Agronomic Mutations in Oats Induced by X-Ray Treatment

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HERE has developed in the United States, largely as a result of Swedish publications, a renewal of interest in "mutation breeding" in the cereal crops. From 1930, when Stadler (8) reported upon his experiments with irradiation of cereal grains, until 1950, there was a conspicuous absence of the use of induced mutations in plant breeding in the United States. Meanwhile, plant breeders in Sweden and Germany (1, 5) succeeded in inducing and isolating mutations with agronomic value from X-ray treated barley. Gustafsson (4, 5) published upon several induced beneficial agronomic mutations in barley including a stiff strayed strain called "erectoides," and two or three mutant lines which produced very high yields. The best of these yielded 10% more grain than the parental variety, Gull, and one line showed improved malting quality.

Shebeski and Lawrence (7) have reported a mutant barley strain from irradiated Montcalm variety which is equal to Montcalm in grain production and malting quality, but has shorter and stiffer straw. MacKey (6) obtained a number of the mutant strains from irradiated oats which were earlier and produced higher yields than the parental varieties. Similar results were obtained with wheat.

This paper is a more complete report of an earlier publication by Frey (2) in which beneficial mutations selected from irradiated oats were briefly described. The data presented herein are from only a few of the 61 mutant lines tested. The families of lines shown were selected to illustrate the various agronomic mutations obtained. Only the agronomic mutations will be discussed since a companion paper (3) will deal with the induction of disease resistance mutations in the same materials.

METHODS AND MATERIALS

Four hundred primary seeds of Huron variety of oats containing 9.5% moisture were irradiated with 25,000 r units of X-ray and planted in the field in 1950. Mature X1 plants were produced from 45% of the irradiated seeds. Each X1 plant was harvested and threshed separately and in 1951 one row containing 25 spaced plants was planted from each X1 progeny, resulting in approximately 4,500 X2 plants which were observed for mutations. Because of the confounding influence of environment on the single plants, it was necessary to save all plants that deviated, even slightly, from the parental variety. The X2 progenies were sown in plant rows in 1952 and 61 mutant strains which appeared to breed true were grown in yield tests at Ames, Iowa in 1953 and 1954. Plot size was 4 rows wide and 8 feet long with measurements being taken on the 2 center rows. Coefficients of variability for yield in these experiments were 5.0 and 3.5% respectively, in 1953 and 1954. In each year a rather severe epiphytotic of oat stem rust, predominantly race 7, developed resulting in a confounding of the yielding ability and stem rust reaction of the mutant strains.

EXPERIMENTAL RESULTS

The most common mutations found in the irradiated material were fatuoids and vine-type plants. The fatuoids were discarded in the X1 generation because they were common