

The Evaluation of Gluten Properties of Individual Wheat Plants in the Early Generations of Breeding Programs by Means of the Whole-Meal Doughball Fermentation Test, of "The Modified Micro-Pelshenke Test".

Evangelina Villegas & Norman E. Borlaug

In aggressive wheat breeding programs it is necessary to have a simple, rapid test for screening breeding materials for gluten properties in the early generations. Such tests should identify the most promising individual plants in the F_2 and F_3 generations, and permit the discarding of a large portion of the undesirable plants that are harvested in each of these early generations.

In order for such a test to be effective it must be rapid, reproducible and adapted to a small grain sample - that is the grain coming from an individual plant. The gluten property values for an effective early generation test must be positively correlated with good performance in more advanced tests, which are generally conducted on grain from advanced generation rows i.e. mixogram, farinographs and baking tests.

The Mexican Wheat Improvement Program has been using "The Modified Micro-Pelshenke Test" to screen all of the early generation selections for the past four years. Each generation tests are made on between 5,000 and 7,000 individual plants. On the basis of strict selection for superior grain types and performance in the Micro-Pelshenke Test for gluten quality, between 65 and 75 percent of the plants harvested in the F_2 and F_3 generations are discarded.

The details for conducting the tests are outlined below. Also attached is a group of photographs showing the equipment and steps used in conducting these tests.

Modified Micro-Pelshenke Test

Equipment:-

- 1.- Grinding apparatus - a German coffee mill "Mokka" with fineness adjustment, or a Wiley mill with a sieve of 1 mm.
- 2- Controlled water baths maintained at 30°C, with capacity for 30 beakers of 150 ml.
- 3- Beakers of 150 ml.
- 4- Heavy paper cups (i.e. Dixie" of 150 ml).

Reagents:-

Yeast suspension made up daily by suspending 2.2 g. of dry yeast (Red Star) in 100 ml. distilled water at 30°C.

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- 1.- Grinding apparatus - a German coffee mill "Mokka" with fineness adjustment, or a Wiley mill with a sieve of 1 mm.
- 2- Controlled water baths maintained at 30°C, with capacity for 36 beakers of 150 ml.
- 3- Beakers of 150 ml.
- 4- Heavy paper cups (i.e. "Dixie" of 250 ml).

Reagents:-

Yeast suspension made up daily by suspending 2.2 g. of dry yeast (Red Star) in 100 ml. distilled water at 30°C.

Procedure:-

Grind 3 grams of the wheat grain sample (wheat kernel with not more than 12.0% of moisture): Place the sample in a waxed paper cup, mix 1.8 ml of yeast suspension with the meal using a stirring rod or spatula. Transfer the mass to the palm of the hand and knead with the fingers until well mixed, then form into a round meal ball with a smooth surface.

The ball is placed in the 150 ml beaker which contains 70 ml of distilled water with temperature maintained by the water bath at 30°C.

Note the time of immersion of the ball into the water and time when the ball starts to disintegrate or part of it goes to the bottom of the beaker.

The relative value obtained in the Felshenke test is time (minutes) between immersion and disintegration of the ball.

Duplicate tests should not differ more than 10%.

1. Wheats with Strong Gluten (Hard Wheats) will have Felshenke Values of from 100 to more than 200 minutes.
 - (a) These wheats are potentially valuable for making strong flours used in bread making.
2. Wheats with Medium Gluten Strength - will have Felshenke Values of from 60 to 100 minutes.
 - (a) These wheats are primarily valuable as "fillers" in mixes with strong gluten wheats to produce flour for bread.
3. Wheats with Weak Gluten - will have Felshenke values of 35 to 60 minutes:
 - (a) These wheats are generally used in production of flours for cookies, crackers, cakes, etc.