Differential Incidence of Loose Smut Among Seed-Size Classes Within Barley Seedlots

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TAYLOR and Harlan (4) found that the incidence of loose smut (Ustilago nuda (Jens.) Rostr.) was much greater in small kernels than in large kernels of certain seedlots of barley. To determine whether this is generally true in spring barley varieties currently grown in Minnesota, 5 seedlots with a naturally occurring high percentage of seed infected with loose smut were each divided into plump kernels (seed retained on a screen with 6/64-inch slots), thin kernels (seed not retained on a screen with 5/64-inch slots), and 2 intermediate seed-size classes. These were planted separately in the field in 1960 and differences were found in percentage infection among them. Nevertheless, the percentage infection in the plump seed was, as a rule, still more than half that in the original bulk seedlot. However, a recent report by McFadden et al. (3) indicated that the percentage infection is often much lower in the largest seeds within the plump class. The utility of these findings depends on how much of a seedlot can be recovered as a low-smut seed fraction, as well as on the reduction in the incidence of loose smut, and on the regularity with which such a reduction can be obtained. To obtain information regarding these questions, samples from 13 seedlots were screened so as to separate the fifth, approximately, with the largest seeds and the fifth with the seeds that were next largest.

MATERIALS AND METHODS

One commercial seedlot of Kindred barley and 4 seedlots of Traill, produced in 1959 in Minnesota or North Dakota, were used in the first test. All had a high percentage of infected seed according to an embryo test on 500 seeds (Table 1). A 200-gram sample of each seedlot was placed on a set of 3 nested standard sieves, with slots 3/4 inch by 6/64, 5 5/64, and 5/64 inch, respectively, in the upper, middle, and bottom sieves. The sieves were about 11 inches square. The stack of sieves was transported across a linear distance of 1/3/16 inches in a direction parallel to the slots with about 470 back-and-forth trips per minute for 3 minutes. Either 400 or 600 grams of each seedlot was thus divided into 4 fractions: 3 fractions retained on the 3 sieves, and one consisting of thin kernels, not retained by the bottom sieve. The percentage of the weight of each bulk sample in each fraction (Table 1) was highly reproducible. The average 1000-kernel weight of seeds retained on a 6/64-inch sieve was 41 grams; that of seed not retained on a 5/64-inch sieve was 20 grams.

Four 250-seed samples from each of the 5 bulk seedlots and from each of their fractions were planted in the field at St. Paul on May 5, 1960, in Waukegan silt loam. The seed was planted 1 1/2 inches deep, using a flat-belt seeder, in 12.5-foot rows 1 foot apart. A split-plot design, with seedlots assigned to whole plots in 4 replicates, and with the seed fractions assigned to subplots, was used. Emerged seedlings were counted on May 24-27 in 2 entire replicates. The percentage of smutted spikes in each row was determined. The data for each of the five seedlots were analyzed separately and together (Table 1).

To determine the distribution of infected seed among further subdivisions of the plump seed fraction, the same five seedlots employed previously were used. Eight additional seedlots—6 of Traill barley, 1 of Kindred, and 1 of Parkland, with all but the Parkland produced in 1960 in various parts of Minnesota—were also used. Most of these lots were selected for their high or moderately high content of loose smut (Table 2), as determined by an embryo test. A sample (400 grams in all but 2 cases) from each of the 13 seedlots was fractionized using a Carter Precision Grader with a set of slotted cylinders with slot-widths at increments of 0.25/64 inch. The cylinders were like those available commercially—about 11 inches in diameter and with 3/16-inch saddles between the slots—except that the cylinders were only 12 inches long. Each cylinder was run 45 seconds at 52 rpm. for...

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