QUANTITY AND QUALITY OF JAPANESE HONEYSUCKLE ON ARKANSAS OZARK FOOD PLOTS[1]

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ABSTRACT

In the spring of 1968 Japanese honeysuckle was planted on four wildlife food plots in the Arkansas Ozarks. Two years later, with moderate fertilization and occasional mowing, this evergreen species produced 239 ovendry pounds of winter forage per acre, 12 times more than the surrounding forest. The nutrient quality of leaves was consistently high throughout the year. Leaves retained through the winter contained about 14 percent crude protein, more than eastern redcedar, flowering dogwood twigs, panic grasses, and pussytoes, the most common native forages eaten by deer during the winter. Honeysuckle leaves were more digestible than any native forage. Since honeysuckle was not browsed heavily by deer until mid-winter, most current annual growth was available after mast had been eaten and when green forage was scarce.

This paper reports yield and nutritive quality of Japanese honeysuckle (*Lonicera japonica*) grown on wildlife food plots in the Arkansas Ozarks; it compares productivity on food plots to that of native vegetation in the surrounding forest. It also shows how the nutritional quality of honeysuckle varied by seasons and to what extent honeysuckle was browsed by white-tailed deer (*Odocoileus virginianus*).

The Sylamore Experimental Forest, where the study was conducted, contains four major habitat types; upland hardwood, upland pine-hardwood, cedar glade, and stream-bottom hardwood. While average summer vegetation yields range from 90 to 210 ovendry pounds per acre for the four types (Segelquist and Green 1968), winter yields are low—averaging about 15 pounds per acre, of which only 2 pounds are green vegetation of preferred species. When mast (primarily acorn) yields are high, sufficient winter food is available for deer, but when mast yields are low, as they frequently are, winter foods are scarce, and the deer population declines (Segelquist et al. 1969).

Honeysuckle was planted on food plots in the spring of 1968 to provide supplemental green winter forage for deer. Food plots were located along narrow ridge tops and stream bottoms, the only areas level enough for mechanical cultivation. Plots were confined to three of the four major habitat types; upland hardwood, upland pine-hardwood, and stream-bottom hardwood. Upland hardwoods occupy north and east slopes, while the pine-hardwood type occurs on the drier south and west exposures. The stream-bottom type occupies the moist fertile zone along the narrow stream valleys. The cedar glades are relatively open, but their shallow rocky soils with dry south and west exposures are not suited for cultivation.

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METHODS

All merchantable timber growing on the plots was harvested, and the stumps, nonmerchantable trees, and underbrush were piled and burned. Plots were tilled and leveled, and honeysuckle was planted in April 1968. Rooted cuttings were planted at 10- to 12-foot intervals in rows spaced 9 to 10 feet apart. Plants were placed in narrow furrows formed by a subsoiler, and soil was packed around the roots with a dibble. Two of the plots each contained about 2 acres and the other two about 1 acre apiece.

The vegetation between honeysuckle plants was mowed once or twice each summer. One and one-half tons of lime and 120 pounds of ammonium nitrate (33-0-0) per acre were applied to each plot at the time of planting. Three months later plots were topdressed with an additional 50 pounds of ammonium nitrate per acre. In the spring of 1969, a 12-12-12 fertilizer and ammonium nitrate were both applied at rates of 100 pounds per acre. In 1970 each plot received 100 pounds of urea (45-0-0) per acre in April and an additional 100 pounds of ammonium nitrate per acre in mid-August.

Living honeysuckle plants were counted, and survival was expressed as a percentage of the total planted. Yields per plant were measured in August 1969 and 1970 by clipping a portion of 10 randomly located plants per acre on each plot. In 1969 one-half of each plant selected for sampling was clipped, dried, and weighed; in 1970 only one-fourth of each sample plant was clipped.

Cages were placed over 10 randomly selected plants per acre in the fall of 1969 and 1970 to prevent browsing by deer. Estimates of winter utilization were obtained by comparing clipped weights of protected and unprotected plants in March.

Native forage yields were estimated in March 1971 on a series of permanently established 6.2-foot-square quadrats. The sampling procedure was described in detail in an earlier publication (Segelquist and Green 1968).

In the summer of 1969 and for each succeeding season through the spring of 1970, samples of the leaves and twigs of honeysuckle were collected for chemical analyses. Commonly eaten native forages—panic grasses (*Panicum* spp.), pussytoes (*Antennaria plantaginifolia*), eastern redcedar (*Juniperus virginiana*) foliage, and the twigs and fallen leaves of flowering dogwood (*Cornus florida*)—were also collected for comparative chemical analyses in the winter of 1969-70. Three replicates of each item were collected.

Replicates of honeysuckle leaves and twigs were made up of the terminal 12 inches of current annual growth from several widely dispersed plants from each of the four food plots. Native species were collected throughout each of the habitat types where they occurred. Leaves and twigs of dogwood and cedar were collected from the terminal 4 inches of current annual growth below 5 feet. Samples of panicum and pussytoes consisted of green foliage. Samples were clipped, ovendried, weighed, ground, and thoroughly mixed to insure that each plant sampled was adequately represented.

Materials were analyzed for crude protein by standard AOAC (1960) procedures and for nonnutritive fractions—cell wall contents, acid detergent fiber, and acid detergent lignin—by Goering and Van Soest's methods (1970). Dry matter digestibility based on the summation of nonnutritive fractions was estimated by the procedures of Goering and Van Soest (1970). Samples were also subjected to the two-step *in vitro* digestion procedure of Tilley and Terry (1963) utilizing 48-hour digestion periods with bovine rumen liquor and pepsin. Crude protein contents and estimates of digestibility were compared for statistically significant differences with Duncan's new multiple range test (Steel and Torrie 1960). All chemical analyses and *in vitro* digestion trials were performed by the Department of Animal Science and Industry at Oklahoma State University. Financial assistance and professional advice were provided by Dr. J. A. Morrison, Unit Leader of the Cooperative Wildlife Research Unit at Oklahoma State University.

RESULTS

Survival

Survival ranged from 92 to 97 percent on the four plots 30 months after planting even though large parts of two plots were on dry pine-hardwood slopes with south and west exposures. An abundance of moisture during the first growing season assured good honeysuckle survival. Rainfall for the 7 months from April through September 1968, the year of planting, was 30 inches (6 inches above normal). Precipitation for the same period the following year was only 16 inches, but by then roots were well established and plants were able to withstand the drought. Precipitation from April through September 1970, the third year following planting, was 30 inches.

Yield

Honeysuckle yields averaged 82 grams of ovendry forage per plant and 67 pounds per acre in 1969; averages in 1970 were 294 grams per plant and 239 pounds per acre (Table 1). Because plants were young and widely spaced, yields were much less than the several tons per acre reported by Lay (1968) from mature fertilized plants in east Texas. Nevertheless, total honeysuckle available during the winter of 1970-71, stems plus evergreen leaves, averaged 12 times as much per acre as native winter forage including all green herbage, evergreen browse, and woody browse twigs. During the same period, native green forages preferred by deer averaged only 2 pounds per acre while honeysuckle leaves, which made up about 60 percent of the total honeysuckle produced, averaged 143 pounds per acre. Thus, 1 acre of honeysuckle produced as much green winter forage as 70 acres of the undisturbed forest.

TABLE 1. Yield of Japanese honeysuckle on wildlife food plots (± 95% confidence intervals)

Unit of	Plot Number				Average for
Weight (ovendry)	1	2	3	4	All Plots
		1969			
Grams/Plant	86±16	100±32	52±22	73±35	82±14
Pounds/Acre	75±14	74±31	46±19	58±29	67±11
		1970			
Grams/Plant	370±147	277±80	224±86	246±139	294±61
Pounds/Acre	323±128	203±59	196±75	195±106	239±50

Seasonal Nutritive Quality

The crude protein content of honeysuckle leaves averaged 11.2 percent in the summer (Table 2), well above the 6-7 percent required for maintenance of deer (French et al. 1955). Leaves contained from 12.8 to 15.9 percent protein during the remainder of the year, near or above the 13-16 percent required for growth (French et al. 1955). Twigs averaged less than 7 percent protein during all seasons.

Predicted dry matter digestibility of honeysuckle leaves, based on the summative equation, averaged 66 percent in the spring, significantly lower ($P < 0.05$) than during the remainder of the year, when values ranged from 72 to 77 percent (Table 2). Cell contents were highest in the fall, when predicted digestion was highest. Predicted digestibility values for twigs were lower than comparative values for leaves during all seasons.

In vitro digestion of honeysuckle leaves was significantly higher ($P < 0.05$) in the winter, averaging 76 percent, than during the rest of the year when it was 67 to 68 percent. Thus, winter leaves were more digestible than spring leaves as estimated both by *in vitro* digestion and the summative equation. *In vitro* digestion of twigs ranged from 27 to

TABLE 2. Seasonal content of crude protein and nonnutritive factions and estimated digestibility for Japanese honeysuckle

Season	Crude Protein	Cell Contents	Cell Wall Contents: Hemi-cellulose	Cell Wall Contents: Lignocellulose: Cellulose	Cell Wall Contents: Lignocellulose: Lignin	Estimated Digestibility: Predicted[1]	Estimated Digestibility: In vitro[2]
			Percent Dry Matter				
			Leaves				
Summer	11.2±0.3[a3]	68.7	10.3	10.5	10.5	71.5±0.7[a3]	67.3±3.8[a3]
Fall	12.8±0.2[b]	74.9	4.0	10.8	10.3	76.9±1.4[b]	68.5±2.1[a]
Winter	13.7±0.7[c]	71.4	9.5	10.3	8.8	74.6±3.6[ab]	75.9±1.6[b]
Spring	15.9±0.2[d]	62.3	14.2	11.4	12.1	65.7±0.8[c]	67.6±0.7[a]
			Twigs				
Summer	4.5±0.2[a]	35.1	13.9	36.5	14.5	55.4±1.5[a]	32.7±1.4[a]
Fall	4.6±0.1[a]	32.7	15.4	34.4	17.5	49.6±1.2[b]	32.6±5.6[a]
Winter	5.2±0.5[b]	23.7	16.9	39.0	20.4	43.1±1.7[c]	27.2±2.3[a]
Spring	6.6±0.1[c]	34.0	14.6	34.1	17.3	50.6±4.7[ab]	44.0±3.9[b]

1 Predicted from summative equation of Goering and Van Soest (1970).
2 Bovine rumen liquor and pepsin digestion periods of 48 hours each.
3 Means (± standard errors) having the same letter in their superscripts are not significantly different ($P < 0.05$).

44 percent with highest values in the spring and lowest ones during the winter. *In vitro* values for twigs were consistently lower than values predicted from the summative equation.

It is possible that the rapid translocation of soluble carbohydrates from honeysuckle leaves resulted in low dry-matter digestibility during the spring. Lignin, cellulose, and hemicellulose contents of leaves were greater in the spring, when honeysuckle was making rapid growth, than during other seasons, and these products lowered predicted as well as *in vitro* digestion values. In contrast, *in vitro* digestion of twigs was higher in the spring than during other seasons. Artifact lignin, which is formed by drying succulent green forages at excessive temperatures (Van Soest 1970), may have been partly responsible for the reduced digestibility of honeysuckle leaves in the spring.

Comparative Nutritive Quality of Winter Forages

Honeysuckle leaves contained about 14 percent crude protein in the winter, significantly more ($P < 0.05$) than in any of the native forages tested (Table 3). Panic grasses and fallen dogwood leaves each contained about 10 percent crude protein, the highest levels found in native forages. Honeysuckle twigs had the least protein of any forage tested.

Digestibility of honeysuckle leaves, as estimated both by the summative equation and *in vitro* digestion, was significantly ($P < 0.05$) greater than in any of the native forages, while digestibility values of honeysuckle twigs were the lowest of all tested (Table 3). The high percentage of easily digested cell contents and relatively low lignin levels accounted for high digestibility of honeysuckle leaves, just as the low cell contents and high lignin levels were responsible for the poor digestibility of honeysuckle twigs. Because acid detergent fiber was higher than neutral detergent fiber in fallen dogwood leaves, it was impossible to predict their digestibility. Such a phenomenon has been observed in plant materials with high tannin contents (Van Soest 1970).

Utilization by Deer

Honeysuckle was heavily browsed by deer each winter, especially during periods of heavy snow when other forages were covered. During the winters of 1968-69 and 1969-70, leaves were completely consumed as were stems back to a diameter of 2-3 mm. Utilization was less severe in the winter of 1970-71, but still averaged 60 percent and included all unprotected leaves. Since almost all utilization was restricted to the winter when honeysuckle was dormant, browsing did not appear to hinder its establishment. Furthermore, since browsing was limited primarily to the winter, most current annual growth was still available to deer when mast had already been eaten and native green forages were scarce.

DISCUSSION

The use of food plots for wildlife habitat management is well documented (Larson 1966), and although their true worth has yet to be determined there is a general feeling that the diversity created by forest openings is desirable. There is also general agreement that if such openings are created and maintained they should produce a maximum of high-quality forage when native foods are scarce.

Honeysuckle is one of the most highly preferred and widely consumed winter deer foods throughout the Southeast (Cushwa et al. 1970). In the study described, it responded well to cultivation and fertilization by producing much more forage and a much higher quality forage than the surrounding forests.

Although honeysuckle planting should certainly not be considered the only solution for providing winter forages in areas where shortages of winter foods are limiting deer populations, it deserves serious consideration, especially where artificial food plots are already a part of the management scheme.

TABLE 3. Crude protein and nonnutritive contents and estimated digestibility of Japanese honeysuckle and selected native forages during the winter of 1969-70

Species	Crude Protein	Cell Contents	Cell Wall Contents: Hemi-cellulose	Cell Wall Contents: Lignocellulose: Cellulose	Cell Wall Contents: Lignocellulose: Lignin	Estimated Digestibility: Predicted	Estimated Digestibility: In vitro
	Percent Dry Matter						
Honeysuckle Leaves	13.7±0.7^{a}[3]	71.4	9.5	10.3	8.8	74.6±3.6^{a}[3]	75.9±1.6^{a}[3]
Honeysuckle Twigs	5.2±0.5^{b}	23.7	16.9	39.0	20.4	43.1±1.7^{b}	27.2±2.3^{b}
Dogwood Leaves	9.7±0.5^{c}	72.3	..	..	18.3	..[4]	50.1±6.5^{c}
Dogwood Twigs	8.0±0.6^{d}	56.5	4.7	25.7	13.1	67.4±1.0^{c}	34.6±3.8^{d}
Eastern Redcedar	7.5±0.5^{de}	56.3	11.9	9.0	22.8	56.0±2.2^{d}	43.8±3.6^{e}
Panic Grass	10.1±0.1^{c}	23.4	39.0	30.9	6.7	60.8±0.2^{e}	42.1±1.0^{e}
Pussytoes (Forb)	7.0±0.1^{e}	53.0	5.1	31.4	10.5	69.9±1.3^{c}	52.8±1.8^{c}

1 Predicted from summative equation of Goering and Van Soest (1970).
2 Bovine rumen liquor and pepsin digestion periods of 48 hours each.
3 Means (±standard errors) having the same letter in their superscripts are not significantly different ($P < 0.05$).
4 Digestibility could not be predicted because of error in analytical procedure.

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SOME CHARACTERISTICS OF WHITE-TAILED DEER REPRODUCTION IN ARKANSAS

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ABSTRACT

During four years of deer collections from three areas in Arkansas, 550 female reproductive tracts were analyzed. Four hundred and twenty-six tracts collected during fall hunting seasons proved to be of little value. Of 124 does collected by spotlighting and from road kills in spring, 101 were pregnant. Eighty-nine of these were adult does and 12 were fawns. The mean conception date (MCD) of adult does from the northern study area was November 13—three weeks earlier than MCD in the central and southern areas. This was a highly significant difference.

The ovulation rate of 108 adult does collected statewide was 1.77 ova per doe. A pregnancy rate of 93% was calculated for 92 adult does collected in spring. The reproductive rate for 108 adult does was 1.66 fetuses per doe. This indicates that 93% of the fertilized eggs implanted. Analysis of variance of each parameter indicated that there were no significant differences between study areas.

Of 143 fetuses old enough to be sexed; 59 were male and 84 female—a sex ratio of 42:58. Fifty-three sets of twins were old enough to sex; 11 were male, 20 female, and 22 of opposite sex. A chi-square test indicated no significant difference between the observed and the expected sex ratio of 50:50.

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