Grain Size and Hull Percentage as Factors in the Milling Quality of Oats

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This study was made to determine how several new oats varieties and experimental selections compare with Columbia for use in milling rolled oats. It was hoped that the results from such a study might suggest a simple method of testing small samples of oats from breeding nurseries for milling quality.

Review of Literature

In 1907, Greig and Findlay (4,3) through milling tests, concluded that variations in milling power of different varieties depend upon the thickness of the husk and the shape of the kernel. Percentage of husk or weight per bushel, taken alone, were not accurate guides to the amount of meal that could be obtained from a given weight of grain. Sunderman (7), in 1931, discussed the grading of oats in the oat mill and described steps in the production of oatmeal. He stated that oats as purchased are commonly of three grades, (1) double or twin, (2) pin, and (3) milling. The double oats and the pin oats too small to mill are removed in the cleaning process. The milling oats are then separated into three grades—pin oats, stub oats, and large oats—which produced when hulled, groats of three sizes and which were utilized in different ways to produce oat foods. All three sizes of groats may be bulked and rolled into flakes producing bulked rolled oats. To produce “cut meal” the groats are cut into short lengths and then separated into three grades, coarse, medium, and fine. For this purpose it is customary to use the hulled pin and stub oats, leaving only the larger oats for flaking.

According to Brownlee and Gunderson (2) in 1938, oats which are either small, light, or double are removed and not used in milling of rolled oats. The milling oats are separated precisely according to size. The largest grains usually constitute a majority and are designated as “large oats” while other fractions are called “slim oats”, “long slims”, “No. 1 stub”, and “No. 3 stub”. Each of these sizes is hulled separately, the “large” oats going to make the choice grade of large flakes, while the smaller oats may be converted into bulk rolled oats.

Atkins (1), in 1943, reported hull percentage and size of “bosom” kernels to be the most accurate measures of milling quality. Kernel weight, ratio of primary to secondary kernels, and bushel weight were indicated to be of value as criteria of quality. By his tests, Marion, Hancock, and Sac were the best varieties for milling purposes. Sac was satisfactory when not injured by rust. Boone and Harrison Counties in Missouri were studied. The best varieties for milling purposes were the most desirable, with large hull percentages and large “bosom” kernels.

Materials and Methods

Fifteen varieties and experimental selections grown in replicated yield trials on experimental fields at Columbia and Lathrop, Mo., and in cooperative tests in Bates, Saline, and Harrison Counties in Missouri were studied. The season was favorable for the production of high yields of oats. Rust did not develop at any location but Helminthosporium blight caused some injury in susceptible varieties.

A measured sample of approximately 15 grams from each replication at each of the five locations was separated into three grades, (a) double grains, (b) small grains, (c) large grains, and (d) slim grains, and percentages of each class were calculated on a weight basis after separation. The double grains were separated from the samples by passing through a 6/64-inch slotted sieve although some had to be separated by passing them over a 4.5/64-inch sieve. The large and stub grains were separated from the small grains by passing through the sieve the small grains and those remaining on the top of the sieve were the stub. These sizes approximate closely those of the small and stub grains described by Klima. The double grains are designated as “non-millable” since they are not used for milling rolled oats. The large, slim, and stub grains are designated as “millable” grains.

The large grain, slim grain, and stub grain samples were hulled, using a machine similar to the one described by Craig (5), and the percentage of hull calculated. Representative grains of each separation for three varieties and five grain sizes and bushel weight of 15 varieties were selected for this purpose. The large grain, slim grain, and stub grain separations were separated into three grades, coarse, medium, and fine. The large grains were separated from the samples by passing them over a 4.5/64-inch sieve. The large grain, slim grain, and stub grain separations were separated into three grades, coarse, medium, and fine. The large grains were separated from the samples by passing them over a 4.5/64-inch sieve.