SHRUB LESPEDEZA AS A QUAIL MANAGEMENT PLANT IN SOUTHEASTERN VIRGINIA

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Bicolor lespedeza *(Lespedeza bicolor)* and related species of shrub lespedeza have been widely recommended (Davison 1949) as quail management plants for the southeastern states. This plant has been widely used in most of the southeastern states (Pierce 1951) and in recent years a considerable amount of attention has been given to the improvement of the strains more suited to a wider area (Davison 1945). The production and distribution of the plant for the improvement of habitat for quail has been undertaken on an extensive scale in a number of states, including Virginia. From 1948 through 1953 Virginia has distributed 6,926,775 plants and 16,851 pounds of bicolor seed to cooperating farmers. This represents an estimated cost of at least $38,000.00 for the materials alone.

So far as can be determined, very little published information is available regarding the increase of a quail population on agricultural lands, the increase being due to the planting of bicolor as a source of food for quail. Davison (1949) does present data on the increase which he has observed on quail preserves. In Virginia, the production and distribution of bicolor has consituted a major portion of the farm game program; therefore, it seemed desirable to investigate the responses of the quail populations present on farms following the planting of bicolor. Thus, the primary objective of this investigation was to determine the influence, if any, of the planting of bicolor upon quail populations present on a group of farms.

The farms utilized in this investigation were selected objectively under the following criteria: 1) Of sufficient size to permit the planting of at least one acre of bicolor in areas on the farm that according to proper land-use were best adapted for such plantings, i.e., without hindrance to normal farming operations; 2) the crops grown on the farm were typical of the county; 3) the farm was operated as a full-time agricultural endeavor, i.e., not a game preserve or as a part-time venture; 4) the farmer would agree to plant the bicolor strips in conformity with good farm land-use practices as recommended by the local technician of the Soil Conservation Service and the game biologist; and 5) the owner would protect the plantings from fire and grazing, and would permit the game biologist to census the farm annually for quail for six years. Fifteen farms were selected, one in each of the following southeastern Virginia counties: Amelia, Brunswick, Dinwiddie, Greensville, Isle of Wight, Lunenburg, Mecklenburg, Nansemond, Norfolk, Nottoway, Prince George, Princess Anne, Southampton, Surry and Sussex.

The fifteen farms were selected, mapped and a quail census made in the fall of 1948. In the spring of 1949 bicolor borders were planted, as near as possible, according to the recommendations of Davison (1948). Each planting utilizing seedlings was planted 15 feet wide and at least 400 feet or more in length, and was fertilized with 2-12-12 fertilizer at the rate of 800 pounds per acre. A total of one acre of bicolor plantings, and an average of six border strips per farm (ranging

from four to eight borders) were planted. One farmer, due to misunderstanding, plowed up his bicolor plantings in 1951, therefore, the records on this farm were not utilized. Thus, the investigation includes records on 14 farms, with 79 field borders totaling approximately 13.5 acres.

The writer assisted in the planting of a majority of the bicolor field borders on the demonstration farms. As is typical throughout most of Virginia, and elsewhere (Marshall 1953), practically no maintenance (cultivation, cutting or fertilization) was given these borders after they were installed. A majority of the plantings would be rated as superior (Rating of "A") under the system proposed by Shaffer (1953).

This experiment was designed with the assumption that if bicolor plantings were properly made under a good land-use plan, they would result in a measurable increase in quail populations on planted farms if they were to be acceped as a quail management tool. The experimental design should have included an equal number of untreated farms. However, after censusing the quail on the planted farms it became evident that, with other duties of the writer, this would be impossible. Approximately 150 man hours and some 300 dog hours were spent afield for each annual census. This did not include the travel time which in most cases was more than the time involved censusing. Therefore, it order to measure the general trends in the quail population of the region for comparative purposes, ten outstanding quail hunters in each of the fifteen counties were requested to supply data on their hunting success during each of the give years, 1949 - 1953. It was impossible to get sufficient cooperators in two of the fifteen counties, and about 30% returns were received from the remaining thirteen counties for the five-year period. From the data received from these hunters (which included hours hunted, coveys located, quail killed, sex of the quail bagged; wings were also collected during the first two weeks of the hunting season), it is believed that a reasonable measure of the quail population, characteristics, and trends for the region was secured.

For an annual census of the demonstration farms approximately one man hour was spent per 100 acres (one-half cleared land) each of five different days during the fall. Usually two well-trained shooting dogs were used. That would mean five man hours and ten dog hours were necessary to make the annual census of 100 acres. On each trip to the farm a separate mimeographed map of the farm was used. The date, time, names of dogs, and notes were recorded on the margin of the map. The location, number and direction of flight of all coveys located was also recorded. Upon the completion of the five census trips an annual census map was made, from the data on the individual census maps, indicating the estimated number of coveys on each farm. It is not claimed that this was a perfect census, but it is believed that the average bird hunter would not locate any more, and probably not as many quail if he were to hunt any one of the farms during the season.

It has been indicated by Stoddard (1936, p. 347) that the records of quail seen and killed afield would make more detailed population studies possible. He states, "such records will be of inestimable value in judging both the trend of quail populations and the causes of abundance and scarcity." Bennitt (1951) indicates in his work in Missouri that the number of coveys flushed per unit of time is "significantly" related to the hunting success. Therefore, the records of 10,082.8 hours of hunting in southeastern Virginia are used to evaluate trends in the quail population for the five-year period 1949 - 53.

The percent of juvenile quail in the hunter's bag has been considered to be an indicator of the trends and condition of a quail population (Sanford 1952). For the period studied, apparently no great change in the ratio of juvenile to adult quail was observed, the average percent of juveniles for the five years 1949 - 53 being 81.6% as compared to "81.9%" juvenile from Missouri for the period 1939 - 48 (Bennitt 1951, p. 34).

The average coveys flushed for eight hours hunting in Missouri (Bennitt 1951) was 5.99 for the period 1943-48, or 0.749 coveys flushed per hour; while in southeastern Virginia for the period 1949 - 53, 0.740 coveys were located per hour hunted. The sex ratio and percent crippling losses appears to be quite similar (Table 1). The apparent difference in hunting success was possible due to 42.1% of the coveys of quail being located in the woods in southeastern Virginia.

Table 1. Data from hunter record cards.

Year	Coveys located per hour hunted	Hours hunted	Quail killed per hour hunted	Males per 100 females	Percent shot and lost
1949	0.81	890	0.92	112.2	12.9
1950	0.72	1,742.5	0.98	115.0	11.2
1951	0.82	2,411.3	0.99	114.7	11.0
1952	0.72	2,699.5	0.89	108.7	8.7
1953	0.68	2,339.5	0.89	127.7	9.4
Average	0.74	2,016.6	0.93	115.7	10.7

(Bennitt 1951: 1943-48, 0.749; 1938-48, 1.44; 1938-48, 113.41; 1939-48, 7.5)

Table 2 records the census of the fourteen farms over the period studied. The total coveys located on the censused farms is plotted on Fig. 1 for the years 1948 - 53. The quail population appeared to make a sharp rise during the second year of censusing (the fall of the year that the bicolor was planted). The next fall there appeared to be a sharp decline in the quail population, then there was a gradual decline in the population of the farms censused with the exception of a slight rise in the population in 1951. It should be noted that there was no large scale change in the crops or land-use practices on any of the farms studied.

Table 1 lists the data from the hunter questionnaires. The average coveys located per 100 hours hunted is plotted on Fig. 1 for the years 1949 - 53. The reported coveys located follows a downward trend from 1949 to 1950, then a slight increase in 1951, and then a gradual decline in 1952 and 1953. Thus the trends in the reported coveys located per 100 hours hunting in the southeastern portion of Virginia appears to follow the same trends as the censused population on the demonstration farms in this region.

The percent of juvenile quail (Table 3) as determined from collected wings appears to follow a similar trend over the period studied, but for all practical purposes appears to remain relatively constant.

Table 2. Census data for bicolor lespedeza demonstration farms, 1948 - 1953.

County	Acreage[a]		Bicolor borders		No. of quail coveys located by years					
	Cleared	Total	1949	1953	1948	1949	1950	1951	1952	1953
Amelia	110	360	6	6	7	9	7	8	6	4
Brunswick	140	290	5	5	6	11	9	11	7	6
Dinwiddie	63	130	8	9	3	5	3	3	4	4
Greensville	119	339	6	6	4	4	4	4	4	4
Isle of Wight	80	160	5	4	3	3	3	2	2	2
Lunenburg	70	142	8	8	2	3	3	4	4	3
Mecklenburg	100	193	5	4	4	5	5	4	3	3
Nansemond	255	405	4	4	5	5	5	5	6	5
Nottoway	115	265	6	4	2	3	4	3	4	3
Prince George	72	177	6	6	3	4	4	2	2	3
Southampton	190	360	6	6	4	3	1	3	3	4
Surry	110	185	4	4	6	7	5	5	4	4
Sussex	70	142	5	5	2	2	3	4	4	4
Princess Anne	310	515	8	8	5	8	6	7	5	5
	1,804	3,661	82	79	56	72	62	65	58	54

[a] The acreage of the area of the farm which was censused; determined in 1953.

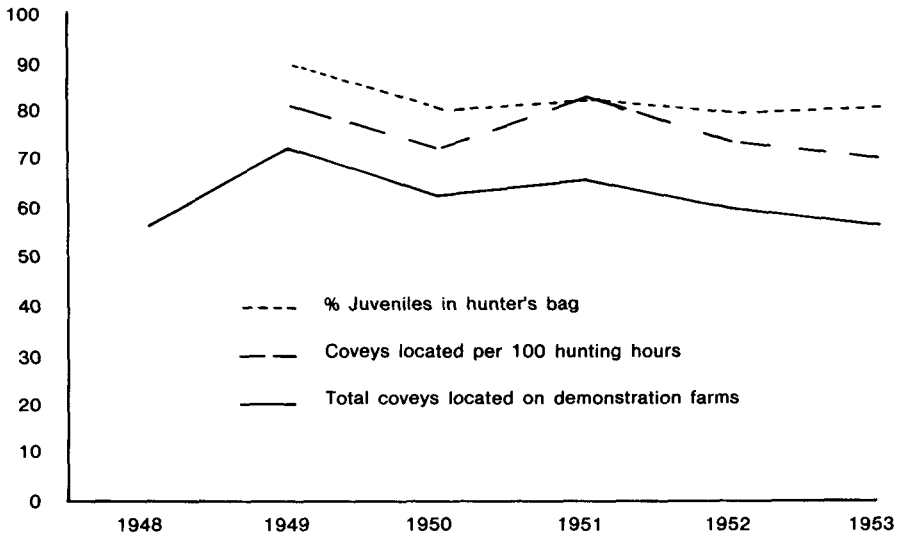

Fig. 1. Hunter and census data as related to year of collection.

Table 3. Data from collected wings.

Year	Wings examined (Petrides and Nestler 1943)	Percent juvenile
1949	482	89.5
1950	558	80.1
1951	476	81.5
1952	477	78.2
1953	414	78.7
Average	481	81.6
(Bennitt 1951) (1942-48)	51,243	81.9

It is assumed that the coveys located per 100 hours by hunters is an indication of trends in the quail population in southeastern Virginia, and that the census of the demonstration farms is a complete census for all practical purposes. The quail populations on the censused farms appears to follow the same trends as the quail population in southeastern Virginia. The statistical aspects of these conclusions are discussed in the Appendix.

From 1,666 dog hours involved in censusing fourteen farms containing approximately a total of 3,661 acres of land with a maximum of 14 acres of bicolor lespedeza and a minimum of 13.5 acres of bicolor lespedeza; records from 10,082.8 hours quail hunting; and the examination of 2,407 quail wings, the following conclusion is drawn. Under the assumptions of the study, bicolor lespedeza field borders planted according to existing recommendations have had no noticeable effect on the quail populations on the fourteen farms censused in southeastern Virginia during the period studied.

ACKNOWLEDGMENTS

This quail management study has been dependent on the cooperation of many people. My humble appreciation and sincere thanks is extended to the following persons: The game wardens in southeastern Virginia aided in the selection of the demonstration farms, and located quail hunters who were willing to keep records of their hunting for the study of the quail population; the unit technicians with the Soil Conservation Service aided in the selection of the farms, planning of the bicolor borders, and the mapping of the demonstration farms; the owners of the demonstration farms, who planted the bicolor field borders and permitted the biologist and his dogs to census the farms five times a year for six years; the hunters in southeastern Virginia for keeping records of their quail hunting, and saving quail wings; the members of the Game Division of the Commission of Game and Inland Fisheries for their interest and encouragement in this project; Dr. H. S. Mosby for his assistance in the preparation of the manuscript, and Dr. Vincent Shultz for the statistical analysis of the data.

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APPENDIX

Dr. Vincent Schultz, former Assistant Unit Leader of the Virginia Cooperative Wildlife Research Unit, submitted the following statistical analysis of the data herewith presented:

"In regard to quail populations, the results of an analysis of variance disclosed a very significant difference (1 percent level of significance) between farms and a significant difference (5 percent level of significance) between years (Table 1). Such a relationship between farms is to be expected as a result of variability of such factors as farm-size and land-use practices.

Table 1. Results of analysis.

Source of variation	D.F.	Sum of squares	Mean square	F
Between farms	13	228.3929	17,5686	16.00[a]
Between years	5	15.7738	3.1547	2.87[b]
Linear	1	2.4500	2.4500	2.23
Quadratic	1	6.5850	6.5850	6.00[b]
Cubic	1	0.0302	0.0302	0.03
Residual	2	6.7086	3.3543	3.05
Error	65	71.3929	1.0983	
Total	83	315.5596		

[a] Very significant (99 percent level).
[b] Significant (95 percent level).

"Using the orthogonal polynomials of Fisher and Yates an analysis of linear and non-linear regression components of the sums of squares for years are made (Table 1). It is seen that a straight line is an inadequate fit of the data and that a quadratic equation is a satisfactory fit. Thus, it appears that the quail population in the region studied gradually increased and then decreased over the period studied.

"The question now arises: Are the quail populations on the farms sampled atypical of the southeastern section of Virginia? As the farms were not selected at random this is a proper question. However, if we study in the region as a whole some variables, such as percent juvenile birds in the hunter's bag or number of coveys flushed per 100 hours of hunting effort, that are related to the total quail population, we might be able to say that the populations on the censused farms are correlated with these variables and, therefore, are not typical of the region. Results of tests for significance of a correlation coefficient (Table 2) resulted in a significant correlation between coveys flushed per 100 hours of hunting effort and

Table 2. Results of tests for the significance of a correlation coefficient.

Correlation Coefficient[a]	D.F.	Value
r_{12}	3	0.88 *
r_{13}	3	0.73
r_{23}	3	0.91 *
r_{123}	2	0.89

$r_3 = 0.878(0.959)$
$r_2 = 0.975(0.995)$

[a] r_{12} = simple correlation between coveys/100 hours flushed by hunters and census results (total coveys).
r_{13} = simple correlation between coveys/100 hours flushed by hunters and percent juveniles in bag.
r_{23} = simple correlation between census results (total coveys) and percent juveniles in bag.
r_{123} = multiple correlation between coveys/100 hours flushed by hunters and both variables.

census results and also between census results and percent juvenile birds in the hunter's bag (Table 2). The simple correlations between coveys flushed per 100 hours hunting effort and the two variables were not significant. It therefore, appears that our sampled farms quite probably had quail populations typical of the region.

"Difficulty now arises in determining whether or not bicolor lespedeza had an effect on the quail population. The data indicates that the studied population followed a quadratic trend over the period studied. Was this the result of the plantings or typical of the population in the region as a whole? The reliability of our answer depends upon the assumptions of our previous attempts, using correlation tests, to identify the sampled population with that of the region. Assuming that the assumptions underlaying these correlations are correct it appears that the wildlife plantings of bicolor lespedeza had no effect on the quail population on the sampled farms. The plantings did not result in a gradual increasing population throughout the period studied or a population that increased and then leveled off."