NDSAB(MS)C8, NDSB(MS)C8(LM)C3, and NDSG(MS)C8(LM)C3: Improved Germplasm Sources for Early Corn Hybrids

H.Z. Cross

Availability of corn (*Zea mays* L.) hybrids that dependably produce higher yields of quality grain with lower production costs would increase profits for North Dakota corn growers. Short-season hybrids are more reliable at producing high quality grain with less need for expensive artificial drying than are full-season hybrids; however, these advantages are gained at the expense of lowered yield potential in favorable growing seasons. Another strategy for producing more profitable varieties is to decrease the time required for full-season hybrids to dry-down under field conditions. Full-season hybrids with very rapid field moisture loss would acquire the advantages of the short-season hybrids without sacrificing the higher yield potential.

The corn improvement project at North Dakota State University has developed two plant breeding procedures that have demonstrated their ability to produce corn breeding populations with reduced harvest moisture without decreasing the time from planting to silking (Cross, 1985; Cross et al., 1987). The first procedures involves drying ears in the laboratory and measuring their daily moisture loss (Cross, 1985). The second method compares moisture contents of individual field grown ears at approximately 40 days after pollination (Cross et al., 1987). Ears which have low moisture at this stage of development are saved and those with high moisture are discarded. This method is effective, practical, inexpensive, and has produced few obvious detrimental effects on the resultant populations.

Although this selection procedure has not yet been used to produce improved hybrid varieties, Kabir (1987) studied hybrids among corn strains which had been derived using this selection method. He found that strains selected to have lower harvest moisture contents produced hybrids with lower harvest moisture, better grain quality (higher test weights), and grain yields equivalent to the original unselected strains. These studies provided direct evidence that these improved germplasm sources should be capable of producing hybrids with improved harvest moisture and test weights with no sacrifice of grain yields.

NDSB(MS)C8(LM)C3 and NDSG(MS)C8(LM)C3 are synthetic varieties with improved drying characteristics developed by the corn improvement project at NDSU from previously released synthetics. NDSAB(MS)C8 is another synthetic with improved potential for producing parental lines for making hybrids with high yield potential. These three synthetics were released by the North Dakota Agricultural Experiment Station for use in early maturity corn breeding programs.

Cross is professor, Department of Crop and Weed Sciences.

BREEDING HISTORY

NDSAB(MS)C8 was developed by five cycles of mass selection for yield and standability from NDSAB (see Cross, 1983). Equal numbers of seeds from 30 ears (half-sib families) were composited to give an improved population each cycle. Selection intensity was approximately 1 percent and was based on dried grain yield per unlodged plant. Grids were employed to reduce environmental effects on selection. NDSAB was derived from 20 full-sib families between NDSA and NDSB, synthetics released in 1979 (Cross, 1980).

NDSB(MS)C8(LM)C3 was derived from NDSB(MS)C8 by three cycles of selection for low moisture at approximate physiological maturity using the selection procedure described by Cross et al. (1987). NDSB(MS)C8 was developed by eight cycles of mass selection for yield and standability at high planting densities from NDSB (see Cross 1980, 1986, and 1989). 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.

NDSG(MS)C8(LM)C3 was derived from NDSG(MS)C8 by three cycles of selection for low moisture at approximate physiological maturity also using the selection procedure described by Cross et al. (1987). NDSG(MS)C8 was produced by eight cycles of mass selection for yield and standability from NDSG, a synthetic derived from the open pollinated variety 'Minnesota 13' (see Cross, 1984 and 1989). To produce NDSG(MS)C8(LM)C3, 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.

AGRONOMIC DESCRIPTION AND PERFORMANCE

NDSAB(MS)C8 averaged significantly higher (14.5 percent) grain yields over eight environments than the previously released version of NDSAB (Table 1). It did not differ significantly from the previous version for harvest moisture or lodging percentages.

NDSB(MS)C8(LM)C3 had similar yields and stalk lodging as its parent, NDSB(MS)C8, but it was significantly earlier as indicated by lower ear moisture at harvest (Table 1).

NDSG(MS)C8(LM)C3, like NDSB(MS)C8(LM)C3, had similar yields and lodging percentages as its parental strain, but had significantly lower ear moisture at harvest in 1988 tests (Table 1). NDSG(MS)C8(LM)C3 tends to be more susceptible to root lodging than NDSB(MS)C8(LM)C3.

CONCLUSIONS

Because both NDSAB and NDSB have proven to be productive source populations (ND247 and ND258 were selected from NDSAB, and ND260 was developed from NDSB), and NDSAB(MS)C8 and NDSB(MS)C8(LM)C3 appear to be equal to or better than the previously released versions, it appears 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.

REFERENCES

Cross, H.Z. 1980. Registration of maize germplasm (Reg. No. GP84 and GP85). Crop Sci. 20:418.

Cross, H.Z. 1983. Registration of NDSAB and NDSF maize germplasm (Reg. Nos. GP125 and GP126). Crop Sci. 23:1227.

Cross, H.Z. 1984. Registration of NDSG(MS)C5, NDSC(FS)C1, and NDSD(FS)C1 maize germplasm. Crop Sci. 24:1217.

Cross, H.Z. 1985. A technique for selecting for ear drying rates in maize. Euphytica 34:409-418.

Cross, H.Z. 1986. Registration of NDSB(MS)C6 maize germplasm. Crop Sci. 26:208.

Cross, H.Z., J.R. Chyle, Jr., and J.J. Hammond. 1987. Divergent selection for ear moisture in early maize. Crop Sci. 27:914-918.

Cross, H.Z. 1989. NDSB(MS)C8 and NDSG(MS)C8: Improved synthetic sources for early corn. North Dakota Farm Research 46(4):36-37.

Kabir, K.M. 1987. Combining abilities of early maize strains divergently selected for ear moisture. Ph.D. Thesis. North Dakota State Univ., Fargo, ND. 100 p.

Table 1. Agronomic performance of NDSAB(MS)C8, NDSB(MS)C8(LM)C3, and NDSG(MS)C8(LM)C3 and corresponding check strains grown over two years in North Dakota.

Entry	Ear moist.	Grain yield	Root lodg.	Stalk lodg.
	%	bu/A	-------- %	--------
1987 — 4 locations				
NDSG(MS)C8	42.57	118.39	7.59	5.61
NDSG(MS)C8(LM)C3	40.91	108.00	8.57	4.90
NDSB(MS)C8	40.35	110.42	7.40	4.62
NDSB(MS)C8(LM)C3	34.55	115.30	4.32	3.30
NDSAB	39.19	108.86	4.77	5.69
NDSAB(MS)C8	42.25	113.10	7.13	7.90
Pioneer Brand 3978	38.12	140.42	0.72	1.78
LSD(0.05)[1]	5.27	17.45	6.74	4.47
1988 — 4 locations				
NDSG(MS)C8	30.31	93.47	29.99	2.05
NDSG(MS)C8(LM)C3	26.28	105.58	25.17	4.98
NDSB(MS)C8	28.49	110.05	13.12	2.53
NDSB(MS)C8(LM)C3	20.82	95.16	17.35	5.44
NDSAB	28.53	78.88	16.67	3.27
NDSAB(MS)C8	28.58	101.90	22.08	2.59
Pioneer Brand 3978	25.91	134.63	21.04	3.01
LSD(0.05)[1]	2.51	16.59	9.00	4.24
1987, 1988 — 8 environments				
NDSG(MS)C8	36.44	105.93	18.79	3.83
NDSG(MS)C8(LM)C3	33.60	106.79	16.87	4.94
NDSB(MS)C8	34.42	110.24	10.26	3.58
NDSB(MS)C8(LM)C3	27.68	105.23	10.84	4.37
NDSAB	33.86	93.87	10.72	4.48
NDSAB(MS)C8	35.42	107.50	14.60	5.24
Pioneer Brand 3978	32.02	137.52	10.88	2.40
LSD(0.05)[1]	2.91	12.04	4.08	4.19

[1]Average differences among hybrids of this amount could be explained by random environmental effects only once in 20 repetitions of this experiment.