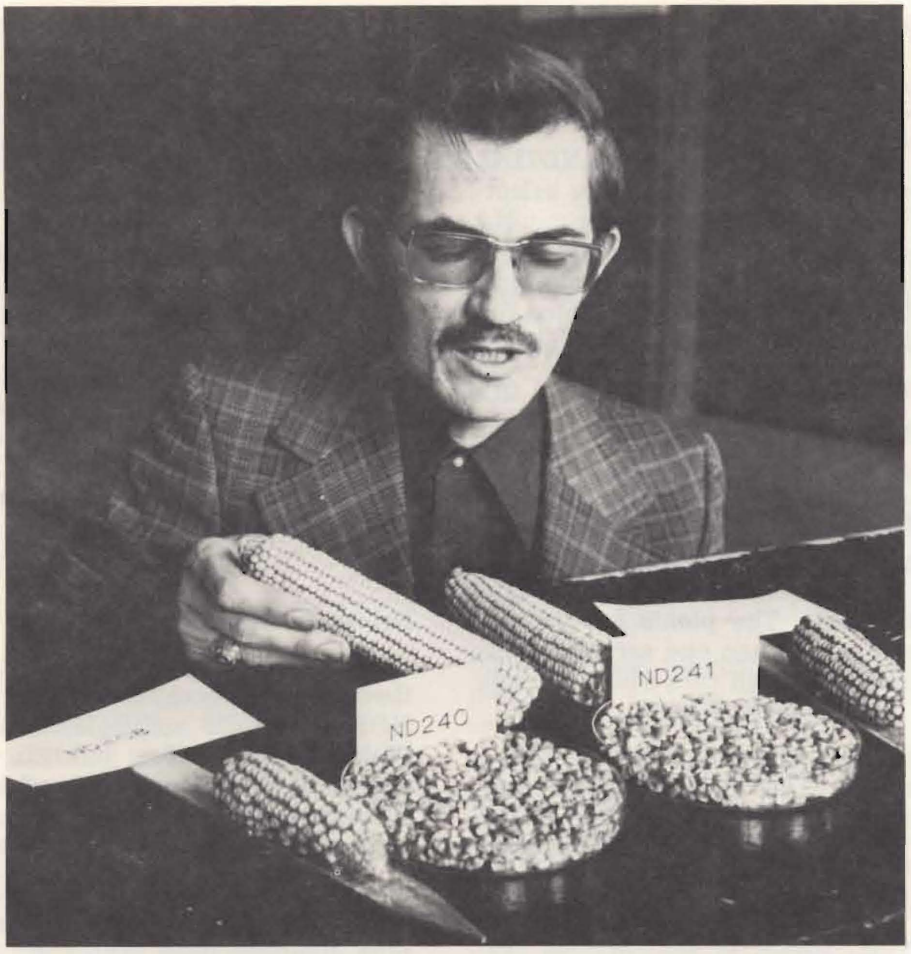

Dr. Cross shows a hybrid ear of corn that results from crossing inbred parent lines.

ND 240 and ND 241 . . . .
New Inbred Lines for Producing Early Maturing Corn Hybrids

H. Z. Cross and William Wiidakas

ND240 and ND241 are yellow dent corn (Zea mays L.) inbred lines developed in the research program at the Agricultural Experiment Station, North Dakota State University. The lines were evaluated for yield and agronomic performance and in hybrid combinations. They are released because of their potential for use by the hybrid corn seed industry in producing very early, superior hybrids for North Dakota and other northern areas, and in their breeding programs.

Introduction

In recent years, the corn acreage in North Dakota has fluctuated around 500,000 acres. Of this total, about 350,000 acres are in areas of the state with a growing season suitable to hybrids in a maturity class rating of 85 relative maturity or earlier. In other areas where later maturing hybrids can be grown, grain often is harvested at moisture contents much in excess of safe storage levels. Such wet corn must be dried using petroleum fuel to achieve safe moisture levels. The use of energy in drying may be unnecessary if early maturing hybrids are used. The major objective of the corn breeding program at the North Dakota Agricultural Experiment Station is to develop early maturing corn inbreds for production of hybrids for very short growing season areas. ND240 and ND241 are yellow dent corn (**Zea mays**

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L.) inbred lines developed in this research program.

Breeding History

ND240 and ND241, also tested as ND71-42 and ND71-49, respectively, are sister lines selected from (ND230 x ND408) x ND408 in a program designed to transfer the early maturity and vigor of ND230 into the more desirable agronomic type of ND408. Both lines have been self-pollinated for 10 generations with selection for desirable agronomic characters.

Agronomic Description

ND240 typically has a medium tall plant with the upper ear set slightly less than midway up the stalk. It produces about 15 short, medium-wide leaves. When grown at Fargo, ND240 silks at about the same date as ND363 and about eight days earlier than NDB8. The plants are usually single stalked, with more than one ear per plant. It produces medium long thick ears which average slightly over 18 rows of deep kernels.

ND241 is slightly taller than ND240 with a higher ear placement. It has about the same number of leaves, which are slightly longer and wider. ND241 usually flowers about two days later than ND240 at Fargo. It also produces multiple eared, single stalked plants. Ears are shorter and thinner with 16 to 18 rows of kernels. Kernels tend to be deeper than those of ND240.

In terms of the North Central Corn Breeding Research Committee maturity classification, these lines would be about AES200.

Inbred Performance

The lines were evaluated for yield and agronomic characters in 1972 (Table 1). Of the five check hybrids included in the trial, only ND363 had lower ear moisture at harvest than the two new lines. No check hybrid produced significantly higher yields regardless of maturity. No significant amounts of root or stalk lodging were recorded in this trial.

The two new inbreds excelled in several ear characteristics (Table 2). ND240 had a significantly higher shelling percentage and more kernel rows than the other six hybrids. The shelling percentage of ND241 was equaled only by ND240. In general, both inbreds produced short ears of large diameter with many rows of deep kernels on a medium to small cob. Both lines tended to produce more than one ear per plant. However, test weights were lower than for the standard lines.

Hybrid Performance

As part of the preliminary testing program, these inbreds were included in a yield trial with NDB564 (ND363 x ND474) as a topcross parent (Table 3). In topcross hybrids, these lines were similar to NDB564 in yield and lodging resistance. They had higher shelling percentages, lower test weights and flowered slightly earlier.

In a second topcross trial with ND474 as the topcross parent, these lines were compared with nine standard lines (Table 4). A higher shelling percentage for ND240 was the only significant difference between ND240 and ND241. Both lines had yields not significantly different from the other lines, but ear moisture at harvest was significantly lower than the average. Although both lines had rather high stalk lodging percentages, differences were not significant.

Table 1. Summary of Yield and Plant Characteristics for Five Standard and Two New Corn Inbreds Grown at Fargo in 1972.

Inbred Line	Yield Bu/Acre	Ear Moisture %	Plant Height Inches	Ear Height Inches	Stalk[1] Lodging %	Root[2] Lodging %	Ears Per Plant
ND474	49.6	32.6	49	20	3.2	0.0	1.26
NDB8	28.3	45.0	61	32	1.2	0.0	.71
ND363	38.2	24.3	50	15	0.7	0.0	1.63
ND405	55.0	41.5	61	29	1.5	1.3	1.38
ND376	42.9	48.7	57	29	1.0	1.0	.88
ND240	53.9	28.8	49	21	3.6	0.0	1.47
ND241	49.0	31.1	56	28	2.2	1.4	1.40
Mean	45.3	36.0	55	25	1.9	0.5	1.25
LSD (.05)	11.3	3.7	3	3	9.2	11.4	.76

[1] *% of plants broken below the ear at harvest.*
[2] *% of plants lodged 30 degrees or more from vertical at harvest.*

Table 2. Summary of Ear Characters for Five Standard and Two New Corn Inbreds Grown at Fargo in 1972.

Inbred Line	Shelling %	Kernel Rows	Kernels Per Row	Ear Length cm	Ear Diameter cm	Cob Diameter cm	Kernel Depth cm	Estimated Kernels Per Ear	Test Weight Lb/Bu
ND474	78.3	16.0	29.5	14.9	4.10	3.06	1.04	471	60.7
NDB8	71.5	14.0	22.1	12.7	3.93	3.04	0.89	309	58.6
ND363	73.7	16.0	25.4	14.4	4.01	3.46	0.55	406	62.0
ND405	75.6	14.6	27.4	13.8	3.85	2.95	0.90	400	59.4
ND376	74.8	17.2	21.4	14.1	4.02	3.25	0.77	369	62.0
ND240	85.5	18.4	23.5	13.6	4.23	3.08	1.15	432	56.6
ND241	81.9	17.0	23.7	12.7	4.11	2.91	1.20	403	57.3
Mean	77.3	16.2	24.7	13.7	4.04	3.11	0.93	399	59.5
LSD (.05)	3.7	1.2	3.1	1.1	.20	.16	.16	61	.8

The term "general combining ability" (GCA) is used to designate the average performance of an inbred in hybrid combination. One method to measure general combining ability utilizes a diallel crossing system. A set of inbred lines is chosen and all possible crosses among these lines is made to produce a diallel set of crosses. Data from these crosses is then used to compute GCA effects.

These inbreds were tested for general combining ability (GCA) in 1974 in a trial covering three locations. In a nine-parent diallel cross experiment, ND240 had the highest GCA effects for yield, shelling percentage and stalk lodging. It had below average GCA effects for ear moisture at harvest and root lodging percentage. GCA effects for ears per plant and test weight were above and near average, respectively.

ND241 exhibited the same general trends in the diallel set of crosses in which it was tested (Table 6). It produced above average GCA effects for yield, test weight, stalk lodging and shelling percentage, and below average GCA effects for ear moisture at harvest and ears per plant.

Since a limited number of years were represented in these tests, the performance of these inbreds in future years cannot be predicted with certainty. However, a wide range of growing conditions were represented and the results should be representative of many of the growing conditions encountered in North Dakota.

Seed Increase and Distribution

Germplasm quantities of breeder seed of these lines, produced by self-pollination in ear-to-row progenies, will be maintained by the Agricultural Experiment Station, North Dakota State University, Fargo. The lines are available in normal cytoplasm only and will be distributed in 50-kernel lots to the extent of available supplies. Seed requests should be directed to the senior author.

Table 3. Mean Inbred Line Performance in Topcrosses with NDB564 (ND363 x ND474) tested at Fargo in 1970, 1971 and 1972.

Hybrid	Yield Bu/Acre	Shelling %	Stalk Lodging %	Root Lodging %	Test[1] Weight Lb/Bu	Days[1] to Silk
ND240xNDB564	89.2	85.2	1.8	7.1	58.2	62.5
ND241xNDB564	87.0	85.0	4.0	9.3	58.2	63.0
NDB564	87.0	82.6	2.7	9.5	59.4	64.5
LSD (.05)	8.2	1.4	5.0	11.4	1.4	2.5

[1] *Data for 1971 and 1972 only.*

Table 4. Mean Values of Agronomic Traits in Topcrosses with ND474 tested at Fargo and Larimore in 1973 and Casselton in 1974.

Hybrid	Ear Moisture %	Yield Bu/Acre	Shelling %	Plant Height Inches	Ear Height Inches	Root Lodging %	Stalk Lodging %	Test Weight Lb/Bu
ND240xND474	23.9	98.2	85.4	65	31	4.9	27.2	56.4
ND241xND474	24.3	100.1	83.2	70	35	13.1	20.5	57.5
CO303xND474	24.4	115.7	84.6	64	29	16.3	10.4	54.7
ND364xND474	25.7	91.8	82.2	68	27	19.9	15.6	57.5
ND363xND474	26.6	101.2	82.5	68	31	12.0	16.5	56.5
ND302xND474	28.2	92.0	82.1	69	30	5.8	7.8	54.7
ND468xND474	29.5	87.7	81.0	66	32	12.6	6.6	56.4
CG10xND474	32.5	104.1	85.3	62	27	13.4	14.3	52.6
MS92xND474	33.7	104.8	80.4	67	29	18.6	22.6	54.6
MS93xND474	33.9	102.3	80.2	67	29	9.2	8.8	55.8
CG1xND474	34.6	95.2	81.0	66	27	3.5	5.1	54.5
Mean	28.8	99.4	82.5	67	30	11.8	14.1	55.6
LSD (.05)	4.0	17.6	1.8	8	5	14.6	18.4	3.3

Table 5. Average General Combining Ability Effects for a Nine Parent Diallel Set of Crosses Including ND240 tested at Casselton, Larimore and Mandan in 1974.

Parental Inbred Line	Yield Q/HA	Ear Moisture %	Test Weight Kg/Hl	Stalk Lodging %	Root Lodging %	Shelling %	Ears Per Plant
ND474	4.26	—3.10	—.13	—.17	—8.88	1.93	—.008
CO303	—.25	—5.20	.64	.16	13.65	1.24	—.056
ND302	—1.98	—4.03	4.69	.56	—4.78	—3.10	.106
ND363	5.49	—4.41	2.51	—1.20	—2.13	1.29	—.018
ND468	—8.91	2.98	—1.39	—1.91	—1.92	—.68	—.007
MS93	—3.14	5.06	—1.33	1.17	10.40	—2.05	—.032
CG1	—1.74	8.43	—2.45	.47	—7.74	—1.95	—.054
MS92	—.70	4.14	—3.20	—1.34	8.54	—1.04	.020
ND240	6.98	—3.88	.67	2.25	—7.14	4.38	.049
LSD (.05)	2.67	1.30	1.37	1.71	6.37	1.17	.044

Table 6. Average General Combining Ability Effects for a Nine Parent Diallel Set of Crosses Including ND241 tested at Casselton, Larimore and Mandan in 1974.

Parental Inbred Line	Yield Q/HA	Ear Moisture %	Test Weight Kg/Hl	Stalk Lodging %	Root Lodging %	Shelling %	Ears Per Plant
ND241	6.27	—1.45	1.43	2.12	—5.94	3.00	—.046
ND364	—4.38	—4.12	1.10	—.99	—.14	.42	—.039
ND302	.45	—5.08	4.54	.27	—.49	—3.09	.099
ND363	1.99	—5.03	1.72	—1.15	—6.04	.71	—.020
ND468	—10.25	2.10	—1.73	—1.54	—2.10	—.49	—.018
MS93	—2.11	4.11	—1.58	1.08	11.70	—1.30	—.031
CG1	1.29	7.13	—.98	.32	—5.38	—1.20	—.007
MS92	.56	3.03	—3.73	—1.05	5.91	—.79	.027
CG10	6.19	—.68	—.77	.93	2.49	2.75	.035
LSD (.05)	2.67	1.30	1.37	1.71	6.37	1.17	.044