GENETIC changes in breeder seed of a bred variety of red clover (Trifolium pratense L.) should be prevented during successive seed generations required to maintain the variety for agricultural use. Such changes are very difficult to prevent because environmental pressures inevitably vary somewhat from generation to generation. A reasonable solution to the problem would seem to be the production of breeder seed on perennially maintained selected clones since red clover can be vegetatively propagated without difficulty (6).

Although some information on persistence of red clover seedlings under seed production conditions exists, very little is available on persistence of clonal transplants. Kendall and Hollowell (4) found that clonal plants which had set seed in a growth chamber produced significantly less growth than less mature plants, but when grown in the dark, the plants which had previously set seed survived as long and grew as much as the less mature plants. Whether this could be equated to persistence under field conditions was not known. Although the response may not be comparable with that of clones, Bird (1) and Smith (5) found that plants which had flowered and presumably produced some seed were more susceptible to winterkilling than those which went into the winter as rosettes. Crowder and Echeverri (2) also stated that plants which had produced seed were less persistent than nonflowering plants. These facts suggest that the mortality of clonal plants under conditions of seed production may be high.

The objectives of the experiments described in this paper were to determine the variation in seed production and length of the life span of clonal transplants and, more important perhaps, to elucidate some of the factors contributing to seed yield and persistence.

PROCEDURE

Plants were obtained from crown-bud cuttings of 416 Kenland red clover plants rooted in flats containing a mixture of equal parts of sand, sedge peat, and a moderately organic soil. Plant bands 25½ by 13½ by 134 inches in size were used to separate the propagules and thus maintain their identities. Each flat contained 70 cuttings, which were placed in a plastic greenhouse and allowed to root. The rooted cuttings remained in the rooting medium until transplanted April 18, 1957, to a field near Lexington, Ky., where they were maintained under clean cultivation.

Five propagules of each clone, spaced 18 inches by 3 feet in each of 4 replications, were transplanted in a randomized block design. One hundred and thirty-four of the clones previously had been selected for persistence from a group of 1636 third-year plants dug from old fields. The other 282 plants were from second-year stands of Kenland red clover. The experiment was maintained for 5 growing seasons, 1957 through 1961.

Plants of each clonal row were scored for vigor, leafiness, maturity, and virus symptoms on a unit basis. The score for a given character in effect represented an average of the plants within the row. In general, scores were made by using a scale of 1 to 9, with the highest number indicating the most of a given character. Top growth of the clones was removed twice during each growing season with seed being harvested by hand during August from the second growth of each clone in the first three seasons. Vigor, leafiness, and maturity usually were scored on the second growth in August and virus symptoms and stand on the third growth in October. In the third season, however, vigor was scored in April on the first growth and virus symptoms on the second growth in July. Threshing, cleaning, and weighing of seed were done during the winter after harvesting. Data were placed on cards and processed by the use of IBM machines at the University of Kentucky. Because of loss of many clones in the test as time passed the data were analyzed as a completely randomized design. Correlation coefficients were calculated on a clonal-row basis.

RESULTS AND DISCUSSION

Persistence—Graphs of the frequency distributions of percent stand by clones at the end of the first 3 growing seasons (Figure 1) show that the number of clones eliminated rose from 12 at the end of the first season to 365 of the original 416 at the end of the third. At the end of the fourth season, only 18 clones with a total of 37 plants remained. Only a few plants were alive in June of the fifth season. Percent stands at the end of the first through fourth seasons were 53.00, 13.40, 0.38, and 0.37, respectively.

The few plants remaining alive in the fifth season were dug, photographed (Figure 2), transplanted to soil in pots, and allowed to flower in a greenhouse. Most of these plants tended to break apart at the crowns giving the appearance of several small plants in a clump. The original crown usually was indiscernible. Because in this experiment only fifth-season plants could be examined, it was of interest to dig plants of other experiments in which the sequence of root and crown growth over several seasons could be observed. The roots and crowns of first-, second-, third-, and fourth-season transplants of clone 713 (Figure 3)