A NOTE ON THE WET-MILLING OF HIGH-AMYLOSE CORN CONTAINING 75-PERCENT-AMYLOSE STARCH[1]

R. A. ANDERSON

In two previous articles we discussed the wet-milling characteristics of a number of high-amylose corns containing starches with apparent amylose contents ranging from 49 to 68% (2,3). Differences in response to various wet-milling procedures were described and compared with that of ordinary dent corn. Significant differences were the increased swelling of the steeped corn kernel, the lower recovery of starch, and in some cases a higher protein content of the starch. These studies have continued as new samples of high-amylose corn have become available. In 1960, one corn breeder supplied a quantity of a single-

[1]Manuscript received September 22, 1961. Contribution from the Northern Regional Research Laboratory, Peoria, Illinois. This is a laboratory of the Northern Utilization Research and Development Division, Agricultural Research Service, U.S. Department of Agriculture.

cross hybrid which contained starch with a 75% apparent amylose content. This note discusses the wet-milling characteristics of this corn and compares them to those of other high-amylose corns.

Wet-milling procedures used have been described in the previous papers (2,3). Protein, starch, and crude fat determinations were carried out essentially as described in *Cereal Laboratory Methods* (1). Moisture was determined by drying a sample for 4 hours at 110°C., under a vacuum of 28 in. of mercury. Apparent amylose analysis of the corn was carried out essentially as described by McCready and Hassid (5) and by Kerr and Trubell (4), as adapted at the Northern Laboratory. Apparent amylose contents of previously studied high-amylose corns have been shown to be higher than the amount of amylose isolable from the starch (6,7). Such a study will be carried out on the 75% amylose corn.

The high-amylose corn, Amicorn X705, bred and grown by Bear Hybrid Corn Co., Decatur, Illinois, had the following chemical analysis (moisture-free basis):

	%
Protein	14.5
Crude fat	7.3
Starch	60.2
Apparent amylose content of endosperm	74.6

Like earlier high-amylose corns, the protein and fat contents are higher than in ordinary dent corn, while the starch content is lower. The amount of starch present in the 75% amylose corn was less than in other high-amylose hybrids.

Table I compares certain milling characteristics of the 75% amy-

TABLE I

COMPARISON OF CERTAIN WET-MILLING CHARACTERISTICS OF THREE HIGH-AMYLOSE CORN HYBRIDS AND ORDINARY CORN
(Average of duplicate runs)

	APPARENT AMYLOSE CONTENT, %			
	24[a]	57[b]	67[c]	75[d]
Steeped kernel volume increase, %	63	128	105	125
Starch recovery, % of total starch in corn	87.3	71.4	82.7	71.6
Protein in starch, % MFB	0.51	0.7	0.48	0.59

[a] Ordinary corn.
[b] Double-cross hybrid, Amicorn 8005, grown in 1958.
[c] Single-cross hybrid, Amicorn 601, grown in 1959.
[d] Single-cross hybrid, Amicorn X705, grown in 1960.

lose corn, other hybrid high-amylose corns, and an ordinary dent corn. Steeped kernels from the 75% amylose corn exhibited a 125% increase in volume over its dry state. This increase is twice the kernel expansion of the ordinary dent corn; it is somewhat greater than the 67% high-amylose corn, but is about the same as that for the 57% amylose corn. Increased swelling of the steeped kernels has occurred during the processing of all high-amylose corns that we have studied.

Overall processing characteristics of the 75% amylose corn were similar to those reported for the 57%. Starch recovery from milling 75% amlyose corn was 71.6%, and its protein content was 0.59%. These results do not compare favorably with those obtained from milling 67% amylose corn, which we reported as the best high-amylose corn studied to date from a milling standpoint. It should be pointed out that of the three high-amylose corns discussed in this Note, only the 57% material has been produced as a double-cross hybrid in semi-commercial quantity. The 67 and 75% amylose corns are single-cross hybrids of different pedigrees that are still in the development stage. Much breeding work remains in perfecting the pedigree of the higher amylose-containing corns to give them better milling characteristics. Processing studies, such as we have described in this article and others, provide breeders and industrial users of high-amylose corn with an insight into some of the problems which they may encounter.

Acknowledgments

The author gratefully acknowledges the assistance of J. G. Pemberton in carrying out the experimental work. The assistance of D. E. Uhl, F. B. Alaksiewicz, D. R. Johnson, G. G. Spyres, and W. L. Deatherage in making the many analytical determinations is also appreciated. R. P. Bear provided the corn samples.

Literature Cited

1. American Association of Cereal Chemists. Cereal laboratory methods (6th ed.). The Association: St. Paul, Minnesota (1957).
2. Anderson, R. A., Vojnovich, C., and Griffin, E. L., Jr. Wet-milling high-amylose corn containing 49- and 57-percent-amylose starch. Cereal Chem. **37:** 334–342 (1960).
3. Anderson, R. A., Vojnovich, C., and Griffin, E. L., Jr. Wet-milling high-amylose corn containing 66- to 68-percent-amylose starch. Cereal Chem. **38:** 84–93 (1961).
4. Kerr, R. W., and Trubell, O. R. Spectrophotometric analyses of starches. Paper Trade J. (TAPPI) **117:** 25–28 (1943).
5. McCready, R. M., and Hassid, W. Z. The separation and quantitative estimation of amylose and amylopectin in potato starch. J. Am. Chem. Soc. **65:** 1154–1157 (1943).
6. Montgomery, E. M., Sexson, K. R., and Senti, F. R. High-amylose corn starch fractions. Die Stärke 13 (6): 215–222 (1961).
7. Wolff, I. A., Hofreiter, B. T., Watson, P. R., Deatherage, W. L., and MacMasters, Majel M. The structure of a new starch of high-amylose content. J. Am. Chem. Soc. **77:** 1654–1659 (1955).