Gamete Selection in Two Early Maturing Corn Varieties

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THE number of inbreds of corn (Zea mays L.) which have high combining ability for yield and acceptable performance for other agronomic characters is generally limited within a maturity group. Frequently, many of the acceptable inbreds are closely related and consequently are of restricted use in hybrid production. The need for new sources of unrelated inbreds is especially critical in the fringes of the corn belt where the breeding effort has been modest and the number of elite lines identified has been relatively small. Many of the local open-pollinated varieties have not been adequately sampled but are potential sources of new inbreds. In 1944 Stadler (15) proposed gamete selection as an efficient procedure for extracting high combining inbreds from open-pollinated varieties. Obviously, a system which is more efficient than the standard inbreeding and selection procedure would be very valuable. This paper summarizes the experience with gamete selection for grain yield and ear moisture in the two early maturing varieties 'Falconer' and 'Rainbow Flint'.

MATERIALS AND METHODS

Gamete selection as developed by Stadler (14, 15) was applied to two strains of Falconer (Kroeker and Elias) and the variety Rainbow Flint. These are early maturing varieties which yield well. To date, however, inbreds satisfactory for yielding ability have not been obtained from these varieties. The inbred A21 was chosen as tester because of its desirable agronomic features. The single cross WD X ND255 was chosen as topcross parent because it has good general combining ability and is not related to the two varieties.

The following procedure was used in the work with Falconer:

First year—Inbred A21 was crossed with the two strains of Falconer. A composite pollen sample from about 130 plants of each strain was used.

Second year—About 300 Fi plants from each of these 2 crosses were grown. In both crosses approximately 70 plants were selfed. These were also crossed onto WD X ND255.

Third year—Sixty-two topcrosses from each strain were tested for yield and ear moisture in a 4-replicate test. On the basis of the yield results of these tests, 18 Fi plants were selected from each strain. The selected plants included the 6 highest, the 6 lowest, and 6 that were intermediate in grain yield in their topcrosses.

Fourth year—The 18 selected Fi topcrosses were again tested for yield and ear moisture in a test with 4 replicates. An Fi family of 20 plants was grown from each of the 18 selected Fi plants. Two plants were selfed in each family and also topcrossed onto WD X ND255.

Fifth year—The F2 topcrosses were tested for grain yield and ear moisture in a four-replicate test.

Sixth year—The yield test of the F2 topcrosses was repeated. The F2 families of the Elias strain of Falconer were grown, and 1 to 3 plants selfed in each of the progenies from the high and low combining groups of Fi plants.

Seventh year—The Fi families were grown. A total of 62 of these plants was selfed, and also topcrossed onto WD X ND255.

Eighth year—Sixty-two F2 topcrosses produced in the previous year were tested for yield and ear moisture in a 5-replicate test, and compared with the check (WD X ND255)A21.

Ninth year—The Fi topcross test was repeated.

A parallel program was carried with Rainbow Flint, in which 19 Fi plants and their progenies were studied. In Fi and F1, 38 and 62 plants, respectively, were tested in topcrosses. One year's data were obtained for the Fi and F1 topcrosses and 2 for the F2 topcrosses.

All of the tests were grown at Morden. In the yield trials each plot consisted of 10 hills spaced 36 inches between rows and hills. The planting rate was 5 seeds per hill. Hills were thinned down to 3 plants each, after germination. Hills with less than 3 plants were not used in yield and ear moisture determinations. A double entry of the hybrid (WD X ND255)A21 in each of the replicates served as a check.

RESULTS

Combining Ability for Grain Yield

The topcrosses of the 62 Fi plants from A21 X Falconer (Kroeker strain) yielded 29.1 to 35.9 cwt. per acre compared with 32.6 cwt. per acre for the check. The 18 selected topcrosses, retested the following year, gave a similar yield range. On the average for the 2 seasons, 4 topcrosses yielded significantly more than the check, which indicates that gametes superior to A21 existed in this strain of Falconer. Among the topcrosses of the Fi plants, 2 yielded more, and 2 less than the check. However, there appears to be little or no relationship between the yields of the topcrosses of the Fi plants and that of their respective F2 progenies. This was indicated by the similar grain yields obtained for the F2 topcrosses derived from the high, medium, and low-combining Fi plants (Table 1).

The combining ability of 62 Fi plants selected from A21 X Falconer (Elias strain) was similar to that of the Kroeker strain; ranging from 28.8 to 36.0 cwt. per acre.