Renovation of Johnsongrass Communities with Vetch to Benefit Northern Bobwhites

Dale H. Arner, *Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, MS 39762*

Jeanne C. Jones, *Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, MS 39762*

Chris H. Bucciantini, *Department of Wildlife and Fisheries, Mississippi State University, Mississippi State, MS 39762*

Abstract: Land taken out of cultivation in the Blackland Prairie soils of Alabama and Mississippi frequently reverts to a plant community dominated by Johnsongrass (*Sorghum halepense*), with co-dominants of marsh elder (*Iva annua*), verbena (*Verbena brasiliensis*), and Illinois bundleflower (*Desmanthus illinoensis*). These plant species are of little value as a food source for the northern bobwhite (*Colinus virginianus*) and eliminate many desirable quail food plants. Renovation of a Johnsongrass community was attempted by mowing during the fall and overseeding with hairy vetch (*Vicia villosa*). Seeds of this species are known to be utilized by quail during both spring and fall months. Data collected from line transects showed a 62% mean coverage of vetch at the end of the first growing season and a 92% mean coverage of vetch after the second growing season, with a corresponding decrease in coverage of Johnsongrass plant community species.

Proc. Annu. Conf. Southeast. Assoc. Fish and Wildl. Agencies 47:231–238

Agricultural lands set aside in the Conservation Reserve Program (CRP) vary greatly in plant composition depending upon soil fertility, erosion, and past land use. Plant species that dominate these areas will determine the quantity and quality of food available for quail. CRP lands in the Blackbelt Prairie resource area are of special interest.

One of the oldest agricultural areas in Mississippi and Alabama is found in the Blackland Prairie soils (Vanderford 1950). Vanderford (1975) estimated that in Mississippi there were 2 million acres of Blackland Prairie soils. He also wrote that these soils developed from soft limestone, are of heavy texture, and are high in fertility. He believes the heavy texture results in low permeability in the soil which causes great runoff of rain water. Vanderford (1950) reports that the high lime content of the soil flocculates the soil particles into aggregates which erode easily.

The Blackland Prairie soils are frequently dominated by Johnsongrass. Vanderford (1950) reported that the Blackland Prairie area is a natural habitat for Johnsongrass, which after it was introduced into the Blackland Prairie of Alabama, spread rapidly over the entire prairie both in Alabama and Mississippi.

Although Johnsongrass seed is known to be used in small amounts by quail (Stoddard 1931, Rosene and Freeman 1988), Stoddard (1931) wrote that after examining many Johnsongrass plants, he found most of the seed heads to be blasted. He came to the conclusion that the plant was below average for quail food and difficult to control.

The ecological characteristics of Johnsongrass negatively impact several genera of herbaceous plants including *Amaranthus, Seteria*, and *Digitaria* which are recognized upland game bird food plants (Martin et al. 1951). Germination and growth of these pioneer plants are inhibited by toxins released from decaying rhizomes and leaves of Johnsongrass (Abdul-Wahab and Rice 1967). Actively growing perennial grasses are also known to release excretions from living roots which inhibit sensitive nitrifying bacteria (Theron 1951). The inhibition could impact important legumes and account for the scarcity of *Lespedeza* spp. and *Desmodium* spp. in Johnsongrass communities.

Plants commonly associated with Johnsongrass on CRP lands in the Blackland Prairie are verbena, coneflower (*Rudbeckia lacinata*), marsh elder, Illinois bundleflower, goldenrod (*Solidago* spp.), and broomsedge (*Andropogon* spp.) (S. McDaniel, Miss. State Univ., pers. commun.). These plant species are not considered to be valuable food sources for upland game birds (Martin et al. 1951).

Disking and plowing often are recommended by wildlife managers as methods to bring about more desirable herbaceous plant communities (Stoddard 1931, Rosene 1969). However, these methods are counterproductive for changing Johnsongrass communities since this grass spreads by underground buds located on rhizomes which are activated by disking and plowing (Duke 1985). Furthermore, disking generally is limited on most CRP lands due to soil stabilization specifications set by the Soil Conservation Service.

Therefore an alternative management plan was sought to reduce Johnsongrass and introduce a desirable species of game bird food plant. We conducted a literature review to ascertain if there were plants known to exhibit allelopathic properties for Johnsongrass or other pioneer plant species. Of the plant species considered, hairy vetch appeared to hold the most promise for testing. Rice (1974) noted that several researchers (Lazauskas and Balinevichiute 1972) found that seeds of hairy vetch inhibited germination and seedling growth of 13 species of herbaceous plants. However, Johnsongrass was not included within that list. Vetch is acknowledged to be a valuable quail food plant by both Stoddard (1931) and Rosene and Freeman (1988). Stoddard (1931) wrote that nesting pairs and unmated cocks station themselves near fields of Austrian winter pea (*Psium sativum*) and vetch during the summer months; birds collected and examined had fed extensively on both legumes. During a 3-year statewide study of hunter-harvested quail in Mississippi, vetch was reported to rank in the top 10 foods taken in 5 different soil resource areas throughout the state (D. Brazil, unpubl. data).

After hairy vetch was selected as the plant species to introduce into CRP lands dominated by an old-field plant community of undesirable grass and forbs, it was felt the mode of introduction should be by overseeding on mowed vegetation. This method involves minimal soil disturbance and does not require specialized equipment.

Methods

The study area was located in east-central Mississippi on CRP lands near West Point in Clay County. The area has been out of cultivation and in the CRP program for a period of 5.5 years. Previously, this area had been in soybeans for 5 years, in pasture for 6 years, and before that, cotton. The CRP field where the study site was established is 45 ha in area and is located in the Blackland Prairie. The soils were identified by D.E. Pettry (Miss. State Univ., pers. commun.) as Leeper clays (fine, montmorillonitic, nonacid, thermic Vertic Haplaquepta), and analysis was made by the Mississippi State University Agronomy Department. Analysis showed a pH range from 7.5 to 8.2, low in available phosphorus, and medium in available potash. The study sites had an estimated slope of 3% and were dominated by Johnsongrass, with scattered clumps of marsh elder, goldenrod, broomsedge, and verbena.

During September 1989, 2 strips were mowed in the grass/forb complex of the above mentioned CRP lands. Each of the mowed strips was approximately 30 m wide nd 200 m long; the 2 mowed strips were separated by a 17-m wide unmowed strip. Within each of the 2 mowed strips, 3 plots measuring 12x15 m were randomly established, for a total of 6 plots. The 3 plots within 1 of the mowed strips received no further treatment and were used as control plots; the 3 plots in the other mowed strip were sowed with hairy vetch at the rate of 56 kg/ha. Apparently winterpea (*Lathyrus hirsutus*) seeds were intermixed with the vetch seed and the resulting plants were often intertwined. Winterpea produces a similar appearing seed and foliage; thus, no attempt was made to differentiate between these species. Within each of the 6 plots, 2 randomly selected 15-m line intercepts as described by Canfield (1941) were established and marked with wooden stakes and flagging. Percent ground coverage of each species was determined along each line intercept during the spring and fall of 1990 and 1991. Statistical evaluation of percent vegetative cover between seeded and unseeded plots was performed utilizing Student's *t*-test for unmatched data.

Results and Discussion

Utilizing a 2-sample *t*-test, vetch coverage was greater on seeded plots than control plots during 1990 ($t = 4.31$, 4 *df*, $P = 0.502$) and 1991 ($t = 8.95$, 4 *df*, $P = 0.000$). Coverage of vetch was highest during the vernal phases of 1990 and 1991, ranging from a mean coverage of 65% in 1990 (Fig. 1) to a mean coverage of 92% in 1991 (Fig. 2). Judging from the greatly increased coverage of this annual species the second year, it was evident that these plants produced an abundance of seed

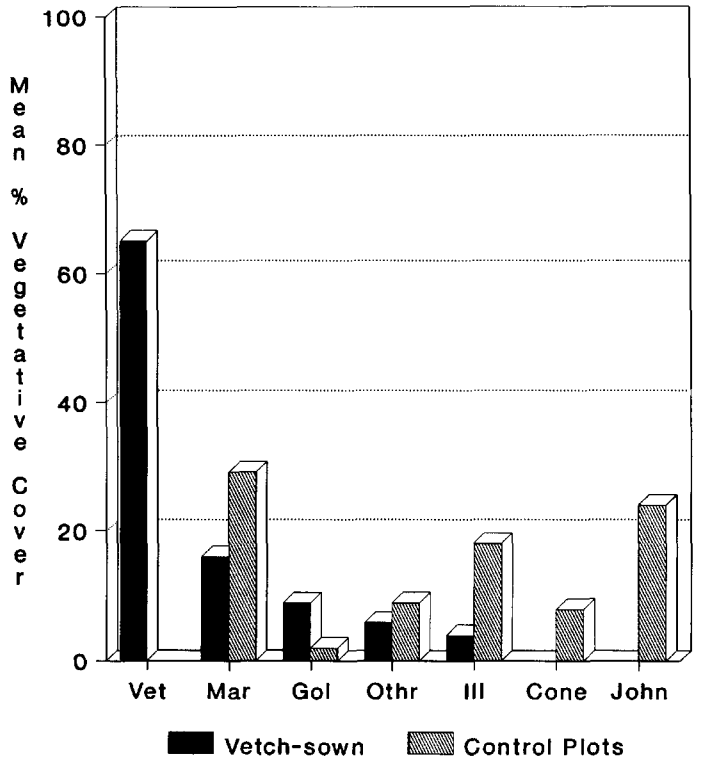

Figure 1. Mean percent ground coverage of vegetation within vetch plots and controls on CRP lands in the Black Prairie - spring 1990. Legend: Cone - coneflower, Gol - goldenrod, Ill - Illinois bundleflower, John - johnsongrass, Mar - marsh elder, Othr - other, Vet - vetch.

during the 1990 growing season. Although line intercepts were not taken the third year, vetch coverage appeared to be extensive that year as well. The density of vetch coverage during the vernal phase could be an impediment to ground feeding birds, thus narrow strips 4–8 m wide providing edges between vetch and old field plant communities would make vetch seeds more available to ground feeding birds.

Vetch plants died during midsummer, producing detrital coverage on vetch seeded plots. Vetch was succeeded during late summer by a paucity of plant species, with the dominant coverage being comprised of aster in 1990 (Fig. 3) and verbena in 1991 (Fig. 4). Percent of detrital coverage in vetch plots was greater than in the control plots ($t = 3.95$, 4 df, $P = 0.017$), ranging from a mean of 36% in 1990 to a mean of 50% in 1991. The most plausible explanation for the reduction of vegetation is the mulching and allelopathic effect of decaying vetch vegetation and seed.

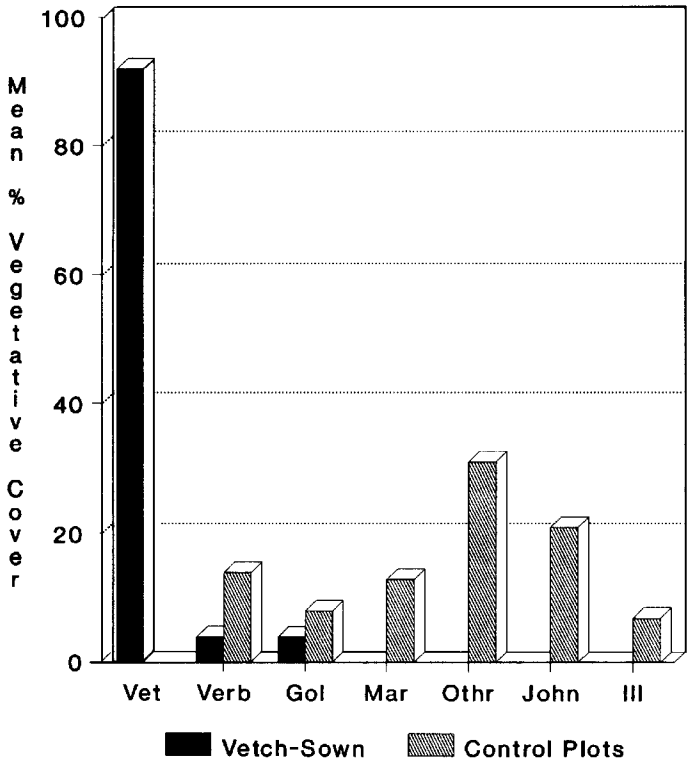

Figure 2. Mean percent ground coverage of vegetation within vetch plots and controls on CRP lands in the Black Prairie - spring 1991. Legend: Gol - goldenrod, Ill - Illinois bundleflower, John - johnsongrass, Mar - marsh elder, Othr -other, Verb - verbena, Vet - vetch.

Few plants of recognized value for quail and doves were documented on the line transect intercepts in the control plots, with Johnsongrass, marsh elder, verbena, Illinois bundleflower, and coneflower dominating the ground coverage. Control plots exhibited significantly greater coverage of Johnsongrass during the fall periods when compared to vetch plots for 1990 (t = 11.00, 4 df, P = 0.000) and 1991 (t = 1.48, 4 df, P = 0.203). During fall 1990, Johnsongrass coverage averaged 4% in vetch-seeded plots, whereas the mean coverage of Johnsongrass on control plots was 17%. During the 1991 fall season, Johnsongrass coverage increased on both vetch-seeded and control plots, with a mean coverage of 24% and 47%, respectively. However, Johnsongrass coverage continued to be less on vetch-seeded plots than on control plots during the fall of 1991 (t = 1.48, 4 df, P = 0.202). Cursory examination in the spring of 1992 showed that vetch was still abundant on the vetch-seeded plots established in 1989.

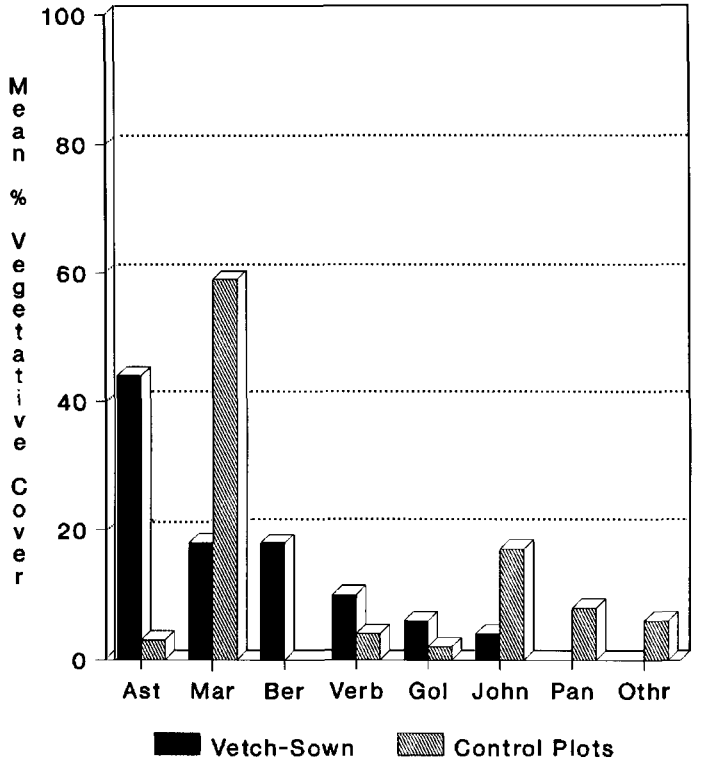

Figure 3. Mean percent ground coverage of vegetation within vetch plots and controls on CRP lands in the Black Prairie - fall 1990. Legend: Ast - aster, Ber - bermuda grass, Gol - goldenrod, John - johnsongrass, Mar - marsh elder, Othr - other, Pan - panic grass, verb - verbena.

Conclusions

Based on the results of this study, September mowing and overseeding with hairy vetch can greatly increase food availability for northern bobwhites on Black Prairie soils. The extensive coverage of vetch during the vernal phases in 1990 and 1991 showed that vetch seed and sprouts were available for quail over a 2-year period. Preliminary results indicate that vetch may also have an inhibitive effect on the establishment of pioneer plants such as Johnsongrass, verbena, and marsh elder.

Additional research is needed to ascertain the longevity and seed production of vetch, as well as the most desirable width and length of vetch strips for enhancement of upland game bird food in CRP lands. More extensive research is planned in order to document vetch treatment effects within different CRP field sites.

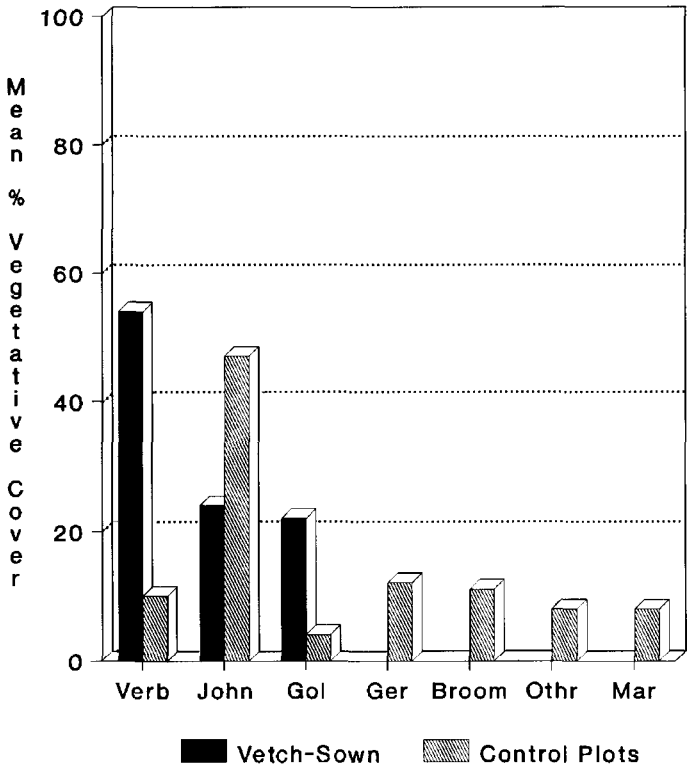

Figure 4. Mean percent ground coverage of vegetation within vetch plots and controls on CRP lands in the Black Prairie - fall 1991. Legend: Broom - broomsedge, Ger - gerardia, Gol - goldenrod, John - johnsongrass, Mar - marsh elder, Othr - other, Verb - verbena.

We feel that mowing and overseeding with hairy vetch is a practical technique which can be used to enhance upland game bird habitat while meeting the CRP soil stabilization constraints.

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