Notes

A PROPOSAL FOR HYBRID BARLEY

The gains realized from heterosis in corn, sorghum, onions, sugar beets, and other crops, through the use of genic mechanisms and systems of mating, have been substantial and continuous. They have stimulated other workers to devise ways to extend such gains to other crops. Such a plan is proposed here for barley. Information is lacking on certain aspects, but it is believed that current research methods and techniques will resolve these difficulties. The plan is presented to elicit suggestions from others and because the genes and the mechanics proposed may serve as a model for other crops. If the conditions described here for barley can be duplicated for any of the present hybrid crops, then the proposed plan is an alternate one which may merit consideration. This plan does not make use of a cytoplasmic type of male sterility and its concomitant restorer and nonrestorer genes. As far as the writer knows, these properties have not been found in barley. If found, there is no reason why they would not work as well for barley as for other crops.

The seed requirements per acre for barley are high and of the same order as for wheat, oats, and rice. Among important field crops only peas and beans require larger amounts. The seed used for barley in the United States averages 25 million bushels annually. This is approximately double that used for corn. Since the amount is so large, any usable plan for the production of hybrid seed must be simple, automatic, and adapted to mechanization, in order to produce this seed at a cost that will insure its use.

The proposed plan makes use of two genes and a phytocide. The genes are a recessive genetic gene for male sterility and a recessive gene for resistance to a phytocide. The phytocide is the insecticide DDT. A complete or very close linkage is required for these two genes, here written as ms-ddt, where ms refers to a gene giving male sterility and ddt to a gene giving resistance to DDT. The term phytocide is used here to denote a differential chemical-killing action within a crop; e.g. in barley, variety A is killed by DDT and variety B is not. The phytocidal action of DDT is described by Hayes, Griffiths and Hayes, and Wiebe and Hayes. They also showed this action to be controlled by a single gene and that resistance to DDT is recessive. Male sterile characters are common in barley. The first one was described by Suneson. Others have been found by Wiebe, Suneson, Eslick, Ramage, and others (unpublished). Three of these are known to be at different loci. The required linkage, ms-ddt, is not known at present, nor have tests been conducted to find it. The probability of finding such a linkage is assumed to be reasonably good. This assumption is based on the common occurrence of the male sterile character, on the existence of a rather high frequency (10%) of DDT resistant varieties among the world barley different genes. A screening procedure to required linkage is described later.

The proposed plan for the production of barley requires adequate isolation and one or more applications of DDT in the early seedling stage. The steps involved are as follows. (1) The linked genes are transferred by backcrossing to the variety chosen as the female or seed parent of the single cross. The chosen variety will be male fertile Ms in the usual Ddt on the basis of its frequency in the United States. Barleys, the linked transfer can be accomplished following the ms and/or ddt gene. In those cases, the variety chosen as the female parent is crossed and the pollen parent will be Ms-Ddt ms-ddt and 1 Ms-Ddt Ms-Ddt Ddt ms-ddt:1 ms-ddt ms-ddt, respectively. The F1 plants are grown in alternate rows; the seedlings in the F2 rows are sprayed with DDT. Plants of the genotypes Ms-Ddt Ms-Ddt, Ms-Ddt Ms-ddt, and Ms-ddt Ms-DDt, where the F1 plants in the unsprayed row of the genotypes 1 Ms-Ddt ms-ddt:1 Ms-Ddt ms-ddt is harvested from sprayed rows only. (3) The seed obtained by step 2 is sown in rows. The seedlings in the sprayed rows will be killed, an adjustment for these rows may be desirable. Seed again only from the male sterile plants in the sprayed rows. This is of the genotypes 1 Ms-Ddt ms-ddt:1 Ms-Ddt ms-ddt:1 Ms-Ddt ms-ddt. Seed stocks of these genotypes can be collected and in any desired volume by repeating the cycle given in this step. (4) The hybrid seed is produced using alternate rows with seed obtained by the variety chosen as the male parent of the single crosses with DDT and all the seed set on the surviving male sterile plants is hybrid seed. Since the male parent of the hybrid plants will be fertile. In the case of a single cross and the three-way cross described below the male can be either Ddt Ddt or ddt ddt. The latter has the advantage of allowing the seed producer to spray the entire set on the rows. (5) The most effective plans for grouping the rows in the field and the mechanics of field operations may vary markedly for different