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Nutritional Value of South Texas Deer Food Plants

L. W. VARNER, L. H. BLANKENSHIP, AND
S. C. HEINEMAN

Summary

Thirty-six native forage plants known to be eaten by deer were collected monthly in the Texas Rio Grande Plain. Samples were separated into leaf, stem, and fruit (when available) components and analyzed for crude protein (CP), phosphorus (P), and dry matter digestibility (DMD). Nutritive value of all species followed a bimodal pattern during the year with peaks in quality during April and May with another lesser peak in September and October. Forage quality was lowest during January and February with another low period in late summer. As a class, forbs were generally higher in quality than browse. DMD of forbs was never below 55 percent while some browse species were less than 30 percent during some seasons of the year. CP content of forb leaves varied from 11 percent (*Euphorbia sp.* in August) to 40 percent (*Desmanthus virgatus* in May). Mean CP of leaves of all forb species averaged 16 percent or greater during all months of the year. Mean CP of leaves of browse species was 14 percent or greater during all seasons of the year. Among the browse species, *Celtis pallida* was the highest in overall quality with annual mean values of 73.3, 23.8, and 0.18 percent for DMD, CP, and P, respectively. *Acacia rigidula* was lowest in DMD of all species averaging 31.4 percent for the entire year. Fruits of browse species generally were available only during the summer months and with the exception of *A. berlandieri* and *Eysenhardtia texana* were less than 21 percent CP and 0.30 percent. These data demonstrate that for deer, CP content of South Texas plants appears adequate throughout the year. However, during certain months of the year, energy and P may be limiting nutrients for deer as evidenced by the low DMD and P content of many plants.

KEYWORDS: Texas Rio Grande Plain/forage plants/nutritive value/deer food/dry matter digestibility/crude protein/phosphorus.

Introduction

The white-tailed deer (*Odocoileus virginianus*) is the most widely recognized and economically important large game species in North America (Taylor, 1956). The management of this species has become more intensive in the last 10 years, particularly in Texas. Increased management intensity necessitates a greater knowledge of the habitat, since forage quality and quantity largely determine the optimum carrying capacity of any white-tailed deer range (Moen, 1973; Robbins, 1973). A healthy, productive deer herd depends upon a year-round availability of a sufficient quantity of nutrients. Studies have been conducted for the past 10 years at the Texas Agricultural Experiment Station, Uvalde, Texas (Blankenship et al., 1982; Varner, 1981; Varner and Blankenship, 1976) to determine the nutritional composition of South Texas deer food plants.

Procedure

Important deer food plants were determined from published information (Chamrad and Box, 1968; Drawe, 1968; Everitt, 1972) and from microhistological analysis of deer rumen contents and feces collected during the seasons of the year. Plants were collected monthly when available; however, some data are reported on a seasonal basis.

Care was taken to sample only the current years' growth or, in the case of winter collections, that from the previous growing season. Approximately 1.5 inches of the tips of shrub twigs were clipped. Analyses reported in this paper are DMD-estimated by the in vitro technique (Newman, 1972), CP (Lauber, 1976) and P (Kallner, 1975). Plant species were collected in three areas of South Texas: (1) Rio Grande Plain Experimental Ranch in Kinney and Maverick Counties, (2) Chaparrosa Ranch in Zavala County, and (3) Chaparral Wildlife Management Area in Dimmit and LaSalle Counties. Scientific name, common name, and a code for all species reported are shown in Table 1. In the succeeding discussion, figures and tables, plants will be idenfified by their species code.

Results and Discussion

Dry Matter Digestibility

On a seasonal basis, DMD of all species was greater in spring and fall than either summer or winter (Table 2).

TABLE 1. NAME AND TYPE OF SOUTH TEXAS DEER FOOD PLANTS

Code	Scientific Name	Common Name	Type
ACBE	*Acacia berlandieri*	Guajillo	Browse
ACGR	*Acacia greggii*	Catclaw	Browse
ACMO	*Acalypha monostachya*	Copperleaf	Forb
ACRI	*Acacia rigidula*	Blackbrush	Browse
ACTO	*Acacia tortuosa*	Twisted acacia	Browse
AMPS	*Ambrosia psilostachya*	Western ragweed	Forb
APRA	*Aphanostephus ramossissimus*	Plains dozedaisy	Forb
BUCE	*Bumelia celastrina*	Coma	Browse
CEPA	*Celtis pallida*	Granjeno	Browse
CEIN	*Cenchrus incertus*	Grassbur	Grass
CHCU	*Chloris cucullata*	Hooded windmillgrass	Grass
COTE	*Colubrina texensis*	Texas colubrina	Browse
COER	*Commelina erecta*	Dayflower	Forb
COOB	*Condalia obovata*	Brazil	Browse
COBT	*Condalia obtusifolia*	Lotebush	Browse
CONU	*Coreposis nuecensis*	Crown coreopsis	Forb
DEVI	*Desmanthus virgatus*	Bundleflower	Forb
DITE	*Diospyros texana*	Texas persimmon	Browse
EPAN	*Ephedra antisyphlitica*	Vine ephedra	Browse
EUSP	*Euphorbia sp.*	Euphorbia	Forb
EYTE	*Eysenhardtia texana*	Kidneywood	Browse
GAPU	*Gaillardia pulchella*	Indian blanket	Forb
HETE	*Hermannia texana*	Texas hermannia	Forb
KRRA	*Krameria ramossissima*	Krameria	Browse
OPLI	*Opuntia lindheimeri*	Texas pricklypear	Browse
PAHA	*Panicum hallii*	Hall's panicum	Grass
PAHY	*Parthenium hysterophorus*	False ragweed	Forb
PHVI	*Physalis viscosa*	Groundcherry	Forb
POAN	*Porlieria angustifolia*	Guayacan	Browse
PRGL	*Prosopis glandulosa*	Honey mesquite	Browse
SCCU	*Schaefferia cuneifolia*	Desert yaupon	Browse
SEMA	*Setaria macrostachya*	Plains bristlegrass	Grass
SIFI	*Sida filicaulis*	Spreading sida	Forb
SICA	*Simsia calva*	Bushsunflower	Forb
THTE	*Thamnosma texana*	Dutchman's britches	Forb
VIST	*Viguiera stenoloba*	Skeletonleaf goldeneye	Browse
ZAFA	*Zanthoxylum fagara*	Lime pricklyash	Browse

OPLI had the highest DMD of all species with a mean of 89.7 percent for the entire year. Forbs were higher in DMD than browse or grasses with an overall average of 70.0 percent compared to 48.9 percent and 51.5 percent for grasses and browse, respectively. COER and PHVI had the highest DMD (> 70 percent) during all seasons of the year. Forbs with the lowest DMD for spring, summer, fall, and winter, respectively, were PAHY (57.2 percent), AMPS (60.6 percent), HETE (66.2 percent), and APRA (52.4 percent). Among the browse species, ACRI and ACTO were the lowest in DMD (= > 37.0 percent) during all seasons of the year. CEPA, the most digestible of all browse species, was never less than 71 percent DMD with an overall mean for the year of 73.3 percent. The mean DMD of all browse species did not vary greatly throughout the year (54.5, 48.5, 51.0, and 49.9 percent for spring, summer, fall, and winter, respectively). The four grass species were highest in DMD in the spring (52.6 percent). CEIN and PAHA were generally higher in DMD than either CHCU or SEMA. Grasses were the lowest in mean DMD (48.9 percent) of all the plant classes although they were higher in DMD than some selected browse species (e.g., ACRI, ACTO, and ACBE).

Crude Protein

Monthly analysis of both forb and browse species show both leaves and stems to be potentially good sources of CP for deer (Figs. 1-3) (Figs. 1-7 on pages 70-75). CP was highest in forb leaves in April with DEVI and PHVI having 29.8 and 40.0 percent CP, respectively. CP was generally lowest in August and September with EUSP the lowest, averaging 11 percent for those 2 months. In addition, EUSP disappeared in November and was not found again until April. Of all the forbs, only AMPS was found throughout the entire year (Fig. 1). Several of the forb species that are highly preferred by deer (DEVI, PHVI, COER, SIFI) were found from December through April. Among browse species, CP leaves varied from a low 11 percent for SCCU in January to 40 percent for COBT in March (Fig. 2). CEPA leaves were among the highest in CP every month, averaging 23.6 percent for the entire year. During average winters many of the browse species (e.g., POAN, EPAN, ACRI, CEPA) will not lose their leaves. In general, even browse species that do defoliate will keep their leaves longer in the fall and leaves will appear earlier in late winter or early spring than forbs (Figs. 1 and 2).

TABLE 2. SEASONAL IN VITRO DRY MATTER DIGESTIBILITY OF SOUTH TEXAS DEER FOOD PLANTS

Species[1] code	Season				
	Spring	Summer	Fall	Winter	Mean
Browse					
ACBE	46.4	38.9	41.1	35.5	40.5
ACGR	62.2	36.7	42.0	47.3	47.0
ACRI	34.1	29.0	37.0	25.6	31.4
ACTO	32.9	36.9	31.9	28.0	32.4
BUCE	47.9	47.0	47.7	40.3	45.7
CEPA	71.7	73.3	75.2	73.0	73.3
COOB	61.4	42.3	47.8	60.4	53.0
COBT	47.7	50.7	38.8	44.4	45.4
EPAN	66.4	54.4	57.5	61.2	60.4
EYTE	62.4	60.2	49.8	54.1	56.6
POAN	58.0	56.6	60.2	54.9	57.4
SCCU	61.4	56.0	58.8	55.5	57.9
ZNFA	56.2	48.1	73.2	69.3	61.7
Mean	54.5	48.5	51.0	49.9	51.5
Forbs					
AMPS	64.9	60.6	69.5	67.7	65.7
APRA	68.0	65.4	85.3	52.4	67.8
COER	82.7	71.5	75.3	—	76.5
CONU	73.0	—	81.8	53.2	69.3
GAPU	68.7	68.0	90.7	60.5	72.0
HETE	74.3	64.5	66.2	—	68.3
PAHY	57.2	60.8	68.4	65.9	63.0
PHVI	74.5	77.9	78.7	78.6	77.4
Mean	70.4	66.9	77.0	63.1	70.0
Grass					
CEIN	58.7	57.1	54.4	48.0	54.5
CHCU	45.3	37.8	49.5	45.8	44.6
PAHA	59.6	37.7	49.2	50.4	49.2
SEMA	47.0	43.5	51.8	46.9	47.3
Mean	52.6	44.0	51.2	47.8	48.9
Cactus					
OPLI	94.8	86.8	90.5	86.8	89.7
Overall Mean	61.2	55.3	61.8	55.0	58.4

[1]See Table 1.

Stems of both forbs and browse species were lower in CP than leaves (Fig. 3) averaging approximately 60 percent the CP level of the leaves. Fruits of browse species were found only during the summer period and varied widely in CP. OPLI and DITE were lowest (6 percent) while ACBE and EYTE were highest (>21 percent). Grasses were generally lower in CP than either forbs or browse (Fig. 5). Mean CP of four grass species was highest at 12.2 and 14.3 percent for spring and fall, respectively. Grasses averaged 11.8 and 8.8 percent for fall and winter.

Phosphorus

Soils in South Texas are generally low in P (Fisher, 1974). This is reflected in the P content of the vegetation (Figs. 4-6). Forb leaves averaged approximately 0.27 percent P while browse leaves averaged 0.22 percent (Fig. 6). Of the forbs, PHVI was the highest in P at 0.51 percent in April and THIE was the lowest at 0.16 percent in September. ACBE and CEPA were the highest in P of the browse species averaging > 0.35 percent in March and April. POAN was the lowest in P of all browse species during most months of the year with a mean of 0.14 percent for the entire year. With the exceptions of EYTE and ACBE (Fig. 4) fruit of browse was > 0.20 percent P. Mean P of four grass species was lowest in winter at 0.16 percent and highest in fall at 0.27 percent.

In addition to quality, both quantity and availability of forage during all seasons is important in the management of wildlife (Walmo et al., 1977). Plants that are very high in protein, such as COBT, with leaves that are 40 percent CP in March may not greatly impact on the total amount of nutrients available to deer. In March the end 3 cm of the twigs of COBT are approximately 30 percent leaves and 70 percent stems (Fig. 7) which are less nutritious than leaves (Sullivan, 1969). Therefore, not only the quality of a particular forage species but the quantity of leaves in relation to stems should be taken into consideration when determining which forage species are important to manage in order to maintain or improve the nutritional plane of deer.

Texas forage plants are generally highest in quality in the spring then gradually decrease in quality through the summer and fall, reaching their lowest value in the winter (Rector and Huston, 1976). Our results show that forage quality in South Texas follows a more bimodal pattern with two peaks of quality during the spring, early summer period and another peak in early fall. Periods of low forage quality were during the hot, dry summer and the winter. These changes in forage quality correspond to the average annual rainfall pattern in South Texas. However, if winter temperatures are mild and adequate moisture is available, forage in South Texas may actually grow throughout the winter. Since green forage is of higher quality than mature forage Sullivan, 1969), low forage quality during the winter may not always be the case. The close relationship between rainfall and forage quality must be considered in making management decisions.

Knowledge of deer food habits, nutritional quality of preferred species, and deer nutritional requirements is necessary to properly coordinate deer management with changes in the nutritional value of the habitat. Deer nutritional requirements are not well defined; however, more information is becoming available on nutrient requirements (Hughes et al., 1981 and 1982) and food habits (Blankenship and Varner, 1980; Varner and Blankenship, 1984) of South Texas deer. This information should allow wildlife managers to make more informed management decisions as more forage quality information becomes available.

Research has shown that CP needed for optimum growth is from 13-16 percent (French et. al., 1956; Ullrey et al., 1967) although actual requirement to maintain rumen function is probably 6-7 percent (Dietz, 1965). This study has shown that most browse and forb species in South Texas contained CP in amounts that would be adequate during all seasons of the year, particularly since deer are selective feeders and select a high percentage of leaves and tendershoots.

Verme and Ullrey (1972) repeated approximately 0.35 percent P was necessary to support maximum gain, bone strength, and antler development of white-tailed bucks. With the exception of a few plants (e.g., PHVI, CEPA, ACBE, SICA, AMPS) in early spring, few species in this study contained this level of P. It is possible that P may be a limiting nutrient in South Texas for maximum antler growth.

Digestible energy (DE) requirements of deer are not well known, particularly how requirements may be affected by physiological status and climatic changes. Since DMD is highly related to DE (Moir, 1961), it accurately reflects the DE content of forages. Based on what is known, DMD requirements for adult deer is probably about 50-55 percent of the diet for maintenance and about 65 percent for lactating does. Only a few browse species (OPLI, CEPA, POAN, EYTE) contained these levels of DMD throughout the year. Almost all the forb species had 50 percent or more DMD during all seasons of the year. Grasses had the lowest DMD levels of all forage types. During the summer, when forage quality may be at its lowest, does in South Texas are under peak lactational stress and bucks are in a period of maximum antler growth. The high DMD content OPLI may explain its high utilization in most reported South Texas deer food habit studies. While OPLI may be a good source of energy, it is deficient in CP and P during all seasons.

These data demonstrate that a diversity of plant species is necessary in a well managed deer habitat. No one plant appeared adequate in all nutrients evaluated during all months. It appears that both P and energy (DMD) could be deficient nutrients for deer in South Texas at certain times of the year. These deficiencies would be aggravated by an overpopulation of deer, which occurs in many parts of Texas, or by competition with sheep, goats, or cattle for preferred, high quality forage species. Livestock and range management practices must be integrated into the wildlife management plan to maintain deer on a high nutritional plane.

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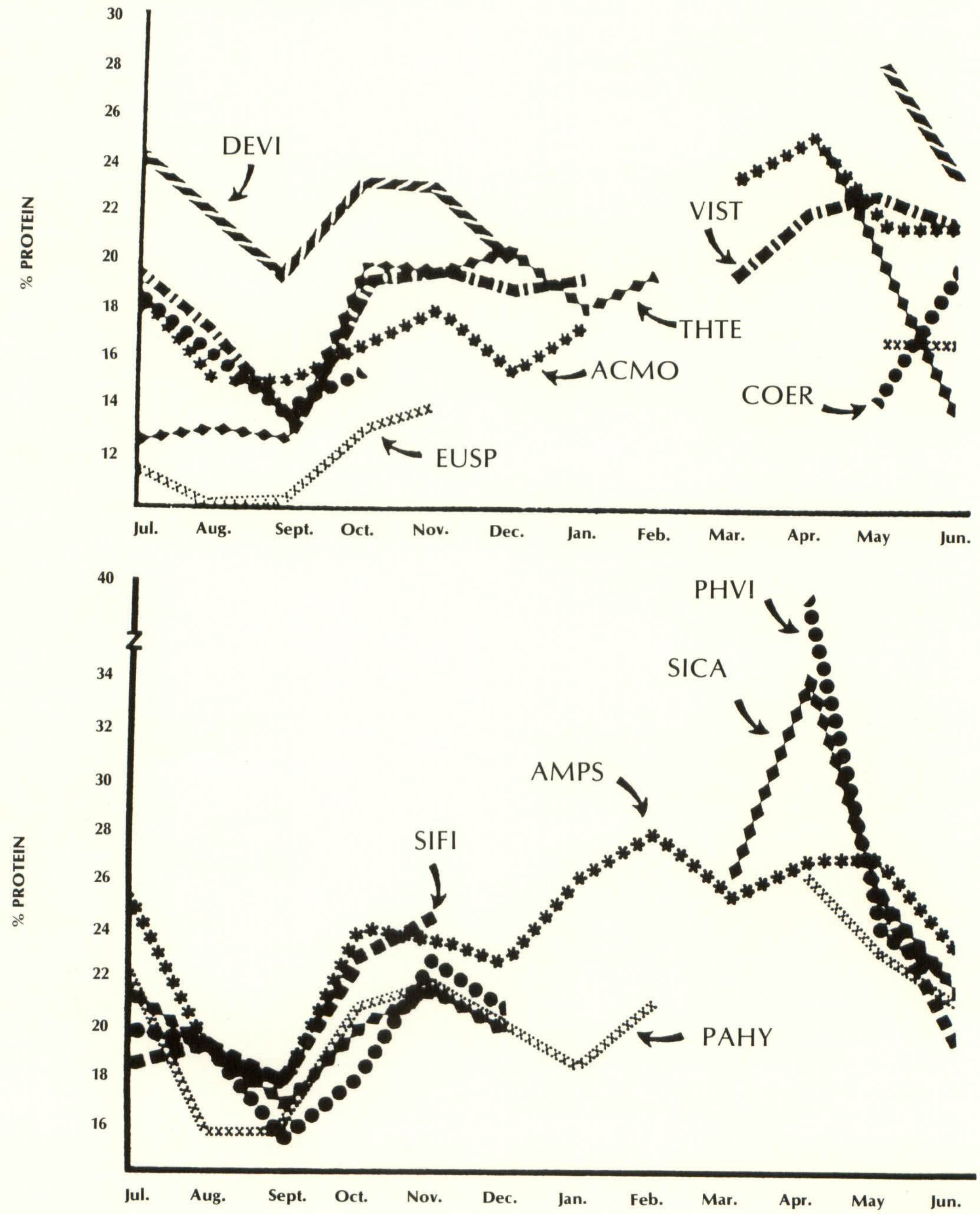
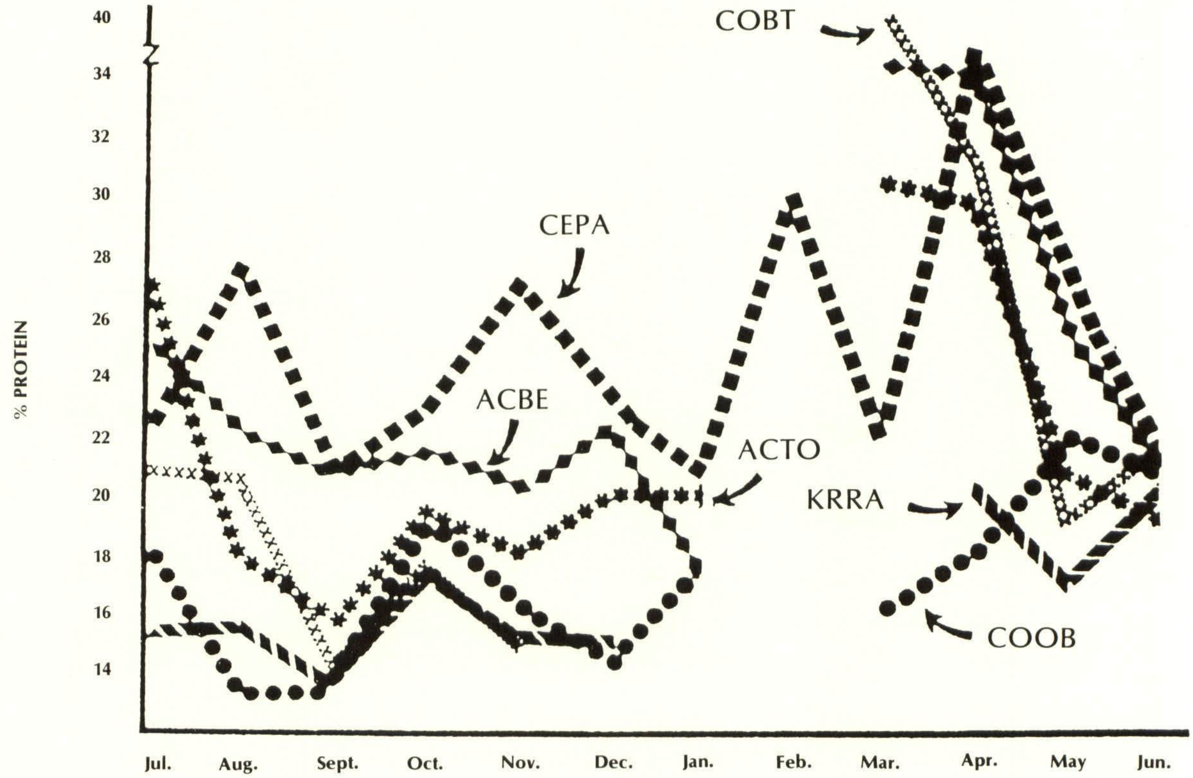


Figure 1. Monthly protein content of leaves of South Texas forb species (Species code listed in Table 1).



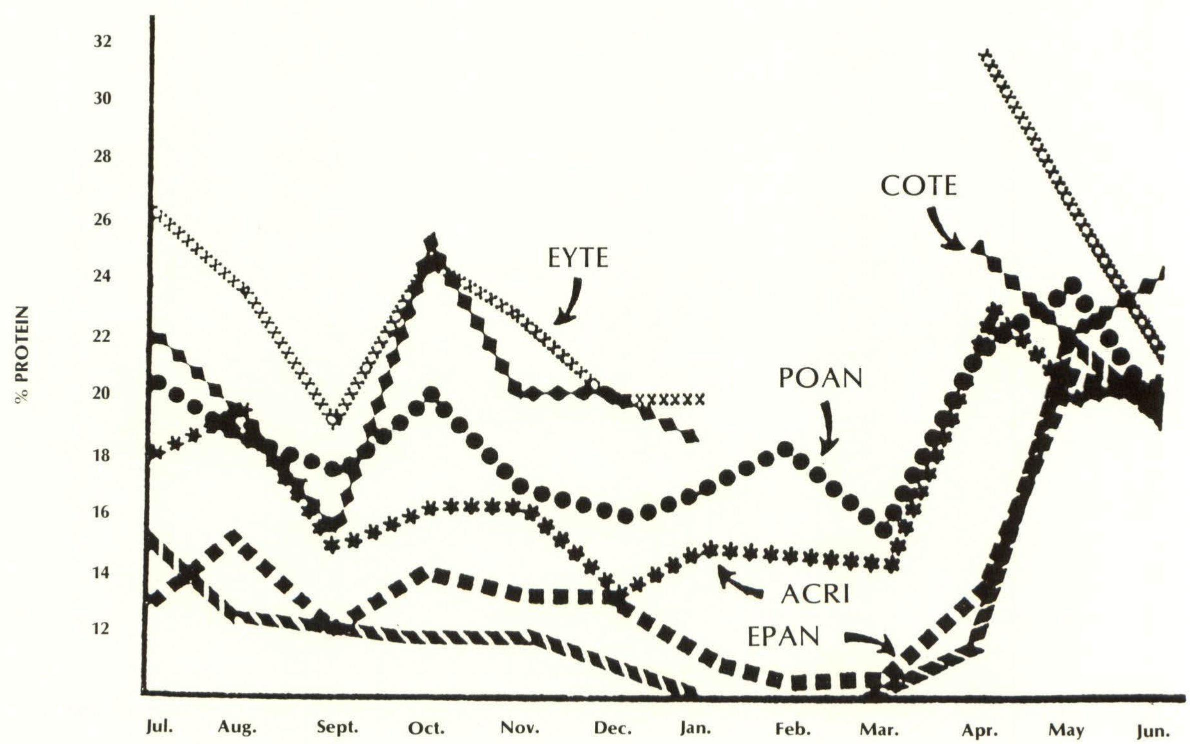
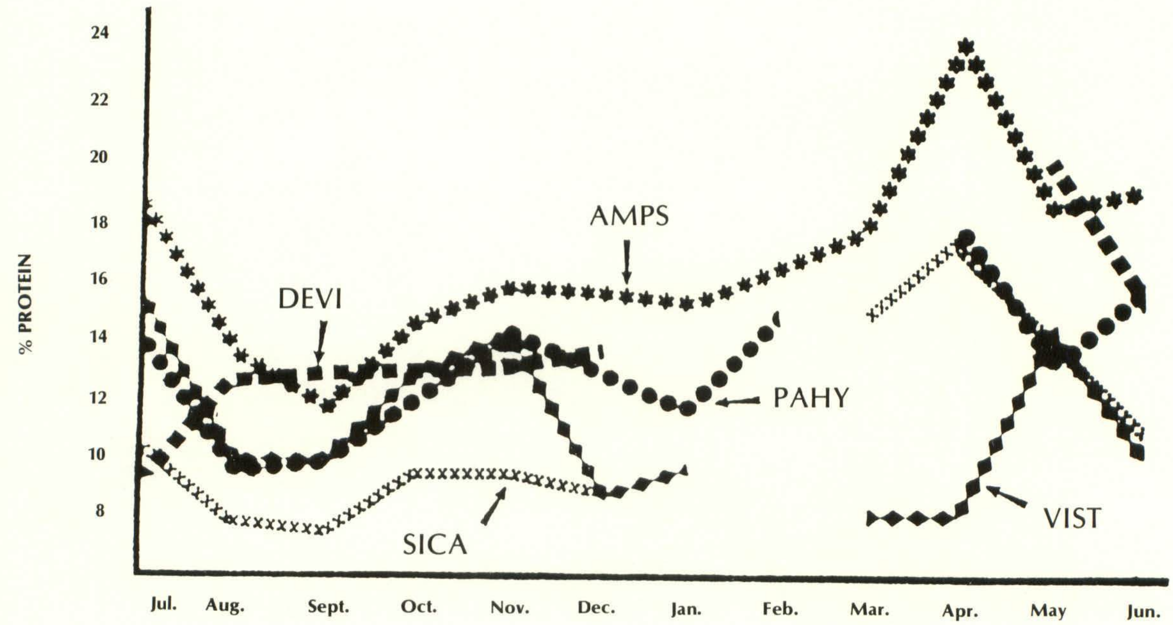


Figure 2. Monthly protein content of leaves of South Texas browse species (Species code listed in Table 1).



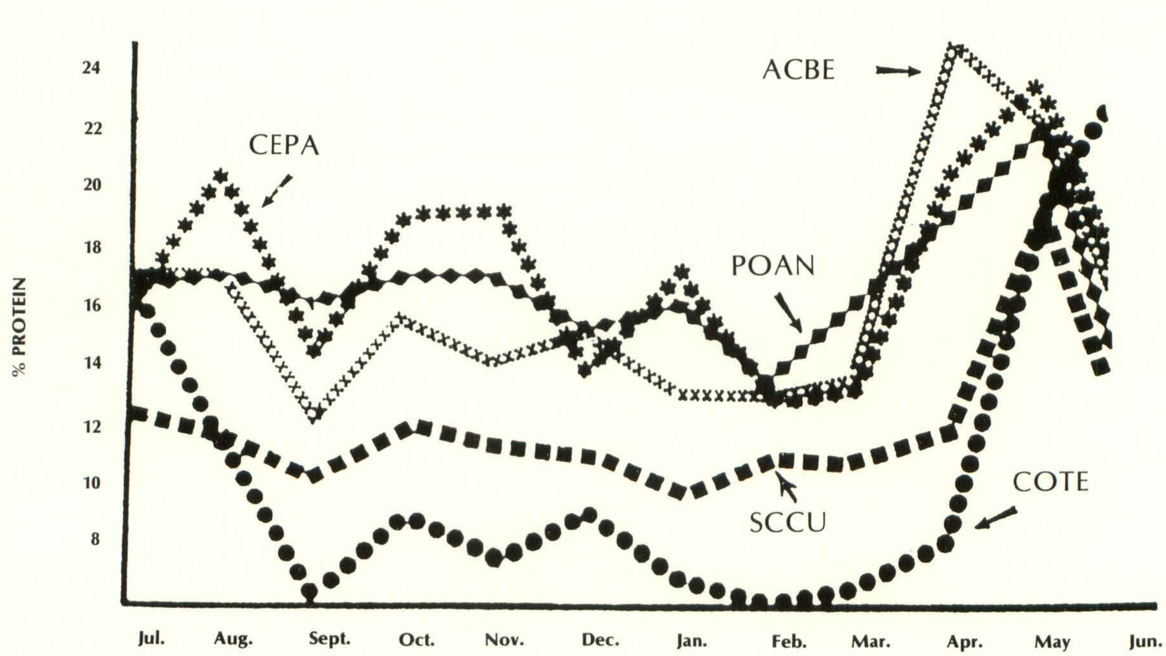


Figure 3. Monthly protein content of stems of South Texas forb (top) and browse (bottom) species (Species code listed in Table 1).

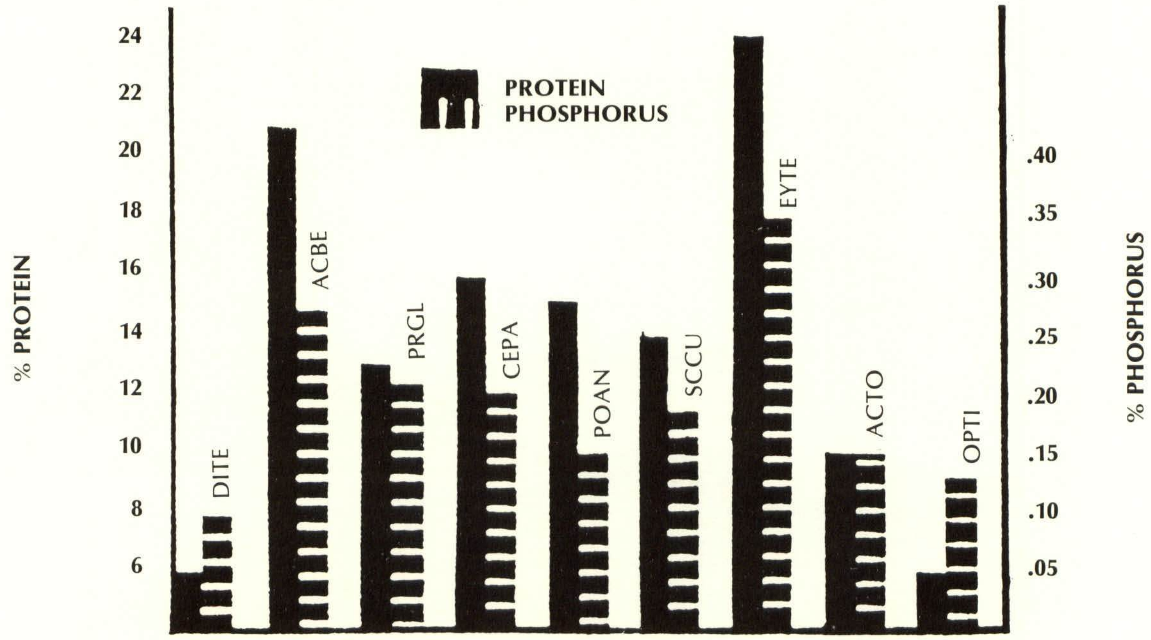


Figure 4. Protein and phosphorus content of fruit of South Texas browse species (Species code listed in Table 1).

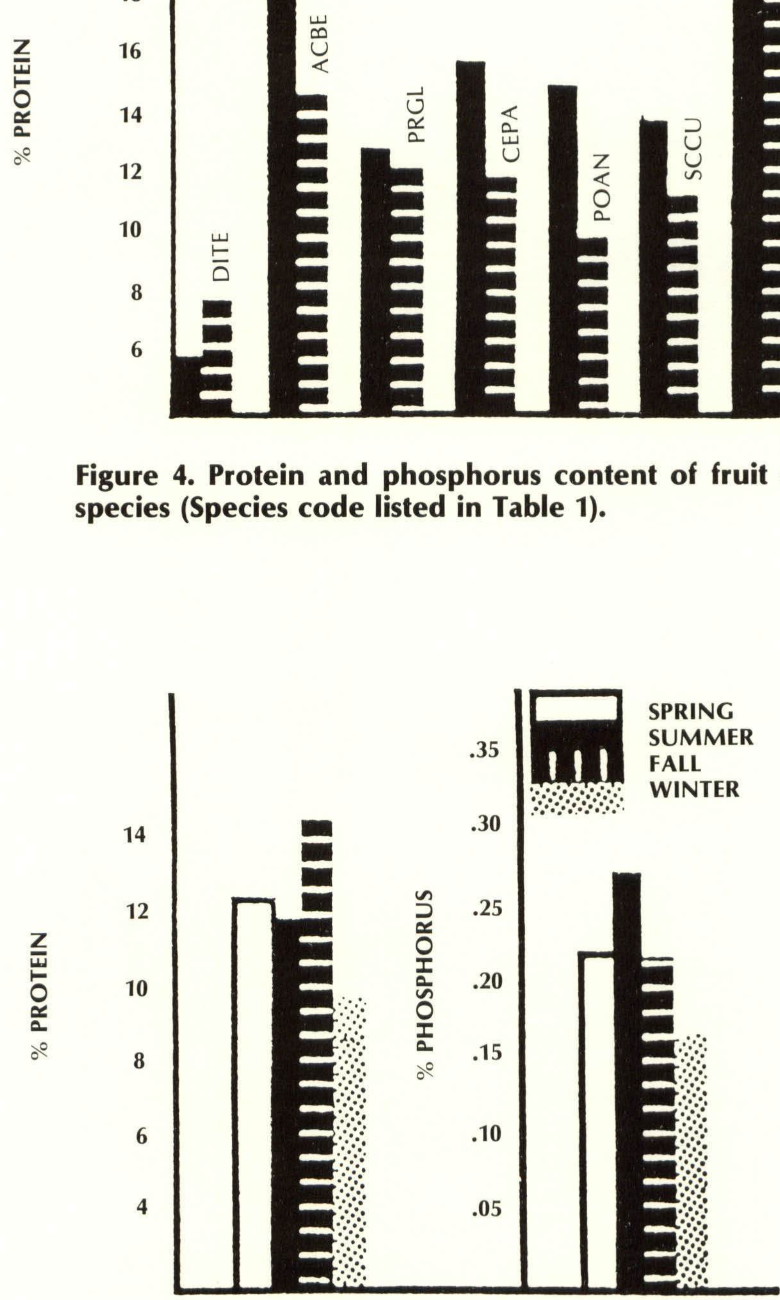
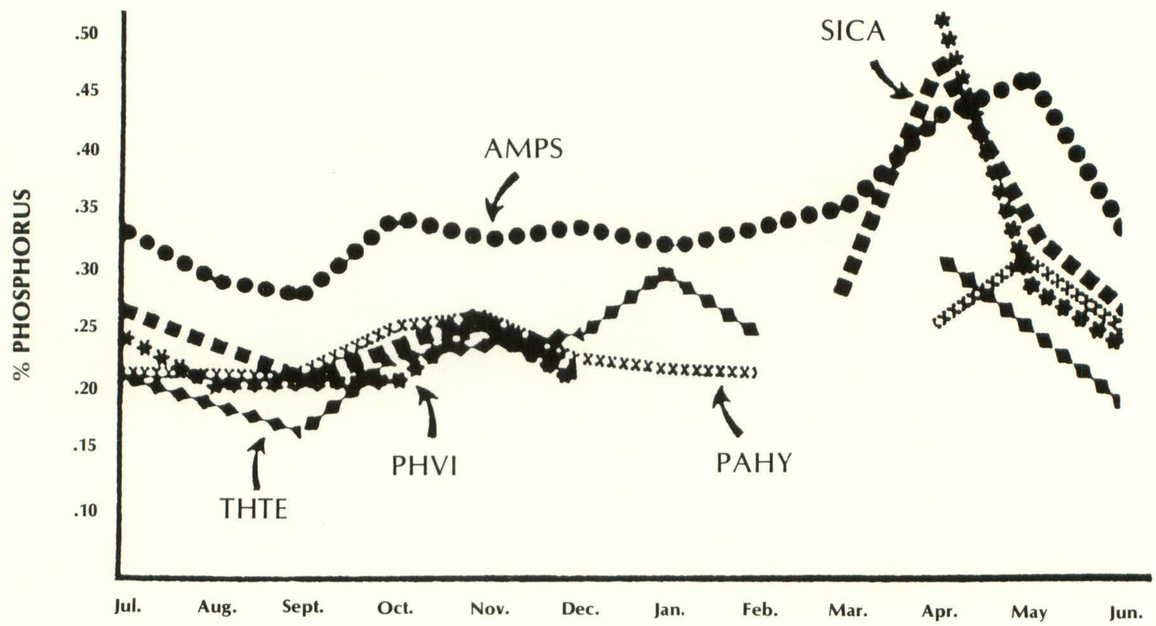


Figure 5. Average seasonal protein and phosphorus of four South Texas grass species (Species same as Table 2).



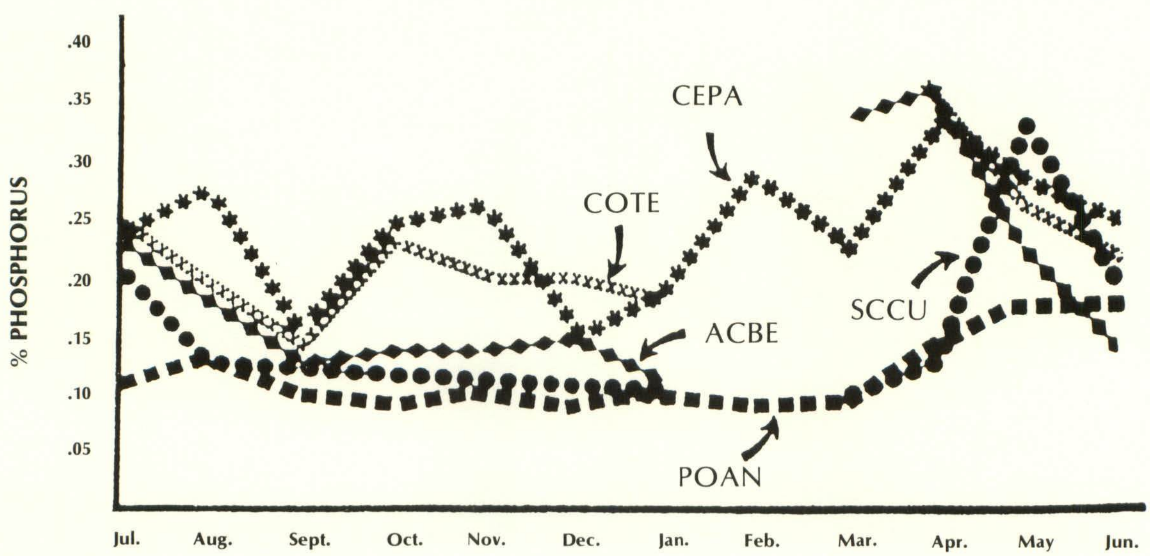


Figure 6. Monthly phosphorus content of leaves of South Texas forb (top) and browse (bottom) species (Species code listed in Table 1).

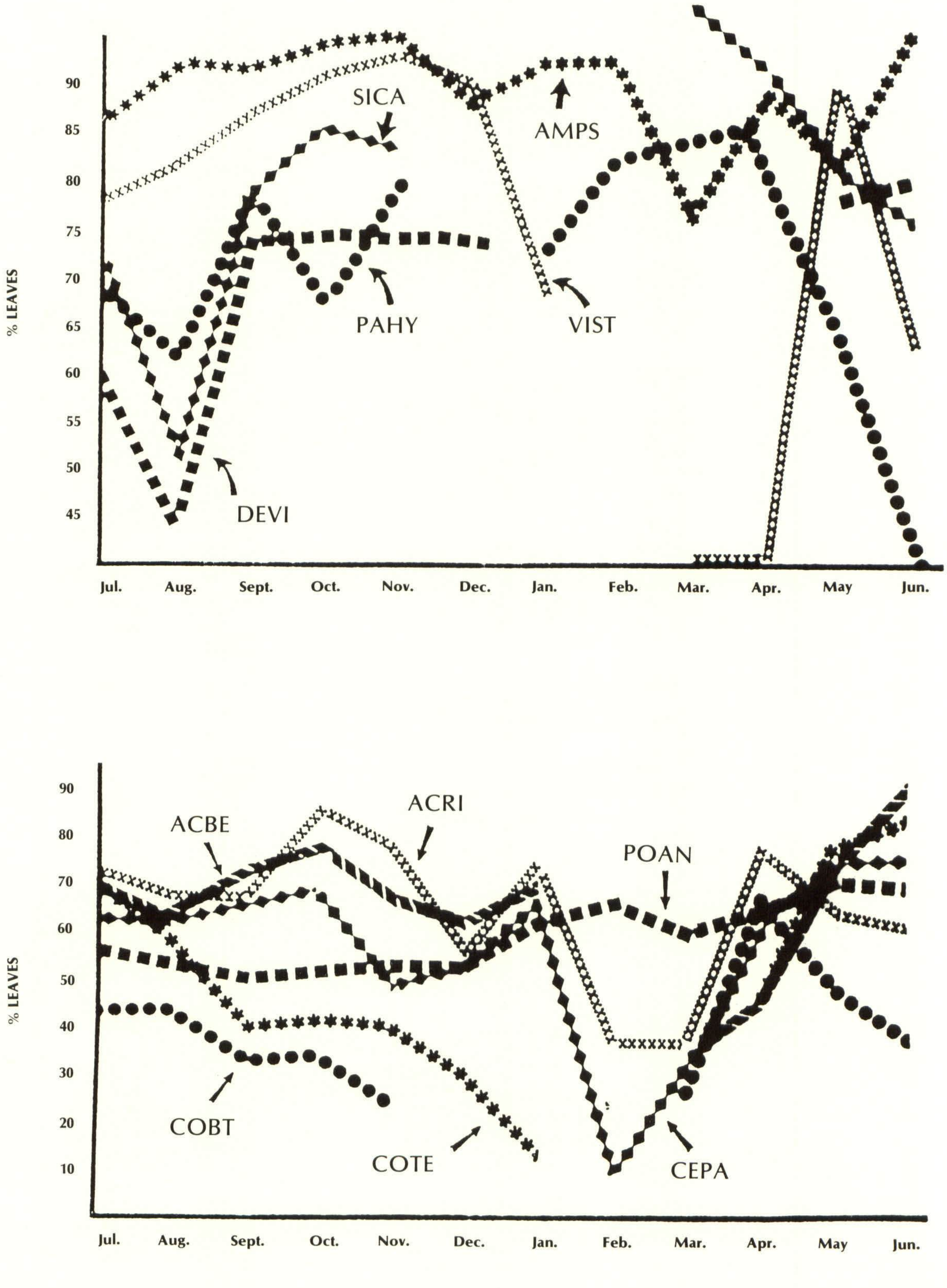


Figure 7. Leaves as a percent of dry matter of South Texas forb (top) and browse (bottom) species (Species code listed in Table 1).