A Justification for Using a Whole-Grain Oven Method to Determine Soybean Moisture Content[1]

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Three air-oven moisture methods, AOCS Ac 2-41, AACC 44-18 and the official USDA method, were compared on 20 samples of 1987 crop soybeans. The AOCS method is a whole-grain method, the other two are two-stage, ground-grain methods. The average difference between the AOCS and USDA methods was 0.04 percentage points with a standard deviation of 0.18 points. The AOCS method can be used interchangeably with the USDA method for calibration of moisture devices. The AACC method averaged 0.15 and 0.19 points higher than the AOCS and USDA methods, respectively.

Oven-dry methods are usually used by analytical laboratories to determine soybean moisture content. The soybean market uses one of several electronic moisture meters that, presumably, are calibrated against an oven method.

Electronic moisture meters have, as a basis of calibration, the United States Department of Agriculture (USDA) two-stage ground-grain method (1). All moisture meters or other moisture devices used for soybean trading should be calibrated to agree with this standard. This method is slow and complicated because any samples over 10% moisture must be predried for 14-16 hr to prevent moisture loss during grinding. The second stage is drying of 5-10 g of ground material for one hr at 130°C. Other disadvantages of the USDA method are potential effects of varying particle granularity and the need for a relatively large (50 g) sample in the predrying stage. Although oven methods are by nature empirical, all USDA-approved methods were adopted after comparison to the more theoretically sound Karl Fischer titration method (2). The introduction of whole-grain near-infrared transmission analytical instruments increases the need for a simpler oven method because, unlike electronic moisture meters, near-infrared units may require individual-unit calibration and more frequent calibration updating.

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Two commonly used oven methods were chosen for comparison with the USDA method—the American Association of Cereal Chemists' (AACC) ground-grain method 44-18 (3), and the American Oil Chemists' Society (AOCS) whole-grain method Ac 2-41 (4). Both the USDA and AACC methods are two-stage methods requiring the room-air drying period of 14-16 hr before grinding. The AACC method specifies drying for two hr at 135°C. The USDA method is also listed by AACC as method 44-15A (5). The AOCS method specifies drying 10 g of whole beans for three hr at 130°C. Whole grain methods are inherently simpler and easier to incorporate into an instrument calibration procedure.

The purpose of this study was to establish that the AOCS method would give results comparable to the USDA method.

MATERIALS AND METHODS

Twenty samples of soybeans were randomly selected from our inventory of 1987 crop soybean samples. These samples were cleaned over a 4.0-mm x 14.4-mm slotted screen. Each sample was divided into four subsamples with a Boerner divider. One subsample was used for each oven method, and one was held back as a file sample. Moisture determinations were made according to method requirements. Three replicates were taken from each subsample. A Wiley Intermediate mill with 20-mesh screen was used to grind for the USDA and AACC methods.

RESULTS AND DISCUSSION

The average moisture contents are for the three moisture methods shown in Table 1.

The slightly higher values from the AACC method can be attributed to the higher oven temperature (135 vs 130°C) and longer heating time (two vs one hr). Of more importance is the close agreement between the AOCS whole-grain method and the USDA method. These methods can therefore be used interchangeably. The differences between methods were not correlated with moisture content over the range of these data, 6.84% to 13.18% by the USDA method.

TABLE 1

Moisture Content of 20 Soybean Samples by Three Air-Oven Methods

	Moisture content			Differences		
	AOCS[a]	AACC[a]	USDA[a]	AOCS-AACC	AOCS-USDA	AACC-USDA
Average, % (n=20)	10.50	10.65	10.46	0.15[b]	0.04	0.19[b]
Std. Dev., points	1.202	1.210	1.209	0.18	0.18	0.06

[a]AOCS Ac 2-41 (4), AACC 44-18 (5), USDA official (1).
[b]Significantly different from 0.00 (P = 0.05).

Substitution of the AOCS method Ac 2-41 for the USDA air-oven method will give similar moisture results for soybeans, with less time invested and less sample destroyed.

REFERENCES

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4. Method Ac 2-41, *Official Methods of the American Oil Chemists' Society*, AOCS, Champaign, IL.
5. Method 44-15A, *Approved Methods of the American Association of Cereal Chemists*, AACC, St. Paul, MN.

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