AN ESTIMATION OF THE NUMBER OF TOP-CROSSED PLANTS REQUIRED FOR ADEQUATE REPRESENTATION OF A CORN VARIETY

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In certain corn breeding problems it is important to know how many plants of a variety are necessary to provide an adequate sample. In 1934, St. John reported yields of 51 top crosses made reciprocally. The average acre yield of all crosses where the variety functioned as the seed parent exceeded that of their reciprocals (inbred X variety) by 3.93 ± 0.46 bushels—a highly significant difference. The individual differences were correlated in part, at least, with differences in seed condition. This suggests that the customary practice of producing top-crossed seed on the inbred parent may not provide an entirely adequate measure of the yielding ability of inbred lines. Variation due to seed condition could easily be eliminated by the consistent use of the variety as the female parent. This would require that the seed be produced by hand pollination and would be feasible only if the variety could be adequately sampled by ears from a very few plants.

Varietal sampling is also of importance in connection with investigations under way at the Missouri Agricultural Experiment Station on a combination of selfing and top crossing in the production of new inbred lines. In brief, this selfing-top-crossing technic requires the production of selfed and top-crossed seeds from each of the selected plants from an open-pollinated variety or F2 of a hybrid. In the first year both types of seed can be produced on the selected plant by double pollination. The plant is first selfed and then, three or four days later, pollinated with a pollen mixture from a variety possessing a different genetic constitution for endosperm color. This permits the separation of selfed and hybrid seed on the basis of xenia. Comparative yield tests of the hybrid seed measure the yielding potentialities of the selected plants. These tests are analogous to the old ear-to-row tests.

The ear-to-row method of breeding was found to be ineffective, partly because high-yielding ears were hybrids of unknown composition which could not be duplicated, and partly because in actual operation the narrow selection practiced resulted in inbreeding, which reduced yields. In our procedure the production of selfed seed maintains the identity of plants tested and avoids the first difficulty. Jenkins has presented evidence indicating that differences in the

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