Selection Methods for Improving Persistence of Red Clover

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IN THE United States, red clover (Trifolium pratense L.) remains an important legume, but its use is limited by a lack of persistence. Though the species is physiologically a perennial, under field conditions it usually behaves as a short-lived perennial, a biennial, or an annual. Diseases, insects, microclimate, and soil and management practices contribute to early stand losses. These factors are believed to be more severe when interacting. Soil-borne root- and crown-rotting organisms play a most important role in reducing the length of life of stands. Undoubtedly, virus diseases also influence survival as shown by their importance in determining the overwintering ability of the crop. If the persistence ("length of life") of the crop could be improved, the general use of red clover would be more widespread.

Studies concerning the morphology, ecology, physiology, pathology, destructive insects, and breeding and genetics of red clover have been adequately reviewed and discussed by Fergus and Hollowell (3). More recently, Fulton and Hansen (4) reported on the pathogenicity of 49 fungus isolates from diseased red clover plants in Wisconsin. Clipping was a useful technique for predisposing red clover to attack by weak pathogens. More root rot developed at higher temperatures and more in some soils than in others. Kendall et al. (10) studied the growth and persistence of several varieties of red clover at various temperature and moisture levels and showed that a slow growth rate may be one of several factors which enhance longevity of stands. Colville and Torrie (2) studied the effects of seedling year fall management and stage of maturity at first harvest on persistence and forage yield of two varieties of red clover. Stand reduction depended greatly on prevailing climatic conditions during the critical fall, winter, and spring periods. Oshima and Kernkamp (12) suggested that winter-killing was more closely associated with degree of virus infection than with incidence of root rot. Hanson and Hagedorn (8) compared the reactions of 10 clones of red clover to each of the 4 viruses inciting red clover vein mosaic, bean yellow mosaic, Wisconsin pea streak, and alfalfa mosaic. Clones differed greatly in reaction to these viruses. Goth and Wilcoxon (6) found that bean yellow mosaic virus infection reduced stands of inbred lines and clones of Wegener red clover as much as 100% but only after the stress of high temperature or cold weather was applied. Taylor et al. (14) showed that absence of virus symptoms was a prerequisite to persistence.

The various breeding methods which have been used in forage improvement programs have been reviewed by Hanson and Carnahan (7) and Myers (11).

Johnson (9) clearly defined the difference between phenotypic and genotypic recurrent selection and cited examples of the use of both types of selection when applied to forage crops. In 1955, Sprague (13) reviewed the principles of recurrent selection as well as the literature concerning its effectiveness in corn breeding programs.

The main objective of the study reported in this paper was to compare several methods of selection for improv-