

Cultivar and Germplasm Release

RELEASE OF MAIZE [*ZEA MAYS L. (WALP.)*] OPEN-POLLINATED CULTIVAR MAYORBELA 05¹

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J. Agric. Univ. P.R. 90(3-4):253-257 (2006)

Maize (*Zea mays* L.) is a traditional crop in Puerto Rico and local demand for the grain remains strong. In 1999, Puerto Rico imported 270,691 t of yellow dent maize (U.S. no. 2) as a feed grain for livestock, worth more than \$26 million (U.S. Census Bureau, 2000). Small-scale farmers in Puerto Rico often harvest maize near physiological maturity for local vegetable markets to be used to prepare traditional dishes. Maize harvested near physiological maturity can be profitable. Farmers often obtain prices of \$0.20 to 0.25 per ear. The unavailability of seed of adapted cultivars is often a constraint to increased maize production in Puerto Rico.

'Mayorbela' (PI 209135), a yellow flint open-pollinated maize cultivar, was developed in the 1930s from cultivars of the Coastal Tropical Flint Race outcrossed to a U.S. inbred line, followed by selection (Goodman and Brown, 1988). Although the cultivar was never formally released by the Puerto Rico Agricultural Experiment Station, several investigators have used Mayorbela in their research. Crosses among 'Diente de Caballo', Mayorbela and southeastern and midwestern U.S. cultivars were evaluated by Moll et al. (1962). Crosses between the Puerto Rican maize cultivars and a southeastern dent 'Indian Chief' produced the highest seed yields at two locations in North Carolina. Pollak et al. (1991) found that the Diente de Caballo × Mayorbela cross had the best heterotic combination among four populations evaluated at Isabela, Puerto Rico. Fuentes et al. (1998) evaluated selection progress for seed yield and agronomic traits of Mayorbela and Diente de Caballo after four cycles of reciprocal recurrent selection. Mayorbela had the lowest seed yield reduction (16%) caused by *Helicoverpa zea*. Robbins and Warren (1993) reported that Mayorbela had resistance to races 0 and 1 of northern corn leaf blight caused by *Exserohilum turcicum*.

Seed of Mayorbela was obtained from the USDA-ARS Tropical Agriculture Research Station. Two thousand seeds of Mayorbela were planted at the Isabela Substation in January 2002. One hundred ears were harvested from the nursery based on the agronomic characteristics of the female parent. Seventy-eight of these ears were selected based on seed type. The half-sib lines for the first cycle of mass selection were evaluated in a nursery planted at the Isabela Substation in November 2002. A randomized complete block design with 78 entries and two replications was used. The experimental units consisted of single 5-m row lengths spaced 76 cm apart. Twenty-five seeds were planted in each row. Approximately 500 kg/ha of 10-10-10 granular fertilizer was applied at planting. Weeds were controlled manually and insects were controlled with methomyl (Nudrin) at

¹Manuscript submitted to the Editorial Board 6 December 2005.

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a rate of 1.2 L/ha. At harvest maturity, plant and ear heights of five plants in each row were recorded. The number of lodged plants in each row was also recorded. The number of plants and the number of ears per row were determined and the number of ears per plant was calculated. Mean ear length, seed quality and the degree of insect damage on the ears were determined based on a random sample of five ears from each row. Seed quality scores were rated on a 1 to 9 scale where 1 = high commercial value, and 9 = no commercial value. Ears with the highest seed quality scores had an intense yellow color. Insect damage scores were based on a 1 to 10 scale where 1 to 3 = very resistant, 4 to 6 = moderate resistance and >6 = susceptible (Widstrom, 1967). Twenty half-sib lines were selected based on mean seed yield and seed quality scores (Table 1). Samples of 100 seeds of each line were bulked and planted in an intercrossing nursery at the Isabela Substation in January 2004. The nursery consisted of twenty 5-m rows spaced 0.76 m apart. Twenty-five seeds were planted in each row. The previously described agronomic practices were used to manage this nursery. One hundred ears were selected from this nursery based on the agronomic traits of the female parent and seed quality. The 100 half-sib families were evaluated in a replicated trial planted at the Isabela Substation in October 2004 (Table 2). The experimental design and most agronomic practices were the same as for the trial planted in November 2002. In this trial, however, an additional 500 kg/ha of 10-10-10 granular fertilizer was applied shortly before flowering. Ear width was estimated based on a random sample of five ears from each row.

Botanical Description

Mayorbela 05 has a yellow flint seed type with a mean 100 seed weight of 30 g. Plants flowered (silked) at approximately 55 days after planting (DAP) and reached harvest maturity at approximately 95 DAP. Mean plant height was 2.40 m in 2002 and 2.63 m in 2004 (Tables 1 and 2). Mean ear height was 1.29 m in 2002 and 1.27 m in 2004. Most plants produced one ear per plant. Ear length averaged 18.7 cm in 2002 and 14.6 cm in 2004 whereas mean ear width was 3.9 cm in 2004.

Tolerance to Pests and Diseases

Some leaf damage caused by *Spodoptera frugiperda* (Smith) was observed during vegetative development, but this damage was controlled by a single application of insecticide. The 20 half-sib families selected after the second cycle of mass selection had mean ear damage scores ≤ 3 , which is considered to be highly resistant (Table 2). No significant damage caused by disease was observed in the 2002 and 2004 plantings.

Production

Mean seed yield of the 20 half-sib families selected after the first cycle of mass selection was 5,457 kg/ha, and 6,494 kg/ha after the second cycle of mass selection (Tables 1 and 2). Some of the differences in mean seed yield may be attributed to higher rates of fertilization used for the 2004 planting. In the 1990s, the national average seed yield of maize in the U.S. was 7,839 kg/ha (Tiefenthaler et al., 2003), and 2,550 kg/ha in Brazil (Morris and López-Pereira, 1999).

Uses

Mayorbela 05 can be harvested near physiological maturity for the fresh market. The cultivar has an intense yellow seed color which is a preferred trait in local markets. Because Mayorbela 05 produces tall plants (>2.5 m) that have a low incidence of lodging,

TABLE 1. Performance of half-sib families of 'Mayorbela 05' maize after the first cycle of mass selection planted at the Isabela Substation in November 2002.

Half-sib families	Seed yield (kg/ha)	Mean plant population ('000 plants/ha)	Lodging (no. plants)	Mean plant height (m)	Mean ear height (m)	Mean ear length (cm)	Mean no. ears per plant	Mean seed quality score ¹ (1 to 9)	Mean ear damage score ² (1 to 10)
12	6317	47.0	0.0	2.50	1.27	19.6	1.07	1.0	3.2
16	6211	48.1	1.5	2.34	1.29	18.9	1.16	1.0	2.6
23	5924	44.8	0.0	2.40	1.23	19.1	1.34	1.0	3.2
60	5842	44.8	0.0	2.55	1.48	19.4	1.17	1.0	3.0
44	5668	44.8	0.0	2.31	1.20	20.3	1.15	1.0	2.2
31	5649	49.2	0.0	2.41	1.27	19.7	1.16	1.0	1.8
75	5562	45.9	1.5	2.51	1.42	20.9	0.95	1.0	3.6
13	5544	44.8	0.5	2.31	1.28	19.8	1.15	1.0	3.0
40	5499	44.8	0.0	2.45	1.27	19.4	1.05	1.0	2.0
9	5489	42.7	0.0	2.63	1.31	21.5	0.93	1.0	2.8
66	5447	49.2	0.0	2.52	1.31	18.2	1.22	1.0	3.0
69	5401	48.1	0.5	2.35	1.22	18.3	0.95	1.0	2.6
35	5234	36.1	0.0	2.46	1.40	18.0	1.33	1.0	3.8
67	5233	42.7	0.0	2.45	1.38	16.8	1.26	1.0	2.4
19	5131	44.8	0.0	2.52	1.22	19.1	1.00	1.0	4.4
76	5040	43.7	0.0	2.40	1.36	17.8	1.10	1.0	2.8
53	5022	44.8	1.5	2.44	1.35	20.4	0.95	1.0	1.8
78	5013	42.7	0.0	2.46	1.32	18.4	1.13	1.0	2.2
6	4990	39.4	0.5	2.20	1.17	19.5	1.28	1.0	2.6
49	4930	47.1	1.0	2.45	1.35	18.7	0.84	1.0	2.0
Cultivar mean	4430	42.4	0.4	2.40	1.29	18.7	1.02	1.6	2.8
LSD (0.05)	NS	NS	NS	7.0	6.0	1.8	0.05	NS	NS

¹ Seed quality scores rated on a 1 to 9 scale where 1 = high commercial value and 9 = no commercial value.

² Insect damage scores—ears evaluated using a 1 to 10 scale where 1 to 3 = very resistant, 4 to 6 = moderate resistance and >6 = susceptible.

TABLE 2. Performance of half-sib families of 'Mayorbela 05' maize after the second cycle of mass selection planted at the Isabela Substation in October 2004.

Half-sib family	Seed yield (kg/ha)	Mean plant population (⁰⁰⁰ plants/ha)	Lodging (no. plants)	Mean plant height (m)	Mean ear height (m)	Mean ear length (cm)	Mean ear width (cm)	Mean no. ears per plant	Mean seed quality score ¹ (1 to 9)	Mean ear damage score ² (1 to 10)
0433-19	7302	45.9	0.0	2.64	1.19	18.9	3.9	1.31	1.7	2.2
0433-1	7252	48.1	0.0	2.44	1.14	19.1	4.2	1.00	1.9	1.8
0433-42	7011	54.7	0.0	2.73	1.30	18.4	3.7	0.94	1.4	2.0
0433-5	6963	47.0	0.0	2.74	1.39	19.8	4.2	1.10	1.3	2.4
0433-8	6958	56.9	0.0	2.67	1.25	16.4	3.7	0.96	1.8	2.0
0433-81	6820	53.6	0.0	2.51	1.17	17.4	4.2	1.02	1.9	1.8
0433-26	6650	43.7	0.5	2.55	1.25	19.2	3.4	1.13	1.1	1.0
0433-3	6580	43.7	0.0	2.62	1.13	19.5	3.9	1.13	1.4	2.1
0433-50	6424	52.5	0.5	2.52	1.17	18.0	4.0	1.25	1.6	2.2
0433-97	6368	48.1	0.5	2.58	1.25	17.9	3.9	1.12	1.8	1.4
0433-23	6289	42.6	0.5	2.51	1.28	18.5	3.3	1.10	2.2	2.0
0433-93	6247	50.3	0.0	2.59	1.35	19.3	3.8	0.98	1.8	2.2
0433-67	6239	42.6	0.0	2.58	1.18	20.0	4.2	1.13	1.8	1.9
0433-56	6200	48.1	0.0	2.50	0.98	19.6	3.7	1.08	1.5	2.0
0433-32	6197	44.8	0.5	2.87	1.50	17.3	3.8	1.11	1.6	1.5
0433-92	6189	52.5	0.0	2.54	1.18	18.4	3.9	0.98	1.8	2.3
0433-89	6188	53.6	0.0	2.90	1.48	18.5	3.6	1.00	1.8	1.7
0433-40	6072	49.2	0.5	2.77	1.37	17.9	4.0	0.96	2.1	0.9
0433-87	5983	50.3	0.0	2.68	1.28	16.9	3.7	1.01	1.0	2.5
0433-78	5949	49.2	0.0	2.77	1.26	17.8	4.0	1.00	1.5	2.5
Cultivar mean	5360	46.6	0.3	2.63	1.27	14.6	3.9	1.05	1.9	2.2
LSD (0.05)	1374	NS	NS	NS	0.32	NS	NS	NS	1.8	NS

¹ Seed quality scores rated on a 1 to 9 scale where 1 = high commercial value and 9 = no commercial value.² Insect damage scores—ears evaluated using a 1 to 10 scale where 1 to 3 = very resistant, 4 to 6 = moderate resistance and >6 = susceptible.

the cultivar may be used to produce silage. The seed of Mayorbela 05 can also be harvested dry and used as a feed grain for livestock.

Availability of Seed

The Agricultural Experiment Station seed program at the Isabela Substation will maintain foundation seed stocks of Mayorbela 05. Recurrent selection based on the performance of half-sib families will be used to continue to select Mayorbela 05 for increased seed yield and reduced insect damage on ears.

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