Comparative Performance of Diallel Crosses and Related Second-Generation Synthetics of Alfalfa, Medicago sativa L. III. Forage Yield

J. C. Theurer and L. J. Eiling

SEARCH for superior germ plasm and determining the best clonal combinations to incorporate into commercial varieties are major problems facing forage crops breeders. In the past, synthetics developed from clones with good general combining ability have been selected for commercial production. However, in recent years increased interest has been expressed in the possibility of utilizing commercially single cross hybrids or early generation synthetics. While several studies have sought to compare diallel crosses of alfalfa, very few reports have provided a comparison between single crosses and all synthetics derived from the same parental clones.

In this paper the comparative forage yields of diallel crosses among 5 alfalfa clones and their 26 Syn-2 generation synthetics are reported.

LITERATURE REVIEW

Tysdal et al. (12) suggested that superior varieties could be obtained by methods similar to those used in corn breeding. They recognized an apparent ceiling in the yield of synthetic varieties and suggested that alfalfa breeders should thoroughly investigate possibilities of utilizing F1 hybrids commercially. Kehr and Gardner (5) estimated that slightly over 1/3 of the total genetic variance for forage yield in a population of 'Ranger' alfalfa was additive. They indicated that it might be possible to obtain greater yields by utilizing Syn-1 generation synthetics, and capitalizing on non-additive variation.

Tysdal and Kiesselbach (11) presented data showing that a 50% mixture of seeded seed with 'Ladak' produced 50% as much forage as a 100% 'Ladak' planting. Tysdal and Crandall (9) noted that the Syn-2 generation of 8 synthetic varieties yielded about the same as the Syn-1. Carnahan (2) found highly significant correlations (r = .77 to .88) for the Syn-1 and Syn-2 generations of six 2-clone diallel crosses of ladino clover. Graumann and Mattlock (6) studied the Syn-1 through Syn-4 generations of 6 synthetics and observed a slight decline in yield from Syn-1 to Syn-2, and a slight increase in yield from Syn-3 to Syn-4. Therefore they assumed that synthesis was approaching completion in Syn-2 and was probably attained in Syn-3. The 2-clone synthetics in their study tended to be more productive than multi-clone synthetics in Syn-1, but this advantage was lost in subsequent generations.

Pearson and Eiling (6) studied the yield response of 2 unrelated 4-clone synthetics and one 3-clone synthetic. Yields of single crosses and synthetics were poor in comparison to those of check varieties. However, the average single cross yield exceeded that of the corresponding synthetic by 0.21 ton per acre. The exact yield of a synthetic could not be predicted from single cross data, but synthetics could be ranked from high to low on this basis.

In a study of all single crosses among 11 alfalfa clones, Lewis found that 12 of the single crosses averaged more yield over a 2-year period than did 'Narragansett', the highest yielding check variety. Downey concluded that single crosses gave more accurate predictions of synthetics than other types of progeny. He found a tendency for the Syn-1 to yield lower than the Syn-2 generation.

Kehr and Graumann studied a diallel series of crosses among 6 Minn. clones (21a), clone 3 (Minn. 249), clone 4 (Minn. 254), clone 5 (Minn. 255), clone 6 (Minn. 265), and clone 7 (Minn. 271).

Seed of diallel crosses and the 26 possible Syn-2 generation synthetics of the 5 clones were obtained by hand-pollination in the greenhouse without emasculating. A more complete description of the clones and crossing procedures has been given previously (7).

The 39 entries in the study consisted of 10 single crosses, ten 2-clone synthetics, ten 3-clone synthetics, five 4-clone synthetics, one 5-clone synthetic, and the 3 check varieties, Ranger, Vernal, and DuPuits. These entries were seeded in the early summer of 1958 at Rosemont, Minnesota, in a split-split-plot randomized block experiment of 4 replications. A more complete description of the clones and crossing procedures has been given previously (7).

The experiment was maintained under clean cultivation during the year of seeding in order to reduce weed competition and enhance good establishment. In early September of the seeding year, the entire nursery was clipped to remove excess foliage and allow time for adequate regrowth and hardening before winter.

Throughout the two years of study the plots were sprayed with insecticide, whenever required, to control harmful insects.

Even though the nursery was hand-weeded during the year of establishment, abundant grassy weeds developed in the spaced plantings during both harvest years. To correct yields for this factor, an estimate of the percent weeds in each plot was made.

MATERIALS AND METHODS

Five clones which were relatively self sterile and of diverse origin were selected for this study. They consisted of clone 3 (Minn. 239), clone 4 (Minn. 247), clone 5 (Minn. 255), clone 6 (Minn. 265), and clone 7 (Minn. 271).

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