NDSAB(MS)C8(LM)C3, NDSD(FS)C1(LM)C4, and NDSM: New Germplasm Sources for Improved Corn Hybrids

H.Z. Cross and D.W. Wanner

Corn (*Zea mays* L.) traditionally has been grown for grain, silage, and forage in North Dakota and surrounding areas of the Northern Great Plains, but in recent years the proportion of corn grown for grain has increased relative to silage and forage corn (Cross, 1985a). Unit trains shipping corn to the West Coast for export are now commonplace, while in the past, most corn was consumed by livestock in the upper Midwest area. With today's keen competition for overseas markets, quality of U.S. corn is becoming increasingly important to exporters, the U.S. government, and researchers. Broken corn and foreign material (BCFM) is a measure used by the grain trade to estimate grain corn quality. Kernel breakage during handling influences the utility of corn for wet and dry milling (Paulsen and Hill, 1985) and may reduce its storage life (Sauer et al., 1982).

Corn hybrids differ in their resistance to kernel breakage (Cloninger, et al. 1975; Koeckeritz, et al., 1988). Kernel breakage is positively correlated with harvest moisture (Cloninger, et al. 1977; Koeckeritz, et al., 1988), so one should expect that strains selected to have lower moisture at harvest would be more resistant to kernel breakage. Because producers are not rewarded for improved grain quality in the current marketing system, breeding procedures which improve breakage resistance at the expense of significantly lower yields are unacceptable.

Cross (1985b) and Cross et al. (1987) have described two breeding procedures which have been used to reduce ear moisture at harvest in strains derived from several genetic backgrounds. Ear moisture was reduced without detectable yield losses (Cross et al., 1987; Kabir, 1987).

NDSAB(MS)C8(LM)C3 and NDSD(FS)C1(LM)C4 are synthetic varieties with improved drying characteristics developed by the corn improvement project at NDSU from previously released synthetics. NDSM is a new synthetic which seems to have potential as a new source for developing parental inbred lines with low harvest moisture, high grain yields, and excellent lodging resistance.

Cross is professor and Wanner is research technician, Department of Crop and Weed Sciences.

BREEDING HISTORY

NDSAB(MS)C8(LM)C3 was developed from NDSAB (MS)C8 by three cycles of selection for low moisture at approximate physiological maturity using the selection procedure described by Cross et al. (1987). Equal numbers of seeds from 30 ears (half-sib families) were composited to give an improved population each cycle. Selection intensity was approximately 10 percent from among plants evaluated for moisture content at approximately 40 days post pollination. NDSAB(MS)C8 was developed from NDSAB by eight cycles of mass selection based on dried grain yield per unlodged plant (Cross, 1990). NDSAB was derived from 20 full-sib families between NDSA and NDSB, synthetics released in 1979 (Cross, 1980).

NDSD(FS)C1(LM)C4 was derived from NDSD(FS)C1 by four cycles of selection for low moisture at approximate physiological maturity using the selection procedure described by Cross, et al. (1987). Seed was bulked from 30 ears (half-sib families) with the lowest moisture content each cycle to give an improved population. Selection intensity was approximately 10 percent from among plants evaluated for moisture content at approximately 40 days post pollination. NDSD(FS)C1 was developed by one cycle of reciprocal full-sib selection using NDSC as the tester population (Cross, 1984).

NDSM was developed by intercrossing 13 elite lines of approximate AES100 to AES300 maturity. The lines were chosen for good general combining ability for resistance to stalk breakage and for good combining ability for grain yield. This population was then random mated for three generations. The 13 parental lines were ND250, ND101, CM153, A654, ND468, A664, PA363, ND363, W59E, ND8RF, CM105, ND245, and ND247.

AGRONOMIC DESCRIPTION AND PERFORMANCE

NDSAB(MS)C8(LM)C3 averaged 5.2 points lower moisture at harvest and 10.4 points lower root lodging than the previously released version, NDSAB(MS)C8, but maintained similar yield and stalk lodging resistance (Table 1).

NDSD(FS)C1(LM)C4 averaged 7.1 points lower ear moisture at harvest than NDSD(FS)C1, but was not significantly different in yield and lodging resistance.

NDSM produced grain yields not significantly different from the best yielding synthetics, but with ear moisture not

Table 1. Agronomic performance of NDSAB(MS)C8(LM)C3, NDSD(FS)C1(LM)C4, and NDSM and corresponding check strains grown in nine North Dakota environments across 1988 and 1989.

Entry	Ear moist.	Grain yield	Root lodg.	Stalk lodg.	P.I.[1]
	%	bu/A	---------- %	----------	
NDSD(FS)C1	38.48	93.37	22.31	0.71	93.9
NDSD(FS)C1(LM)C4	31.38	85.87	23.36	1.82	105.5
NDSM	31.61	92.51	14.29	1.01	113.2
NDSG(MS)C8	39.55	80.38	36.31	2.49	78.6
NDSG(MS)C8(LM)C3	35.22	93.63	34.35	3.76	102.8
NDSB(MS)C8	36.69	98.27	20.63	1.66	103.6
NDSB(MS)C8(LM)C3	29.25	96.03	30.19	3.44	127.0
NDSAB	39.24	77.01	28.97	2.42	75.9
NDSAB(MS)C8	37.04	91.39	32.76	2.01	95.5
NDSAB(MS)C8(LM)C3	31.87	87.84	22.40	1.44	106.6
Pioneer Brand 3963	32.51	115.36	21.14	0.85	137.3
LSD(0.10)[2]	1.80	9.99	8.17	2.20	

[1]P.I. = Performance Index = (Yield/test mean)/(Moisture/test mean) x 100.

[2]Average differences among hybrids of this amount could be explained by random environmental effects only once in 10 repetitions of this experiment.

significantly higher than the earliest synthetics tested. Root lodging percentage for NDSM was the lowest of all populations as well as the commercial hybrid tested.

CONCLUSIONS

Because both NDSAB and NDSD(FS)C1 have proven to be productive source populations (ND247 and ND258 were selected from NDSAB and ND261 and ND266 were developed from NDSD(FS)C1), and NDSAB(MS)C8(LM)C3 and NDSD(FS)C1(LM)C4 seem to be equal to or better than the previously released versions, it seems that they should be promising source populations for developing early inbreds. Also, NDSB(MS)C8 and NDSG(MS)C8 have been the highest yielding synthetics in previous tests (Cross, 1989), indicating that these improved versions should be capable of producing very early, high yielding hybrids. NDSM has had less lodging than other synthetics and even commercial check hybrids, yet has high yields and low ear moisture, indicating it may be a promising new source population with a high potential for developing very early inbreds with exceptional lodging resistance.

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