TECHNIQUES used in a long-term bromegrass breeding study are presented. The information given should be of value to breeders of this and other crops, particularly cross-pollinated grasses. Forage grass breeding is in a relatively early stage of development compared with the breeding of such crops as small grains and corn. Consequently, there is special need for exchange of information such as this paper contains. The broad, general principles of breeding all crops apply but many problems are peculiar to bromegrass breeding.

EXPERIMENTAL MATERIAL

A nursery containing 49 clones previously selected for yield and leaf spot resistance was established at the Rosemount Experiment Station in the fall of 1953. Plants were spaced 5' × 5' with 25 plants in a row. There were 6 replications of each clone in a triple lattice design. Two rows in the field comprised a replication, and at the end of each replication a row of unspayed leaf spot-susceptible material was planted for a source of inoculum.

The clones under test were genetically diverse, including 8 recently introduced into the breeding program from U. S. and foreign experiment stations and 41 selected from previous polycross and progeny tests at Minnesota.

In September 1956 open-pollinated seed from 47 of the 49 selected clones were planted at Rosemount in a simple lattice making 4 replications. Seed was insufficient from 2 of the clones. The 6 × 30-foot plots were broadcast-seeded. 'Lincoln' and Canadian commercial were included as checks. Plants did not fully develop in 1957 but in 1958 stands were uniformly excellent and vigorous. Adequate nitrogen fertilizer was applied. One swath (lengthwise of each plot after trimming the ends) was taken for forage yield on June 17, 1958, and the rest of the plot left in order for a seed and straw yield on July 26 of the same year.

For estimating time of flowering, notes were taken at bloom time on a scale of 1 to 5.

All data were obtained from the two nurseries described above except for seedling weights, which were obtained by Robison in a replicated field test using the same seed lots as in the progeny test.

RESULTS

Table 1 shows, in abbreviated form, results of progeny tests. For each character studied some clonal progeny were superior to commercial checks. Heritability estimates were obtained from the variance analyses of the progeny tests, using the formula

\[ H = \frac{\sigma^2_{aa}}{\sigma^2_{aa} + \sigma^2_{ae}} \]

with variance components used to estimate \( \sigma^2_{aa} \) (genetic) and \( \sigma^2_{ae} \) (environmental).

With the exception of 1959, the highest-yielding progeny exceeded the check by more than twice the standard error in every case. Such large increases over Lincoln are very unusual in bromegrass material in this area. In 1959 the difference between Lincoln and the highest-yielding progeny was not significant. For this cutting heritability was low (6.2%). For all other determinations heritabilities ranged from approximately 20 to 70%.

Table 1. Results from progeny test grown in broadcast plots with a simple lattice repeated, making 4 replications. Parents were 47 clones all exposed to the same random sample of pollen.

Table 2. Correlations (r) between parent clones in an individual plant nursery and their progeny in replicated broadcast plots.

Table 2 shows that between parent clones and their progeny were less than expected. However, the two sets of data (i.e., parents and progeny) were taken in different years with parents grown as individual plants and progeny as broadcast plots. Data on parents were not as extensive as on progeny.

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Based on rather limited data available clones and their progeny were classified into maturity groups. Experience has shown that maturity is very strongly influenced by environment. For example, a period of cool weather in June will delay early bloom so that most clones flower at the

Thomas, H. L., Hanson, Earle W., and Jackobs, J. A. Varietal trials of smooth bromegrass. North Central Region Publication No. 93. Published at the University of Minnesota Exp. Sta., St. Paul.