Breeding for Wilt Resistance in Alfalfa

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Bacterial wilt of alfalfa, caused by Corynebacterium insidiosum (McCulloch) Jensen, is one of the most destructive and widely occurring diseases of alfalfa. It is considered to be one of the principal factors causing thinning of alfalfa stands after the second crop year. The disease has been known in the United States since 1925, and reports indicate that it is present in most alfalfa growing areas of this country. Early in the search for control measures, it was learned that the development of resistant varieties offered the only practical approach. Several varieties relatively resistant to the disease have been developed.

Resistance to bacterial wilt is inherited. Pelletier and Tysdal (4) concluded that more than one factor and possibly three are involved in wilt resistance. Brink et al. (1) concluded that resistance probably depends on a complex genetic basis. They found that resistant plants may differ greatly in composition with respect to the genes governing resistance and susceptibility. Similar results were obtained by Weimer and Madison (6). Albrecht (2) concluded that the genetic factors involved are numerous and appear to be additive in their effect. Wilson (7) concluded that resistance can be resolved into terms of separate genes. Three and possibly four partially dominant, supplementary genes for resistance were isolated and designated, P, R, T, and T'. His data indicated that P, R, and T are separate genes; that P is the strongest while R is intermediate between P and T. T and T' are both weak, behave similarly, and may be identical. His work indicated that while each of these four genes had an effect in the heterozygous condition they were not completely dominant, and when R and T were both present, they supplemented each other.

The objective of this work was to study the effect of the P gene in a backcross program with selected clones, and to obtain information on the possible use of this gene in breeding for wilt resistance. This gene was reported by Wilson (7) to give practical resistance to wilt. According to Stanford and Jones (5), the P gene is being backcrossed into California Common. They report that the type of the recurrent variety has been recovered after four backcrosses as might be expected. The gene can be easily identified, and resistant plants can be selected from synthetics or from crosses currently in different breeding programs for resistance to bacterial wilt.

The following clones were used: C-5, C-177, C-40, C-10, C-139, and the California clone. Due to a shortage of seed, used primarily in local crosses were set in the winter of 1948-49, 60 plants were set at random and brought into the greenhouse, and the crosses were done by hand. Each cross was set three-fourths of an inch apart in rows 2 inches apart in a greenhouse. The plants were dug and classified in September 1950. The following four classes were used:

Class 1—plants which showed no discoloration after inoculation.
Class 2—plants which showed slight discoloration limited to small areas or streaks in longitudinal sections of the taproot.
Class 3—those plants in which the discoloration was more evident than in Class 2, but not so pronounced as to be considered severe.
Class 4—those plants which died or were killed as might be selected in any breeding program. If the infection was severe, it was desirable to select the F2 generation, as might be expected. Several varieties were isolated and designated, P, R, T, and T'. His data indicated that P, R, and T are separate genes; that P is the strongest while R is intermediate between P and T. T and T' are both weak, behave similarly, and may be identical. His work indicated that while each of these four genes had an effect in the heterozygous condition they were not completely dominant, and when R and T were both present, they supplemented each other.

The plants were then set three-fourths of an inch apart in rows 2 inches apart in a greenhouse. Six seedlings were then set in the field the following spring. During the summer months following inoculation, the number of live seedlings was counted. Low growing four classes were used:

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