Use of Fertilized Honeysuckle by White-tailed Deer in Western Tennessee

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Abstract: Use of fertilized Japanese honeysuckle (*Lonicera japonica*) by white-tailed deer (*Odocoileus virginianus*) was examined by a marked-plant and twig procedure to assess the potential for utilizing naturally-occurring foods that have been enhanced by fertilization in deer management. We conducted the study on the Milan Army Ammunition Plant in Gibson and Carroll counties, Tennessee. Twenty transects were established in August 1992 and were examined ca. every 3 weeks until March 1994. Percent frequency of browse by deer was different ($P = 0.0001$) among all seasons ($n = 7$). Browse percentages were lowest during the summer, increased during fall, and peaked during winter for all transects. Ten transects were randomly selected and fertilized in spring 1993 to determine if fertilization increased deer use of honeysuckle. Browsing of fertilized and non-fertilized transects within each season was not different ($P \leq 0.05$) except for winter 1994 ($\chi^2 = 7.330$, $P = 0.0068$). Percent frequency of browse was highest during winters. Results suggest that fertilization of natural foods may have useful management implications.

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In many parts of the southeastern United States, populations of white-tailed deer have increased (Halls 1984, Kroll 1992, Marchinton et al. 1993). With this increase in number of deer, one growing concern of wildlife managers has been quality and quantity of available forages. White-tailed deer feed on numerous plant species (see Halls 1984), and nutritional content of forages and temporal and spatial availability are important factors when assessing food regimes for this species. Because of differences in soil and climate, these factors may vary among geographic regions. If white-tailed deer populations are to be maintained in good health and condition in the Southeast, good nutrition is

critical. Management procedures such as fertilization of naturally-occurring forage plants to enhance dietary quality and quantity could have significant management implications. At present, limited research has focused on enriching natural foods to improve resources available to white-tailed deer.

Because Japanese honeysuckle is an established deer forage already high in nutritional content and available throughout the year, it makes an interesting subject for studies related to enrichment of natural foods. Cultivation and fertilization of honeysuckle can increase forage production per unit area by 70 times and result in a significantly higher crude protein content than that of nonfertilized forest stands of honeysuckle (Segelquist et al. 1971, Craft and Haywood 1972, Segelquist and Rogers 1975). Dyess et al. (1994) found browse production and crude protein content to increase significantly in fertilized-natural stands. While previous studies have shown that fertilization of naturally-occurring honeysuckle increases protein content, use of such nutritionally-enhanced forage by wildlife has not been studied in detail (see Segelquist et al. 1971, Sheldon and Causey 1974). At this time, no investigations relating to use of fertilized honeysuckle by deer have been conducted in Tennessee. The purpose of this study was to determine if white-tailed deer in western Tennessee would browse fertilized honeysuckle more than nonfertilized honeysuckle, and, thereby, partially assess potential of fertilization of natural foods as a deer management tool.

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Methods

The study was conducted on the Milan Army Ammunition Plant in Gibson and Carroll counties, Tennessee. This site was ca. 9,100 ha and consisted of primarily agricultural crops (ca. 49%) common to the region (corn, wheat, cotton, and soybean). A portion of the area consisted of managed timber (ca. 36%) interspersed with open pastures. Timber was comprised of oaks (*Quercus* spp.), hickories (*Carya* spp.), elms (*Ulmus* spp.), and scattered pines (*Pinus* spp.). Areas of industrial use (ca. 3%) were assumed to be unavailable to deer due to security fences. Other landuses (ca. 10%) were roads, railroads, and parking lots. Cattle were present on portions of the site. Water sources (ca. 2%) included several streams and ponds. The North Fork of the Forked Deer River flowed along the northern portion of the site. A large deer herd occurred on the Plant. Controlled hunting was allowed from September through January.

We established 20 honeysuckle transects at 20 locations (accessible to deer but not cattle) that were similar in understory structure and canopy cover dur-

ing August 1992. All transects had >75% canopy cover and generally were located 10–20 m inside of the forest edge. Along each transect, honeysuckle stems or twigs were tagged at 5 m intervals (height such that deer would be the browser), providing 10 marked plants per transect. Transects were checked ca. every 3 weeks from August 1992 to March 1994. Marked plants were visually inspected for signs of browse. If a tagged plant was browsed, the tag was moved to a new plant. Marked plants that were still in place after 3 weeks and either browsed or not browsed were considered operable plants (available for browse by deer). If a marked plant was dead or missing, it was considered inoperable (not available for browse by deer) and not recorded. The number of plants that were operable and number of plants browsed for each transect were recorded for the 3 week interval. A percent frequency of browse was calculated for each transect by taking number of plants browsed divided by number of operable plants × 100. For this project, seasons were: winter, January–March, spring, April–June, summer, July–September, and fall, October–December.

Ten transects were randomly selected for fertilization during the last week of March 1993 and March 1994. During spring 1993 and 1994 the randomly selected lines were fertilized using 13-13-13 fertilizer at a rate of 12.22 kg/250 m^2. Recommendations for fertilization were obtained from the The University of Tennessee's Milan Agricultural Experiment Station (J. Bradley, pers. commun.). Approximately 12 kg of fertilizer were applied in a 5-m wide strip along the randomly selected lines with a hand spreader. Data were analyzed using the Statistical Analysis Systems (SAS) package (SAS Inst. 1989). A nonparametric Kruskal-Wallis test (Proc NPAR1WAY) was conducted to detect differences in percent frequency of browsing among seasons and between fertilized and nonfertilized lines and we used a Kruskal-Wallis multiple comparisons test to compare seasons. A Bonferroni adjustment was made to control for group-wide Type I error (Rice 1989).

Results

There was a significant difference in percent frequency of browse among seasons examined ($n = 7$, $\chi^2 = 33.2$, $P = 0.0001$). The multiple comparisons test showed that each season was different from every other season except between summer 1992 and fall 1993 (Fig. 1). Utilization of transects was lowest during summer, increased in fall, peaked in winter, and decreased in spring.

Use of fertilized and nonfertilized lines within each season was not different except for winter 1994 (Table 1). Browsing of honeysuckle was highest during both of the winter periods (Fig. 1).

Discussion

Dyess et al. (1994) showed browse production and crude protein content to be increased in fertilized stands of honeysuckle (averaging 11.1% for controls and 16.5% for treatments). Because deer show a definite selection of plants and

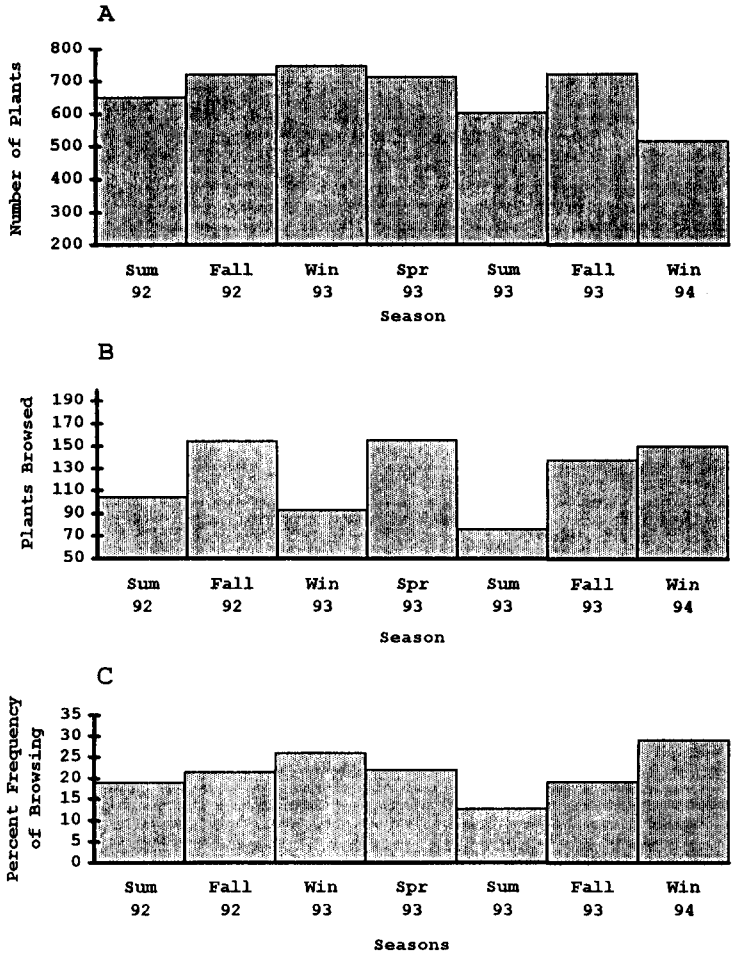

Figure 1. Seasonal use of fertilized honeysuckle by white-tailed deer in western Tennessee: (A) number of plants tagged; (B) number of tagged plants browsed; and (C) percent frequency of browsing. Abbreviations for seasons are: Sum 92 = Summer 1992, Fall 92 = Fall 1992, Win 93 = Winter 1993, Spr 93 = Spring 1993, Sum 93 = Summer 1993, Fall 93 = Fall 1993, Win 94 = Winter 1994.

seem to take first those that are most nutritious and palatable (Klein 1970, Schwartz and Schwartz 1981, Baker and Hobbs 1982, Verme and Ullrey 1984), it is not unreasonable to suspect that deer would take fertilized honeysuckle in preference to nonfertilized honeysuckle in their foraging activities. However, our results indicated considerable seasonal variability in use of honeysuckle and little discrimination of fertilized and nonfertilized for all seasons except winter. Differences among seasons would be expected due to known seasonal differences in the use of foods by deer (Harlow and Hooper 1971, Weckerly 1988).

Table 1. Seasons, average percentage frequency of browsing, χ^2 values, degrees of freedom, and P-values from Kruskal-Wallis test for differences between fertilized and nonfertilized transects of Japanese honeysuckle used by white-tailed deer.

Seasons	$\bar{x}$ percent frequency of browsing		χ^2 value	Degrees of freedom	*P*-value
	Nonfertilized	Fertilized			
Spring 1993	21.958	22.947	0.016	1	0.900
Summer 1993	12.715	13.339	0.002	1	0.968
Fall 1993	20.872	19.134	0.216	1	0.643
Winter 1994	20.925	36.308	7.330	1	0.007[1]

The similarity between fall 1993 and summer 1992 (Fig. 1) may be from the increase in rainfall experienced on the site during the early part of fall, 1993. This moisture increase could have created a lag in utilization by deer because they were still foraging on late summer food resources later into fall, 1993.

Results of our study showed utilization of honeysuckle was greatest in winter. Weckerly and Kennedy (1992) reported browse to be among the important fall and winter foods of deer at 2 sites in western Tennessee. They also reported diets to be lower in crude fat, crude protein, and fiber in spring and higher in most nutritional parameters in fall and winter. Neither nutritional value nor abundance of forage had a strong impact on diets in any season or year (Weckerly and Kennedy 1992). These results would seem to indicate that sufficient (high quality) foods are available to deer in western Tennessee throughout all seasons. However, our study suggests that during some years an enriched food may be taken over a lower quality food during winter. Based on our results and those of Weckerly and Kennedy (1992), it seems that during some years fertilization of natural foods would have little impact on foraging of white-tailed deer in western Tennessee. However, in years when foods are reduced in quality and quantity, enriched foods could be important in sustaining quality deer herds. Our results suggest that the most efficient management procedures in relation to enhancement of foods would be to focus on winter in western Tennessee. Because Japanese honeysuckle is naturally rich in protein in western Tennessee (see Weckerly 1988) and its protein levels can be increased by fertilization (Segelquist et al. 1971, Craft and Haywood 1972, Segelquist and Rogers 1975, Dyess et al. 1994), this plant should be viewed as a favorable choice for enrichment practices. Additionally, because it remains green during winter, it is a food that can be provided in a nutritionally-enhanced state at a time (winter) when availability of food is typically limited. Moreover, the greatest potential for widespread benefits to deer from fertilization of natural foods may not be in highly agricultural areas (with rich soils) like western Tennessee, but in areas of marginal habitat quality. Future studies that examine use of fertilization techniques on natural food of deer in areas of reduced habitat quality provide valuable insight toward maintaining quality deer herds in the Southeast.

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