NOTE ON SMALL-SCALE LABORATORY EQUIPMENT FOR SEPARATING GERM FROM WHEAT[1]

Cereal Chem. 54(2): 306-310

L. C. BOLTE and K. F. FINNEY[2], U.S. Grain Marketing Research Center, USDA, ARS, North Central Region, Manhattan, KS 66502

A study of the structure, composition, or biochemistry of wheat germ, or determination of the extent to which (in relation to other wheat components) it is contaminated with fungicides, herbicides, or insecticides requires an efficient method of obtaining germ from 1 kg or less of wheat. A combination of sifting, aspiration, and inclined surfaces that is used commercially to separate the germ from the bran and endosperm of wheat (1), has been applied in a small-scale method. We now describe that method for separating germ from wheat, so that the germ-depleted sample can be used later for milling and other quality tests.

MATERIALS AND METHODS

Equipment

1. Forester scourer, Model No. 6, beater shaft speed of 2225 rpm.
2. South Dakota seed blower (aspirator), Model D.
3. Ro-Tap testing sieve shaker.
4. Tyler sieves, 12, 14, 24, 35, and 42 meshes/in. Corresponding openings,

[1]Mention of specific instruments or trade names is made for identification purposes only and does not imply any endorsement by the U.S. Government.

[2]Respectively: Food Technologist and Research Chemist, Hard Winter Wheat Quality Laboratory, Grain Quality and End-Use Properties Unit.

0.0550, 0.0460, 0.0276, 0.0164, and 0.0138 in.

5. Oregon vibratory separator (Fig. 1) with table sloped at an angle of 9° from right to left (adjust at A), and 3° from feed to discharge side (adjust at B) for first fibratory separation, and with table sloped at an angle of 14° from right to left and 1° from feed to discharge side for second and subsequent fibratory separations. Table vibrator is set at C to give about a 1.25-mm stroke that may need to be adjusted, especially for each sample. Vibratory feeder is adjusted at D to give a relatively slow and uniform rate of flow.

6. Separator table covers, one cut from a brown file folder (first separation) and the other from a desk-top blotter (second and subsequent separations). Materials will move to the bottom or rise to the top of the table, depending on the smoothness or roughness of the cover.

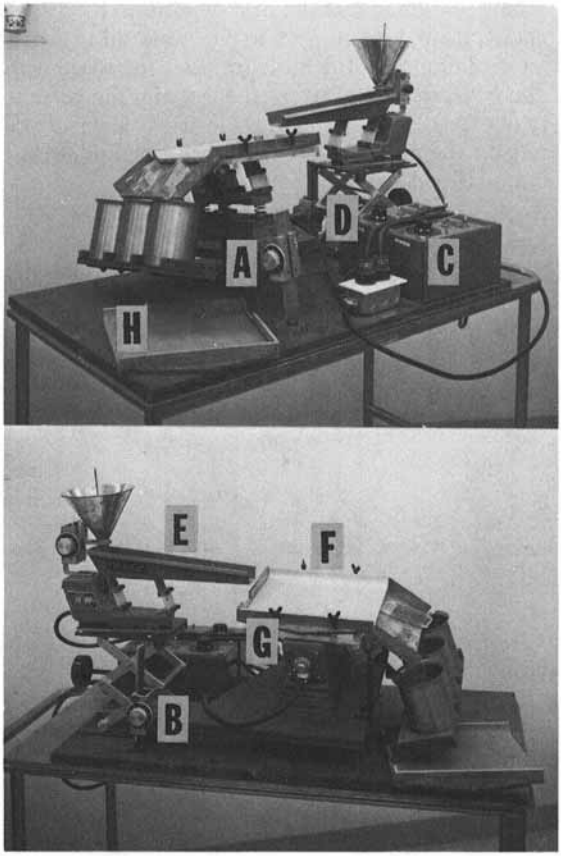

Fig. 1. Oregon vibratory separator. Slope of table is adjusted at A (right to left) and at B (feed to discharge side). Table vibrator is set at C and vibratory feeder E is adjusted at D. The installed vibratory separator table covered from top, F, to bottom, G, with a file folder, and the blotter-paper table H are alternated during the separation of the germ.

Procedure

Temper the wheat sample to 13% moisture (higher levels reduce germ yield) 18 to 24 hr before one to six passes through scourer (Fig. 2). Sift the fine material (in the drawers beneath the scourer) and the scoured wheat over 12-, 14-, 24-, 35-, and 42-mesh sieves for 3 min on the Ro-Tap sifter. Retain the overs of the 12-mesh sieve and thrus of the 42-mesh sieve for milling and other tests. Separately aspirate the overs of the 14-, 24-, 35-, and 42-mesh sieves. Regulate the air stream of the seed blower so that the light bran particles will be lifted to the top of the column for discard or milling.

Add the germ, bran, and endosperm particles remaining in the bottom of the aspirator column (all four aspirations) to the funnel of the vibratory feeder E for entry onto the table of the vibratory separator. The bran and germ will move to the upper side F and the endosperm particles to the lower side G of the vibratory separator (VS) table. Set the dividers to guide all stocks to the stainless-steel beakers at the discharge end. Collect the bran and germ fractions from the upper side F of the table, aspirate, and subject to a second vibratory separation after changing the cover and angles of the table (replace file folder table with blotter-paper table H). The bran should move to the top and the germ to the bottom of the table. Those two steps of aspiration and vibratory separation may need to be repeated, depending on the purity of germ desired. All nongerm material should be retained if milling studies are contemplated.

RESULTS AND DISCUSSION

Separation of germ, as described in the procedure, is based on yield of germ

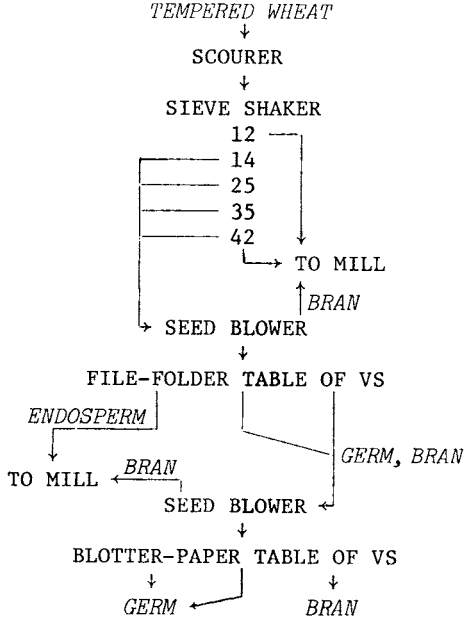

Fig. 2. Flow diagram of procedure for obtaining wheat germ.

TABLE I
Weight (g) and Particle Size of Scourings and Recovered Germ after Each of Six Passes (through the Scourer) of a 1000-g Sample of a Hard Winter Wheat Composite

Tyler Sieve meshes/in.	Passes through Scourer					
	1st	2nd	3rd	4th	5th	6th
			Scourings			
O-14[a]	15.83	31.35	24.39	19.15	21.22	30.05
O-24	3.25	6.80	9.68	10.32	11.10	12.89
O-35	3.00	5.88	8.38	10.14	11.00	10.25
O-42	1.58	2.40	3.48	3.94	4.22	4.00
T-42	5.81	8.30	14.87	19.37	23.78	28.00
			Germ			
	2.83	4.99	5.60	4.40	1.51	0.86

[a]O = Overs, T = thrus.

TABLE II
Milling and Analytical Data for Flours Milled from Wheat before and after Removal of Germ[a]

Passes through Scourer	3rd Break Germ Stock		Flour Yield	Protein	Ash
	Amount[b] g	Protein %	%	%	%
0 (control)	164	15.8	72.3	10.3	.34
4[c]	170	13.2	73.7	10.2	.33
6[c]	175	12.6	73.9	10.3	.37

[a]Chemical data expressed on 14% moisture basis.
[b]Total of three 1000-g millings.
[c]Wheat was tempered to 13% moisture about 24 hr prior to separating the germ. Scoured wheat was tempered to 15% moisture about 24 hr prior to milling; nongerm materials (Fig. 2) were mixed with corresponding scoured wheat about 2 hr after tempering to 15% moisture.

after each of six consecutive passes through the scourer (Table I). The weight of scourings over (O) the 14-, 24-, 35-, and 42-mesh sieves after the first pass through the scourer yielded 2.83 g of germ. Scourings from the second, third, and fourth passes yielded 4.99, 5.60, and 4.40 g germ, respectively. Yield of germ decreased to 1.51 g for the fifth pass and further decreased to only 0.86 g for the sixth. Total germ from the first four passes of 1000 g wheat through the scourer was 17.82 g, and for all six passes it was 20.19 g, amounts that are equivalent to about 59 and 67% yields, respectively, based on 3.0% germ in wheat (2).

The procedure was based on many combinations of different table surfaces, slopes, and vibrator adjustments. Glossy surfaces, in contrast to the functional surfaces described above, allowed all the material to fall to the bottom of the table. Rough surfaces caused all the material to climb to the top. Germ separated differently for different varieties of wheat because of variations in size and shape. The germ, 82.6% pure and essentially whole, contained 6.3% moisture, 30.3% protein (N × 5.45, in ref. 3), and 4.5% ash (14% mb). The nongerm particles were endosperm and bran. The remaining germ-free kernels and scourings were suitable for milling (4) and other quality tests (Table II).

Acknowledgments

The vibratory separator was developed by the departments of Agricultural Engineering and Farm Crops at Oregon State University, Corvallis, Oreg., under contract with ARS, USDA (formerly Agricultural Marketing Service), Beltsville, Maryland.

Literature Cited

1. NATTRASS, P. The production of bran, wheat-feed and germ. In: The practice of flour milling, Vol. I, Chap. 14. Northern Pub. Co.: Liverpool, England (1966).
2. HINTON, J. J. C. The distribution of ash in the wheat kernel. Cereal Chem. 36: 19 (1959).
3. TKACHUK, R. Nitrogen-to-protein conversion factors for cereals and oilseed meals. Cereal Chem. 46: 419 (1969).
4. FINNEY, K. F., SHOGREN, M. D., BOLTE, L. C., HUBBARD, J. D., GOFORTH, D. R., EICHMAN, B. M., DAIGGER, G. C., JATKO, J. A., and SMITH, F. L. Quality characteristics of hard winter wheat varieties grown in the Southern, Central, and Northern Great Plains of the United States, 1974 crop. USDA Mimeographed Publication HWWQL-38 (1975).

[Received May 13, 1976. Accepted September 8, 1976]