Milling and Macaroni-Making Quality of 4 New Durums

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In the Bimonthly Bulletin for January-February, 1955, the writers pointed out the severe losses inflicted on the durum growing industry of North Dakota by stem rust. They also described the quality of some promising rust-resistant durum hybrids which had been grown in experimental plots at the Langdon Branch Station. Methods of evaluating durum wheat quality were briefly discussed and their commercial importance pointed out. The present report describes equipment used in evaluating durum quality and methods of operation and shows results from both the 1954 and 1955 crops grown on the experimental plots at Langdon, Minot, Edgeley and Fargo.

Methods and Equipment

The major operations included in macaroni processing are mixing, kneading, pressing, fanning and drying. The laboratory is maintained at approximately 60 per cent relative humidity while processing is being done. The press temperature is held at 92° F. A special macaroni die is used which is substantially thicker than the customary experimental dies and has its center rod held firmly by three knife-edge supports instead of one, as is usual in most experimental dies. This arrangement prevents possible displacement of the center rod during pressing with resultant variations in macaroni wall thickness.

In processing, 600 grams (1.3 lbs.) of purified semolina is used. Sufficient water is added to form a stiff dough and the semolina and water are then mixed and kneaded to optimum consistency. The dough is permitted to rest for 10 minutes at press temperature before being pressed into macaroni. The 30-inch lengths of macaroni are suspended over wooden rods and surface-dried at room temperature and humidity in an air current from a fan.

Fig. 1 represents a section of the modern macaroni-processing laboratory located in the new Grain Products Laboratory on the campus of North Dakota Agricultural College. Shown are the experimental mixer, kneader and temperature controlled press. After pressing and surface drying the material is placed in the drying cabinet (Fig. 2) where it is sweated for a minimum period of one hour at 90° F. and 95 per cent relative humidity. The drying of the macaroni is performed in the cabinet, which is fitted with devices for accurately and automatically controlling the temperature and relative humidity. Drying is done at a constant temperature and under a falling humidity gradient, for a period of 60 to 63

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hours. The visual color score is then determined on the dried macaroni. The apparatus and methods employed closely resemble those used in commercial macaroni (long goods) manufacture.

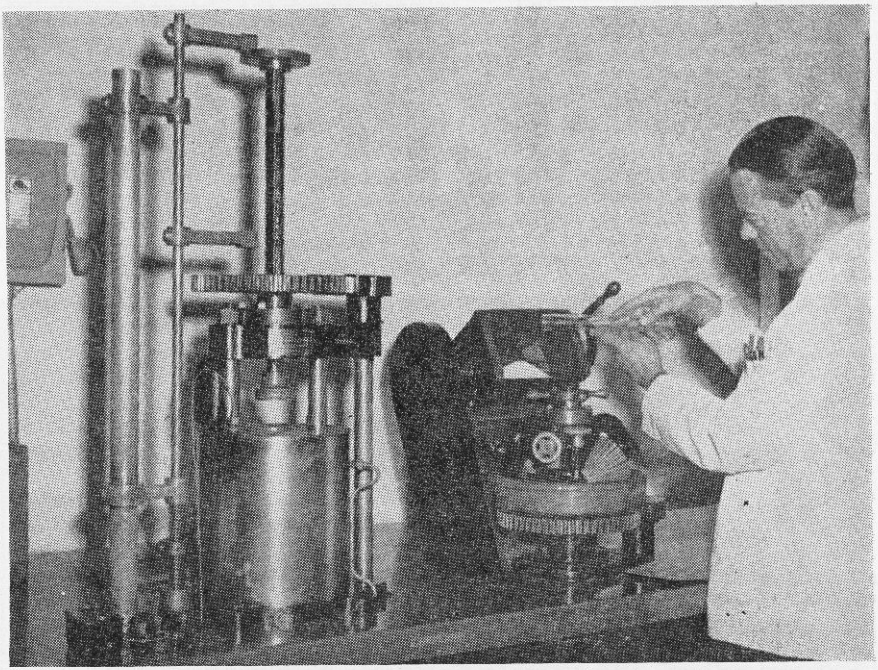


FIGURE 1.—*Experimental macaroni processing equipment.*

Results and Discussion

Table I shows the data obtained from the wheats, arranged in order of decreasing test weight. It is evident that Langdon had the highest yield per acre with Ramsey next highest. For test weight Towner was best, although all the varieties except Mindum were close to 60 pounds or above. Mindum was also definitely lower than the others in both wheat and semolina protein content, probably owing to damage from stem rust. Yuma was highest. For semolina yield Mindum was lowest, while the four newer varieties were all higher, with Ramsey yielding the largest proportion of unpurified semolina. Varieties which produce relatively good yields of semolina are more valuable to the miller than varieties of lower yield potential.

Table II shows additional quality information obtained from the semolinas. There was little difference in speck count with the exception of Yuma, which had distinctly less speckiness than the other semolinas. For ash content Towner was the lowest and Mindum and Vernum were a trifle higher than the average. However, the relative difference between the semolina ash content of these three standard varieties and that of the newer wheats noted

TABLE I.—**Comparative Wheat Quality Values for Seven Durum Varieties Arranged in Order of Decreasing Test Weight.**

Variety	Yield	Test Weight	Protein[1]		Semolina Yield[1]	
			Wheat	Semolina	Unpurified	Purified
	b.p.a.	lbs./bu.	%	%	%	%
Towner	32.2	62.8	13.8	12.7	70.4	52.8
Ramsey	35.6	61.9	13.7	12.9	72.7	56.8
Langdon	38.7	61.4	13.8	12.8	71.8	56.8
Sentry	31.4	60.5	14.0	13.1	69.4	53.0
Yuma	33.9	59.7	14.8	13.6	70.5	54.2
Vernum	27.6	59.4	13.3	12.5	68.4	52.8
Mindum	22.2	57.4	11.9	11.3	66.2	50.7

NOTE: [1]Expressed on 13.5% moisture basis.

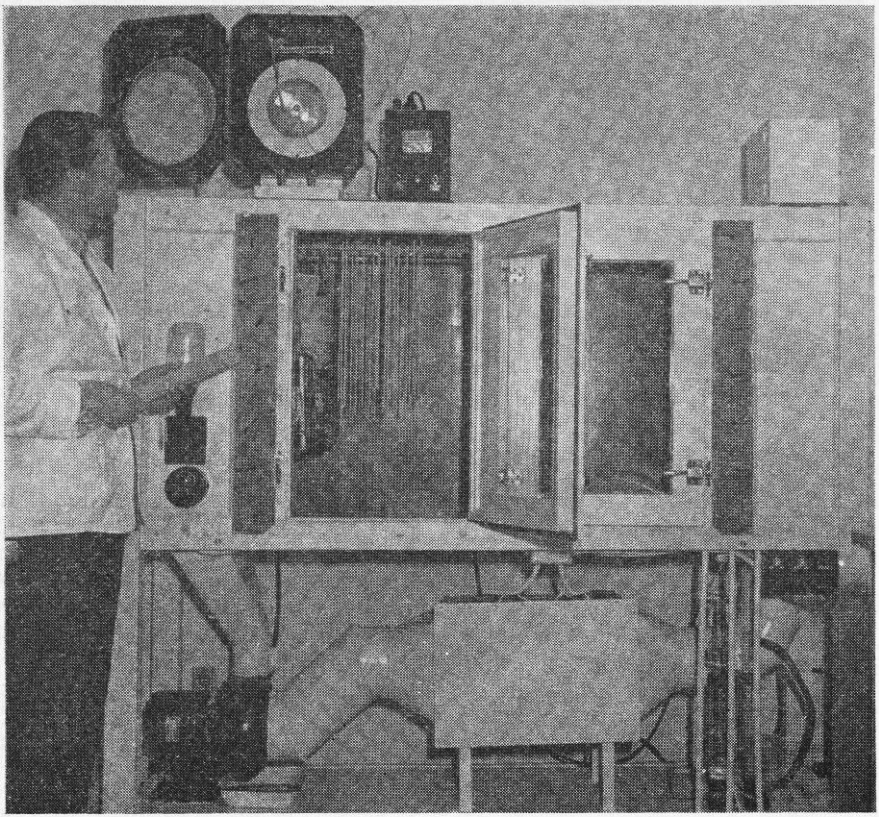


FIGURE 2.—*Experimental macaroni drying cabinet.*

is much less than was found for the 1954 crop. This may have been caused by the lower rust incidence in 1955, and probably to some extent to the effect of using wheats grown at four stations in 1955 rather than having only wheats from Langdon, as in the 1954 comparisons.

TABLE II.—**Comparative Semolina and Macaroni Quality for Seven Durum Varieties Arranged in Order of Decreasing Macaroni Color Score.**

Variety	Semolina Specks per 10 sq. in.	Ash Content[1]	Absorption[1]	Visual Color Score of Macaroni	Mixogram Curve Classification
Langdon	33	0.60	27.9	9.3	Weak
Sentry	37	0.62	26.8	9.1	Very Weak
Ramsey	34	0.64	27.9	8.0	Medium Weak
Mindum	33	0.66	28.8	7.9	Medium
Vernum	45	0.65	28.4	7.7	Medium
Yuma	18	0.60	28.3	7.4	Strong
Towner	35	0.56	28.0	7.1	Medium Weak

NOTE: [1]Expressed on 13.5% moisture basis.

Sentry had the lowest water absorption when mixing the macaroni dough for processing. The others did not differ appreciably. For macaroni visual color score, Langdon was the best variety, closely followed by Sentry. Towner was the poorest, with Yuma somewhat better. In years before the threat of 15B stem rust appeared these wheats would have been viewed with suspicion for the production of good quality macaroni. These two varieties, of course, produce macaroni greatly superior to bread wheat, or to the 50-50 blends used currently by macaroni manufacturers. Their

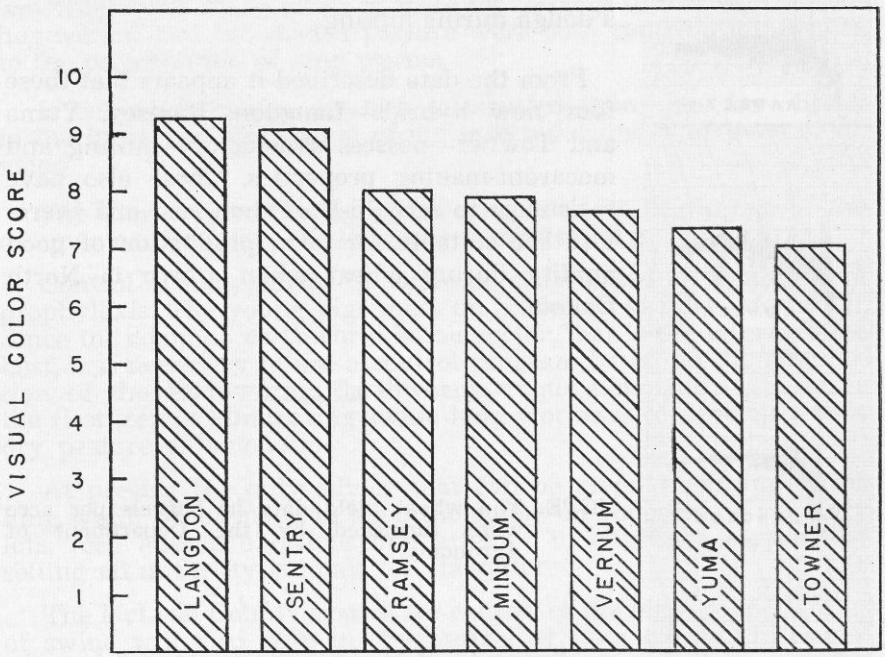
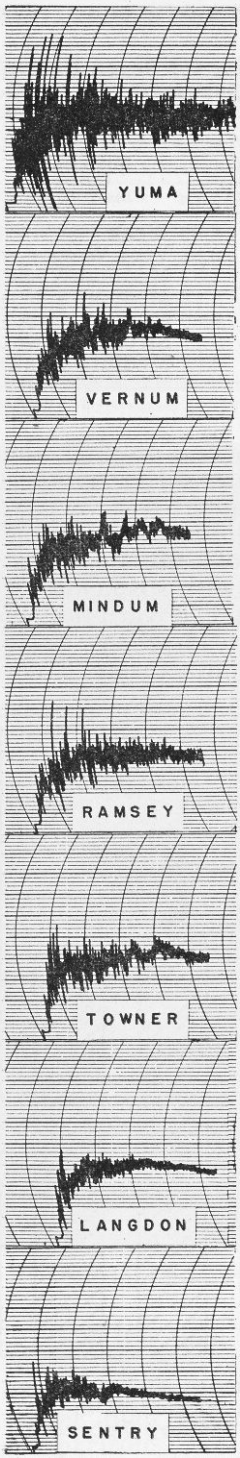


FIGURE 3.—*Visual macaroni color score of the seven durum varieties. The range in color, while significant, is not as marked as in the comparisons for the* 1954 *wheats represented in the January-February* 1955 *Bimonthly Bulletin.*



release helps materially in safeguarding the North Dakota durum crop against loss from stem rust infection. Their lower yield per acre as compared with Langdon and Ramsey should tend to limit their growth in the state.

Fig. 3 represents the visual macaroni color score of the three varieties which have been released and the four new varieties. This illustrates the differences in color existing among the varieties which is less than was reported for wheats grown in the Langdon plots in 1954.

Fig. 4 shows the variability in gluten quality found among the seven varieties by use of a mixograph. This instrument is a device for measuring automatically changes occurring in a dough during mixing.

From the data described it appears that these four new hybrids—Langdon, Ramsey, Yuma and Towner—possess satisfactory milling and macaroni-making properties. These also have resistance to race 15-B of stem rust and therefore are suitable for farm production of good quality durum wheat when grown in North Dakota.

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NOTE: The wheat yield data in bushels per acre were furnished by the Department of Agronomy.

FIGURE 4.—*Mixogram patterns obtained from the seven durum varieties arranged in order of decreasing gluten strength, from top to bottom.*