

AZURE

A New Barley Variety for North Dakota

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The Director of the North Dakota Agricultural Experiment Station in cooperation with the Agricultural Research Service, US Department of Agriculture, announced the release of a new barley variety on January 14, 1982. Seed increase of 'AZURE' (C.I. 15865) will be made to County Crop Improvement Associations in most counties in North Dakota in 1982 under contract with the North Dakota Agricultural Experiment Station. Some seed of this variety will be available for commercial production in 1982. Seed allocations of AZURE also will be made to the North Dakota seed trade and interested states in the region.

Hybridization, selection, and development of AZURE was done at North Dakota State University through cooperation of the departments of Agronomy, Cereal Chemistry and Technology, and Plant Pathology. Also, branch experiment stations in North Dakota, cooperating states in the region, the USDA Barley and Malt Laboratory at Madison, Wisconsin, and industry-laboratories under the auspices of the Malting Barley Improvement Association collaborated in testing this barley variety.

HISTORY OF AZURE BARLEY

AZURE (pronounced A zure) is a selection from the cross Bonanza//Nordic/NDB130 made in the 1971 spring greenhouse. NDB130 is a North Dakota experimental line with good yield and moderate resistance to leaf spotting diseases. Early generations of AZURE were grown at Fargo in greenhouses or field and at Cd. Obregon, Sonora, Mexico. A single F₃ plant was selected in 1968 and the F₄ row was bulked to provide seed for yield tests starting in 1973 in North Dakota. AZURE was tested under the number ND1894 and was entered in regional tests in 1978 and 1979. Fifty head rows with uniform agronomic type were bulked in 1978 and was the Breeder seed used for subsequent release.

AGRONOMIC CHARACTERISTICS OF AZURE

AZURE is a six-rowed, smooth-awned, spring barley with blue aleurone and long hairs on the rachilla. Com-

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parisons of AZURE with Bonanza for several agronomic characteristics are presented in Table 1.

Table 1. Agronomic performance of AZURE compared with Bonanza at several locations in North Dakota, 1975-81.

Characteristic	No. of Station years	AZURE	Bonanza
Yield, bu/A	38	90.6	83.9
Days to heading after May 31	35	29.4	30.4
Height, inches	35	31.2	34.4
Lodging, Percent	18	34.5	46.2
Test weight, lbs/bu	27	46.5	46.2

The average grain yield of AZURE has exceeded that of Bonanza in North Dakota and regional tests. The yield advantage of AZURE over Bonanza is greater in eastern than in western North Dakota. AZURE is slightly earlier in maturity than Bonanza and has shorter and stronger straw. The test weight of AZURE and Bonanza is nearly equal.

DISEASE REACTION OF AZURE

AZURE can be compared to Bonanza for reaction to several diseases using the data in Table 2, collected at several North Dakota locations or greenhouse trials. AZURE has slighter better resistance to spot blotch but slightly poorer resistance to net blotch than Bonanza. Also, AZURE lacks Bonanza's resistance to loose and covered smuts; however, growers can prevent losses from these two diseases by treating the seed with Vitavax or a similar chemical. Both varieties are resistant to stem rust and susceptible to leaf rust. Leaf rust has been a problem only in late planted barley fields in eastern North Dakota.

Table 2. Reaction of AZURE and Bonanza to prevalent diseases in North Dakota, 1975-81.

Characteristic	No. of Station years	AZURE	Bonanza
Leaf spot, 1-10*,**	6	4.5	4.7
Net blotch, 1-10**	Greenhouse	5.5	4.0
Spot blotch, 1-10**	5	4.0	4.5
Loose smut	—	Sus.	Res.
Covered smut	—	Sus.	Res.

Disease notes were taken at selected locations where good differential readings could be obtained.

*Includes foliar diseases (primarily spot blotch and net blotch).

**1 = no symptoms, 10 = severe symptoms.

MALTING AND BREWING QUALITY OF AZURE

Laboratory scale malting tests have been performed on AZURE since 1972. Table 3 presents a comparison

Table 3. Comparison of AZURE and Bonanza.

	Kernel Plump (%)	Assortment Thin (%)	Protein Score Total (%)	Wort (%)	W/T (%)	Extract Fine (%)	F-C (%)	Diastatic Power (°L)	Alpha Amylase (20° D U)
AZURE	74.5	3.4	571 13.6	4.48	33.2	77.0	6.9	204	33.2
Bonanza	67.8	4.8	570 14.2	4.81	34.1	77.0	5.6	219	34.9

of the malting characteristics of this new variety with Bonanza, the only blue aleurone variety currently grown in North Dakota. The data presented were obtained from samples grown in variety plot trials in 1979 and 1980 at several locations in North Dakota. These data represent a total of 13 station years for each variety. Table 4 shows a comparison over 22 station years between AZURE and Larker, a white aleurone variety which has been the standard of malting quality for almost 20 years.

Table 4 Comparison of AZURE and Larker.

	Kernel Plump (%)	Assortment Thin (%)	Protein Score Total (%)	Wort (%)	W/T (%)	Extract Fine (%)	F-C (%)	Diastatic Power (°L)	Alpha Amylase (20° D U)
Larker	81.6	3.1	579 14.1	4.57	32.3	75.5	4.8	178	36.8
AZURE	79.8	3.8	576 12.9	4.58	35.4	77.6	4.1	162	40.5

A comparison of the kernel size of AZURE with Larker, which is characterized by a large percentage of plump kernels, shows them to be virtually equal in this characteristic. AZURE clearly is superior to Bonanza in this respect. Plump kernels are desirable as they tend to yield higher levels of extract and will grow more evenly in the malt house. It was noted on two occasions that kernels of AZURE may "skin" during the seed cleaning operation.

The total protein content of barley is a significant marketing factor and is important in determining how the barley performs in the malt house and brewery. Most brewers set an upper limit of 13.5% protein on malting barley. AZURE has an advantage over Larker in having lower protein percentage and also has lower protein than Bonanza. AZURE is equal to Larker in soluble protein percentage and is slightly lower than

Bonanza. Low levels of soluble protein have a detrimental effect on fermentation due to the lack of sufficient nitrogen for yeast growth and metabolism. High levels of soluble protein increase the possibility of hazy beer. The levels found in AZURE appear to be within the desirable range. AZURE also is equal to Bonanza in the ratio of soluble to total protein.

The extract produced by malt determines how much beer can be made from a given quantity of malt and high levels of extract are desirable. AZURE is superior to Larker for extract and our data show it to be equal to Bonanza. Data from the USDA Barley and Malt Laboratory and Malting and brewing industry laboratories show AZURE to have a slightly higher extract than Bonanza. The fine-coarse grind extract difference is a measure of how readily the barley endosperm modifies during malting and small differences are desirable. In this respect, AZURE is slightly better than Larker and slightly poorer than Bonanza.

The amylolytic activity of a malt is a measure of how readily it is able to convert starch from the endosperm into fermentable sugars for yeast metabolism and alcohol production. Amylolytic activity is measured as diastatic power and alpha-amylase activity. AZURE shows slightly lower diastatic power and alpha-amylase activity than Bonanza but its levels are acceptable.

AZURE has been tested by commercial maltsters and brewers for four years (1977-1980). The results of malting tests have been quite favorable, supporting our data showing AZURE to be a suitable malting variety. The first year of plant scale test results (1979) were favorable in all respects. The brewer in this test is a major user of blue aleurone malting barley. The second carlot test (1980) resulted in a favorable report except for beer flavor. However, this brewer uses no blue aleurone malting barley because of a flavor problem it perceives in all blue varieties.

In summary, AZURE is superior in malting and brewing quality to Bonanza for those brewers who use blue aleurone malting barley in their process.