The Use of $I_1$ Families in Breeding Smooth Bromegrass

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Forage-crops breeding, $I_1$ families can serve in three principal ways: (a) progeny testing of selected plants, (b) source of new superior clones, and (c) development of synthetic varieties through isolated seed increases of one or more superior families. The first and second of these techniques have been applied widely, but the third has been used on a more limited scale.

The use of advanced generations of $I_1$ forage plants for the development of new synthetic varieties has been practiced most widely in Europe. In Sweden, for example, the varieties Primus and Gloria timothy, Skanda II and Brage orchardgrass, Viking red fescue, and Victoria perennial ryegrass were developed by this method (1). Each of these varieties was derived from one or more advanced generations of the 1-year selfed progeny of a single selected clone. Similar promising results with the breeding of alfalfa by this method were also reported by the Swedish Seed Association (1). An example of the early use of this method in the United States is the timothy breeding at Cornell, where the varieties 1777 and 4059 were produced by isolated increase of self-pollinated seed from single clones; these original clones are still maintained for the production of breeder's seed.

Materials and Methods

In 1944, a source nursery of approximately 11,000 spaced plants was established at Ithaca, N. Y., from 246 seed sources which had been collected widely in both the United States and Canada. Before these plants flowered in 1945, about 1000 were selected for selfing on the basis of notes that had been taken up to that time. In order to assure self-pollination, three parchment bags were used to enclose four heads per bag on each of the selected plants.

Among the 1000 bagged plants, 206 which set over three selfed seedlings started in the green-house, and the test consisted of one to four replications of 10-plant rows, with the individual plants spaced 3 x 3 feet. In 92 of the 206 progenies, sufficient seedlings were available for 4 complete replications, and the results from these 92 progenies are reported here.

In the progeny-test nursery, every 11th row was planted to seedlings from the check variety, Fischer, which had been the highest-yielding variety in plot trials at Ithaca. The mean of the check variety was thus calculated from 55 replications, whereas the means for each $I_1$ family were determined from 4 replications. The average least significant differences were obtained from an error variance based on only the 92 families without including the check rows.

Notes were taken on an individual plant basis in all four replications for several characteristics including vigor, disease reaction, and lodging, by use of a numerical score from 1 (least) to 10 (most), and for plant height in inches. In addition, a note on the incidence of disease, and for yield in pounds per plot. The data on the incidence of disease were recorded in late August 1947. The data on yield were recorded in late August 1947.

Experimental Results

Self-fertility of the Parental Clones

The bagged heads from each of the 1000 selected plants in the source nursery were threshed and recorded in order to obtain the $I_1$ seed for progeny testing of these clones, which had been selected at random for an intensive study of selfed seed-set, a care being made of the good seed in each head. For the 206 selected plants, the average seeds per panicle was 7, and this ranged from 0 to 166.

After the selfed seeds had been counted, the 36 most self-fertile and 5 representative self-sterile plants were selected, and 8 open-pollinated panicles from each were threshed. The former plants averaged 165 seeds per open-pollinated panicle and the latter 167; the difference between these 2 averages was not significant.

In the source nursery, 239 plants set less than 1 selfed seed per panicle, and the best 192 of these self-sterile clones likewise were selected on the basis of notes taken in 1944 and 1945. For disease notes, the means for the total $I_1$ population were significantly different from those of the self-fertile plants. The breeding program of self-sterile clones has involved: (a) further clonal evaluation in a polycross seed production nursery through progeny testing, and (c) the development of synthetic varieties from the better clones, selected on the basis of the first two tests. The results from these breeders with the self-sterile clones will be reported in a separate paper.

The Use of $I_1$ Families as a Progeny Base of Selected Clones

On the basis of the notes taken in 1944 and 1-year selfed-progeny rows, several families were significantly equal or superior to the checks (table 1). Significant differences among the means of the $I_1$ families were found for all six characters. For the height notes, the means for the total $I_1$ population were significantly lower than the corresponding check to 3 families, however, were significantly higher than the check, and 22 to 28 were not different, but the character noted. In other words, for height and aftermath vigor, approximately 25% of the $I_1$ families were superior to the check, and 22 to 28 were not different.