

ND 246 and ND 301 . . . NEW PARENTAL INBREDS FOR EARLY CORN HYBRIDS

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ND246 and ND301 are yellow dent corn (*Zea mays* L.) inbred lines developed in the corn breeding research program at the Agricultural Experiment Station, North Dakota State University. These lines were evaluated for yield and agronomic performance and in several hybrid combinations. ND246 is an AES200 maturity inbred released for its potential use to produce early maturing hybrids with good yields, low ear moisture at harvest, and high test weights. ND246 also appears to contribute good stalk and root lodging resistance to hybrids. ND301 is an early AES300 maturity inbred which has demonstrated high yield potential in several hybrid combinations. This inbred appears to produce hybrids with acceptable lodging resistance, good test weights, and acceptable ear moisture at harvest.



Dr. Cross examines an ear of the new inbred, ND301

INTRODUCTION

One of the major objectives of the corn improvement project at North Dakota State University is to develop early maturing parental inbred lines of corn to provide improved hybrids for North Dakota's corn growers. Hybrid seed corn production requires much technical knowledge, specialized equipment, and labor for detasseling. Several years ago, much of the seed corn sold in

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North Dakota was produced by contract growers under direct supervision of the Experiment Station, using parental lines developed and maintained by the Experiment Station. This seed production system had many serious problems and eventually was abandoned in favor of the present policy of releasing inbreds for use by privately owned seed companies.

Most seed corn companies have the necessary technical expertise, equipment, and facilities to produce high quality seed. However, many seed corn companies devote little time or investment to develop parental inbreds specifically adapted to North Dakota. For larger companies, North Dakota is a relatively minor market and smaller companies cannot afford the high cost of inbred line development. Therefore, development of inbreds to produce hybrids adapted to fringe areas of the corn belt probably will remain an important responsibility and objective of Experiment Station research in the future.

The North Dakota corn improvement project has stressed very early maturity to provide germplasm adapted to areas not being considered by other private and commercial corn breeders. Also, most of the recently developed North Dakota inbreds are relatively unrelated to inbreds which are widely and perhaps excessively used as parents in commercial production. Hopefully, these North Dakota inbreds will provide more genetic diversity to help reduce the genetic vulnerability of early corn hybrids. ND246 and ND301 are yellow dent inbred lines developed in this research program.

Breeding History

ND246 (tested as ND76-1) was selected from a cross of two Wisconsin inbreds (W755 x W771). It was self-pollinated for seven generations with selection for desired plant and ear traits. ND301 (tested as ND76-8) was selected from an outcross of the Wisconsin inbred W673. It also was self-pollinated for seven generations with selection for plant and ear traits.

Agronomic Description

ND246 typically produces medium height plants with ears borne a little less than midway up the stalk.

Plants have moderately long, narrow leaves and relatively small tassels. Long, slender ears with 10 to 14 rows of rather shallow kernels are borne singly on short shanks. ND246 is resistant to wheat streak mosaic virus (WSMV) and bacterial leaf blight (caused by *Erwinia stewartii*), and has high stalk crushing strength and root pulling resistance. ND246 would be rated AES200 maturity in terms of the North Central Corn Breeding Research Committee (NCR-2) classification system.

ND301 produces medium tall plants with slightly lower ear placements than ND246. Plants have medium large tassels and wide leaves of intermediate length. Ears are borne singly on short shanks, are intermediate in length and diameter, and have 14 to 16 rows of kernels

of moderate depth. ND301 is resistant to southern leaf blight (caused by *Helminthosporium maydis*) and northern corn leaf spot (caused by *Helminthosporium carbonum*). This inbred is an early AES300 maturity.

Inbred Performance

ND246 and ND301 were evaluated for yield and agronomic characters in 1978 at Fargo (Table 1). ND246 had above average yield, below average ear moisture, and no root or stalk lodging. ND301 had below average yield, above average ear moisture, and near average root and stalk lodging. Evaluation of ear characters (Table 2) indicated ND246 had near average shelling percentage

Table 1. Summary of yield and plant characteristics for ND246 and ND301 and 10 standard inbreds grown at Fargo in 1978.

Inbred line	Yield bu/a	Ear moist. %	Plant ht. cm	Ear ht. cm	Stalk ¹ lodging %	Root ² lodging %	Leaf length cm	Leaf width cm	Ears/ plant	Shank length cm	Tassel branches No.	Leaves No.
ND474	36.6	23.5	113	47	9.2	0.0	64	7.2	0.97	10	8	12.0
NDB8	19.4	30.9	133	67	0.0	0.0	62	8.0	1.00	9	18	13.0
ND363	28.3	17.3	122	37	0.0	0.0	67	8.2	1.00	15	14	12.0
ND405	25.9	33.5	123	66	5.6	5.6	69	9.0	0.97	13	15	12.0
ND376	51.6	35.7	133	58	0.0	7.1	65	7.8	1.08	6	22	12.0
ND240	38.9	23.9	114	61	3.6	3.3	57	8.0	1.28	11	19	11.5
ND241	21.9	18.1	116	44	0.0	0.0	56	9.4	1.35	20	16	12.0
ND100	24.5	25.0	108	53	0.0	0.0	64	9.5	1.04	13	13	10.5
ND300	40.1	28.7	113	50	0.0	3.1	74	9.4	1.00	11	12	14.0
ND245	26.0	31.9	124	52	0.0	0.0	61	8.5	0.96	8	16	11.5
ND246	32.3	18.2	117	52	0.0	0.0	65	7.5	0.90	4	10	11.0
ND301	22.1	34.3	124	48	3.6	3.6	64	9.3	0.86	4	16	12.0
L.S.D. (0.05) ³	14.8	10.5	18	21	10.1	12.2	11	1.8	0.29	3	9	1.6

¹% of plants broken below the ear at harvest.

²% of plants lodged 30 degrees or more from vertical at harvest.

³Inbred differences larger than this value would be expected due to random environmental effects only one year in 20.

Table 2. Summary of ear characters for ND246 and ND301 and 10 standard corn inbreds grown at Fargo in 1978.

Inbred line	Shelling %	Kernel rows No.	Ear length cm	Ear diameter cm	Cob diameter cm	Kernel depth cm
ND474	73.7	15.4	11.2	3.6	3.3	0.62
NDB8	71.7	16.4	11.4	3.7	2.2	0.74
ND363	73.0	13.8	13.1	3.6	2.5	0.56
ND405	69.5	14.6	11.3	3.3	2.3	0.51
ND376	76.9	16.2	13.1	3.9	2.6	0.67
ND240	79.5	16.6	10.9	3.8	2.5	0.65
ND241	76.3	16.2	9.7	3.4	2.4	0.51
ND100	70.4	14.0	10.3	3.0	2.2	0.39
ND300	78.7	15.2	14.1	3.3	2.2	0.58
ND245	75.0	11.8	11.7	2.8	2.0	0.37
ND246	73.7	12.4	12.7	2.9	2.2	0.39
ND301	70.1	15.2	11.3	3.4	2.3	0.55
L.S.D. (0.05) ¹	6.3	2.0	2.0	0.3	0.4	0.19

¹See Table 1.

but below average kernel depth. ND301 had below average shelling percentage but near average kernel depth.

Hybrid Performance

ND246 and ND301 were tested in a number of single cross hybrid combinations in six North Dakota environments in 1978. These hybrids were components of diallel sets of hybrids permitting estimates of general combining ability (GCA) with nine standard inbreds chosen for high GCA effects in previous experiments (Cross, 1978). Yields and agronomic performance of hybrids including ND246 or ND301 as parents are included in Table 3. ND246 combined well with several inbreds including

B14 related lines. ND301 also appears to have good combining ability with B14 related lines.

The GCA effects for ND246 (Table 4) indicate this inbred contributed low ear moisture, high test weights, and below average stalk and root lodging percentages to its hybrids. Only CG10 had significantly higher GCA effects for yield. CG10 also had the highest GCA effects for ear moisture content, which indicates its hybrids were not of comparable maturity to those of ND246. ND301 had above average GCA effects for yield, test weight, stalk lodging, and root lodging (Table 5). It had below average GCA effects for ear moisture at harvest and shelling percentage.

Table 3. Average performance of selected single cross hybrids with ND246 and ND301 tested at six North Dakota environments in 1978.

Hybrid	Pedigree	Yield bu/a	Ear moisture %	Stalk lodging %	Root lodging %	Test weight lb/bu	Shelling %	P.I. ¹
NDC686	ND246 x ND240	97.0	28.9	5.3	0.4	61.0	85.6	127.1
NDC687	ND246 x ND241	81.9	29.8	7.4	0.4	61.1	84.3	104.1
NDC688	ND246 x A509	81.1	25.0	2.1	1.2	60.5	79.4	122.9
NDC689	ND246 x W59E	72.5	30.1	3.4	0.0	63.1	81.1	91.2
NDC690	ND246 x W182B	73.9	33.0	2.3	1.2	61.9	79.7	84.9
NDC691	ND246 x ND474	85.4	29.3	6.2	0.4	62.7	82.2	110.4
NDC692	ND246 x CM182	85.1	24.3	6.0	0.0	62.0	82.8	132.6
NDC693	ND246 x CG10	88.3	31.9	1.1	3.0	61.1	85.5	104.8
NDC694	ND246 x ND8Rf	88.1	35.0	4.4	1.7	61.3	79.8	95.3
NDC695	ND246 x ND302	86.2	29.2	3.0	0.4	62.6	79.5	111.8
MEAN (ND246 hybrids)		84.0	29.6	4.1	0.9	61.8	82.0	108.5
NDC735	ND301 x ND240	98.9	31.6	11.4	0.8	58.0	85.6	118.5
NDC736	ND301 x ND241	92.5	32.6	6.7	1.4	58.0	86.4	107.5
NDC737	ND301 x A509	93.8	30.9	2.2	2.7	58.2	80.3	115.0
NDC738	ND301 x W59E	89.6	33.3	4.4	1.1	60.6	84.0	102.0
NDC739	ND301 x W182B	84.6	32.6	3.6	10.0	59.9	82.1	98.3
NDC740	ND301 x ND474	69.3	31.4	6.4	4.9	59.4	83.0	83.6
NDC741	ND301 x CM182	88.4	29.3	11.4	4.6	60.4	83.6	114.3
NDC742	ND301 x CG10	79.8	34.2	6.7	3.6	58.2	82.1	88.4
NDC743	ND301 x ND8Rf	89.5	37.4	2.5	5.9	57.8	80.7	90.7
NDC744	ND301 x ND302	87.3	31.8	4.8	11.3	59.6	82.3	104.0
MEAN (ND301 hybrids)		87.4	32.5	6.0	4.6	59.0	83.0	102.2
NDC267	ND240 x ND474	98.6	28.9	12.1	5.6	58.2	85.3	129.2
NDC678	W182B x ND474	86.8	30.2	7.5	5.5	60.6	82.3	108.9
MEAN (100 hybrids)		84.7	32.1	4.8	2.6	59.5	82.7	100.0
L.S.D. (0.05) ²		16.0	3.6	6.9	5.4	1.3	2.3	—

¹P.I. = Performance index = (Yield/test mean) / (ear moisture/test mean) x 100. The P.I. is a measure of a hybrid's yield compared to other hybrids of similar maturity as indicated by ear moisture at harvest.

²Average differences among hybrids of this amount could be explained by random environmental effects only once in 20 repetitions of this experiment.

Table 4. Average general combining ability effects for a nine parent diallel set of crosses including ND246 tested at six North Dakota environments in 1978¹.

Parental inbred line	Grain yield bu/a	Ear moisture %	Test weight lb/bu	Stalk lodging %	Root lodging %	Shelling %
ND474	-2.1	-0.91	1.1	0.31	2.08	0.22
CG10	6.4	3.15	2.3	-1.15	0.03	2.23
W182B	2.5	-0.01	0.5	0.36	0.59	-2.57
ND240	3.9	-1.11	-2.0	2.61	-0.84	1.83
ND8Rf	1.2	2.87	0.2	-1.46	-0.31	-0.43
CM182	1.7	-1.63	-0.4	1.07	2.22	-0.38
ND241	-17.0	1.19	-1.2	0.15	0.18	0.41
W59E	4.6	-1.00	1.1	-0.66	-1.81	-0.40
ND246	-1.2	-2.55	3.0	-1.23	-2.15	-0.91
L.S.D. (0.05) ²	6.0	1.35	0.5	2.60	2.03	0.89

¹General combining ability effects are differences between the mean of all hybrids in the test and all hybrids produced from a particular inbred. Negative values indicate that inbred's hybrids were below average while positive values indicate above average performance.

²See Table 3.

Table 5. Average general combining ability effects for a nine parent diallel set of crosses including ND301 tested at six North Dakota environments in 1978¹.

Parental inbred line	Grain yield bu/a	Ear moisture %	Test weight lb/bu	Stalk lodging %	Root lodging %	Shelling %
ND474	-5.1	-1.25	1.3	-0.20	1.92	0.13
CG10	4.6	2.83	-2.0	-0.90	-0.67	1.55
W182B	3.3	-0.70	0.9	0.00	1.05	-2.44
ND240	3.5	-1.37	-1.7	2.94	-1.58	1.63
ND8Rf	0.8	2.58	0.4	-2.28	-0.50	-0.51
CM182	1.5	-1.57	0.1	1.31	2.08	-0.48
ND241	-16.1	0.95	0.9	0.48	-0.48	0.51
W59E	6.4	-1.19	1.4	-1.06	-2.45	-0.20
ND301	1.1	-0.29	0.5	0.68	0.63	-0.19
L.S.D. (0.05) ²	6.0	1.35	0.5	2.60	2.03	0.89

¹See Table 4.

²See Table 3.

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. These 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 author.

REFERENCES

1. Cross, H. Z. 1978. Evaluation of Inbred Parents of Corn Hybrids for North Dakota. North Dakota Farm Research 35 (5):12-15.