MICRO-PROCESSING EQUIPMENT FOR DURUM WHEAT

By
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North Dakota is the principal durum producing area in the United States, some 35,000,000 bushels being grown annually. In view of this fact it is quite logical for the Station to have projects dealing with the development and testing of new varieties of durum. Glenn Smith, Agronomist, Division of Cereal Grains and Diseases, Bureau of Plant Industry, Soils and Agricultural Engineering, U. S. Department of Agriculture, is stationed at Fargo and is in charge of the durum breeding work. The testing for milling and macaroni processing quality is done at the Division's laboratory, Beltsville, Maryland, under the direction of C. C. Fifield, and in the Department of Cereal Technology, North Dakota Agricultural Experiment Station, Fargo. This program has resulted in the recent release of the high-quality durums, Carleton and Stewart.

In 1937, the State Legislature appropriated money for the purchase of experimental durum milling and macaroni processing equipment. This equipment has been employed in testing durum varieties grown in experimental plots at Langdon, Fargo and Edgeley, and the work has assisted in the development of Carleton and Stewart. Some 10 pounds of wheat are needed for a test. However, in addition to the wheats grown on plots, there is a relatively large number produced in the wheat nursery, consisting of new hybrids and selections under test for agronomic characteristics. It is important to the wheat improvement program that these wheats be tested for processing quality at as early a date as feasible so that those individual wheats showing promise of good agronomic traits and high quality may be released as soon as possible. This situation corresponds to that which existed at this Station before 1937, in the hard red spring wheat breeding program, but micro milling and baking techniques have been installed to assist in this project, with resultant acceleration of the release of new bread wheats. This work is reported by Sibbitt, Scott and Harris (1943).

Fifield, Smith and Hayes (1937) described a macaroni disc test for the evaluation of breeder's small samples of durum which has been exceedingly useful for determining the color of macaroni processed from semolina representing hybrid material. This method, with modifications, was used by Smith, et al. (1946) and Sibbitt and Harris (1946) in determining the effect of variations in pressing on disc macaroni properties. It has also been used by the Canadian Grain Research Laboratory (Cunningham and Anderson, 1943) for similar studies. The method has one rather obvious fault, it does not produce material which resembles even faintly the commercial product made from durum wheat. To overcome the objection, a procedure has been developed by Martin, Irvine and Anderson (1946) which employs a miniature experimental pro-

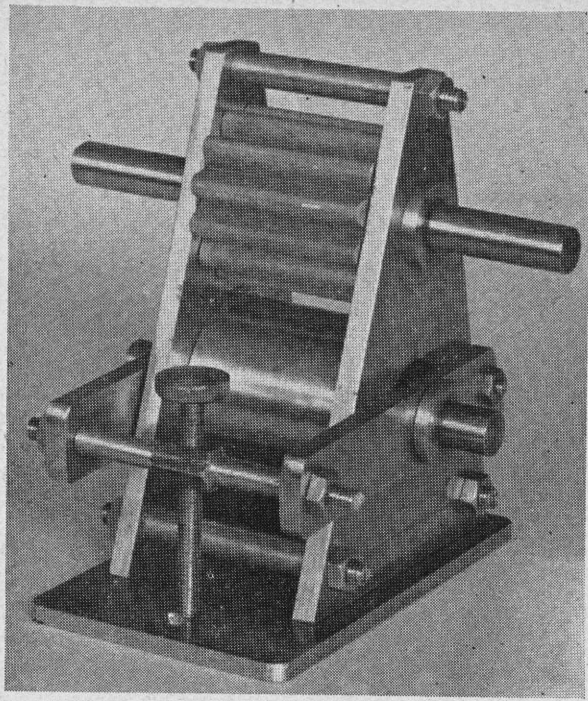

Figure 1. Miniature kneader used in the manufacture of single tubes of macaroni from small samples of semolina. Electric motor and driving attachments not shown.

cessing apparatus to produce a single strand of macaroni, and which requires only 50 grams of semolina instead of 600 grams used by the larger experimental method. This type of miniature equipment has been secured by the North Dakota Station and has been set up and a satisfactory procedure is being worked out.

Figure 1 is the kneading unit, which is driven by a small electric motor, not shown. The stiff dough, made from 30 grams of semolina and a suitable quantity of distilled water (about 32% of the weight of semolina) is passed repeatedly through the kneader to reach optimum consistency. It is then allowed to rest under pressure before pressing. The two Carver hydraulic presses employed for pressing are shown in Figure 2. The press on the left shows the cylinder which contains the resting dough under pressure. The press on the right supplies the force required to extrude the dough from the die; the small test cylinder with die in lower end which contains the dough, and a trough to receive and guide the tube of macaroni, are also shown. A length of 6 feet of macaroni can be made from one charge of dough. A temperature of approximately 114° F. is maintained in the dough during pressing and this is important, since temperature indirectly affects viscosity of the dough.

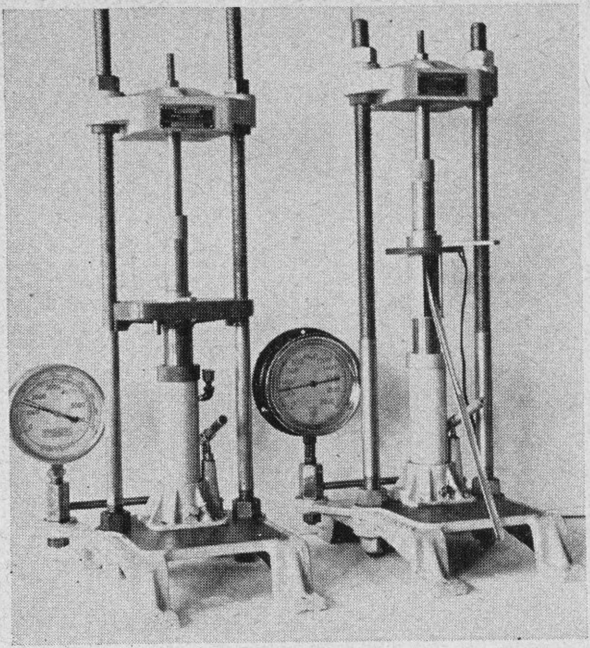

Figure 2. Laboratory hydraulic pressure required for pressing single tubes of macaroni. The dough is resting under pressure in press to left, while extrusion of the macaroni has just commenced from press on right. Gauges show pressure in pounds per square inch usually required to properly press the product. Heating unit is to be seen immediately below thermometer.

After pressing, the macaroni is dried in the manner described by Harris and Sibbitt (1942) in the experimental drier shown in Fig. 3. In the apparatus a constant temperature of 92° F. is maintained throughout the drying period, while the relative humidity is reduced from 96% to room humidity. The drying operation formerly required a three-day period, but tests made at this Station have shown that two days is sufficient for micro macaroni. After drying the macaroni is removed from the drier, and carefully examined for quality.

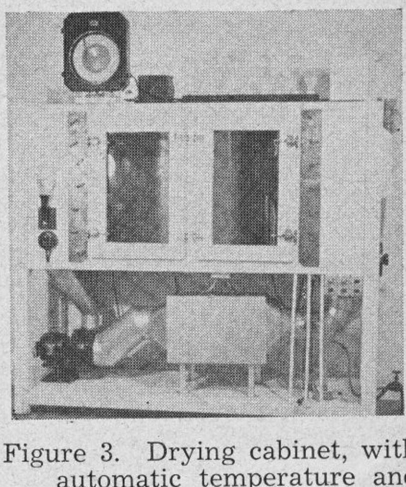

Figure 3. Drying cabinet, with automatic temperature and humidity control, employed in drying macaroni.

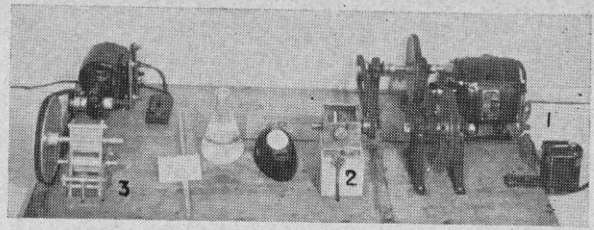

Figure 4.—Mixing and kneading assembly employed in preparing the dough for pressing into tubular macaroni. Number 1 is the electric motor which drives the miniature mixer 2. Reversing switch is visible at lower right. Speed reducing pulleys and belt drives connect motor to the mixer. 3 is the kneader, with driving motor. Stop watch used for timing the mixing and kneading, and flask containing distilled water, with measuring pipette, are shown between the mixing and kneading assemblies.

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