National Quail Symposium Proceedings

Volume 4 Article 15

2000

Food Plot Use by Juvenile Northern Bobwhites in East Texas

D. Scott Parsons
Austin State University

R. Montague Whiting Jr.
Austin State University

Xiangwen Liu
Austin State University

Donald R. Dietz
Austin State University

FOOD PLOT USE BY JUVENILE NORTHERN BOBWHITES IN EAST TEXAS

D. Scott Parsons[1]
College of Forestry, Stephen F. Austin State University, Nacogdoches, TX 75962

R. Montague Whiting, Jr.
College of Forestry, Stephen F. Austin State University, Nacogdoches, TX 75962

Xiangwen Liu[1]
College of Forestry, Stephen F. Austin State University, Nacogdoches, TX 75962

Donald R. Dietz
Temple-Inland Forest Products Corporation, Lufkin, TX 75904

ABSTRACT

We examined use of spring-summer (i.e., warm-season) food plots by northern bobwhites (*Colinus virginianus*) with broods using radio telemetry on a 563-ha study area in Trinity County, eastern Texas, where habitat was modified to enhance it for these birds. Bobwhites from South Texas and disjunct areas of East Texas were introduced to supplement a small, resident population. All relocated and most resident bobwhites were fitted with necklace-style transmitters. Bobwhites which produced chicks were intensively radio-tracked (≥3 times/day) for ≥4 weeks or until the radio-marked parent was lost. Nine hens moved their broods to food plots within an average of 2.1 days after the eggs hatched; average distance moved was 217 m. Use of food plots by 12 broods was proportionally greater than that of native vegetation ($P < 0.001$). Food plots had lower quail-level foliage density ($P = 0.015$) and more arthropods ($P < 0.001$) than native vegetation. Our results demonstrate that warm-season food plots can potentially provide brood habitat for bobwhites in eastern Texas.

Citation: Parsons, D.S., R.M. Whiting, Jr., X. Liu, and D.R. Dietz. 2000. Food plot use by juvenile northern bobwhites in East Texas. Pages 71–74 *in* L.A. Brennan, W.E. Palmer, L.W. Burger, Jr., and T.L. Pruden (eds.). Quail IV: Proceedings of the Fourth National Quail Symposium. Tall Timbers Research Station, Tallahassee, FL.

INTRODUCTION

Although the reproductive season may be the most important phase of bobwhite life history, little is known about factors that influence chick survival during this period (Hurst 1972). Difficulty in capturing, marking, and observing young chicks in the field has precluded the gathering of quantitative data on the biology of juvenile bobwhites (Roseberry and Klimstra 1984).

Bobwhite chicks rely primarily on small arthropods during the early stages of life (Cottam 1931). Beetles (Coleoptera), true bugs (Hemiptera), and grasshoppers (Orthoptera) typically provide >90% of the foods eaten during the first 2 weeks (Hurst 1972, Eubanks and Dimmick 1974). Although aspects of brood habitat structure may vary throughout the geographic range of northern bobwhites, it appears that parents select brood foraging areas with high insect densities (DeVos 1986).

Planted food plots have long been viewed as an important management tool for increasing quail numbers (DeVos 1986). However, a search of the literature revealed a dearth of information concerning use of planted food plots by bobwhite chicks. Therefore, our objective was to evaluate the use of planted food plots by radio-marked parent bobwhites with chicks.

STUDY AREA

During 1989, Temple-Inland Forest Products Corporation conducted intensive habitat modifications on a 563-ha study area in the South Boggy Slough Hunting and Fishing Club. The modifications were implemented for a study designed to compare survival and reproduction of resident bobwhites and bobwhites relocated to the study area from other areas of East Texas and from South Texas (Liu 1995). The study area was in southeastern Trinity County, which is in the Pineywoods Ecological Region of eastern Texas (Gould 1975). The study area was in an upland forest comprised of pine and mixed pine-hardwood stands (Parsons 1994, Parsons et al. *this volume*). The dominant pines were loblolly (*Pinus taeda*) and shortleaf (*P. echinata*); dominant hardwoods included sweetgum (*Liquidambar styraciflua*), southern red oak (*Quercus falcata*), white oak (*Q. alba*), post oak (*Q. stellata*), black hickory (*Carya texana*), and bitternut hickory (*C. cordiformis*). Topography was gently rolling hills

[1] Present address: Texas Parks and Wildlife Department, 4200 Smith School Road, Austin, TX 78744.

with elevations ranging 57–105 m above mean sea level (Parsons 1994, Liu 1995, Liu et al. 1996).

Habitat modifications, detailed in Parsons et al. (*this volume*), included basal area reduction and a burning regime whereby approximately 50% of the study area was subjected to prescribed fire each year. Escape cover, both naturally occurring and planted, was established throughout the study area. Naturally occurring thickets, primarily of blackberry (*Rubus* spp.), American beautyberry (*Callicarpa americana*), and yaupon (*Ilex vomitoria*), were protected from prescribed fires. Where such thickets were lacking, strips of Thunberg lespedeza and autumn olive were planted, usually in association with food plots. When 2 young (i.e., 5-year-old) 10-ha pine plantations were included, patches of escape cover comprised about 12% of the study area.

Supplemental food plots, both permanent and temporary, comprised approximately 20% of the study area. Permanent food plots ranged in size from 0.1–2.1 ha. These plots were located such that each was within sight of another; the maximum distance between such food plots was approximately 150 m (Liu 1995:30). Seventy-five percent of each permanent food plot was comprised of 3 approximately equal proportions of cool-season crops planted to mature during fall and winter. These portions consisted of the current-year cool-season crop, the first-year fallow cool-season crop, and the second-year fallow cool-season crop. The remaining 25% of the plot was devoted to a crop planted to mature during the current-year spring and summer (i.e., warm season). Cool-season species planted in food plots were wheat, ryegrass, crimson clover, arrowleaf clover, and hairy vetch. Warm-season species included browntop millet, Japanese millet, pearltop millet, Egyptian wheat, American jointvetch, kobe lespedeza, partridge pea, Alyce clover, iron and clay peas, and Florida beggarweed. Temporary food plots were in natural openings, abandoned log sets, roadsides, firelanes, and pipeline right of ways. They were planted during the early spring using warm-season species and again during early fall using cool-season species. Temporary food plots were generally smaller than permanent plots and did not contain fallow areas. All food plots were disked and fertilized (13N:13P:13K) before they were seeded. Firelanes were established throughout the study area to protect escape cover, food plots, and young pine plantations.

METHODS

The 3 groups of bobwhites were comprised of 2 subspecies, *C. v. texanus* from South Texas and *C. v. mexicanus* from East Texas (Johnsgard 1973), including an unknown portion of birds that were native residents of the South Boggy Management Area. South Texas bobwhites were trapped on the King Ranch in Kleberg and Kenedy Counties, in the South Texas Plains Ecological Region (Gould 1975). Most bobwhites relocated from other areas of East Texas were trapped approximately 15 km north of the study area in Trinity and Houston Counties. Resident bobwhites were trapped on the study area. Bobwhites were captured during the winters (January–March) of 1990, 1991, and 1992 in funnel traps similar to those described by Stoddard (1931). Each captured bobwhite was aged (Rosene 1969), sexed, weighed, checked for injuries, and fitted with a numbered aluminum leg band and a chest-mounted radio-transmitter (Parsons et al. *this volume*).

Resident bobwhites were released at the point of capture. For birds relocated from East Texas and South Texas, the minimum covey size was 4 birds; these birds were released at predetermined sites throughout the study area. After release, radio-marked quail were tracked with a hand-held directional Yagi antenna 3–5 days a week throughout the breeding season and during fall and winter months.

During 1990, 4 radio-marked hens moved their chicks to warm-season food plots within 3 days after the eggs hatched. Also, 6 other radio-marked bobwhites with chicks were regularly recorded in warm-season food plots and a brood with unmarked parents was flushed from such a plot.

Food plot use data were collected during spring and summer, 1991 and 1992. Use of food plots by chicks was evaluated based on the location of the radio-marked parent(s). Beginning the day after the clutch hatched, we attempted to locate the radio-marked parent ≥4 times a day at ≥1-hour intervals. Radio locations were gathered using homing techniques (White and Garrott 1990). Normally, the observer approached to within approximately 50 m of the radio-marked parent and then continuously located it as he moved around it. When the observer was confident of the bird's location, it was plotted on a detailed map of the study area. Location data were accumulated until either the parent was lost or mid-September.

Using geographical information system techniques, Liu (1995) determined that the average random-point-to-food-plot distance was 44 m. For a conservative estimate, we assumed that if the parent's location was within 15 m of a warm-season food plot, the bird and its chicks were using the plot. Usually it was not necessary to measure parent-to-food plot distances; >90% of the parent locations were either in the plot or well away from it. However, if necessary, distances were measured on the map.

Characteristics of each warm-season food plot used by a radio-marked parent and its brood were evaluated at 5 different points. These data were recorded within 2–3 days after the parent was first recorded in the plot, but at a time when the bird was away from the plot. The initial point sampled was at the estimated location of the parent the first time it was recorded in the food plot. The remaining 4 points were in randomly selected directions and were approximately 5.0 m from the first. All points were within the warm-season portion of the food plot. We did not evaluate characteristics of the cool-season portions of permanent food plots because in 1990, 8 of the 11 food plots used by parents with chicks were temporary plots.

At each vegetation sampling point, stem density,

Table 1. Vegetation density and insect biomass in native vegetation and in warm-season food plots used by northern bobwhites with broods in East Texas, spring and summer 1991 and 1992.

Variable	*n*	Native vegetation $\bar{x}$	Native vegetation SE	Food plot $\bar{x}$	Food plot SE	*P*-Value
Stem density (per m²)	13	1975	73	1515	33	0.127
Foliage density						
Quail-level (0–15 cm)	13	64.00	1.57	44.55	1.26	0.015
Overhead (15–100 cm)	13	45.18	1.42	44.27	0.96	0.885
Insect biomass (g)	25	0.105	0.003	0.302	0.010	<0.001

quail-level foliage density, and overhead protection were evaluated. Stem density of both native and planted species was measured at ground level by counting the number of stems within a 144-cm^2 circular plot. Quail-level foliage density and overhead protection density were evaluated in the 0–15-cm and the 15–100-cm strata, respectively, using a 10-pin frame. The pin frame was 1.1 m long; within the frame, the pins were spaced at 10-cm intervals. As each pin was lowered from a height of 1.0 m, each pin-to-plant contact within a stratum was recorded; thus, several contacts with the same plant may have been recorded. To compare characteristics of warm-season food plots to those of native vegetation, a set of 5 points was established in a random direction 50.0 m from each food plot evaluated; 50.0 m was selected because it was slightly longer than the random-point-to-food plot distance.

During 1992, insect biomass of each warm-season food plot used by brooding parents was sampled using the sweep net method (Hurst 1972). One sample was taken at the approximate location of the parent the first time it was recorded in the food plot. A similar sample was taken in native vegetation in a randomly chosen direction 50 m from the food plot. Since the technique was somewhat destructive of the vegetation, insects were sampled after the vegetation data had been collected.

Insects in each sample were separated from debris, dried (7 hours at 83° C), and weighed. Individual insects weighing more than 0.035 grams were discarded since they were considered too large to be ingested by quail chicks (Hurst 1972).

Use of warm-season food plots by bobwhite chicks was evaluated by comparing the number of parent radio-locations associated with food plots to the number of locations not associated with food plots using Chi-square goodness-of-fit tests. Stem density, quail-level foliage density, and overhead protection were compared between warm-season food plots and native vegetation using multivariate analysis of variance (Parsons 1994). Differences in insect biomass between warm-season food plots and native vegetation were evaluated using paired *t*-tests. The null hypothesis for all data analyses was that there was no difference between the samples being compared. All statistical tests were performed at an alpha level of 0.05.

RESULTS

A total of 37 nests were found during the 2 nesting seasons. Eggs in 10 of these nests hatched, 2 by relocated East Texas bobwhite hens and the remainder by resident bobwhites, including 1 by a subadult male. After the eggs hatched, the 9 radio-marked hens moved their broods from the nest site to a warm-season food plot in an average of 2.1 days (range 1–8); the cock and his brood were not recorded in a food plot for 36 days. Average distance moved from the nest site to a food plot was 217 m (range 100–300 m for hens, 400 m for the cock). Additionally, 1 hen paired with a radio-marked cock and flightless chicks (*ca* 7 days old) were captured on the edge of a food plot; the hen was fitted with a transmitter and released at the food plot. Another hen for which no nest was found was first recorded with chicks in a food plot. For the 12 broods with radio-marked parents, 774 telemetry locations were recorded. Of these, 501 (65%) were ≤15 m from a warm-season food plot and 273 (35%) were >15 m away from such a plot ($P < 0.001$).

During 1991 and 1992, 13 food plots (8 temporary and 5 permanent) were used by radio-marked parents with chicks. Neither density of stems at ground level nor overhead protection differed between food plots and native vegetation (Table 1). However, quail-level foliage was less dense in food plots than in native vegetation ($P = 0.015$) (Table 1). As only 6 warm-season food plots were used by radio-marked parents with chicks in 1992, 19 additional food plots were randomly selected and insects were collected in them and in adjacent native vegetation; thus, 25 samples were taken in food plots and in native vegetation. Mean weight of insects in the warm-season food plots was 0.302 g/sample, almost 3 times that in native vegetation, which was 0.105 g/sample ($P < 0.001$) (Table 1).

DISCUSSION

DeVos (1986) reported that while the use of brood habitats varied considerably, bobwhites tend to select areas with high insect densities. In our study, radio-marked parent bobwhites used warm-season food plots which were located within a matrix of native vegetation. This use of habitat was probably a result of greater insect biomass and more accessible structure in food plots than in native vegetation. Stoddard (1931) stated that legumes attracted or produced more insects than nonlegumes and Rosene (1969) noted that certain legume crops attracted bobwhites. More specifically, Burger et al. (1995) found that red clover produced significantly more invertebrate numbers and biomass than did 6 other types of cover crops. On the South

Boggy Slough study area, warm-season food plots contained several species of legumes, including American jointvetch, kobe lespedeza, partridge pea, Alyce clover, and iron and clay peas. The relatively high biomass of insects in food plots may be attributed to the presence of these plants. Differences in quail-level foliage density suggest native vegetation was more dense than food plot vegetation. The distance traveled and rapidity with which hens moved their broods to food plots demonstrated the importance of these plots. However, only 4 of 10 parents used the food plot which was nearest its nest. In no instance was more than 1 radio-marked parent with chicks recorded in a food plot and unknown parents with chicks were never recorded in a food plot that had a radio-marked parent and chicks.

Soil types, fertilizer rates, and planting rates and times were similar for all plots. Lack of familiarity with the area, trails leading to more-distant food plots, and better escape cover in and around plots may have influenced the parent bobwhites. Also, it is possible that competition with other bobwhites and their offspring may have influenced use of food plots.

Behavior of 4 radio-marked hens with broods suggests that the food plots served as more than insect-catching grounds for the chicks. Two such hens utilized food plots for approximately 9 weeks, and 2 others were actively using food plots when radio-tracking was concluded in October, 1992. In all cases, the chicks were still associated with the food plots when they were well past the age (2–4 weeks) at which they switch from insects to seeds, berries, and other types of vegetation (Landers and Mueller 1986).

Due to relatively small sample sizes, our results must be viewed with caution. However, the 11 hens with broods definitely moved to and remained in and around warm-season food plots. Johnson (1999:764) pointed out that the outcome of a statistical hypothesis test depends on results that were not obtained. In our case, it would have required 22 parents with broods which did not use warm-season food plots to statistically balance the 11 that did; we recorded only 1 such parent, the subadult male. Additionally, although radio locations were less frequent in 1990, 11 of 12 broods were recorded in warm-season food plots during that spring and summer. We encourage other biologists to investigate the use of warm-season food plots by bobwhites with chicks.

MANAGEMENT IMPLICATIONS

Our results suggest that properly implemented warm-season food plots can potentially provide habitat for bobwhites with chicks. Our data indicate that food plots should be within 200 m of suitable nesting habitat and escape cover should be associated with the plots. Escape cover can be in the form of native vegetation, cultivated species such as autumn olive and Thunberg lespedeza, or a combination of native and cultivated species.

In eastern Texas, supplemental food plots which contain warm-season species such as browntop, pearltop, and Japanese millets, Egyptian wheat, Alyce clover, iron and clay peas, American jointvetch, and kobe lespedeza are used by northern bobwhites.

ACKNOWLEDGMENTS

We thank R.M. Capps, H.B. Clark, K.E. Clock, S.L. Cook, S.D. Cottrell, B.G. Eichler, C.D. Foster, and R.D. Stanley for assistance in data collection. This research was funded by Temple-Inland Forest Products Corporation and Stephen F. Austin State University College of Forestry.

LITERATURE CITED

Burger, L.W., T.V. Dailey, E.W. Kurzejeski, and M.R. Ryan. 1995. Survival and cause-specific mortality of northern bobwhite in Missouri. Journal of Wildlife Management 59: 401–410.

Cottam, C. 1931. Animal food. Pages 158–159 and 521–533 *in* H.L. Stoddard. The bobwhite quail: its habits, preservation and increase. Charles Scribner's Sons, New York, NY.

DeVos, T. 1986. The Tall Timbers Report: Brood mortality and habitat. Quail Unlimited 5:20.

Eubanks, T.R., and R.W. Dimmick. 1974. Dietary patterns of bobwhite quail on Ames Plantation. University Tennessee Agriculture Experiment Station Bulletin 534, Knoxville.

Gould, F.W. 1975. Texas plants: a checklist and ecological summary. Texas Agriculture Experiment Station, Texas A & M University, College Station.

Hurst, G.A. 1972. Insects and bobwhite quail brood habitat management. Proceedings National Bobwhite Quail Symposium 1:65–82.

Johnsgard, P.A. 1973. North American game birds of upland and shoreline. University Nebraska Press, Lincoln.

Johnson, D.H. 1999. The insignificance of statistical significance testing. Journal of Wildlife Management 63:763–772.

Landers, J.L., and B.S. Mueller. 1986. Bobwhite quail management: a habitat approach. Miscellaneous Publication No. 6, Tall Timbers Research Station, Tallahassee, FL.

Liu, X. 1995. Survival, movements, and habitat selection of relocated and resident northern bobwhite in East Texas. Dissertation. Stephen F. Austin State University, Nacogdoches, TX.

Liu, X., R.M. Whiting, Jr., D.S. Parsons, and D.R. Dietz. 1996. Habitat preferences of relocated and resident northern bobwhite in East Texas. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 50:632–643.

Parsons, D.S. 1994. Nesting, brood habitat, and utilization of planted food plots by northern bobwhite in East Texas. Thesis, Stephen F. Austin State University, Nacogdoches, TX.

Roseberry, J.L., and W.D. Klimstra. 1984. Population ecology of the bobwhite. Southern Illinois University Press, Carbondale.

Rosene, W. 1969. The bobwhite quail, its life and management. Rutgers University Press, New Brunswick, NJ.

Stoddard, H.L. 1931. The bobwhite quail: its habits, preservation and increase. Charles Scribner's Sons, New York, NY.

White, G.C., and R.A. Garrott. 1990. Analysis of wildlife radio-tracking data. Academic Press, San Diego, CA.