ACORN YIELD AND YEARLING WHITE-TAILED DEER ON LAND BETWEEN THE LAKES, TENNESSEE

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ABSTRACT--The percentages of yearling male and female white-tailed deer in fall harvests on the Tennessee portion of Land Between The Lakes (LBL) were significantly related to the density of sound, fallen acorns 2 years previously. Mean antler beam diameter, mean beam length, and mean number of antler points of yearlings were significantly related to acorn density of the previous year. Sustained acorn production, enhanced by improvement-type timber harvesting, is central to multiple-use forest and wildlife management on LBL.

Acorns are an important autumn food for white-tailed deer (*Odocoileus virginianus*) throughout much of their range (Harlow et al., 1975; Pekins and Mautz, 1987). For many deer populations, acorn availability is a factor affecting both reproductive success and physical condition. Here, we report on the effects of fall acorn density on the percentage of male and female yearling white-tailed deer harvested and on the mean number of antler points, mean antler beam diameter, and mean antler beam lengths of yearling white-tailed deer. The percentage of yearlings in the population each year is a reflection of recruitment and overall reproductive success. Antler characteristics are important considerations in a deer management program oriented toward harvesting deer.

MATERIALS AND METHODS

The study area was the Tennessee portion of Land Between The Lakes (LBL), a 22,980-ha area dominated by oak (*Quercus* sp.)-hickory (*Carya* sp.) forest with interspersed fields of lespedezas (*Lespedeza* sp.), Kentucky 31 fescue (*Festuca elatior*), white clover (*Trifolium repens*), grasses, and sedges. Yield of sound, fallen acorns (with no insect or disease damage) was estimated each year using methods of Whitehead (1967). This procedure has been used throughout Tennessee since 1967 and has been validated on LBL using felled trees (M. Cope, pers. comm.). Ten stations, each consisting of 10 trees >25 cm diameter breast height (dbh), were monitored. About 60 trees were from species in the white oak group, including white oak (*Quercus alba*), chestnut oak (*Q. prinus*), post oak (*Q. stellata*), chinkapin oak (*Q. muehlenbergii*), swamp oak (*Q. bicolor*), overcup oak (*Q. lyrata*), and bur oak (*Q. macrocarpa*). The remaining 40 trees were from the red oak group, including red oak (*Q. rubra*), southern red oak (*Q. falcata*), scarlet oak (*Q. coccinea*), black oak (*Q. velutina*), blackjack oak (*Q. marilandica*), willow oak (*Q. phellos*), and pin oak (*Q. palustris*). Percentages of trees from each group equalled overall forest composition, and sites represented various slope and topographic aspects. For each tree, an estimate was made of the percentage of the total live crown that produced acorns. Five 1-m long limbs were selected from the portion of the crown producing acorns. The number of twigs, number of twigs with acorns, and the total number of acorns were counted for each limb. An estimate of sound, fallen acorns was then derived from these three variables, the mean basal area of acorn-producing oaks (on LBL, total basal area of oaks >25 cm dbh averages 10.4 m^2/ha), and the known average percentage of acorns available to deer (= 53%; the remainder of acorns are eaten in the tree or lost to insects and disease on the ground). Acorn yield data from 1976 through 1988 were used in the analyses.

Percentage of yearlings was the number of harvested adults ($\geq$1.5 years of age) that were 1.5 years old. Antler characteristics were measured at deer-check stations from 1977 through 1989. Only antler points >2.5 cm in length were counted. Mean antler beam diameter (measured 2.5 cm above the coronet) and length were measured. Acorn yield was used as the independent variable in simple linear regressions. Percentage male and female yearlings harvested 2 years later and antler characteristics 1 year later were used as dependent variables to determine relationships. All data were normally distributed (Shapiro-Wilk *W* statistic). Relationships were considered statistically significant at $P < 0.05$.

RESULTS AND DISCUSSION

From 1974 through 1989, the average sample size of yearling males was 233 (range = 165-326); percentage of yearling males ranged from 49.0 to 78.2 of the adult male harvest. The average sample size of yearling females was 60 (range = 43-87); percentage yearling females ranged from 21.6 to 44.0 of the adult female harvest. Acorn yield varied from 0.4 to 51.6 kg/ha. For both sexes, there was a direct, significant relationship between acorn yield and the percentage of yearlings in the harvest 2 years later (Fig. 1). Harlow and Jones (1965) also found a direct relationship between acorn abundance and the percentage of harvested yearling males 2 years later in Florida. Although a poor acorn year may not directly affect gross productivity the following spring, the nutritional stress on pregnant does may reduce overall reproductive success through increased postnatal mortality of fawns (Verme, 1962; Murphy and Coates, 1966; Segelquist et al., 1969).

During the study period, the mean number of antler points for yearlings was 3.8 (range = 3.2-5.0), mean antler beam diameter was 1.78

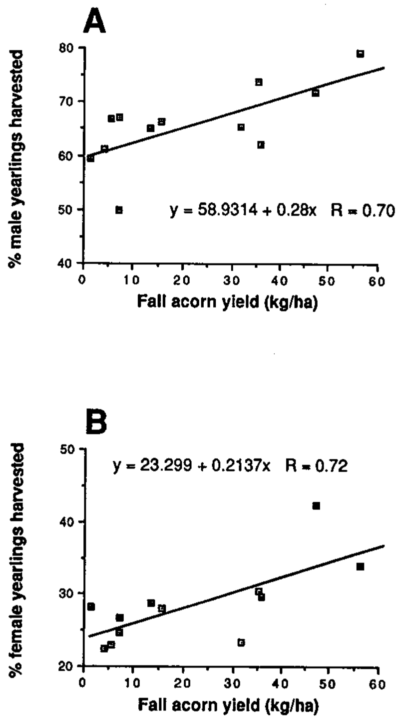

FIG. 1. Relationship between fall acorn yield from 1976 through 1987 and the percentage of yearling males (A) and yearling females (B) harvested 2 years later, 1978 through 1989, on Land Between The Lakes, Stewart Co., Tennessee.

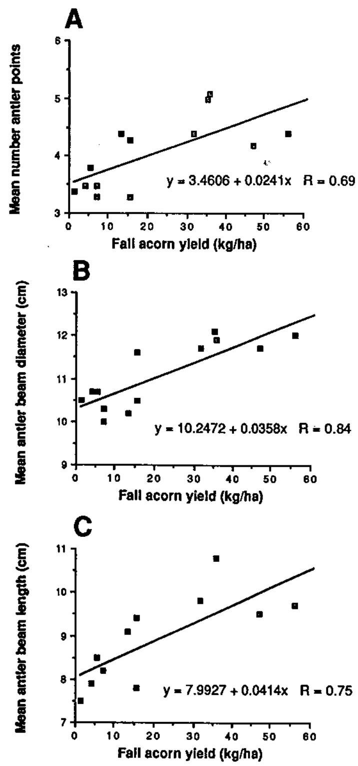

FIG. 2. Relationship between fall acorn yield from 1976 through 1987 and mean number of antler points (A), mean antler beam diameter (B), and mean antler beam length (C) in yearling males harvested 1 year later, 1977 through 1988, on Land Between The Lakes, Stewart Co., Tennessee.

cm (range = 1.57-2.03 cm), and mean antler beam length was 22.76 cm (range = 18.79-27.18 cm). Significant linear relationships were apparent between each of these three variables and acorn yield the previous year (Fig. 2). Besides age and genotype, nutrition is a well-known component of antler development in white-tailed deer (Hesselton and Hesselton, 1982; Ullrey, 1982). Fall-winter feed restrictions (acorn yield) may not significantly affect antler development if diets are good during the spring-summer period (Cowan and Long, 1962; Suttie and Kay, 1983). The direct relationships between acorn yield and antler development in white-tailed deer on LBL reinforces the importance of acorns and suggests that spring-summer forage is not always adequate for deer to establish necessary winter fat and energy reserves without acorns.

Considering the importance of acorn availability to deer and other wildlife, forest management activities should be carefully planned to provide a sustained yield of acorns. Acorn production is influenced by age, size, and species of oak (Goodrum et al., 1971) and weather factors. On the Tennessee portion of LBL, fall acorn density and body weight of fawn and yearling white-tailed deer were shown to be positively related to the cumulative number of days with precipitation during the previous three or four winters (Feldhamer et al., 1989). Systematic regeneration cuttings, thinnings, and improvement-type timber harvests that enhance dominant/codominant trees and provide a range of age classes can be used to maintain or enhance acorn yields during a longer percentage of the rotation period (Minckler, 1957; Sharp and Sprague, 1967; Shaw, 1971). Thus, one of the forest management objectives on each of the 65 management zones on LBL is to maintain 50% of the zone in tree species and size class compositions capable of sustained mast production. Although acorn yields may be extremely variable because of weather and other factors beyond a manager's control, maintaining a variety of oak species and age classes within each zone may minimize fluctuations in acorn production. This is essential to sustained acorn yield and associated direct impacts on several important aspects of deer populations.

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