

# Primary Foods of Northern Bobwhites Inhabiting Disposal Areas of the Tennessee-Tombigbee Waterway

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*Abstract:* Although numerous studies have been conducted on food habits of the Northern bobwhite (*Colinus virginianus*), there is a paucity of information on food items taken by quail on severely-disturbed land bases. To collect more information, crop content analysis was conducted on 1,015 hunter-harvested northern bobwhites from 1982 to 1992. Quail were collected from disposal areas created by the deposition of spoil material during construction of the Tennessee-Tombigbee Waterway. These disposal areas are classified as severely-disturbed due to edaphic and pedogenic conditions. Vegetative cover was monitored during the study on disposal areas where bobwhites were collected. The seeded legume, sericea lespedeza (*Lespedeza cuneata*), dominated these sites with ground coverages of  $\geq 60\%$  for most study years. Naturally-colonizing food plants, such as *Lespedeza striata*, exhibited mean coverages  $< 5\%$  for each study year. Importance values calculated from percentage occurrence and aggregate volume measurements of crop contents indicated that major food items taken by quail during winter were *L. cuneata*, *L. striata*, green vegetation, invertebrates, *Rhus* spp., *Quercus* spp., *Cassia* spp., *Vicia* spp., *Lonicera japonica*, and *Pinus* spp. Seed of *L. cuneata* and *L. striata* ranked in the top 5 food items over all study years, with importance values ranging from 12 to 16. Use of *L. striata* was similar to or higher than use of sericea during most years, despite low ground coverages.

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Diet of the Northern bobwhite probably has been investigated more than that of any other gamebird (Speake 1967, Brazil 1993). However, there is very little information concerning their diet on severely-disturbed lands, such as spoil disposal sites and reclaimed surface mines. Studies conducted on restored mine

and disposal sites report that these reclaimed lands exhibit similar edaphic conditions and vegetative successional trends including a predominance of seeded, perennial vegetative cover, low occurrence of bobwhite food plants, and low survival rates of shrub and tree plantings (Vogel 1980, Wade et al. 1985, Hartley et al. 1989, Ammons et al. 1991).

The purpose of this study was to ascertain major food items used by quail inhabiting disposal areas. We initiated a study to analyze crops of hunter-harvested bobwhites during winters of 1983 through 1987 and 1989 through 1992. This study was part of a 10-year research project designed to investigate vegetative succession, wildlife utilization, and edaphic changes on disposal areas. The primary objectives of our study were to: 1) determine major food items taken during winter by northern bobwhites inhabiting disposal areas on the Divide Section Wildlife Management Area along the Tennessee-Tombigbee Waterway and 2) report annual changes in percentage ground cover for common and sericea lespedeza on disposal areas and discuss quail utilization relative to these coverages.

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## Methods

The study area was located on the Divide Section Wildlife Management Area in Tishomingo County, Mississippi. This 4,423-ha management area is comprised primarily of disposal areas which were created during the construction of the Tennessee-Tombigbee Waterway. Disposal areas are classified as severely-disturbed sites due to the origin of disposal soil and edaphic conditions. Completed in 1981, disposal areas were seeded with erosion control seed mixtures by the U.S. Army Corps of Engineers. We monitored 20 disposal sites from 1982 through 1991 for vegetative composition and percent coverage along permanently-located, line intercepts (Canfield 1941) with 61 m of line intercept being monitored annually on each disposal study site. Sixteen of the 20 disposal sites were selected for quail collection during 1983. Four disposal areas were selected from each of the 4 reclamation seed mixtures with total acreage of each sample disposal area ranging from 20 to 35 ha. The four seed mixtures included the following: 1) weeping lovegrass (*Eragrostis curvula*) (22.4 kg/ha), sericea lespedeza (33.6 kg/ha), and Pensacola bahiagrass (*Paspalum notatum*) (33.6 kg/ha); 2) weeping lovegrass (11.2 kg/ha), sericea lespedeza (33.6 kg/ha), Pensacola bahiagrass (56 kg/ha), and common bermudagrass (*Cynodon dactylon*) (33.6 kg/ha); 3) weeping lovegrass (5.6 kg/ha), Kentucky 31 fescue (*Festuca arundinacea*) (39.2 kg/ha), Pensacola bahiagrass (50.4 kg/ha), and sericea lespedeza (22.4 kg/ha).

**Table 1.** Mean percentage occurrence, percentage aggregate volume, and importance value of major food items taken during winter by northern bobwhites inhabiting disposal areas of the Tennessee-Tombigbee Waterway, 1982–1991.

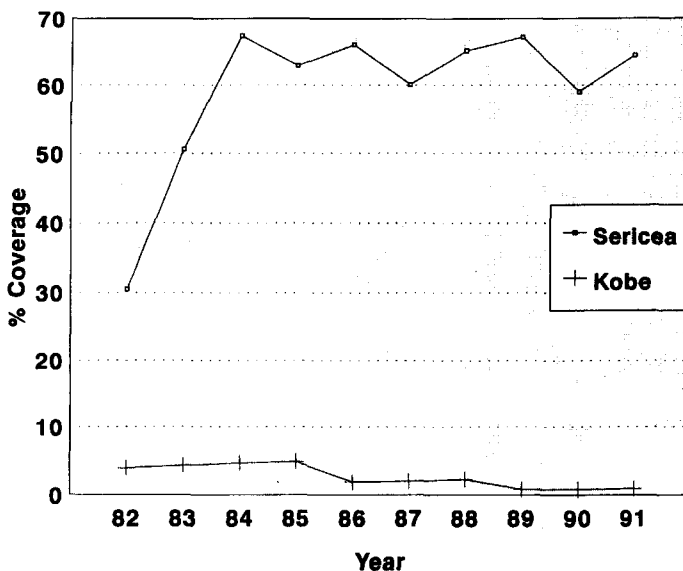
Food item	Occurrence (%)		Aggregate volume (%)		Importance value (range)
	$\bar{x}$	(SE)	$\bar{x}$	(SE)	
<i>Lespedeza striata</i>	39.28	(1.22)	20.50	(0.22)	12–14
<i>Lespedeza cuneata</i>	37.95	(0.38)	14.30	(0.41)	14–16
Green vegetation	28.56	(0.16)	6.04	(0.30)	8–16
<i>Vicia</i> spp.	23.74	(0.75)	14.35	(0.60)	5–16
Invertebrates	17.07	(0.15)	0.97	(0.04)	6–14
<i>Lonicera japonica</i>	13.62	(1.29)	3.83	(1.22)	4–15
<i>Quercus</i> spp.	13.13	(0.67)	18.33	(1.84)	12–16
<i>Rhus</i> spp.	12.15	(0.29)	3.55	(0.10)	6–15
<i>Cassia</i> spp.	11.33	(0.26)	2.09	(0.10)	8–15
<i>Pinus</i> spp.	8.71	(0.29)	2.85	(0.19)	9–14

ha); and 4) weeping lovegrass (22.4 kg/ha), Pensacola bahiagrass (56 kg/ha), and sericea lespedeza (22.4 kg/ha). Study sites lacked supplemental wildlife plantings of annual legumes. Relation of coverage of naturally-colonizing and seeded agronomic plant species was analyzed using correlation analysis (Myers 1990).

Bobwhites were harvested over 7 years from selected disposal areas by cooperating hunters from November-February. Crops and harvest location information was submitted by cooperating hunters in preprinted envelopes. Crop contests were oven-dried, sorted according to disposal area number and location, and identified to species. Percentage occurrence and percentage aggregate volume were assessed for each food item for each research year. Importance values were derived for food items taken by quail following Landers and Johnson (1976) which uses percentage occurrence and percentage aggregate volume measurements for each food item. Importance values range 1.0 to 16.0. Annual utilization, including percentage occurrence and percentage aggregate volume, of kobe and sericea lespedeza were analyzed using the signed-rank wilcoxon test (Daniel 1990), because data distribution characteristics and interdependence of food items occurring within each crop and the potential feeding activity of quail within the same covey precluded using parametric techniques.

## Results and Discussion

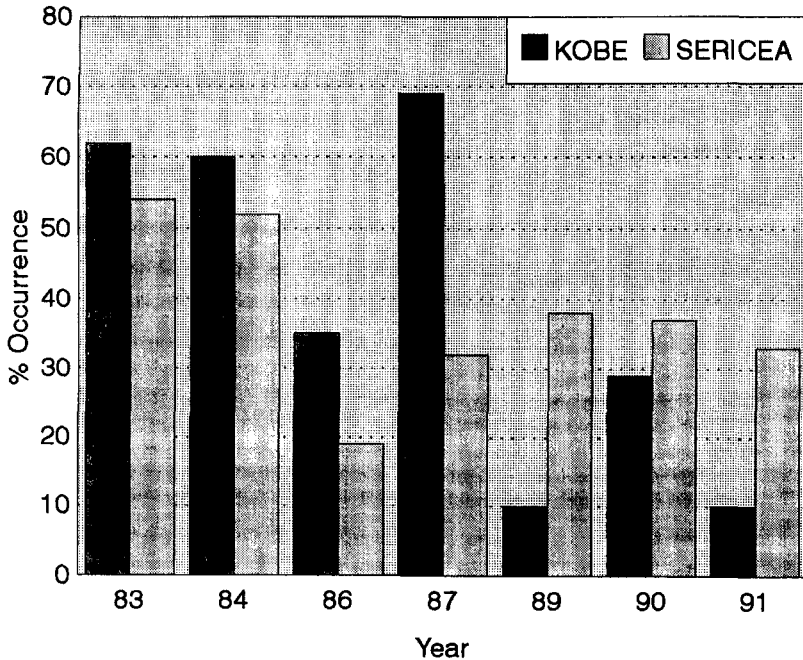
We collected 1,105 quail crops during the study period from cooperating quail hunters. Number of crops collected for each year were: 1983–84,  $N = 105$ ; 1984–85,  $N = 25$ ; 1986–87,  $N = 75$ ; 1987–88,  $N = 129$ ; 1989–1990,  $N = 105$ ; 1990–91,  $N = 282$ ; 1991–92,  $N = 292$ . The lowest sample numbers occurring in 1984–5 were from limited hunter involvement. Major food items found in quail



**Figure 1.** Mean percentage occurrence of common and sericea lespedeza in crops of northern bobwhites harvested from disposal areas of the Tennessee-Tombigbee Waterway (1983–1991).

crops during each of the 7 study years included common lespedeza (*L. striata*), sericea (*L. cuneata*), green vegetation, invertebrates, acorns (*Quercus* spp.), partridge pea (*Cassia* spp.), vetch (*Vicia* spp.), sumac (*Rhus* spp.) and pine (*Pinus* spp.) (Table 1). Importance values for these foods ranged from 12 to 16 during at least 5 of the 7 research years. Naturally-colonizing food plants, such as common lespedeza, vetch, sumac, and partridge pea and planted species, such as sericea, were present within the disposal areas. Mast-producing pine and oaks were generally located around the periphery of disposal areas. A diversity of other plant seeds was found in crops; however, seed from these plants comprised between 2% and 8% mean occurrence in collected crops and were found during  $\leq 4$  years. Genera which occurred in this use category (2%–8%) included *Desmodium*, *Centrosema*, *Galactia*, *Lepedeza* (Bicolor), *Trifolium*, *Vigna*, *Sorghum*, *Panicum*, *Digitaria*, *Paspalum*, *Cyperus*, *Ambrosia*, *Polygonum*, *Helianthus*, *Amaranthus*, *Bidens*, *Ilex*, *Eleagnus*, *Vaccinium*, *Ostrya*, *Fraxinus*, *Liquidambar*, *Sambucus*, and *Vitis*. Genera occurring in  $< 2\%$  of the crops annually and in  $< 4$  study years were considered as trace food items.

Common and sericea lespedeza ranked in the top 5 food items found in quail crops during all study years. Percentage occurrence of the 2 legume species did not differ ( $P > 0.1$ ) for 3 years (1983, 1984, and 1990); whereas, percentage occurrence of common lespedeza exceeded that of sericea during 1986 and 1987. Percentage occurrence of sericea was higher than common lespedeza during 1989 and 1991 ( $P < 0.05$ ). Over the study period, percentage aggregate volumes



**Figure 2.** Mean percentage cover of common and sericea lespedeza on disposal areas along the Tennessee-Tombigbee Waterway from 1982 through 1991.

were similar for sericea and common lespedeza ranging from 7% to 23.9% and 12% to 26.8%, respectively. Ranges in annual percentage occurrence for common and sericea lespedeza were 10% to 68.9% and 19% to 54.3%, respectively (Fig. 1).

Bobwhite use of sericea and common lespedezas was important due to occurrence of these species within the study area. Vegetative inventories conducted on disposal areas revealed sericea lespedeza was a dominant ground cover over the 10-year period (1982–1991). Correlation analysis depicted an increase in sericea lespedeza coverage from 1982 to 1991 ( $P < 0.05$ ,  $r = 0.67$ ). From 1983 through 1991, sericea exhibited mean coverages of  $\geq 50\%$  ( $SE = 1.16$ ); whereas, common lespedeza exhibited ground coverages of  $\leq 5\%$  ( $SE = 0.20$ ) for the study period on the same study areas (Fig. 2).

## Conclusions

Bobwhites on disposal areas selected common lespedeza despite its limited occurrence within these habitats. Use of sericea lespedeza was higher in this study than in previous diet studies (Handley 1931, Davison 1942, Johnson 1941, Speake 1967, Landers and Johnson 1976, Rosene and Freeman 1988, Brazil 1993). We believe that this high use is related to abundance of sericea on dis-

posal areas and not necessarily preference by bobwhites. Based on vegetative surveys, sericea lespedeza exhibits a long-term persistence on the droughty substrates found on disposal areas. High coverage of this seeded plant, in combination with edaphic factors, such as soil acidity and texture, limits native plant colonization and food plant diversity.

In our study, naturally-colonizing food plants, such as common lespedeza, were used consistently by bobwhites on disposal areas despite low ground coverages. We feel that this recorded use of common lespedeza supports conclusions of numerous other quail diet studies conducted in the southeast. However, low occurrences of desirable food plants on severely disturbed, reclaimed habitats may offer new challenges to upland gamebird managers.

Additionally, we believe the site's plant community should be evaluated when determining diets of bobwhites on severely-disturbed lands. Evaluation of food items used on reclaimed lands may yield lower than expected native food use rates, because of low native food plant colonization rates. Food item availability and/or occurrence within the habitat area should be ascertained when making any inferences about food preferences on reclaimed habitats which are dominated by perennial, agronomic plant species.

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