BREEDING RYE BY CONTINUOUS SELECTION

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ALTHOUGH satisfactory breeding systems have been devised for crops that are largely cross-pollinated, such as corn, and those that are largely self-pollinated, such as wheat, oats, barley, etc., there is considerable divergence of opinion as to the most satisfactory method of breeding for the improvement of partly cross-pollinated crops. In fact, reliable estimates as to the degree of cross-pollination are wanting for most crops falling in the latter group. Obviously, it is necessary to have some approximate values on the amount of natural crossing and the consequent degree of heterozygosity in order that breeding systems may be given the proper theoretical treatment from the standpoint of genetics.

Rye (Secale cereale) is listed by Hayes and Garber as a naturally cross-pollinated plant. Quoting various investigators, rye flowers are reported to be so constructed that it is difficult, if not actually impossible, for the pollen to fall on stigma of the same flower. Evidence is also given supporting the view that "the rye flower is self-sterile, but that the spikelet is not necessarily so". Heribert-Nilsson using a waxless type of rye plant as an indicator, observed cross-pollination to the extent of 37.3% to 54.4% when separated 60 meters from fields of normal plants. Other evidence is cited to indicate that self-fertilized florets are capable of producing seed, at least in some strains.

In view of the modern conception of the genetic causes of self-sterility in cross-pollinated species, it seemed worthwhile to re-investigate the extent to which cross-pollination occurs in other strains of rye than those used by European workers. A preliminary study indicated that, although self-pollination of florets might occur to a considerable degree with normal plants, pollen from other plants must account for a considerable part of fertilized flowers, even though the capacity for self-fertility prevails. The possibility of crossing between flowers of the same spike, or between flowers of different spikes on the same plant, which are genetically identical with self-pollination, also seemed to indicate the possibility of an appreciable amount of selfing with this crop.

On the basis of a substantial degree of self-pollination, continuous selection of superior plants in open-pollinated lines should gradually concentrate the genetic factors responsible for higher yields and permit gradual elimination of non-adaptive traits. This process should be more rapid when crossing is limited to strains of equal duration in the breeding nursery. In view of the continuous outcrossing, there would

1Contribution from the Department of Agronomy, New Jersey Agricultural Experiment Station, New Brunswick, N. J. Journal series paper, New Jersey Agricultural Experiment Station, department of Agronomy. Received for publication December 24, 1938.
2Agronomist.

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