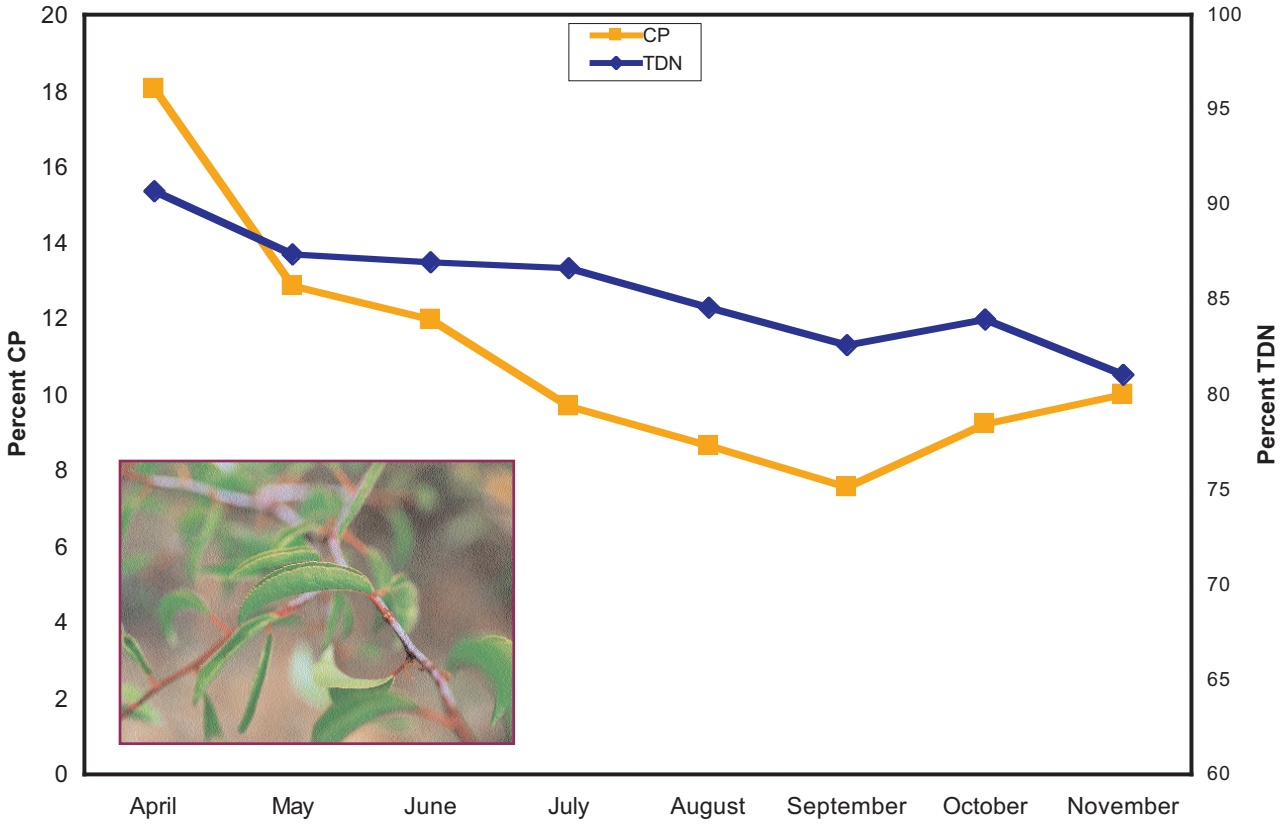
Greenbrier, 3-Year Average



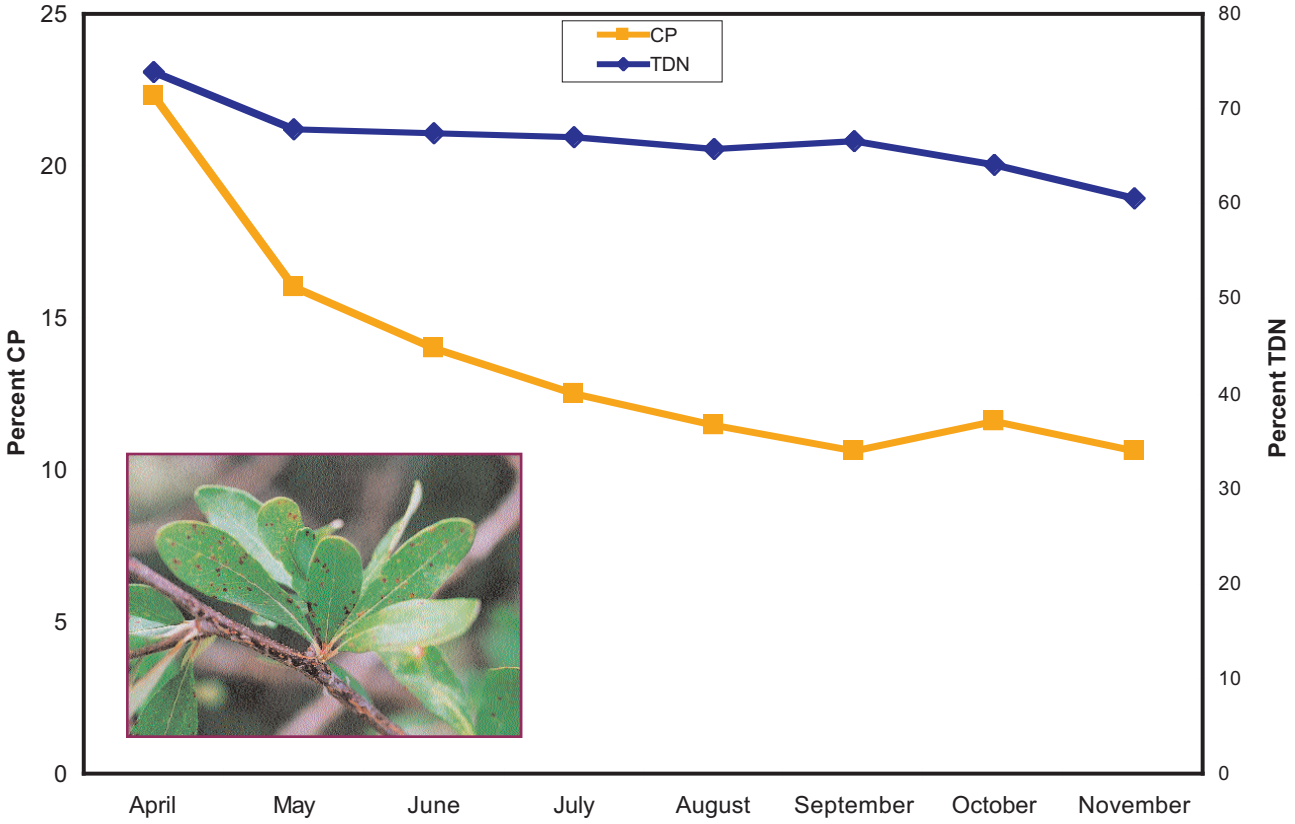
Osage orange, 3-Year Average



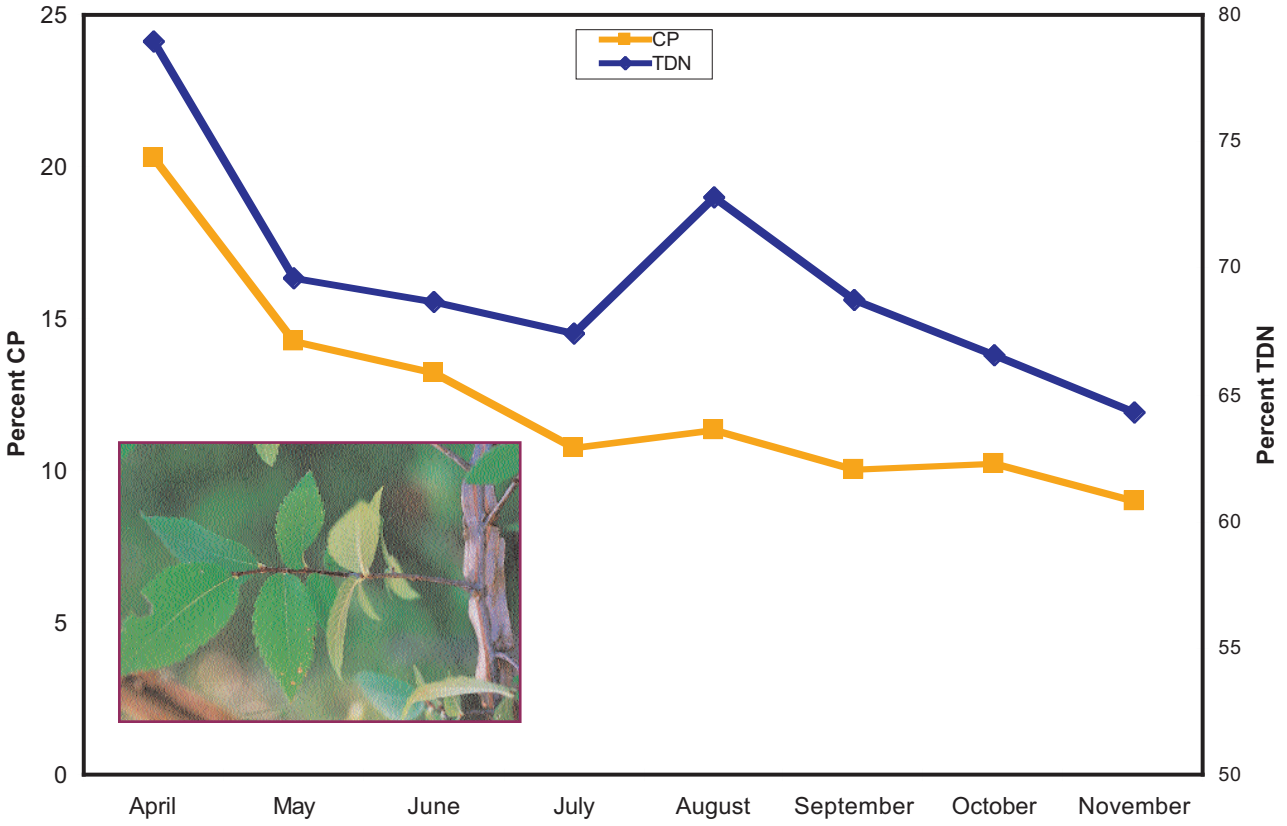
Chickasaw plum, 3-Year Average



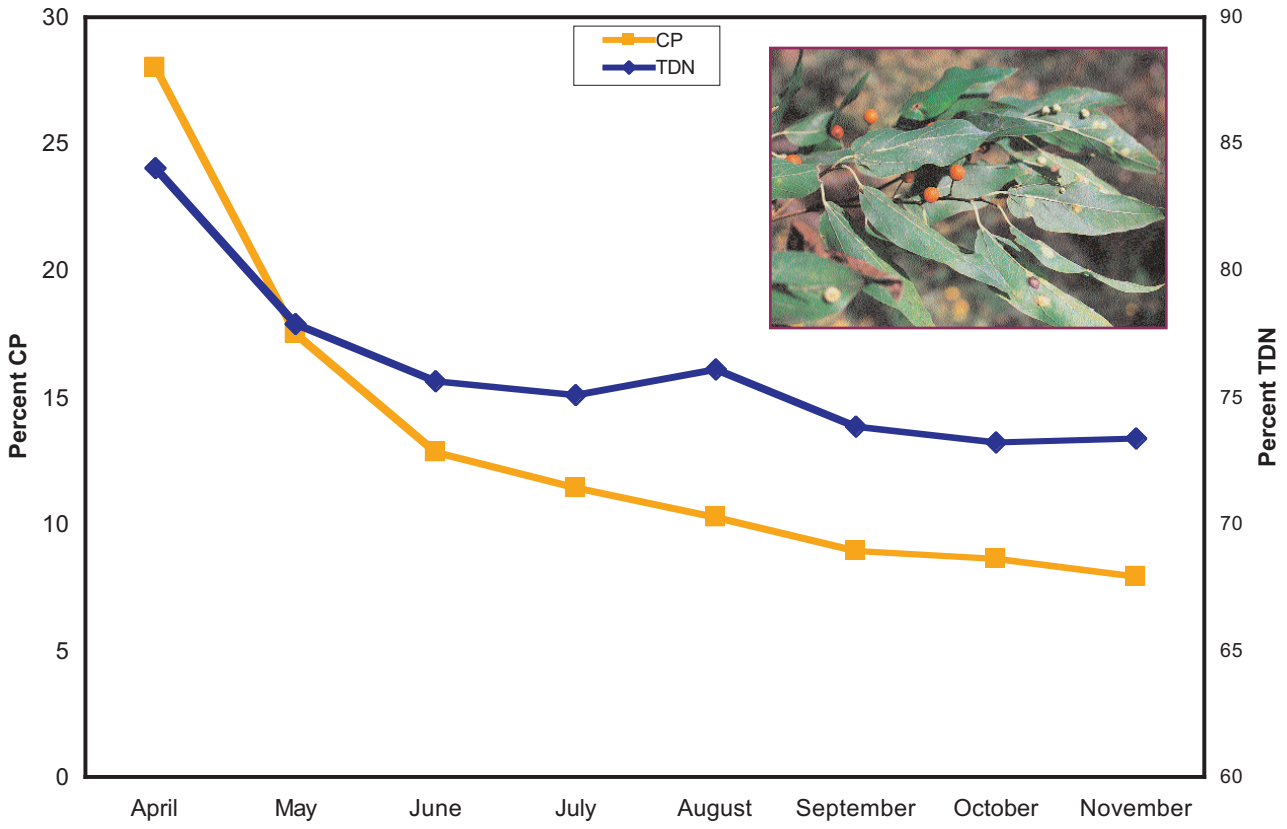
Chittamwood, 3-Year Average



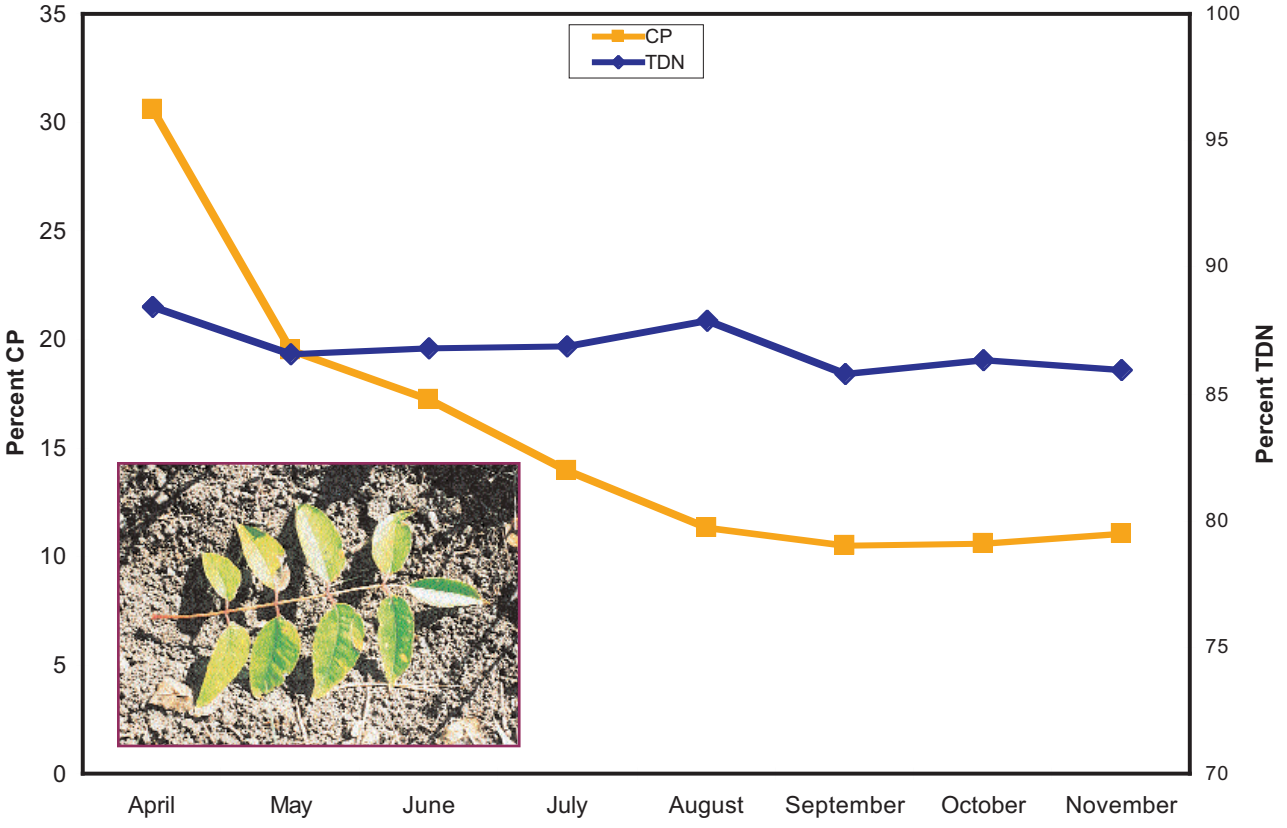
Winged elm, 3-Year Average



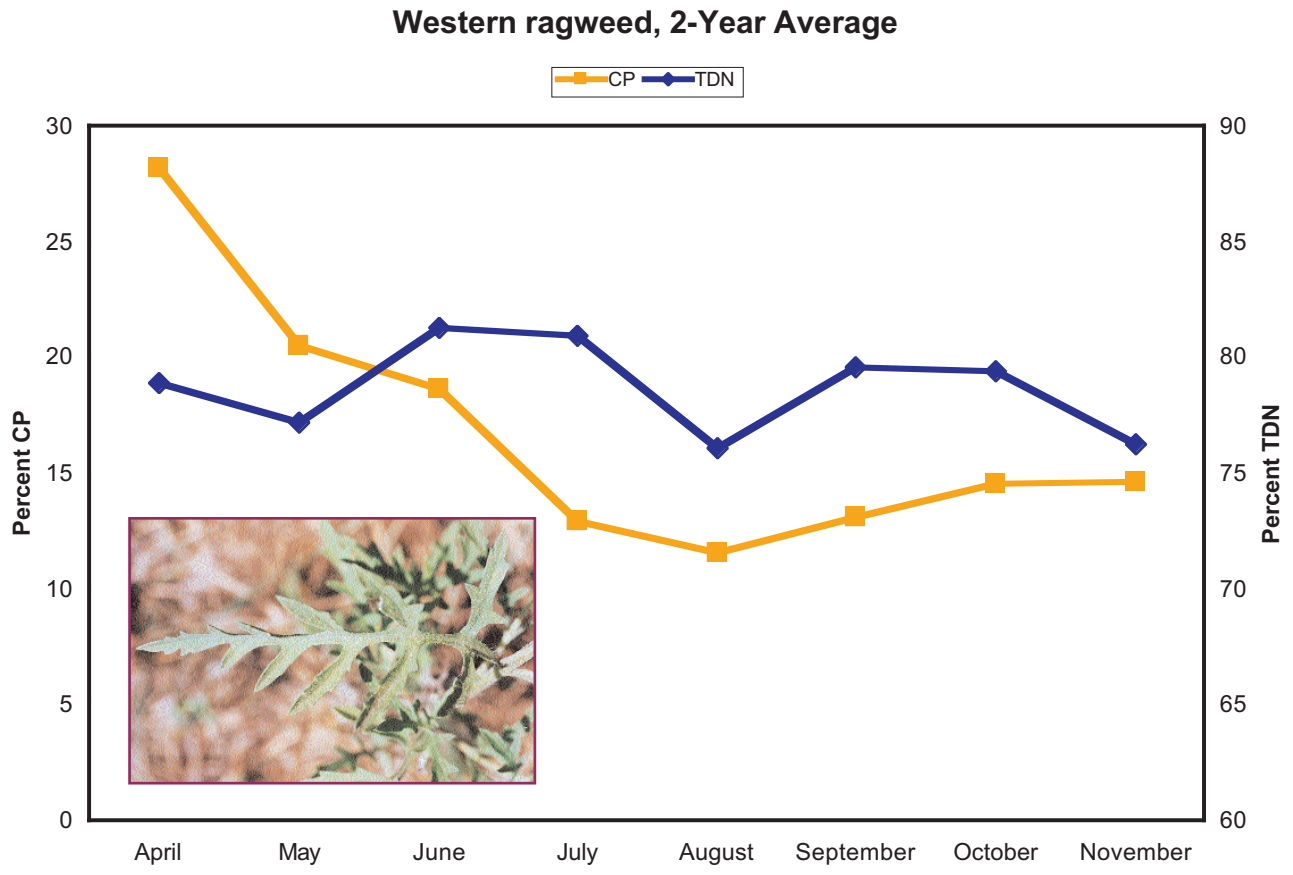
Hackberry, 3-Year Average

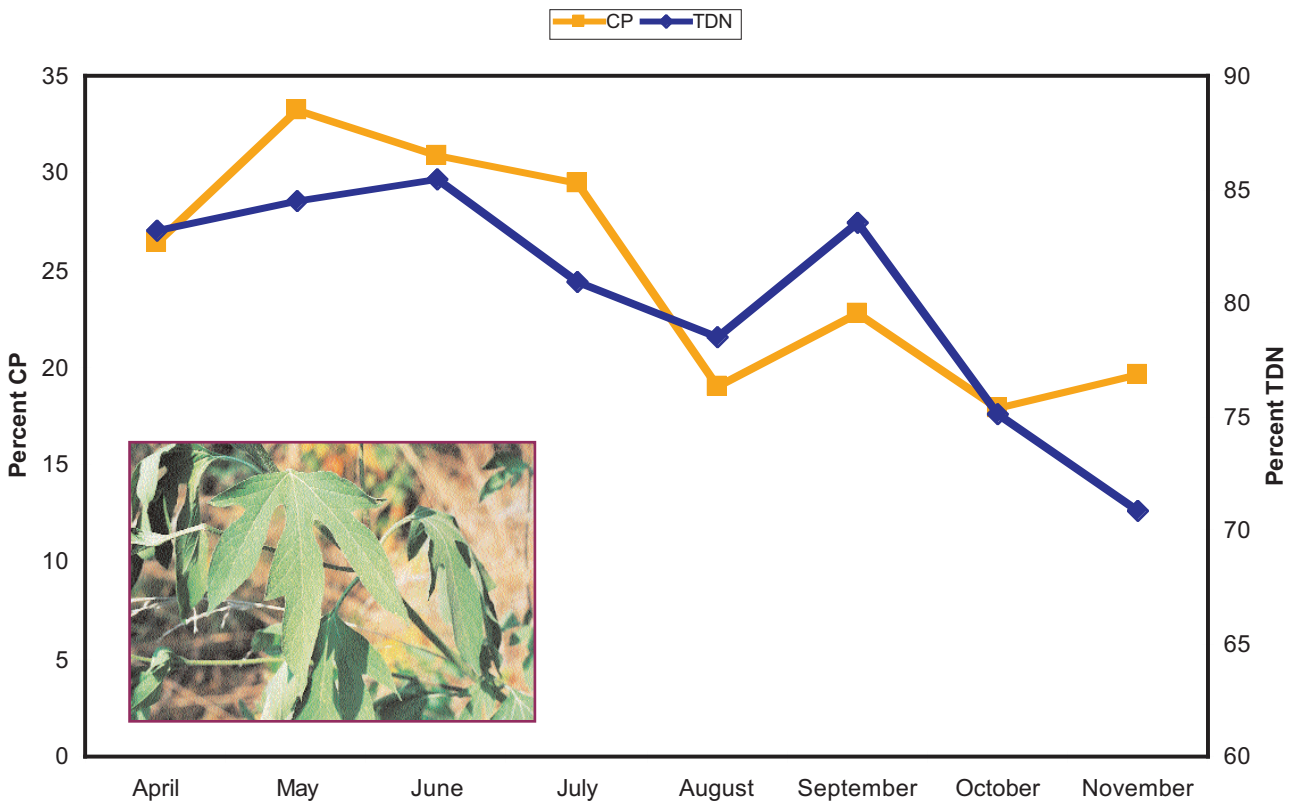


Texas prickly ash, 3-Year Average

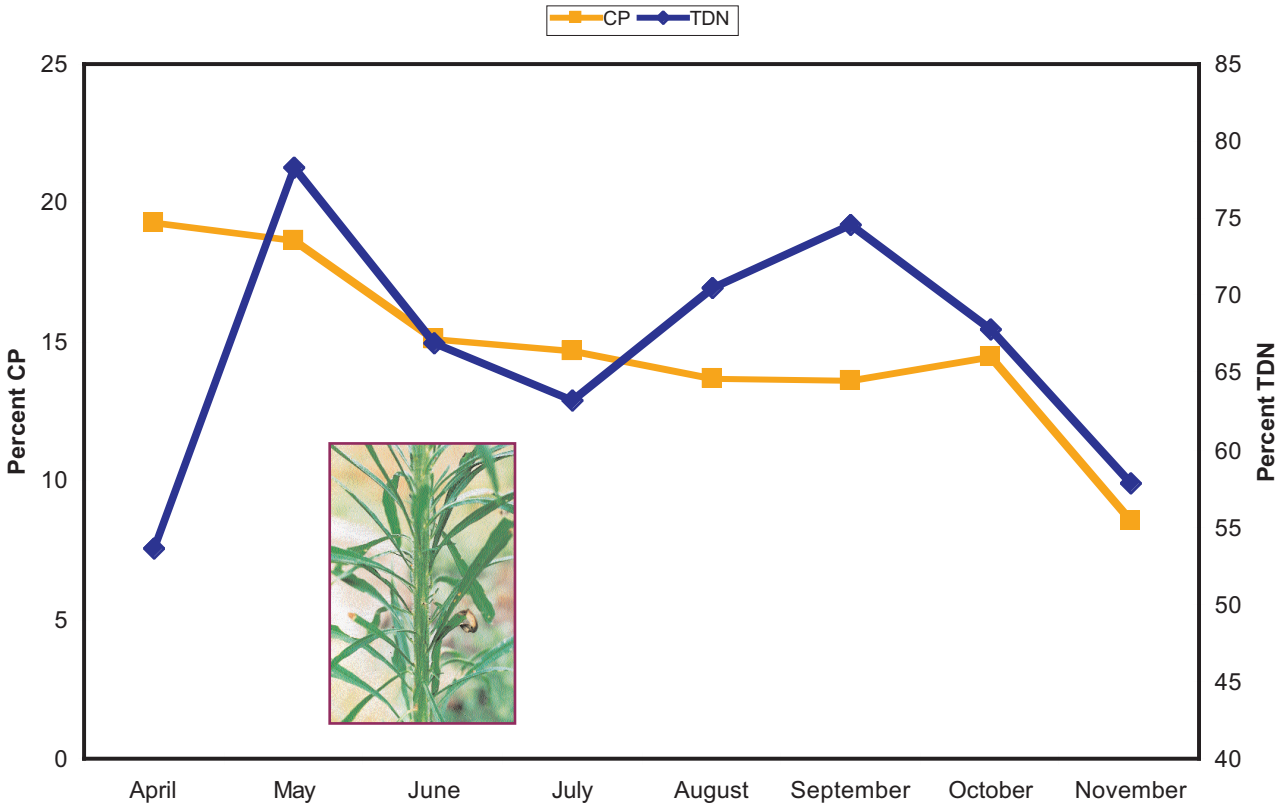


CP and TDN Monthly Two-year Average for Forbs

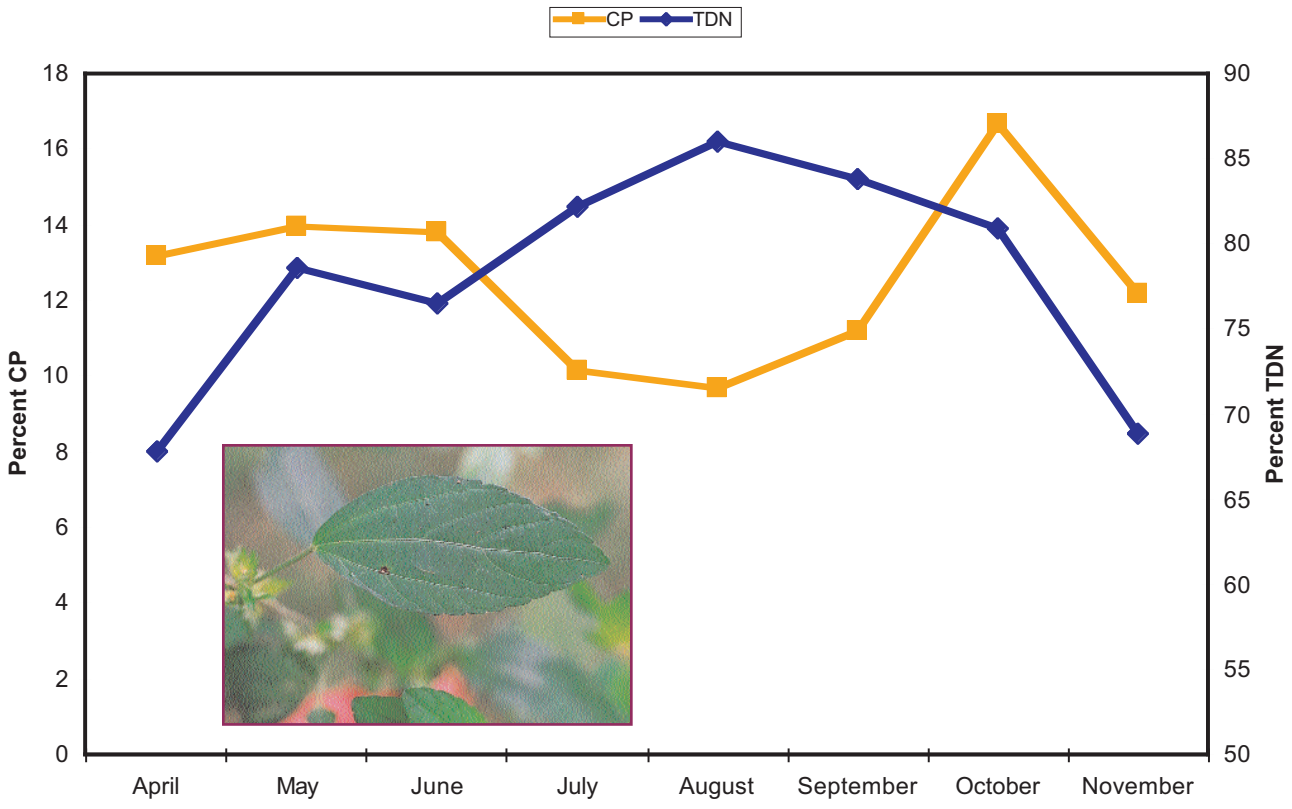




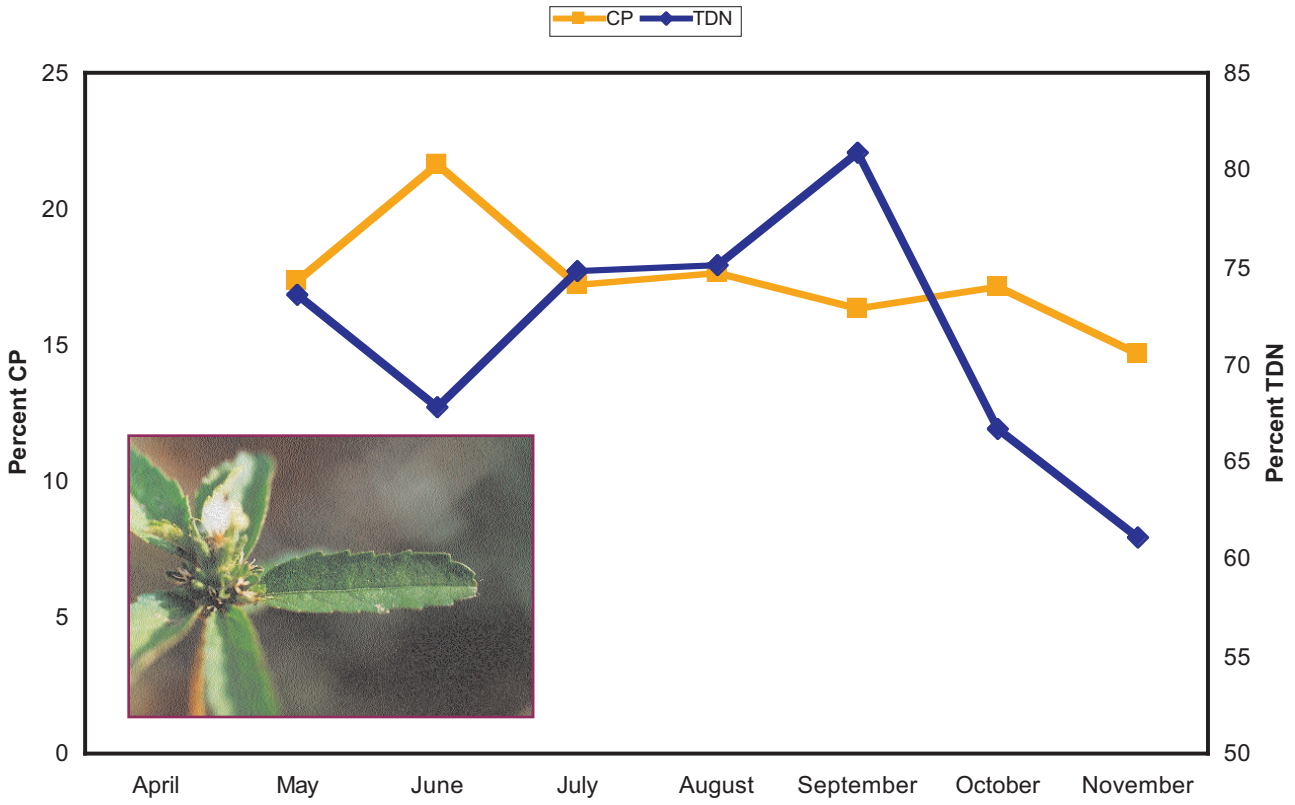
Mare's tail, 2-Year Average



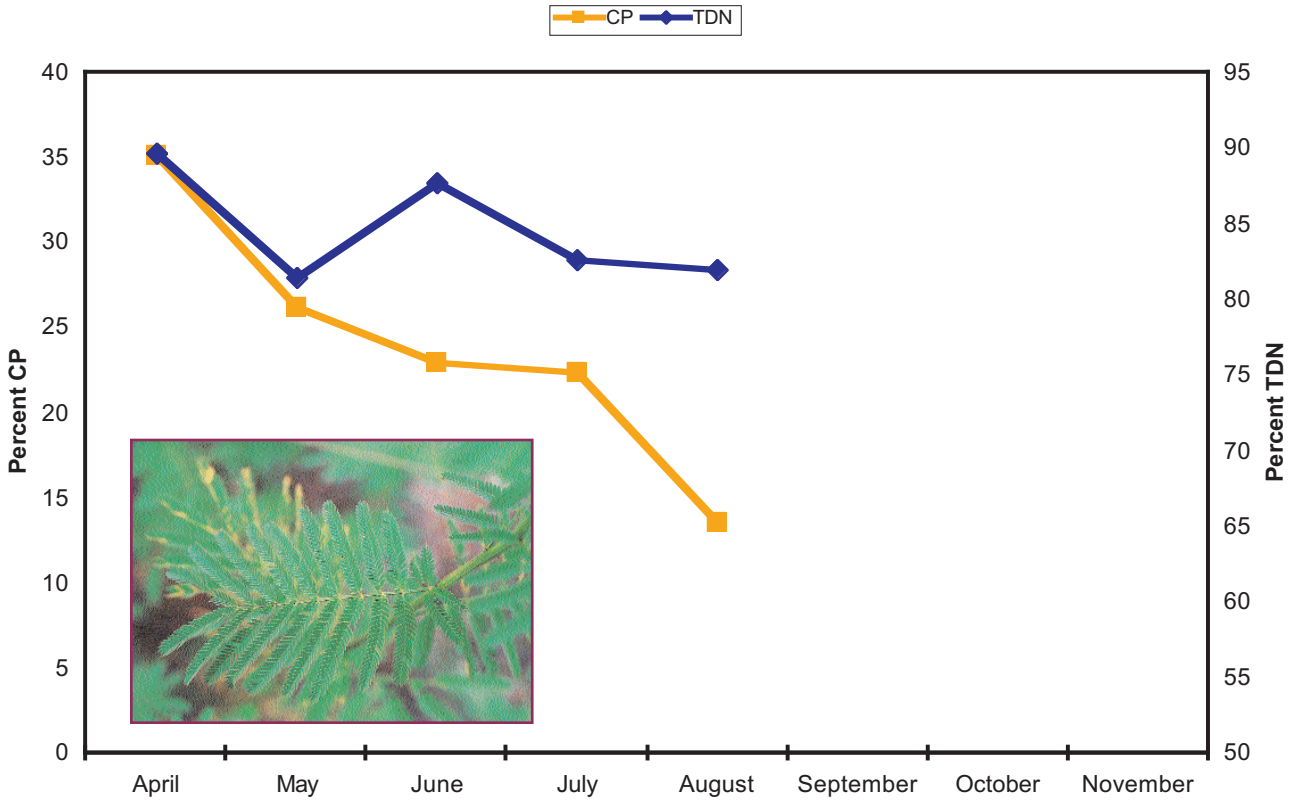
Three-seeded mercury, 2-Year Average



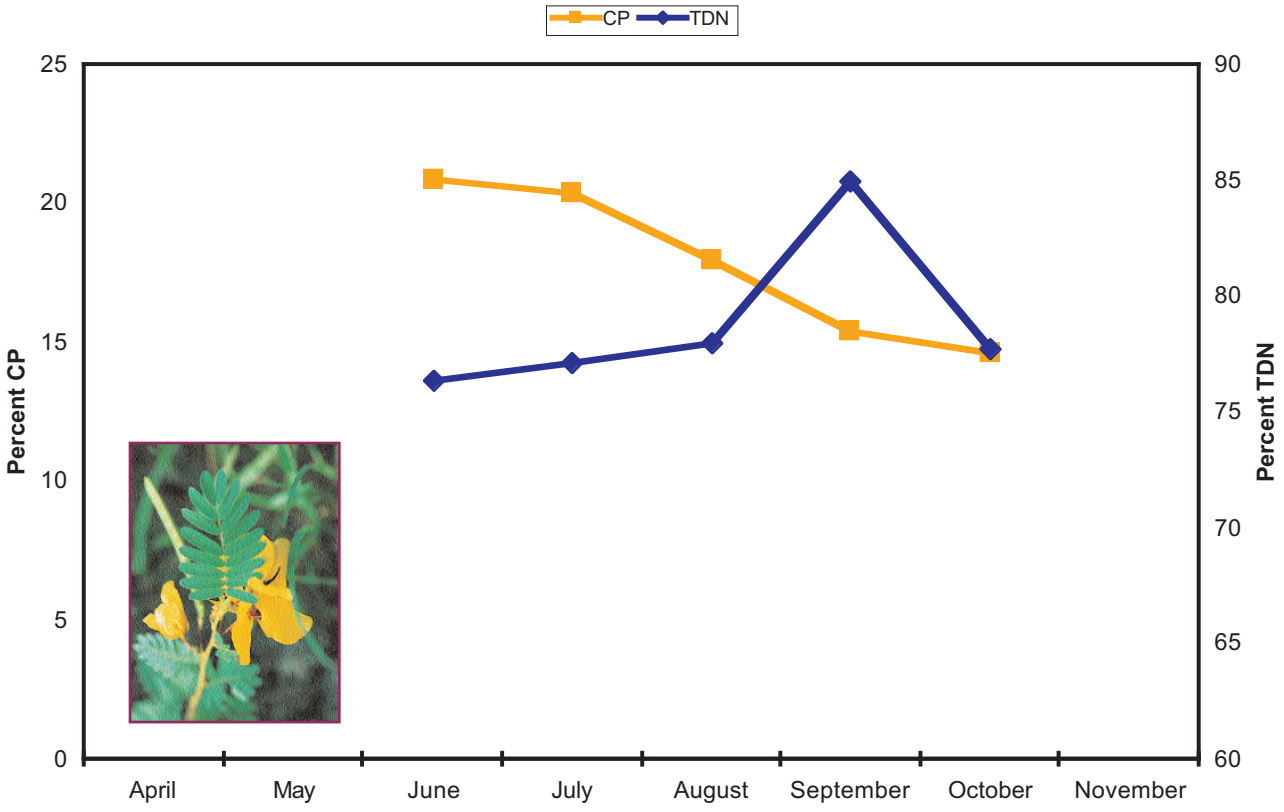
Tropic croton, 2-Year Average



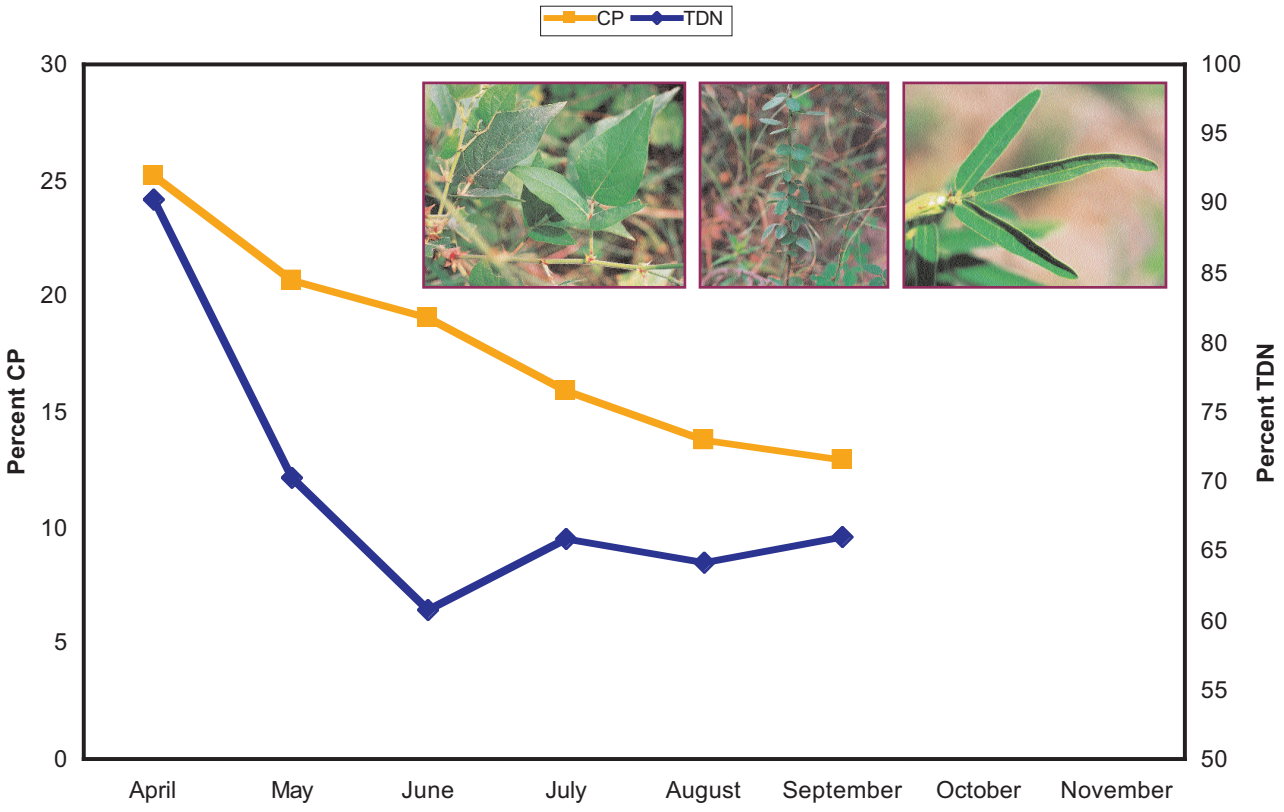
Illinois bundleflower, 2-Year Average



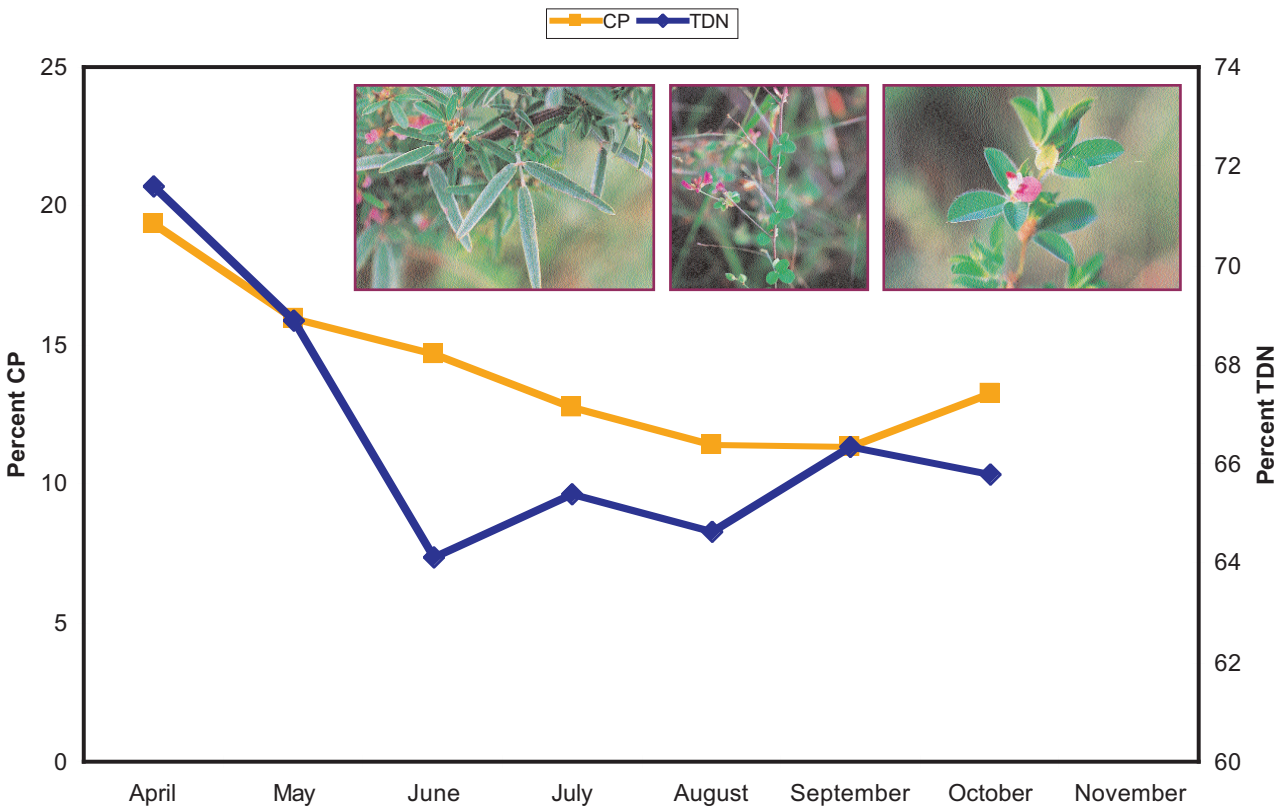
Partridge pea, 2-Year Average



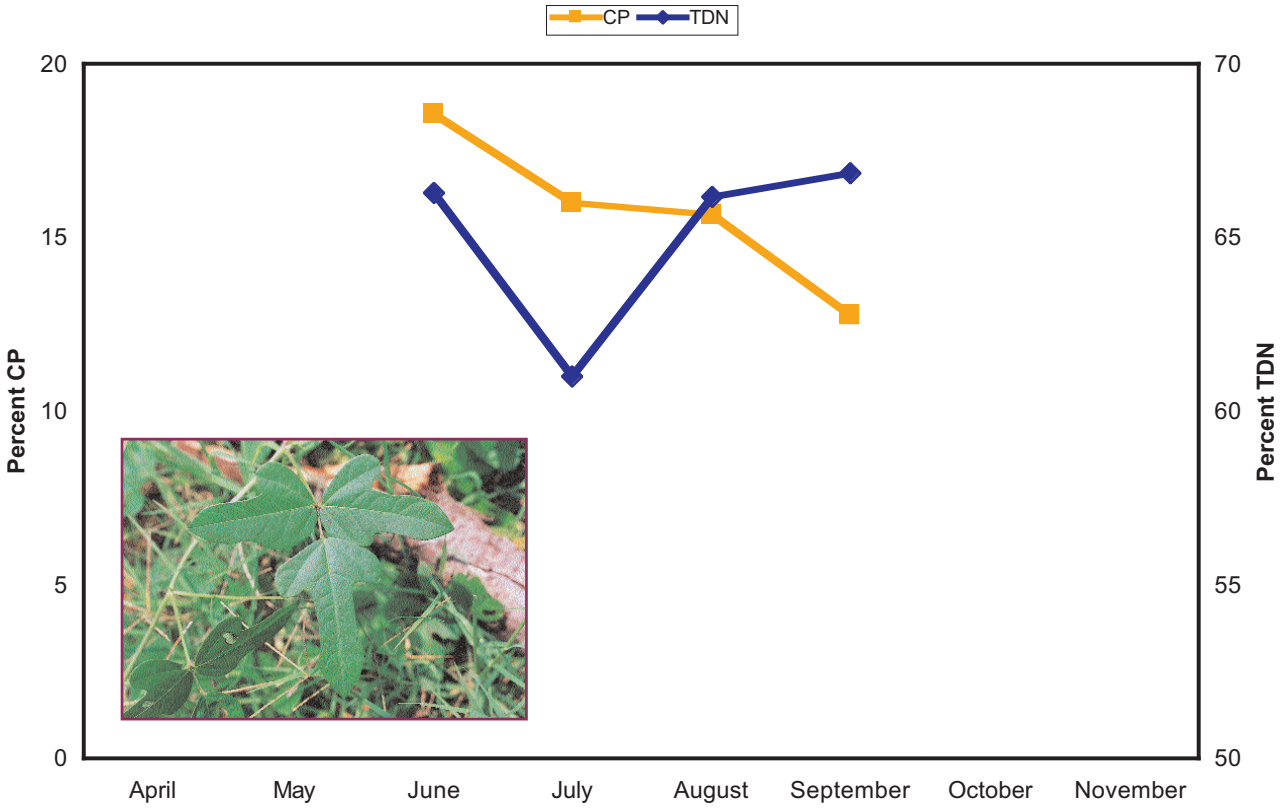
Tick clover (*Desmodium* complex), 2-Year Average



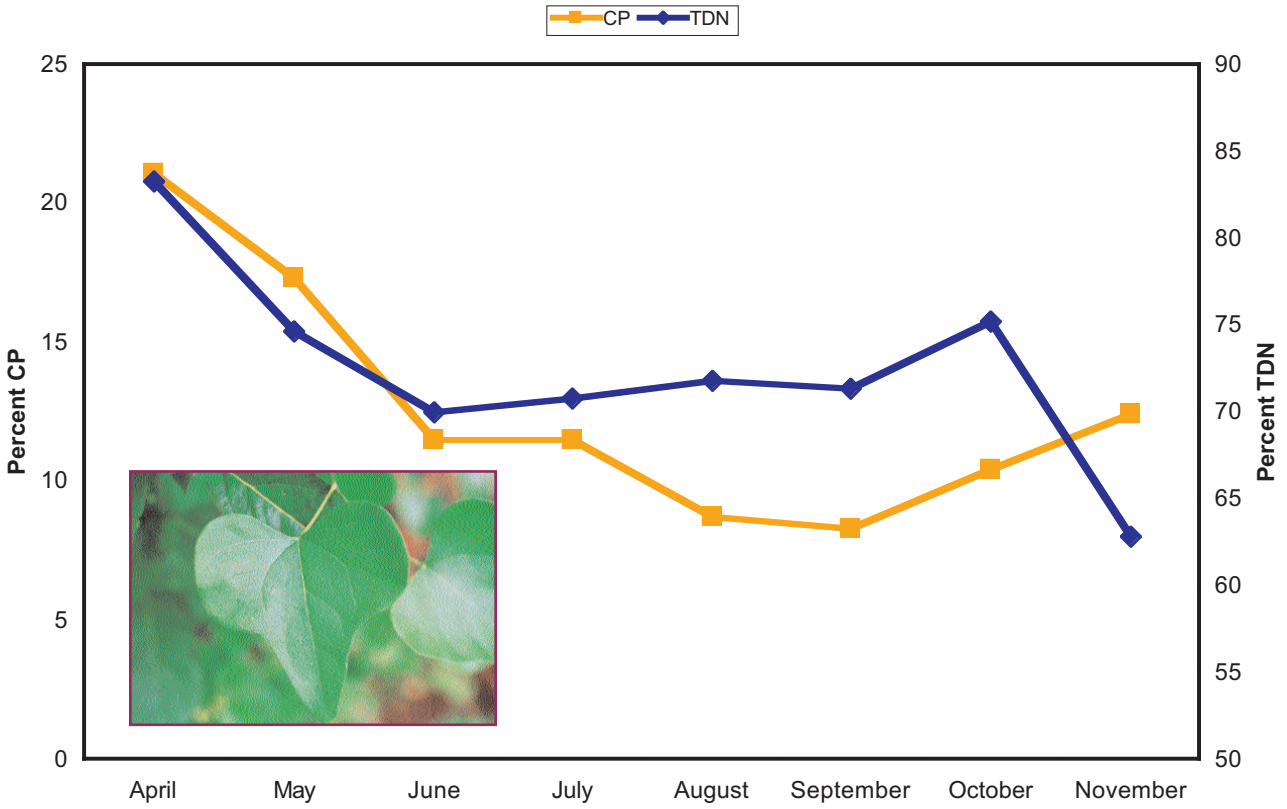
Lespedeza (*Lespedeza* complex), 2-Year Average



Trailing wild bean, 2-Year Average



Carolina snailseed, 2-Year Average



Yellow wood sorrel, 2-Year Average

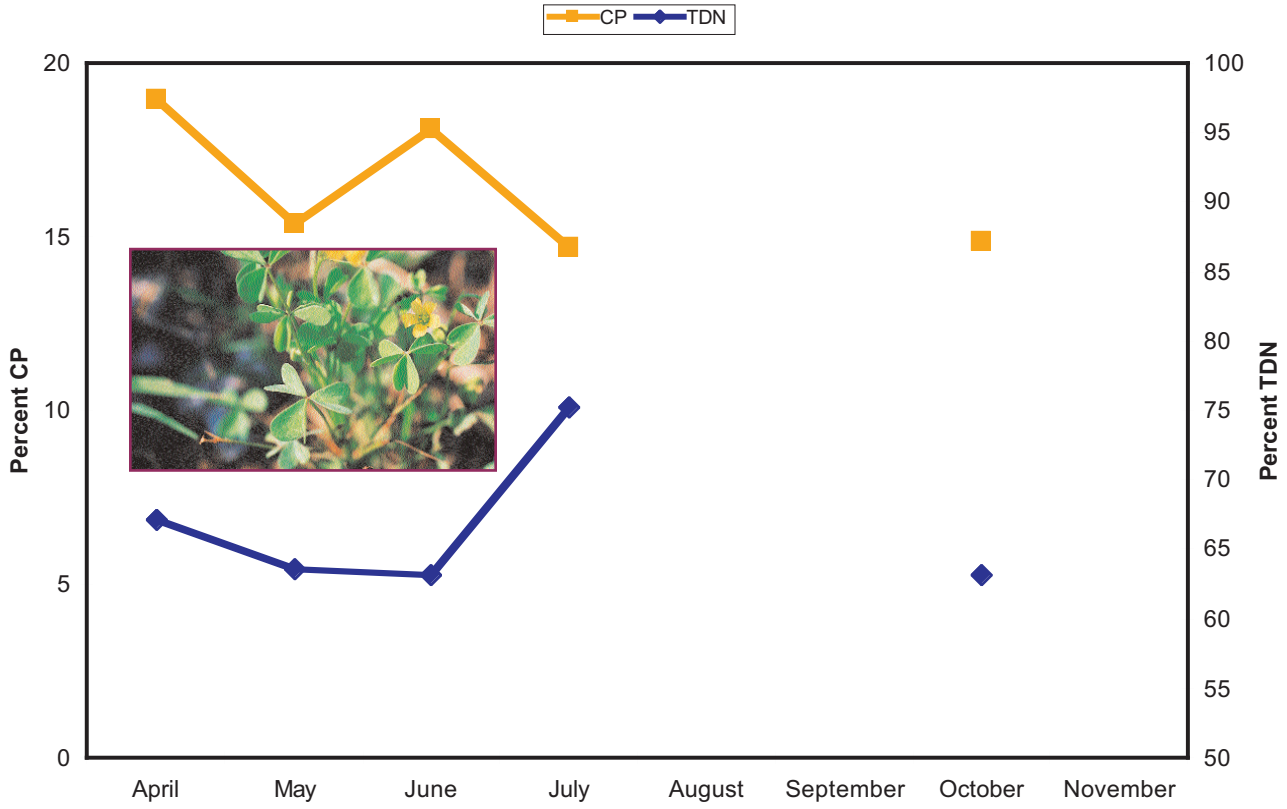


Figure 2. Average CP & TDN During April and May for Woody Plants During 1998-2000 and Forbs During 1999-2000

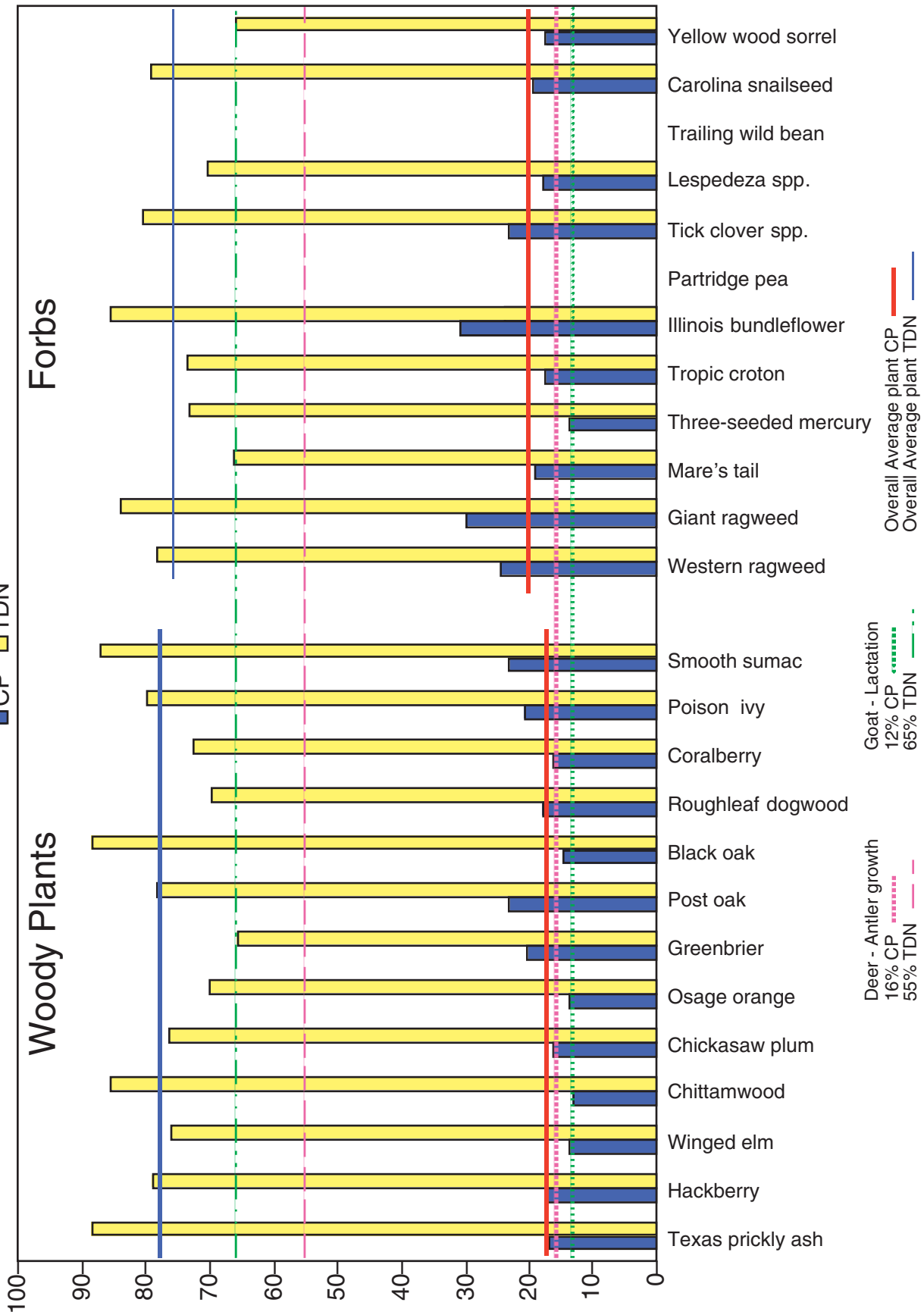


Figure 3. Average CP & TDN During June, July and August for Woody Plants During 1998-2000 and Forbs During 1999-2000

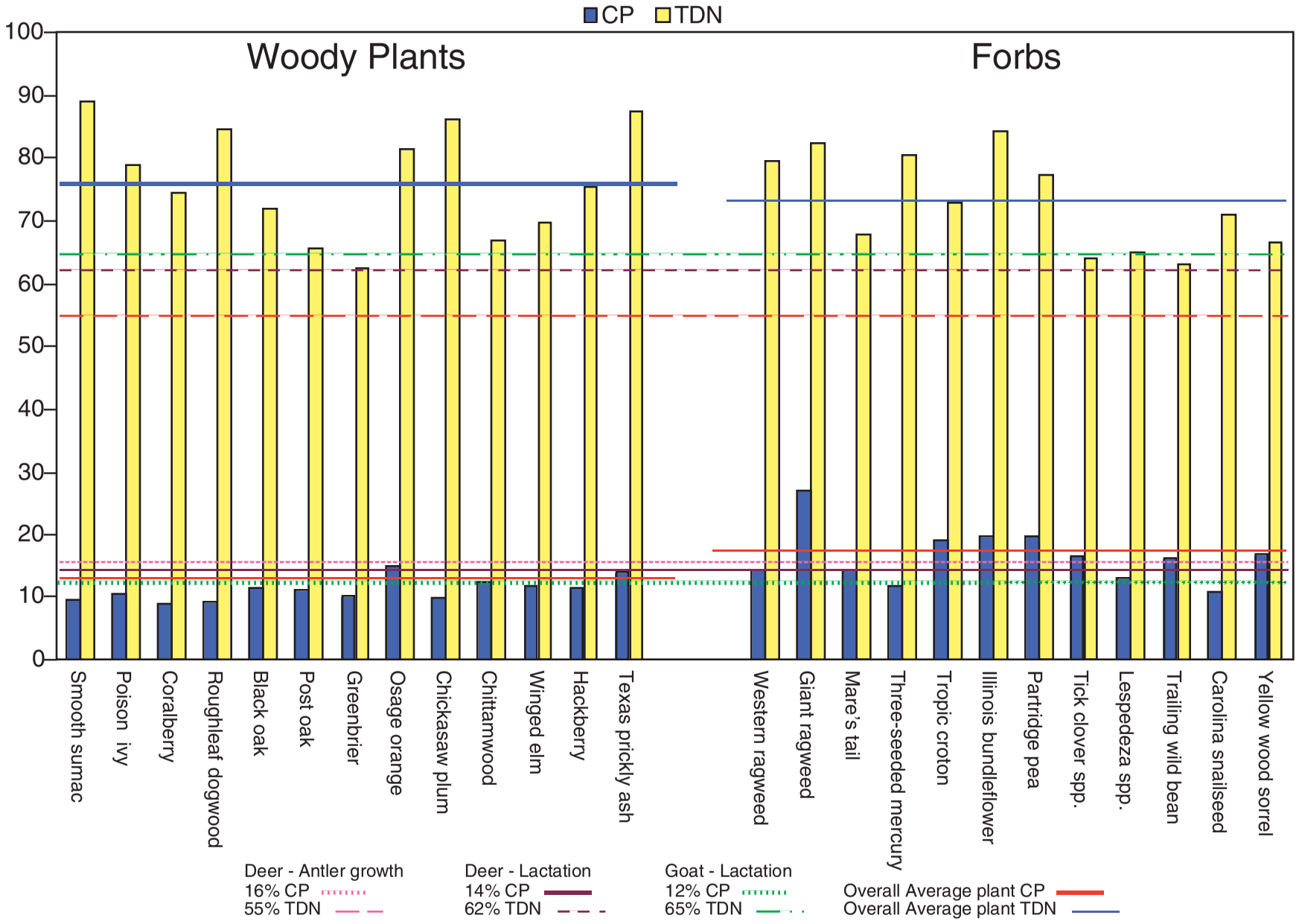
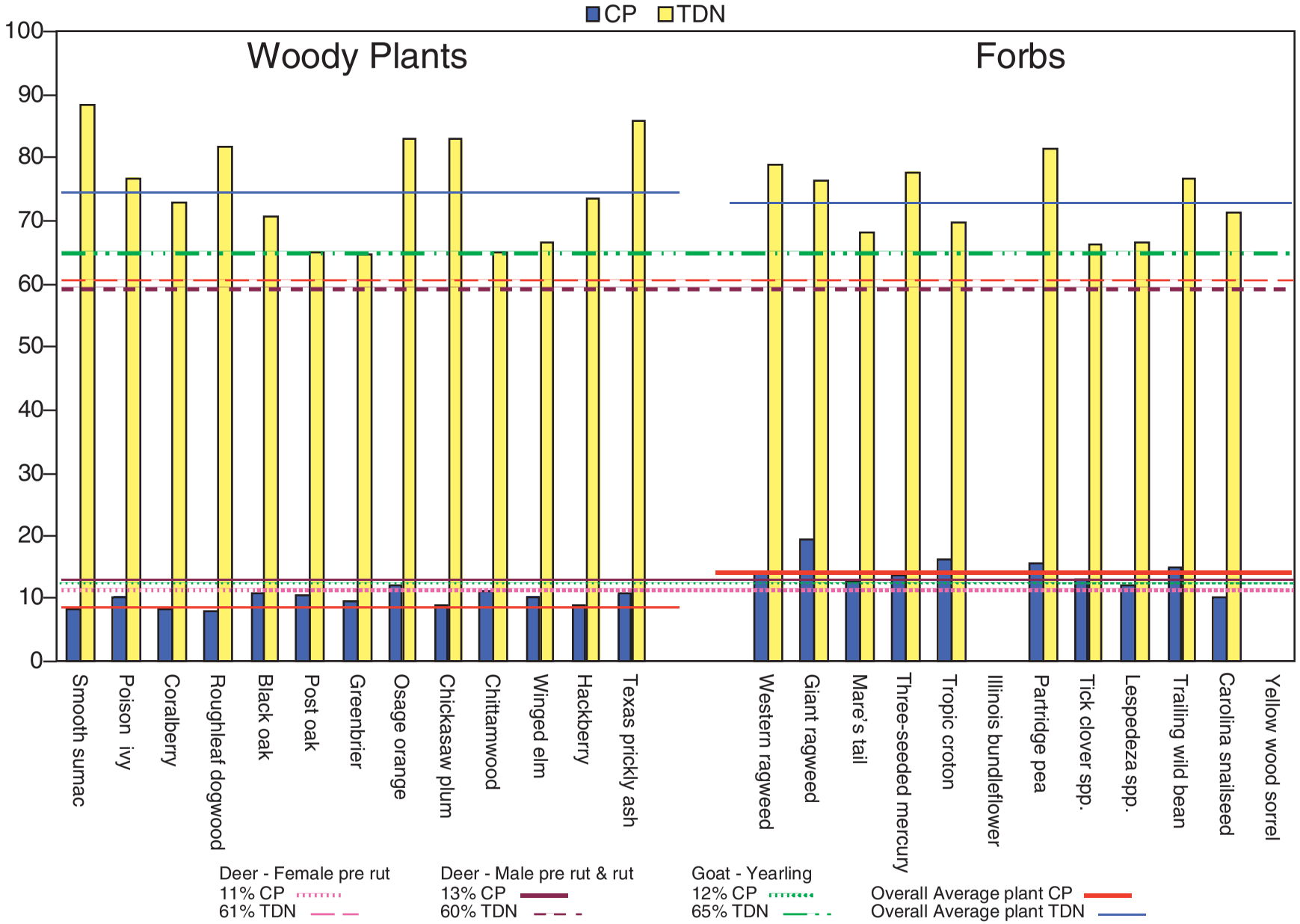


Figure 4. Average CP & TDN During September, October and November for Woody Plants During 1998-2000 and Forbs During 1999-2000



These results represent hand-grab samples and do not encompass the same diet preference and selective capability of white-tailed deer or goat. Deer or goats probably select higher quality plant parts than we were able to select. Also, we did not estimate season or volume of use by deer or goats of the plants sampled in this study. However, forbs comprise the majority of deer diets in the spring and summer, and Osage orange, sumacs-poison ivy complex and oaks are important browse species throughout the year in south central Oklahoma (Gee, et. al., 1994).

Average rainfall was below and average temperature was above the 30-year average during the growing season in all three years of the study (Figure 1). These dry, hot conditions may have influenced the quality of samples collected, especially during the latter part of each growing season when plants may have matured more rapidly than normal, potentially reducing quality and production. Monthly rainfall and temperature during the growing season in 1998, 1999 and 2000 are depicted in Appendix Figures 5, 6 and 7 respectively.

Considering our sampling method and weather conditions, it is probable that the native plants sampled were capable of providing adequate nutrition for deer and goats during the study period (Figures 2, 3 and 4, and Tables 5 and 6). Bryant, et. al. (1980) found that annual diets averaging 11.3% and 11.1% CP for deer and goat, respectively, were acceptable for maintenance and production.

Average CP and TDN of the woody plants sampled exceeded requirements for deer and goat during April and May. Woody plant average TDN exceeded requirements for deer and goat from June through November but CP was not sufficient. Average CP and TDN of the forbs sampled exceeded requirements for deer and goat in all months sampled. This may explain why deer eat predominantly forbs during the spring and summer and supports the finding by Gee, et. al., of forbs being the dominant plant type in deer diets during the spring and summer in south central Oklahoma.

Table 5. Estimated Nutrient Requirements of White-tailed Deer (dry matter basis), assuming peak fawning June 1-7 and peak rut Nov. 10-17 (Klein, 1999)

Class/Age	Protein %	TDN %	Calcium %	Phosphorus %
Juveniles				
4-6 months (Sept-Nov)	18-20	68	0.60	0.30
7-11 months (Dec-Apr)	12-16	60-62	0.58	0.30
12-18 months (May-Nov)	12-14	63-65	0.50	0.30
Females				
Gestation (Jan-Apr 15)	12-14	57	0.50	0.40
Late Gestation (Apr 15-May)	14-16	59	0.50	0.40
Lactation (June-July 15)	14-16	64	0.70	0.40
Lactation (July 15-Aug)	12-14	61	0.60	0.40
Pre Rut (Sept-Oct)	10-12	61	0.50	0.40
Maintenance (Nov-Dec)	7-10	51	0.35	0.25
Males				
Maintenance (Jan-Mar)	7-10	51	0.35	0.25
Antler Growth (Apr-Aug)	16	55	1.40	0.70
Pre Rut & Rut (Sept-Dec)	12-14	60	0.50	0.40

Table 6. Nutrient Requirements for Meat and Fiber Producing Goats (Reynolds, 2002)

Class/Age	Daily feed, lb (forage+grain)	Protein %	TDN %	Calcium %	Phosphorus %
***Young Goats**					
Weanling (30 lbs)	2.0	14	68	0.6	0.3
Yearling (60 lbs)	3.0	12	65	0.4	0.2
Does (80 lbs)					
Dry pregnant	4.5	10	60	0.4	0.2
Lactating					
Average milk	4.5	11	60	0.4	0.2
High milk	5.0	14	65	0.6	0.3
Buck					
(80-120 lbs)	5.0	11	60	0.4	0.2

*Expected weight gain >.44/day

Due to the difficulty of working with wild deer, information on mineral requirements is sketchy. Major minerals deer need are calcium and phosphorus, which they use for bone and antler development, milk production, blood clotting, muscle contraction and general metabolism (Brown, 1996). Studies designed to determine mineral requirements for deer antler growth have yielded conflicting results ranging from a low of .09% Ca and .27% P to a high of .64% Ca and .56% P (Brown, 1996). Klein (1999) states P requirements of .70% for deer antler growth (Table 5). Grasman (1993) concluded that seasonal P requirements for adult deer varied between .12% and .16%.

Goats require salt, Ca, P and Mg for basic body functions and optimum performance. The ratio of Ca to P in the diet is important and should be kept about 2:1 except for bucks where urinary calculi can be a problem (Reynolds, 2002). Meat and fiber producing goats require a range of .40% to .60% Ca and .20% to .30% P (Reynolds, 2002).

Plants sampled in this study met or exceeded Ca requirements for deer and goats in all three years (Appendix tables 1 and 2). Interestingly, average P content for all woody plants in this study exceeded deer and goat requirements during all sample periods in 1998, but only just met requirements during the April sampling period in 1999 and 2000. The only sampling period where the average P content for all forbs met deer and goat requirements was June of 1999. However, average P content over all sampling periods in 1999 and 2000 for mare's tail, Carolina snailseed and yellow wood sorrel met P requirements for deer and goats.

SUMMARY

These data indicate that native landscapes with diverse forb and woody plant communities should provide deer and goat with adequate nutrition during the growing season when animal numbers are balanced with the habitat capacity to support them.

Intensive management strategies such as food plots, feeders and planting monocultures for deer or goats have their place. However, based on these data, native plant communities can meet nutrient requirements for deer and goat with no additional inputs if managed properly. Extensive management of native plant communities should be the primary emphasis of habitat management before intensive management practices are implemented.

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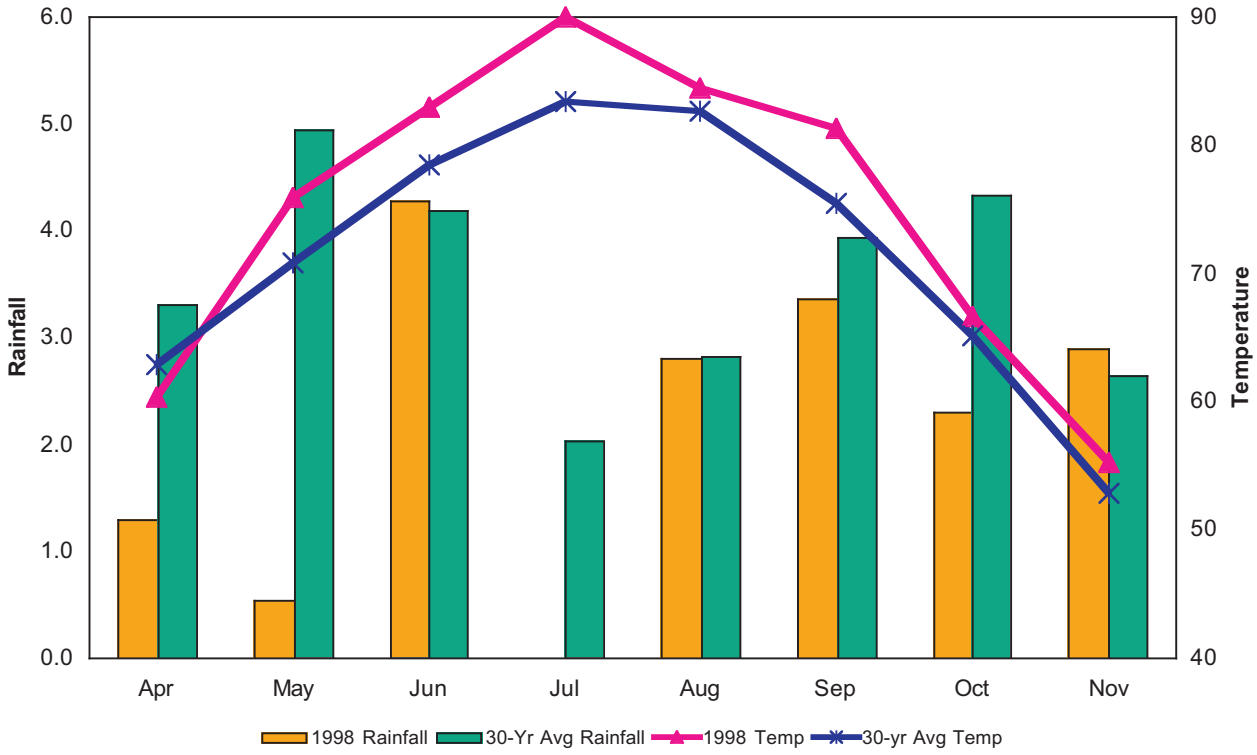
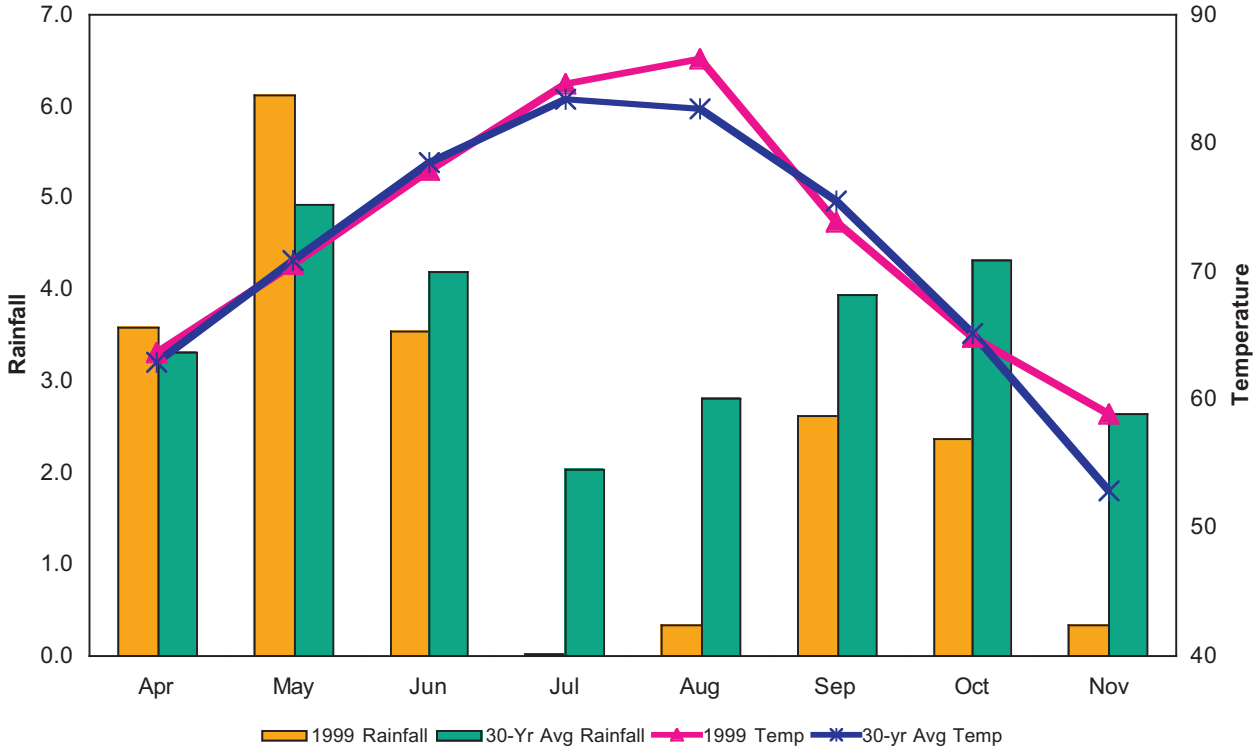
Appendix Figure 5

Rainfall and Mean Temperatures for the 1998 Growing Season Compared with the 30-Year Average, Love County, Oklahoma



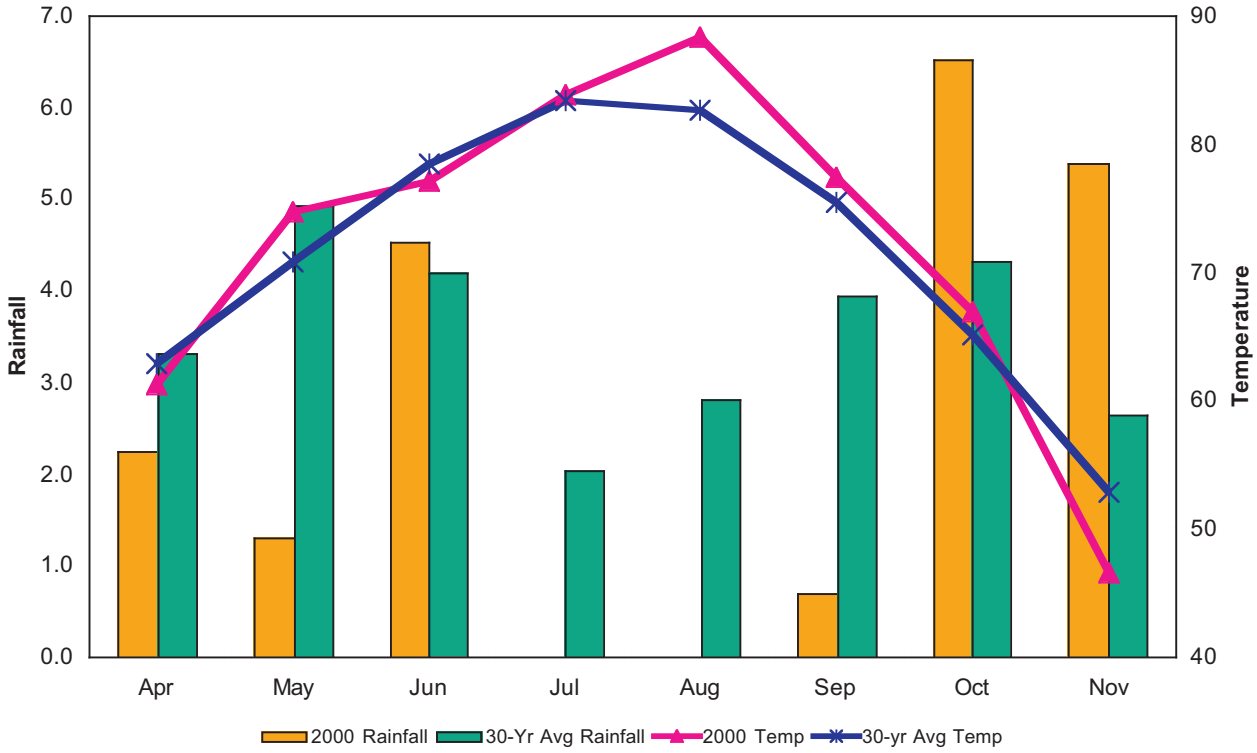
Appendix Figure 6

Rainfall and Mean Temperatures for the 1999 Growing Season Compared with the 30-Year Average, Love County, Oklahoma



Appendix Figure 7

Rainfall and Mean Temperatures for the 2000 Growing Season Compared with the 30-Year Average, Love County, Oklahoma



Appendix Table 1. Monthly CP, TDN, P, Ca, K and Mg for Woody Plants in 1998–2000

	1998															
	April		May		June		July		Aug		Sept		Oct		Nov	
Crude Protein																
Smooth sumac	23.0	21.4	14.9	10.4	10.5	8.9	8.1	7.3	7.6	7.9	7.8	7.2	7.3	9.7	6.4	5.9
Poison ivy	29.3	18.0	15.7	11.9	14.8	11.3	12.0	9.5	10.0	10.7	9.7	9.0	12.7	15.5	7.6	12.3
Coralberry	17.7	13.2	12.6	12.4	11.4	10.5	7.5	8.6	8.4	7.7	7.8	7.6	8.7	8.6	7.9	6.5
Roughleaf dogwood	22.3	14.1	10.1	12.4	10.4	9.7	9.6	8.5	7.5	7.4	7.1	7.1	7.8	7.5	7.7	6.2
Black oak	23.2	16.9	12.9	11.8	10.1	8.7	10.8	10.5	12.5	10.9	11.9	11.6	11.8	9.2	11.6	9.9
Post oak	20.6	14.4	12.8	11.9	13.7	12.0	10.9	9.7	11.7	11.1	9.9	10.8	12.3	11.7	9.9	10.5
Greenbrier	37.9	27.3	23.9	13.7	11.8	10.1	9.7	10.2	9.0	9.5	10.2	9.6	9.0	7.8	11.2	11.0
Osage orange	28.5	22.3	22.6	14.5	20.2	21.8	13.3	11.7	11.6	8.8	14.7	13.6	11.8	14.2	8.9	9.5
Chickasaw plum	18.4	18.1	10.2	10.5	15.3	9.4	11.0	9.4	7.7	6.7	8.9	6.9	7.6	8.9	20.5	7.7
Chittamwood	22.5	19.4	16.7	14.2	15.9	13.6	11.6	11.8	11.7	8.9	13.0	10.8	9.9	12.6	8.4	10.0
Winged elm	24.9	15.8	14.3	13.0	11.1	12.7	9.5	10.2	8.7	15.3	10.2	7.3	10.3	9.5	8.4	8.4
Hackberry	22.5	23.2	19.8	14.3	13.2	12.0	10.5	10.7	8.7	7.3	10.5	11.5	9.3	12.7	9.1	9.1
Texas prickly ash	35.3	25.3	21.2	17.3	13.2	12.9	12.6	10.8	11.8	9.6	10.7	11.8	12.2	12.5	12.0	10.6
TDN																
Smooth sumac	89.7	87.7	87.1	90.3	87.3	87.8	90.2	88.4	89.8	90.2	90.4	89.3	90.1	90.7	88.0	86.0
Poison ivy	89.7	77.9	79.4	73.9	79.6	73.1	71.0	74.8	85.7	77.8	86.3	72.6	78.1	73.1	75.3	83.8
Coralberry	76.4	77.7	67.9	65.8	63.2	72.1	68.2	67.3	74.2	74.6	75.7	75.2	70.6	66.6	72.9	68.6
Roughleaf dogwood	87.7	84.1	87.2	84.1	86.5	85.3	78.3	80.6	88.2	82.9	86.3	87.0	82.3	80.7	81.9	81.6
Black oak	88.6	85.9	68.1	74.5	68.5	79.9	72.6	72.7	69.4	71.0	72.6	73.2	71.5	68.0	69.6	66.4
Post oak	81.9	79.9	61.3	66.0	68.5	67.3	61.8	63.0	66.6	65.8	65.6	53.5	64.5	68.3	69.9	67.0
Greenbrier	71.4	68.0	62.1	66.3	60.5	60.1	58.6	58.9	60.8	61.6	66.6	68.9	60.2	59.8	64.3	58.4
Osage orange	66.7	72.2	69.6	71.6	70.9	72.1	71.8	75.7	76.3	77.1	83.8	82.8	75.9	78.8	79.2	82.4
Chickasaw plum	90.9	91.3	87.9	89.3	87.8	86.4	86.9	87.1	85.6	84.7	87.1	81.9	82.4	82.2	88.1	77.1
Chittamwood	71.3	74.8	67.5	66.9	68.1	68.8	63.2	66.2	68.6	63.6	69.9	61.6	59.8	64.5	63.1	59.6
Winged elm	82.2	72.8	63.9	68.0	66.5	69.3	59.5	65.4	73.8	83.0	74.7	60.3	70.4	65.0	62.7	64.9
Hackberry	79.8	84.1	79.8	75.0	71.9	74.9	70.3	76.9	75.2	70.7	77.9	74.5	71.2	71.6	75.1	72.9
Texas prickly ash	89.0	87.8	87.8	88.0	86.0	89.3	85.5	84.8	89.6	88.5	88.4	88.6	89.1	88.4	87.9	83.3
Calcium																
Smooth sumac	0.67	0.51	0.47	0.33	0.63	0.71	0.61	0.48	0.63	0.52	0.89	0.97	1.27	1.27	1.61	1.93
Poison ivy	0.60	1.44	1.55	1.20	2.06	2.28	2.66	1.82	1.78	3.45	4.15	3.73	3.38	1.85	2.94	2.20
Coralberry	0.46	0.33	0.71	0.77	0.97	1.20	1.43	1.34	1.36	1.24	1.31	1.33	1.80	1.39	1.29	1.76
Roughleaf dogwood	2.45	2.64	2.25	2.32	2.99	3.24	3.46	3.07	2.79	3.43	3.31	3.19	3.71	3.32	3.68	3.95
Black oak	0.49	0.73	0.78	1.27	0.79	0.65	1.48	1.40	1.04	0.89	0.97	1.77	0.95	1.04	1.21	1.24
Post oak	0.57	0.38	0.70	1.20	1.16	0.90	1.00	0.83	1.47	1.71	1.59	1.63	1.06	1.23	1.05	1.52
Greenbrier	0.53	0.64	0.58	1.06	1.34	1.49	1.72	1.78	1.70	1.60	1.64	1.44	2.01	1.48	1.96	1.66
Osage orange	1.67	1.92	1.74	2.45	3.96	4.13	4.52	3.86	3.72	5.29	5.04	4.63	5.79	5.37	5.11	5.86
Chickasaw plum	0.97	0.84	1.21	0.98	0.75	1.31	1.40	1.84	1.31	1.60	1.56	1.82	2.30	1.57	0.69	2.24
Chittamwood	1.66	1.11	0.85	1.78	1.73	2.54	2.54	2.42	1.93	2.15	2.52	2.72	2.52	3.07	3.49	2.59
Winged elm	1.13	1.18	1.23	1.68	1.71	1.85	1.79	1.74	1.75	1.99	1.69	1.85	1.93	1.89	2.06	3.29
Hackberry	2.90	2.99	3.50	4.63	4.69	4.22	4.62	5.81	5.44	4.51	5.83	6.80	5.81	5.98	7.47	6.02
Texas prickly ash	0.79	0.96	1.32	1.70	1.77	1.82	2.98	2.13	2.78	2.69	2.63	3.50	3.18	3.32	3.48	3.47
Phosphorus																
Smooth sumac	1.89	1.28	1.31	1.20	0.61	0.56	0.62	0.52	0.58	0.86	0.69	0.84	0.84	0.40	0.50	0.38
Poison ivy	0.74	1.34	1.44	0.87	1.09	1.34	1.09	1.16	1.09	1.17	0.69	0.95	1.09	1.44	0.72	1.32
Coralberry	0.32	1.69	2.13	1.80	1.78	1.90	1.48	1.60	1.44	0.95	1.23	1.58	1.23	0.82	1.23	1.09
Roughleaf dogwood	0.51	1.15	1.04	0.95	0.87	0.70	0.91	0.85	0.41	0.93	0.50	0.38	0.46	0.51	0.37	0.34
Black oak	0.46	1.19	0.79	0.56	0.55	1.10	0.62	0.51	0.70	0.93	0.77	0.96	0.76	0.44	0.84	0.68
Post oak	1.44	1.03	0.98	0.87	0.73	0.87	0.89	0.90	0.90	0.70	0.66	0.95	0.93	0.64	1.05	0.48
Greenbrier	0.85	3.07	2.54	1.83	1.42	1.30	0.96	1.68	1.26	1.37	0.93	1.37	1.31	1.44	1.45	1.27
Osage orange	3.21	2.36	2.33	2.08	1.09	2.06	2.04	1.88	1.90	1.96	0.68	0.78	0.89	0.75	0.90	0.67
Chickasaw plum	0.29	0.82	1.29	1.03	1.80	0.97	1.11	0.09	1.52	1.10	1.16	1.04	0.83	0.87	1.34	0.61
Chittamwood	1.56	1.27	1.19	0.79	0.84	0.54	0.80	0.62	0.56	0.42	0.73	0.42	0.43	0.50	0.44	0.74
Winged elm	0.44	1.43	1.43	0.92	0.95	1.04	0.67	0.76	0.80	1.10	0.87	0.67	0.88	0.91	0.49	0.88
Hackberry	1.88	1.70	1.47	1.30	1.19	1.00	1.00	1.10	0.53	1.24	0.73	1.18	0.52	1.02	0.94	0.71
Texas prickly ash	2.40	2.03	2.16	2.02	1.75	1.61	1.71	1.60	1.19	1.12	1.65	1.31	1.26	1.39	0.97	1.26

1998 *Continued*

	April		May		June		July		Aug		Sept		Oct		Nov	
Magnesium																
Smooth sumac	0.15	0.16	0.12	0.10	0.14	0.16	0.12	0.11	0.14	0.13	0.17	0.19	0.19	0.26	0.17	0.32
Poison ivy	0.21	0.27	0.31	0.22	0.39	0.32	0.36	0.37	0.40	0.45	0.48	0.44	0.66	0.41	0.49	0.30
Coralberry	0.22	0.16	0.28	0.33	0.36	0.27	0.30	0.32	0.31	0.32	0.30	0.27	0.48	0.25	0.33	0.38
Roughleaf dogwood	0.41	0.41	0.35	0.72	0.52	0.36	0.48	0.45	0.36	0.48	0.28	0.33	0.48	0.55	0.43	0.35
Black oak	0.22	0.27	0.25	0.36	0.41	0.16	0.37	0.35	0.32	0.24	0.31	0.14	0.27	0.47	0.29	0.30
Post oak	0.19	0.17	0.19	0.22	0.28	0.19	0.24	0.22	0.31	0.32	0.15	0.30	0.14	0.18	0.17	0.19
Greenbrier	0.19	0.17	0.16	0.18	0.22	0.20	0.30	0.23	0.24	0.24	0.24	0.20	0.26	0.31	0.27	0.24
Osage orange	0.32	0.29	0.29	0.33	0.45	0.39	0.42	0.22	0.24	0.33	0.45	0.44	0.35	0.38	0.27	0.44
Chickasaw plum	0.26	0.21	0.24	0.23	0.23	0.27	0.31	0.37	0.48	0.44	0.55	0.37	0.46	0.55	0.21	0.45
Chittamwood	0.18	0.20	0.20	0.33	0.29	0.27	0.24	0.36	0.33	0.20	0.28	0.32	0.24	0.26	0.31	0.19
Winged elm	0.30	0.22	0.18	0.28	0.22	0.42	0.21	0.23	0.19	0.42	0.17	0.19	0.16	0.30	0.29	0.52
Hackberry	0.52	0.43	0.48	0.44	0.43	0.44	0.49	0.50	0.41	0.21	0.45	0.43	0.26	0.33	0.31	0.48
Texas prickly ash	0.29	0.23	0.27	0.36	0.35	0.35	0.36	0.41	0.41	0.58	0.45	0.50	0.59	0.49	0.55	0.24
Potassium																
Smooth sumac	0.46	0.34	0.25	0.13	0.08	0.09	0.07	0.06	0.06	0.07	0.07	0.07	0.09	0.08	0.17	0.21
Poison ivy	2.23	0.36	0.36	0.11	0.16	0.15	0.25	0.10	0.13	0.15	0.11	0.13	0.23	0.41	0.20	0.28
Coralberry	1.67	0.22	0.32	0.17	0.13	0.14	0.10	0.17	0.09	0.10	0.11	0.09	0.14	0.09	0.13	0.08
Roughleaf dogwood	1.21	0.39	0.23	0.28	0.23	0.21	0.20	0.19	0.11	0.20	0.11	0.08	0.18	0.17	0.20	0.09
Black oak	1.24	0.20	0.16	0.09	0.07	0.08	0.08	0.07	0.11	0.08	0.11	0.10	0.10	0.11	0.16	0.10
Post oak	0.36	0.22	0.21	0.11	0.10	0.12	0.10	0.11	0.09	0.10	0.09	0.11	0.12	0.14	0.10	0.11
Greenbrier	3.09	0.50	0.43	0.19	0.10	0.11	0.09	0.12	0.10	0.11	0.09	0.07	0.09	0.08	0.13	0.11
Osage orange	0.62	0.30	0.43	0.22	0.15	0.59	0.14	0.15	0.13	0.20	0.11	0.11	0.12	0.16	0.12	0.14
Chickasaw plum	1.31	0.19	0.17	0.11	0.15	0.10	0.11	0.09	0.08	0.10	0.09	0.06	0.07	0.11	0.28	0.09
Chittamwood	0.31	0.21	0.24	0.12	0.11	0.09	0.09	0.10	0.11	0.07	0.10	0.11	0.09	0.14	0.09	0.10
Winged elm	1.70	0.23	0.23	0.14	0.11	0.14	0.12	0.10	0.07	0.21	0.11	0.12	0.09	0.25	0.19	0.10
Hackberry	0.39	0.33	0.36	0.15	0.11	0.14	0.10	0.10	0.09	0.07	0.09	0.10	0.09	0.13	0.14	0.07
Texas prickly ash	0.71	0.44	0.45	0.17	0.14	0.13	0.12	0.11	0.09	0.14	0.23	0.11	0.16	0.39	0.13	0.11

1999

	April		May		June		July		Aug		Sept		Oct		Nov	
Crude Protein																
Smooth sumac	21.4	16	12.3	12.1	11.9	9.9	11.4	9.9	8.7	8.7	7.7	10.4	10.6	10	5.3	
Poison ivy	24.5	14.6	15.2	16.0	11.8	12.2	10.4	10.9	8.3	8.9	7.9	11.8	13.1	10.4	6.9	
Coralberry	15.2	15.3	12.1	10.4	11.2	8.8	8.6	9.6	7.6	8.3	7.2	7.6	8.8	8.4	9.7	
Roughleaf dogwood	15	13.3	11.4	10.6	10.8	9.9	10.3	9.3	8.4	8.3	7	8.3	8.4	9.9	6.6	
Black oak	16.9	14.2	13.7	13.1	13.2	11.8	12.7	11.7	10.2	14.2	9.8	9.9	13.2	11.7	11	
Post oak	13.5	14.8	12.1	12.5	11.6	11.9	10.3	10.4	9.5	9.3	9.5	10.2	9.5	10.5	8.3	
Greenbrier	25.1	20.4	12.1	11.6	13.4	10.5	9.9	10	8.2	8.3	8.6	7.5	10.3	9.5	12	
Osage orange	30.5	31.7	22.1	22.4	20.3	19.1	18.9	13	- -	12.7	15.7	11.9	12.8	11.5	9	
Chickasaw plum	19.9	16.2	15.7	15.2	11.8	11.6	9.8	10.3	9.2	9	8.3	10.7	6.5	8.3	12.4	
Chittamwood	25.0	16.8	16.1	15.0	14.1	11.6	14.3	11.3	11.9	12.5	12.2	11.5	14.5	11.5	11.3	
Winged elm	18.4	15.9	14.5	15.6	13.6	13.5	12.2	11.8	11.6	10.2	13.1	10	12.5	11.6	9.7	
Hackberry	39.0	21.7	15.5	14.2	14.1	11.0	11.9	9.2	9.5	10.9	9	8.3	8.9	6.4	6.8	
Texas prickly ash	33.1	23.2	20.6	18.5	15.6	18.6	18.3	16.5	11.7	14.8	10.7	9.9	10.6	8.9	11.6	
TDN																
Smooth sumac	90	88	88.1	87.2	85.1	89.3	88.3	89.1	89.4	88.3	88.5	89	90.3	89.2	82.6	
Poison ivy	87.5	84.4	75.7	74.8	78.8	80.3	80.4	80.6	81.5	77.2	79.2	79.1	80.6	76.2	75.8	
Coralberry	86.0	81.4	78.8	79.1	79.3	79.6	77.5	76.8	75.5	75.7	75.6	75.7	75.6	74.8	74.8	
Roughleaf dogwood	86.8	84.3	88.5	87.5	85.2	89.2	87.9	87.1	84.8	83.4	83.1	81.5	83.4	83.7	81.3	
Black oak	87.3	66.2	69.7	73.7	71.2	74.4	72.3	73	72.4	73.4	77.8	68.5	72.3	70.3	71.6	
Post oak	74.7	66.5	66.7	67.7	65.5	67.2	66	66.8	69	65.7	65.9	64.3	63.7	68.9	61.9	
Greenbrier	75.0	72.4	59.1	62.1	63.0	57.5	59.9	64.7	59.7	69.4	64.5	65.7	68.8	69.2	62.7	
Osage orange	88.8	87.3	78.4	86.9	87.1	83.2	86.8	85.8	- -	84.4	89.1	88.0	83.8	84	81.9	
Chickasaw plum	89.1	88.6	88.9	87.6	87.7	89.9	88.8	87.4	87.7	83.2	82.8	84.4	86.5	85.6	85.1	
Chittamwood	77.3	66.6	69.7	67.5	69.2	68.4	68	72.1	68.7	64.9	86.2	67.1	65.2	64.7	61.9	
Winged elm	78.6	72.5	72.1	69.5	70.1	69.5	67.5	64.5	68.9	71.4	69.1	70	70.7	69.4	63.8	
Hackberry	87.1	81.9	78.3	76.1	75.4	78.1	73.3	74	80.1	77.4	77	70.3	78.5	70.7	73.9	
Texas prickly ash	88.1	87.5	87.3	84.8	85.6	89.3	87.9	87.7	87.9	88.9	78.4	87	87.1	85.1	88.6	

1999 *Continued*

	April		May		June		July		Aug		Sept		Oct		Nov
Calcium															
Smooth sumac	0.49	0.64	0.59	0.67	0.83	0.8	0.88	0.98	1.28	1.35	1.64	1.74	2.22	2.09	1.66
Poison ivy	1.39	1.36	1.63	1.33	1.66	2.18	1.95	2.72	2.93	3.14	2.91	2.84	2.34	2.44	3.51
Coralberry	0.75	0.69	0.90	0.88	1.03	1.03	1.17	1.26	1.42	1.49	1.41	1.68	1.52	1.57	1.87
Roughleaf dogwood	3.54	2.79	2.57	2.94	2.47	2.00	2.24	2.77	3.01	2.72	3.53	3.04	3.17	3.74	3.47
Black oak	0.56	0.95	0.90	1.37	1.36	0.65	1.4	1.36	1.43	1.35	0.93	1.66	1.3	1.26	1.46
Post oak	0.44	0.71	1.20	0.92	1.06	1.93	1.96	1.75	0.94	0.94	1.97	1.06	0.98	1.51	1.17
Greenbrier	0.63	0.98	1.31	1.50	1.75	1.60	1.62	1.68	1.57	1.52	1.58	1.36	1.79	1.57	1.6
Osage orange	2.10	1.74	2.10	3.05	1.33	2.34	2.12	3.56	- -	3.63	3.38	4.01	5.75	5.36	6.23
Chickasaw plum	0.99	1.56	1.15	1.38	1.77	1.69	1.93	1.84	1.8	1.28	1.08	1	1.21	1.17	1
Chittamwood	0.96	2.00	2.12	2.24	1.76	2.53	2.95	2.99	3	2.19	2.25	3.07	2.29	2.71	2.87
Winged elm	2.18	1.68	1.55	1.45	1.54	1.68	1.82	2.23	2.14	1.41	1.79	1.81	1.81	1.71	2.61
Hackberry	2.07	3.30	4.53	4.80	5.03	5.05	3.54	5.68	6.26	4.69	7.06	4.7	8.25	5.34	6.9
Texas prickly ash	1.38	1.67	1.87	1.99	1.91	1.59	1.91	2.47	2.77	2.56	2.71	2.54	2.46	2.25	3.57
Phosphorus															
Smooth sumac	0.35	0.24	0.2	0.16	0.12	0.1	0.13	0.1	0.09	0.08	0.08	0.11	0.2	0.11	0.06
Poison ivy	0.55	0.34	0.27	0.33	0.13	0.14	0.1	0.13	0.09	0.09	0.09	0.12	0.15	0.13	0.11
Coralberry	0.28	0.27	0.19	0.16	0.16	0.07	0.11	0.11	0.09	0.1	0.09	0.1	0.1	0.08	0.1
Roughleaf dogwood	0.42	0.34	0.18	0.24	0.19	0.13	0.11	0.17	0.17	0.18	0.18	0.21	0.2	0.17	0.11
Black oak	0.23	0.13	0.12	0.09	0.11	0.11	0.08	0.08	0.09	0.12	0.07	0.1	0.15	0.15	0.16
Post oak	0.21	0.18	0.12	0.14	0.13	0.11	0.09	0.1	0.11	0.07	0.09	0.1	0.07	0.11	0.11
Greenbrier	0.44	0.33	0.14	0.11	0.10	0.09	0.08	0.08	0.09	0.07	0.08	0.08	0.1	0.1	0.11
Osage orange	0.50	0.55	0.33	0.22	0.31	0.24	0.17	0.12	- -	0.11	0.12	0.11	0.15	0.14	0.12
Chickasaw plum	0.26	0.19	0.18	0.15	0.12	0.12	0.09	0.11	0.1	0.09	0.08	0.15	0.09	0.08	0.17
Chittamwood	0.30	0.18	0.14	0.13	0.10	0.09	0.12	0.17	0.1	0.11	0.12	0.11	0.17	0.08	0.08
Winged elm	0.22	0.17	0.17	0.20	0.14	0.13	0.11	0.13	0.11	0.13	0.11	0.11	0.15	0.16	0.14
Hackberry	0.67	0.30	0.18	0.16	0.14	0.12	0.13	0.08	0.12	0.1	0.11	0.11	0.13	0.15	0.1
Texas prickly ash	0.62	0.32	0.23	0.25	0.19	0.20	0.24	0.15	0.11	0.16	0.09	0.09	0.09	0.08	0.16
Magnesium															
Smooth sumac	0.13	0.15	0.16	0.14	0.15	0.14	0.13	0.14	0.15	0.15	0.15	0.17	0.18	0.15	0.13
Poison ivy	0.24	0.29	0.32	0.31	0.29	0.30	0.27	0.4	0.33	0.41	0.31	0.29	0.26	0.28	0.39
Coralberry	0.30	0.30	0.30	0.32	0.34	0.27	0.36	0.35	0.35	0.28	0.32	0.35	0.27	0.26	0.28
Roughleaf dogwood	0.50	0.47	0.37	0.50	0.50	0.24	0.29	0.43	0.47	0.39	0.53	0.39	0.47	0.24	0.41
Black oak	0.27	0.26	0.38	0.34	0.26	0.26	0.4	0.39	0.41	0.31	0.27	0.18	0.27	0.25	0.4
Post oak	0.17	0.21	0.30	0.21	0.35	0.20	0.27	0.17	0.24	0.23	0.23	0.14	0.24	0.14	0.09
Greenbrier	0.16	0.16	0.17	0.19	0.23	0.19	0.19	0.23	0.28	0.2	0.32	0.28	0.36	0.28	0.25
Osage orange	0.36	0.37	0.34	0.42	0.32	0.39	0.35	0.31	- -	0.37	0.31	0.37	0.35	0.35	0.29
Chickasaw plum	0.24	0.27	0.29	0.29	0.32	0.38	0.39	0.36	0.35	0.32	0.35	0.37	0.38	0.29	0.32
Chittamwood	0.21	0.26	0.28	0.30	0.22	0.33	0.37	0.43	0.33	0.24	0.25	0.34	0.23	0.2	0.22
Winged elm	0.41	0.31	0.32	0.28	0.27	0.32	0.26	0.27	0.26	0.23	0.23	0.17	0.36	0.3	0.27
Hackberry	0.42	0.48	0.43	0.40	0.52	0.63	0.58	0.21	0.47	0.43	0.5	0.45	0.35	0.28	0.5
Texas prickly ash	0.34	0.28	0.34	0.41	0.42	0.39	0.29	0.4	0.5	0.46	0.5	0.32	0.31	0.26	0.36
Potassium															
Smooth sumac	1.91	1.7	1.6	1.28	1.39	1.07	0.91	0.85	0.67	0.74	0.74	0.83	1.09	0.72	1.04
Poison ivy	1.67	1.22	1.30	1.27	1.13	1.13	1.08	1.02	0.63	1.19	0.71	0.9	1.01	0.94	0.68
Coralberry	2.31	2.31	1.72	1.43	1.15	1.69	1.71	1.75	1.41	1.59	1.46	1.41	1.48	1.15	1.39
Roughleaf dogwood	1.48	1.16	0.83	0.70	1.01	0.91	0.77	0.87	0.65	0.84	0.51	1.15	0.61	0.48	0.45
Black oak	1.20	0.70	0.68	0.54	0.88	0.85	0.54	0.59	0.63	0.75	0.86	0.85	0.89	0.74	0.61
Post oak	1.53	1.04	0.75	0.72	0.55	0.63	0.63	0.51	0.58	0.41	0.61	0.63	0.37	0.82	0.49
Greenbrier	3.15	2.30	1.43	1.20	1.31	1.52	1.52	1.45	1.21	1.08	1.56	1.56	1.47	1.35	1.66
Osage orange	2.74	2.52	2.57	1.31	2.13	2.19	2.20	1.61	- -	2.01	1.07	0.66	1.39	1.2	0.55
Chickasaw plum	1.50	1.23	1.27	0.71	1.22	1.06	1.05	1.25	1.21	1.27	1.68	1.51	1.12	1.35	1.35
Chittamwood	1.61	1.27	0.95	0.78	0.82	0.65	0.65	0.5	0.61	0.75	0.72	0.56	0.75	0.35	0.36
Winged elm	1.50	0.96	1.03	1.04	0.96	0.86	0.67	0.81	0.77	1.07	0.85	0.68	0.88	0.84	0.92
Hackberry	2.64	1.47	1.18	1.30	1.02	1.49	0.97	0.75	1.08	1.18	1.24	0.85	0.68	0.65	0.99
Texas prickly ash	2.75	2.71	2.39	1.96	2.25	1.65	1.89	1.87	1.31	1.16	1.35	1.45	1.44	1.3	1.55

	2000														
	April		May		June		July		Aug		Sept		Oct		Nov
Crude Protein															
Smooth sumac	24.7	20.3	13.2	14.1	13.9	10.4	9.3	8.8	9.7	7.8	9.3	7.2	7.3	8.5	10.7
Poison ivy	22.6	18.5	12.3	10.6	12.0	10.4	10.1	9.9	8.1	8.0	7.3	8.0	8.0	8.4	- -
Coralberry	17.3	14.9	12.8	11.2	9.5	10.1	8.7	7.4	7.2	7.1	7.7	7.7	9.4	9.7	- -
Roughleaf dogwood	15.6	13.3	11.5	9.6	10.1	11.1	10.1	8.5	8.5	7.6	7.1	7.1	5.8	8.6	8.7
Black oak	25.7	18.1	15.9	12.3	13.1	12.1	12.8	9.3	11.4	10.1	9.7	9.8	10.3	7.2	- -
Post oak	16.5	16.2	12.7	9.1	11.7	13.6	11.9	8.2	10.1	10.0	10.5	8.6	8.0	9.8	8.9
Greenbrier	27.1	18.9	14.1	12.1	12.2	9.6	10.7	10.6	9.5	9.1	9.3	8.2	7.6	11.6	9.5
Osage orange	31.7	26.8	18.8	9.1	14.1	15.7	16.5	15.5	11.2	14.1	12.4	11.6	11.5	12.7	- -
Chickasaw plum	16.0	15.2	12.8	9.7	10.1	10.7	10.1	9.6	9.7	8.4	7.3	4.8	6.6	7.3	6.8
Chittamwood	22.4	20.4	14.6	13.5	14.1	13.9	13.4	13.6	12.1	10.5	9.7	9.9	11.3	12.3	10.9
Winged elm	22.1	15.1	13.9	13.1	12.4	14.0	11.7	11.5	9.5	10.5	9.2	10.3	8.7	10.6	- -
Hackberry	27.5	20.9	15.7	15.0	12.5	12.9	18.0	11.1	11.8	11.7	8.7	7.2	7.6	8.3	7.7
Texas prickly ash	28.9	25.8	13.5	15.3	18.2	24.1	13.9	14.3	12.1	9.5	9.5	9.0	7.7	11.8	11.2
TDN															
Smooth sumac	89.6	88.2	90.0	87.3	86.2	88.6	90.5	91.2	89.6	90.0	88.1	89.7	90.1	87.9	85.3
Poison ivy	84.1	77.6	73.9	70.5	78.7	77.5	77.6	80.2	78.2	76.3	73.5	74.9	76.0	74.6	- -
Coralberry	63.8	80.2	77.7	77.7	77.6	76.0	77.3	74.2	73.5	76.3	74.9	73.5	72.0	67.5	- -
Roughleaf dogwood	85.2	84.2	85.3	82.6	81.4	85.2	81.9	84.1	80.6	83.8	81.4	81.7	82.1	79.9	75.8
Black oak	86.3	76.7	70.3	70.7	65.2	69.8	67.4	71.4	73.9	74.4	71.8	69.6	69.5	69.0	- -
Post oak	82.7	69.9	64.1	60.9	63.1	61.3	66.8	64.1	63.7	65.1	68.7	64.6	63.6	64.3	65.5
Greenbrier	76.6	63.0	61.1	52.1	62.8	62.9	65.2	64.2	63.3	64.6	68.7	63.7	63.5	64.1	68.5
Osage orange	88.0	86.2	82.4	60.9	82.1	82.4	86.1	87.6	82.7	87.2	85.8	83.3	84.7	84.5	- -
Chickasaw plum	91.6	88.7	85.3	83.6	83.3	86.7	85.2	85.7	83.0	82.2	81.8	82.3	81.6	82.8	81.2
Chittamwood	72.9	71.7	64.2	68.8	63.6	67.0	66.0	66.1	66.6	62.1	63.7	61.6	64.3	65.3	61.9
Winged elm	82.5	69.9	72.7	68.2	65.0	70.8	70.1	71.4	66.0	72.7	70.3	68.4	63.2	66.7	- -
Hackberry	85.3	81.4	75.9	73.4	74.9	78.4	76.4	79.6	74.5	76.4	74.6	75.6	72.5	74.5	70.0
Texas prickly ash	88.9	87.4	84.0	84.1	85.3	87.6	86.7	86.0	85.7	88.3	86.2	85.6	85.3	86.2	84.8
Calcium															
Smooth sumac	0.46	0.63	0.51	0.71	1.11	0.64	0.77	1.50	2.51	1.82	2.08	1.34	2.08	1.61	1.75
Poison ivy	1.34	1.31	1.94	2.06	1.84	2.03	2.49	3.14	3.47	2.29	2.94	2.40	3.13	2.54	- -
Coralberry	0.65	0.76	0.84	0.89	0.82	1.09	1.32	1.00	1.11	1.03	0.96	1.26	1.26	0.82	- -
Roughleaf dogwood	2.23	2.81	2.21	2.58	2.26	2.50	2.90	2.91	2.76	2.88	2.57	2.35	2.90	3.36	3.04
Black oak	0.50	0.68	0.69	0.84	0.89	0.95	1.02	0.81	1.14	1.24	1.03	1.06	1.19	0.81	- -
Post oak	0.62	0.60	0.99	1.04	1.04	1.09	1.39	1.08	1.18	1.88	0.66	1.89	1.44	1.69	1.53
Greenbrier	0.62	0.83	1.04	1.17	1.04	1.36	1.31	1.40	1.57	1.56	1.55	1.50	2.17	1.40	1.47
Osage orange	1.48	2.05	2.34	1.04	4.55	4.50	3.44	4.06	3.58	3.47	3.79	5.23	6.08	3.55	- -
Chickasaw plum	1.06	1.15	1.22	1.55	1.68	1.85	1.40	1.42	1.38	1.21	1.13	0.78	1.08	1.01	1.02
Chittamwood	1.22	0.92	1.20	2.33	1.57	2.47	2.39	2.40	3.13	3.14	1.70	1.92	1.74	2.03	2.72
Winged elm	0.99	1.12	1.13	1.75	1.39	1.30	1.53	2.16	1.70	2.13	2.03	1.82	1.83	2.19	- -
Hackberry	2.84	4.12	2.38	3.12	4.43	5.37	6.25	6.35	4.48	4.58	4.77	5.07	5.60	6.15	6.40
Texas prickly ash	1.20	1.40	1.24	1.43	1.47	1.22	2.19	2.77	2.14	2.95	2.43	2.41	2.96	3.09	2.34
Phosphorus															
Smooth sumac	0.46	0.28	0.21	0.15	0.17	0.09	0.08	0.10	0.22	0.10	0.18	0.07	0.12	0.09	0.14
Poison ivy	0.49	0.37	0.28	0.20	0.14	0.12	0.11	0.12	0.11	0.09	0.08	0.11	0.09	0.13	- -
Coralberry	0.31	0.25	0.16	0.14	0.15	0.12	0.12	0.16	0.18	0.10	0.10	0.13	0.12	0.14	- -
Roughleaf dogwood	0.41	0.37	0.22	0.28	0.25	0.26	0.22	0.21	0.19	0.20	0.10	0.11	0.11	0.16	0.18
Black oak	0.43	0.24	0.17	0.10	0.15	0.12	0.11	0.10	0.10	0.09	0.09	0.11	0.10	0.12	- -
Post oak	0.29	0.21	0.11	0.11	0.13	0.11	0.11	0.11	0.16	0.13	0.09	0.09	0.11	0.11	0.12
Greenbrier	0.47	0.29	0.17	0.11	0.10	0.09	0.11	0.10	0.11	0.12	0.12	0.11	0.12	0.10	0.13
Osage orange	0.54	0.47	0.24	0.11	0.14	0.13	0.13	0.12	0.19	0.11	0.11	0.19	0.13	0.13	- -
Chickasaw plum	0.22	0.18	0.14	0.13	0.13	0.10	0.10	0.08	0.11	0.11	0.07	0.08	0.09	0.10	0.11
Chittamwood	0.34	0.10	0.16	0.12	0.12	0.09	0.11	0.13	0.16	0.11	0.10	0.10	0.12	0.08	0.11
Winged elm	0.38	0.21	0.16	0.14	0.18	0.13	0.12	0.20	0.15	0.13	0.14	0.15	0.12	0.13	- -
Hackberry	0.41	0.29	0.18	0.18	0.18	0.14	0.19	0.13	0.13	0.11	0.11	0.09	0.11	0.07	0.13
Texas prickly ash	0.50	0.37	0.20	0.17	0.23	0.32	0.13	0.14	0.20	0.12	0.14	0.14	0.09	0.12	0.14

2000 *Continued*

	April		May		June		July		Aug		Sept		Oct		Nov
Magnesium															
Smooth sumac	0.15	0.13	0.15	0.14	0.18	0.11	0.10	0.16	0.22	0.17	0.21	0.14	0.17	0.14	0.15
Poison ivy	0.23	0.30	0.35	0.37	0.28	0.32	0.36	0.33	0.41	0.29	0.36	0.34	0.35	0.31	- -
Coralberry	0.26	0.26	0.31	0.32	0.29	0.25	0.31	0.24	0.28	0.32	0.25	0.33	0.33	0.24	- -
Roughleaf dogwood	0.36	0.52	0.43	0.43	0.43	0.50	0.47	0.41	0.42	0.42	0.22	0.22	0.38	0.41	0.34
Black oak	0.29	0.32	0.36	0.36	0.38	0.40	0.37	0.44	0.39	0.38	0.38	0.01	0.41	0.40	- -
Post oak	0.25	0.23	0.29	0.26	0.21	0.26	0.29	0.29	0.23	0.16	0.15	0.17	0.30	0.19	0.16
Greenbrier	0.14	0.16	0.22	0.20	0.19	0.19	0.29	0.31	0.23	0.26	0.32	0.30	0.19	0.24	0.34
Osage orange	0.27	0.37	0.33	0.26	0.43	0.39	0.38	0.39	0.33	0.29	0.28	0.30	0.32	0.21	- -
Chickasaw plum	0.22	0.24	0.31	0.27	0.32	0.37	0.44	0.45	0.48	0.36	0.39	0.35	0.42	0.42	0.41
Chittamwood	0.21	0.23	0.40	0.29	0.30	0.29	0.32	0.25	0.33	0.25	0.17	0.17	0.18	0.16	0.19
Winged elm	0.29	0.26	0.22	0.27	0.22	0.20	0.30	0.28	0.26	0.26	0.25	0.24	0.24	0.25	- -
Hackberry	0.43	0.52	0.40	0.45	0.38	0.42	0.62	0.44	0.50	0.50	0.39	0.45	0.37	0.44	0.33
Texas prickly ash	0.25	0.28	0.34	0.32	0.31	0.34	0.61	0.52	0.76	0.40	0.74	0.78	0.70	0.55	0.35
Potassium															
Smooth sumac	2.18	1.82	1.52	1.01	1.12	1.66	1.15	1.21	1.40	0.90	0.98	0.89	1.13	1.09	1.21
Poison ivy	1.57	1.68	1.20	1.34	1.18	0.97	0.93	0.95	0.62	0.79	0.89	1.15	0.67	0.57	- -
Coralberry	1.71	1.23	1.70	2.53	1.39	1.98	0.86	1.42	1.25	0.77	1.02	1.07	1.25	1.14	- -
Roughleaf dogwood	1.14	1.06	0.98	1.31	0.96	0.80	0.82	0.68	0.87	0.71	0.55	0.84	0.44	0.64	0.42
Black oak	1.50	1.15	0.80	0.79	0.81	0.80	0.77	0.62	0.58	0.52	0.60	0.63	0.62	0.76	- -
Post oak	1.32	1.27	0.80	0.84	0.49	0.53	0.66	0.66	0.78	0.49	0.45	0.44	1.34	0.64	0.62
Greenbrier	2.61	1.50	2.13	1.85	1.03	1.30	1.74	2.02	1.02	1.63	1.21	1.27	0.52	1.64	1.27
Osage orange	2.33	1.34	2.06	0.84	1.43	1.31	1.38	1.15	2.56	0.90	0.94	1.23	0.62	1.09	- -
Chickasaw plum	1.06	2.32	1.33	1.14	1.07	1.22	1.01	1.21	1.11	1.45	1.17	1.27	1.13	1.30	0.98
Chittamwood	1.60	1.50	1.54	0.97	0.67	0.73	0.60	0.73	0.88	0.39	0.47	0.49	0.67	0.72	0.50
Winged elm	1.33	1.95	1.21	0.98	0.84	1.10	0.76	0.94	0.97	0.58	0.65	1.03	1.00	0.38	- -
Hackberry	1.48	2.99	1.27	1.93	1.34	1.00	0.99	1.07	0.88	1.14	0.89	0.56	0.87	0.54	0.30
Texas prickly ash	1.78	1.22	3.14	2.19	1.82	2.32	1.58	1.71	1.45	1.78	1.10	1.30	0.88	1.46	1.56

Appendix Table 2. Monthly CP, TDN, P, Ca, K and Mg for Forbs in 1999 and 2000

1999

	April	May	June	July	Aug	Sept	Oct	Nov
Crude Protein								
Western ragweed	- -	- -	17.3	13.5	11.1	10.4	15.4	14.7
Giant ragweed	- -	- -	37.8	34.8	19.1	23.1	21.7	19.7
Mare's tail	- -	- -	14.4	14.7	13.7	14.6	14.5	8.6
Three-seeded mercury	- -	- -	12.7	10.2	9.7	11.2	16.7	12.2
Tropic croton	- -	- -	19.7	19.6	17.1	16.4	17.2	14.7
Illinois bundleflower	- -	- -	23.4	25.8	14.3	- -	- -	- -
Partridge pea	- -	- -	22.4	20.7	18.9	15.8	14.4	- -
Tick clover spp.	- -	- -	20.2	16.5	13.2	13.8	- -	- -
Lespedeza spp.	- -	- -	13.4	12.4	10.3	12.8	13.3	- -
Trailing wild bean	- -	- -	19.3	16.3	15.7	14.4	- -	- -
Carolina snailseed	- -	- -	10.2	12.2	7.9	6.3	12.0	12.4
Yellow wood sorrel	- -	- -	18.5	14.7	14.9	- -	- -	- -
TDN								
Western ragweed	- -	- -	81.4	80.8	75.5	77.7	79.6	76.3
Giant ragweed	- -	- -	88.8	82.3	78.5	85.4	76.6	70.9
Mare's tail	- -	- -	73.9	63.3	70.6	78.2	67.9	57.9
Three-seeded mercury	- -	- -	77.6	82.2	86.1	83.8	80.9	68.9
Tropic croton	- -	- -	66.1	77.5	77.3	80.9	66.7	61.2
Illinois bundleflower	- -	- -	89.7	83.0	86.4	- -	- -	- -
Partridge pea	- -	- -	75.6	73.5	79.4	90.1	74.9	- -
Tick clover spp.	- -	- -	59.9	67.0	62.7	69.9	- -	- -
Lespedeza spp.	- -	- -	63.1	63.6	63.8	66.7	65.8	- -
Trailing wild bean	- -	- -	68.1	60.9	66.2	76.6	- -	- -
Carolina snailseed	- -	- -	70.2	70.7	72.6	68.4	73.8	62.8
Yellow wood sorrel	- -	- -	72.3	75.3	63.2	- -	- -	- -

1999 *Continued*	April	May	June	July	Aug	Sept	Oct	Nov
Calcium								
Western ragweed	- -	- -	3.55	3.90	3.45	4.25	4.19	4.08
Giant ragweed	- -	- -	1.96	2.53	5.42	6.75	4.73	4.82
Mare's tail	- -	- -	1.30	1.30	1.57	1.58	1.10	1.37
Three-seeded mercury	- -	- -	2.46	1.64	1.43	1.72	1.69	1.43
Tropic croton	- -	- -	2.11	2.01	1.90	2.61	1.54	2.38
Illinois bundleflower	- -	- -	1.07	1.10	2.02	- -	- -	- -
Partridge pea	- -	- -	0.74	0.75	0.85	1.04	1.42	- -
Tick clover spp.	- -	- -	2.39	2.16	2.21	2.07	- -	- -
Lespedeza spp.	- -	- -	1.23	1.22	1.34	1.42	1.48	- -
Trailing wild bean	- -	- -	1.22	1.16	1.46	1.88	- -	- -
Carolina snailseed	- -	- -	1.39	2.13	2.08	1.51	2.09	1.89
Yellow wood sorrel	- -	- -	1.14	1.53	1.69	- -	- -	- -
Phosphorus								
Western ragweed	- -	- -	0.21	0.23	0.12	0.26	0.17	0.16
Giant ragweed	- -	- -	0.48	0.47	0.40	0.40	0.43	0.44
Mare's tail	- -	- -	0.36	0.33	0.18	0.21	0.25	0.09
Three-seeded mercury	- -	- -	0.36	0.18	0.12	0.15	0.22	0.17
Tropic croton	- -	- -	0.40	0.23	0.19	0.17	0.22	0.18
Illinois bundleflower	- -	- -	0.27	0.23	0.08	- -	- -	- -
Partridge pea	- -	- -	0.21	0.11	0.12	0.10	0.14	- -
Tick clover spp.	- -	- -	0.17	0.11	0.08	0.10	- -	- -
Lespedeza spp.	- -	- -	0.12	0.11	0.09	0.13	0.11	- -
Trailing wild bean	- -	- -	0.21	0.17	0.14	0.11	- -	- -
Carolina snailseed	- -	- -	0.32	0.15	0.25	0.23	0.37	0.12
Yellow wood sorrel	- -	- -	0.63	0.17	0.16	- -	- -	- -
Magnesium								
Western ragweed	- -	- -	0.73	0.67	0.88	0.50	0.64	0.48
Giant ragweed	- -	- -	1.02	1.20	2.16	1.85	1.02	1.37
Mare's tail	- -	- -	0.30	0.31	0.32	0.33	0.26	0.29
Three-seeded mercury	- -	- -	0.30	0.24	0.21	0.24	0.28	0.27
Tropic croton	- -	- -	0.46	0.38	0.31	0.49	0.32	0.49
Illinois bundleflower	- -	- -	0.40	0.65	0.17	- -	- -	- -
Partridge pea	- -	- -	0.22	0.13	0.14	0.15	0.18	- -
Tick clover spp.	- -	- -	0.32	0.21	0.19	0.23	- -	- -
Lespedeza spp.	- -	- -	0.27	0.22	0.25	0.24	0.23	- -
Trailing wild bean	- -	- -	0.29	0.28	0.27	0.30	- -	- -
Carolina snailseed	- -	- -	0.20	0.20	0.20	0.18	0.18	0.21
Yellow wood sorrel	- -	- -	0.34	0.42	0.53	- -	- -	- -
Potassium								
Western ragweed	- -	- -	2.66	2.45	2.00	2.19	2.36	1.98
Giant ragweed	- -	- -	3.06	2.85	1.58	1.90	2.28	1.60
Mare's tail	- -	- -	5.00	4.47	3.50	3.36	2.23	1.30
Three-seeded mercury	- -	- -	1.64	1.08	0.80	0.96	0.95	0.92
Tropic croton	- -	- -	2.69	2.32	1.78	1.32	1.96	1.76
Illinois bundleflower	- -	- -	1.31	1.18	0.43	- -	- -	- -
Partridge pea	- -	- -	1.16	0.83	0.79	0.69	0.65	- -
Tick clover spp.	- -	- -	1.03	0.59	0.68	0.94	- -	- -
Lespedeza spp.	- -	- -	0.55	0.58	0.50	0.82	2.27	- -
Trailing wild bean	- -	- -	1.30	1.27	0.91	0.87	- -	- -
Carolina snailseed	- -	- -	2.35	1.76	1.77	1.99	1.64	1.95
Yellow wood sorrel	- -	- -	3.51	2.99	2.06	- -	- -	- -

2000	Apr	May	June	July	Aug	Sept	Oct	Nov
Crude Protein								
Western ragweed	28.2	20.5	20.1	12.4	12.1	15.9	10.4	18.0
Giant ragweed	26.5	33.3	24.0	24.2	22.5	14.2	17.9	- -
Mare's tail	19.3	18.7	15.8	12.7	- -	- -	- -	- -

	2000 *Continued*							
	April	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**
Three-seeded mercury	13.2	14.0	14.9	- -	- -	- -	- -	- -
Tropic croton	- -	17.4	23.6	14.9	18.3	- -	- -	- -
Illinois bundleflower	35.1	26.2	22.4	18.9	12.8	- -	- -	- -
Partridge pea	- -	- -	19.4	20.1	17.1	15.0	14.9	- -
Tick clover spp.	25.2	20.7	17.9	15.3	14.4	12.1	- -	- -
Lespedeza spp.	19.4	16.0	16.0	13.2	12.5	9.9	- -	- -
Trailing wild bean	- -	- -	17.9	15.8	11.2	- -	- -	- -
Carolina snailseed	21.1	17.3	12.8	10.8	9.6	10.3	8.9	- -
Yellow wood sorrel	19.0	15.4	17.8	- -	- -	- -	- -	- -
TDN								
Western ragweed	78.9	77.2	81.2	81.2	76.8	81.5	79.9	78.7
Giant ragweed	83.2	84.5	82.2	79.7	81.7	77.3	71.6	- -
Mare's tail	53.7	78.4	60.1	71.0	- -	- -	- -	- -
Three-seeded mercury	67.8	78.6	75.4	- -	- -	- -	- -	- -
Tropic croton	- -	73.6	69.7	72.3	73.0	- -	- -	- -
Illinois bundleflower	89.6	81.4	85.6	82.3	77.4	- -	- -	- -
Partridge pea	- -	- -	77.2	80.7	76.6	79.8	80.5	- -
Tick clover spp.	90.4	70.3	61.7	64.8	65.8	62.1	- -	- -
Lespedeza spp.	71.6	68.9	65.2	67.2	65.5	66.0	- -	- -
Trailing wild bean	- -	- -	64.5	61.1	57.2	- -	- -	- -
Carolina snailseed	83.3	74.7	69.9	70.8	71.1	74.4	76.7	- -
Yellow wood sorrel	67.2	63.7	54.0	- -	- -	- -	- -	- -
Calcium								
Western ragweed	2.47	2.87	3.74	3.63	3.14	4.64	3.43	3.54
Giant ragweed	2.13	1.74	4.96	4.60	6.15	4.63	4.02	- -
Mare's tail	1.58	1.00	1.02	1.57	- -	- -	- -	- -
Three-seeded mercury	0.99		1.66	- -	- -	- -	- -	- -
Tropic croton	- -	1.88	1.64	1.62	1.48	- -	- -	- -
Illinois bundleflower	0.79	0.80	1.15	1.20	1.63	- -	- -	- -
Partridge pea	- -	- -	0.76	0.93	0.96	1.06	1.20	- -
Tick clover spp.	1.00	1.48	1.79	1.87	1.78	1.96	- -	- -
Lespedeza spp.	0.73	1.23	1.39	1.17	1.51	1.43	- -	- -
Trailing wild bean	- -	- -	1.05	1.18	1.01	- -	- -	- -
Carolina snailseed	0.90	1.07	1.42	1.80	1.49	1.74	1.50	- -
Yellow wood sorrel	1.20	1.06	1.15	- -	- -	- -	- -	- -
Phosphorus								
Western ragweed	0.39	0.26	0.24	0.20	0.14	0.19	0.17	0.19
Giant ragweed	0.52	0.34	0.40	0.41	0.33	0.34	0.40	- -
Mare's tail	0.60	0.30	0.21	0.17	- -	- -	- -	- -
Three-seeded mercury	0.25		0.20	- -	- -	- -	- -	- -
Tropic croton	- -	0.17	0.23	0.26	0.25	- -	- -	- -
Illinois bundleflower	0.41	0.25	0.21	0.15	0.11	- -	- -	- -
Partridge pea	- -	- -	0.18	0.16	0.15	0.09	0.11	- -
Tick clover spp.	0.34	0.22	0.15	0.13	0.17	0.11	- -	- -
Lespedeza spp.	0.25	0.16	0.15	0.12	0.13	0.10	- -	- -
Trailing wild bean	- -	- -	0.20	0.16	0.10	- -	- -	- -
Carolina snailseed	0.46	0.33	0.31	0.30	0.44	0.31	0.28	- -
Yellow wood sorrel	0.17	0.27	0.24	- -	- -	- -	- -	- -
Magnesium								
Western ragweed	0.56	0.80	0.77	0.72	0.57	0.76	0.57	0.62
Giant ragweed	0.52	0.68	1.56	1.28	1.95	2.35	1.40	- -
Mare's tail	0.30	0.34	0.30	0.43	- -	- -	- -	- -
Three-seeded mercury	0.25		0.28	- -	- -	- -	- -	- -
Tropic croton	- -	0.44	0.44	0.43	0.37	- -	- -	- -
Illinois bundleflower	0.39	0.18	0.44	0.67	0.74	- -	- -	- -
Partridge pea	- -	- -	0.17	0.18	0.11	0.14	0.15	- -
Tick clover spp.	0.31	0.31	0.32	0.26	0.22	0.23	- -	- -
Lespedeza spp.	0.25	0.25	0.32	0.21	0.40	0.19	- -	- -
Trailing wild bean	- -	- -	0.34	0.27	0.10	- -	- -	- -

	2000 *Continued*							
	April	**May**	**June**	**July**	**Aug**	**Sept**	**Oct**	**Nov**
Carolina snailseed	0.14	0.19	0.22	0.21	0.19	0.20	0.21	- -
Yellow wood sorrel	0.45	0.43	0.45	- -	- -	- -	- -	- -
Potassium								
Western ragweed	3.83	3.62	2.36	2.73	2.69	1.22	2.15	2.10
Giant ragweed	4.07	3.35	2.27	2.82	1.52	2.12	1.44	- -
Mare's tail	4.31	4.55	2.95	2.01	- -	- -	- -	- -
Three-seeded mercury	1.39		1.09	- -	- -	- -	- -	- -
Tropic croton	- -	2.53	2.53	2.29	2.07	- -	- -	- -
Illinois bundleflower	1.51	1.21	1.02	1.13	0.81	- -	- -	- -
Partridge pea	- -	- -	1.00	0.80	0.72	0.51	0.68	- -
Tick clover spp.	1.52	1.25	0.99	0.79	0.98	0.91	- -	- -
Lespedeza spp.	1.40	0.77	0.54	0.97	0.70	0.67	- -	- -
Trailing wild bean	- -	- -	1.73	1.34	0.90	- -	- -	- -
Carolina snailseed	1.66	2.34	2.07	1.62	2.13	1.53	1.78	- -
Yellow wood sorrel	1.67	3.11	2.15	- -	- -	- -	- -	- -

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Appendix Photographs for the Woody Plants Sampled

Smooth sumac

Poison ivy

Coralberry

Roughleaf dogwood

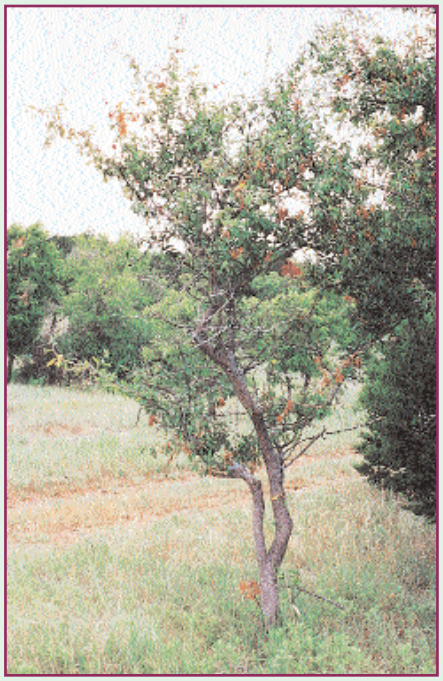
Black oak

Post oak

GREENBRIER

OSAGE ORANGE

CHICKASAW PLUM



CHITTAMWOOD

WINGED ELM

HACKBERRY

Appendix Photographs for the Forbs Sampled

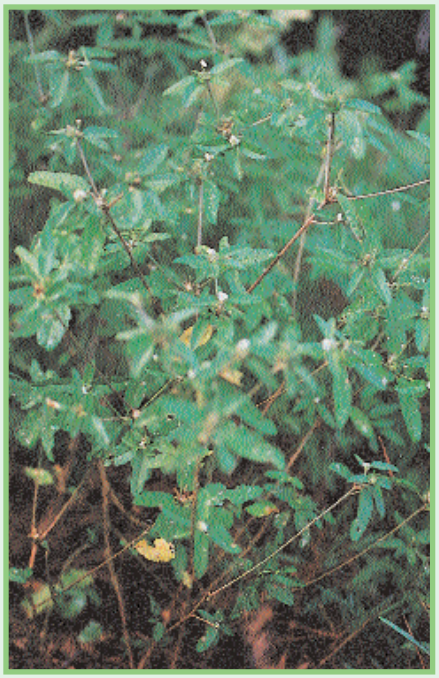
Texas prickly ash

Western ragweed

Giant ragweed

Mare's tail

Three-seeded mercury



Tropic croton

Illinois bundleflower

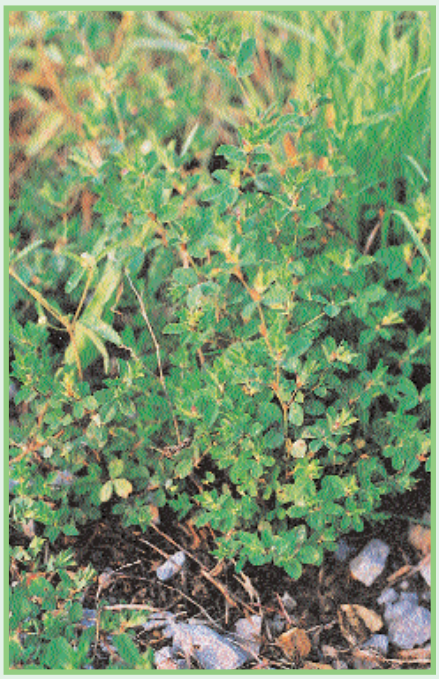
Partridge pea

Hoary Tick Clover

Sessile Tick Clover

Maryland Tick Clover

Slender Lespedeza



Korean Lespedeza

Creeping Lespedeza

Trailing wild bean

Carolina snailseed

Yellow wood sorrel