

**NEW from
MSU**

Zorro

A NEW BLACK BEAN

for Michigan



- High-yielding, upright black bean variety with resistance to lodging.
- Erect, short-vine growth habit suitable for direct harvest.
- Matures in 95 days, four days earlier than Shania and Black Velvet.
- Uniform maturity and excellent dry-down.
- Only black bean variety with moderate resistance to common bacterial blight.
- Resistant to strains of anthracnose, rust and mosaic virus.
- Similar in seed size and shape to T-39.
- Good canning quality and color retention after cooking.

Zorro is a new upright black dry bean variety from Michigan State University. Zorro is a high-yielding, midseason-maturing variety with an upright, short-vine growth habit and excellent canning quality. Zorro is resistant to strains of bean anthracnose, rust and bean common mosaic virus in Michigan and is partially resistant to common bacterial blight. Zorro most closely resembles Jaguar in plant appearance but is more vigorous and higher yielding and has good canning quality and enhanced disease resistance to common bacterial blight.

Origin and Breeding History

Zorro, tested as breeding line B04554, was developed as an upright, short-vine, midseason-maturity black bean variety with disease resistance and good

canning quality. The B04554 black bean breeding line was developed from the cross B00103*2/X00822 and one backcross made to MSU black bean breeding line B00103. B00103 is a sister of the black bean variety Condor and possesses many of same yield, disease resistance and canning quality traits as Condor. The MSU black bean breeding line X00822 (B98311/VAX5) was selected to possess the drought tolerance of B98311 and the common bacterial blight (CBB) resistance of VAX 5. The purpose of the cross was to introduce common blight resistance into high-yielding, erect black beans and combine it with resistance to anthracnose, virus and white mold while retaining good canning quality in future erect black bean varieties. The cross made in 2001 was advanced to the F₇ generation and was entered into yield trials in 2004 under the code number B04554.

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Agronomic and Disease Information

Zorro exhibits an erect, short-vine growth habit combined with better resistance to lodging (<2) than T-39 (3.6; Table 1). Plants average 21 inches in height, are more upright than those of Condor and exhibit an overall upright appearance similar to that of Jaguar. Plants of Zorro are broader than those of Jaguar and have shown greater stress tolerance tracing back to the drought-tolerant grandparent, B98311. Zorro is a mid- to full-season bean maturing 95 days after planting. The range in maturity is from 88 to 99 days, depending on season and location. It matures with Condor and is one day later than T-39 and Jaguar, three days earlier than Domino, and four days earlier than Shania and Black Velvet. Zorro has demonstrated the same uniform maturity and dry-down as Jaguar. Zorro has a high agronomic acceptance rating because of its

upright habit, resistance to lodging, and excellent pod load and favorable high pod placement in the plant canopy. Growers should follow current recommended practices for fertility and weed control in growing Zorro beans.

Zorro has been tested for five years (2004-08) over 35 locations by MSU in cooperation with colleagues in Michigan, New York and Ontario. Over all 35 locations, Zorro yielded 27.8 hundredweight (cwt)/acre and significantly exceeded the yield of all other entries at the locations tested (Table 2). Yield ranged from a high of 44.4 cwt/acre in Brussels, Ontario, in 2008 to a low of 17.3 cwt/acre in Tuscola County in 2006. Over the locations tested, Zorro significantly outyielded all the commercial check varieties: Jaguar (92 percent), Condor (91 percent), T-39 (87 percent), Eclipse (89 percent) and Domino (92 percent). With narrow row width (20 inches) and direct harvest in

Saginaw, Zorro yielded from 39 to 41 cwt/acre in 2005 and 2006 and appears well-suited to this increasingly popular management system. In similar direct-harvest, narrow-row trials at Brussels and Kippen, Ontario, in 2008, Zorro yielded the highest. In comparative trials over 14 locations in 2008, Zorro yielded 28.3 cwt/acre compared with 27.8 cwt/acre for the full-season black bean Shania. Zorro is also competitive with current navy bean varieties. Over three years of testing at 11 locations in Michigan, Zorro yielded 24.5 cwt/acre compared with 23.9 cwt/acre for Vista and 24.4 cwt/acre for Medalist.

Zorro possesses the single dominant *I* gene, which conditions resistance to seed-borne bean common mosaic virus (BCMV). Zorro possesses rust resistance equivalent to that of other black bean varieties and was rated as resistant in field trials conducted at Beltsville, Md., in 2008. However, Zorro is susceptible to

Table 1. Comparison of agronomic, disease and canning characteristics of Zorro with other black bean varieties over 4 years of testing (2005-08) in Michigan.

VARIETIES	ZORRO	JAGUAR	CONDOR	T-39	ECLIPSE	DOMINO
AGRONOMIC TRAITS						
DAYS TO FLOWER	48	48	47	48	45	49
DAYS TO MATURE	95	94	95	94	91	98
HEIGHT (inches)	21	20	21	18	20	20
LODGING SCORE	1.8	1.1	2.4	3.6	1.2	3.3
SELECTION INDEX	5.2	4.9	4.4	3.3	4.3	3.2
100 SEED WEIGHT (grams)	20.7	18.3	20.2	19.7	19.9	20.0
YIELD (percent)	100	92	91	87	89	92
DISEASE RESISTANCE TRAITS						
BCMV	R	R	R	R	R	R
ANTHRACNOSE: RACE 73	S	R	R	S	S	S
ANTHRACNOSE: RACE 7	R	R	R	S	S	S
RUST RACE 53	S	S	S	R	HR	HR
COMMON BACTERIAL BLIGHT (CBB)	MR	S	S	S	S	S
WHITE MOLD (percent)	46	48	62	—	—	—
CANNING QUALITY TRAITS (3 years)						
COLOR L-SCALE	15	16	14	16	—	14
TEXTURE (kg/100 g)	55	49	51	49	—	69
VISUAL RATING	3.8	3.8	4.7	3.4	3.5	3.2
LODGING: 1 = ERECT, 5 = PROSTRATE. SELECTION INDEX: 1 = WORST, 5 = AVERAGE, 9 = EXCELLENT. DISEASES: BCMV = BEAN COMMON MOSAIC VIRUS, R = RESISTANT, S = SUSCEPTIBLE, MR = MODERATELY RESISTANT, HR = HIGHLY RESISTANT. VISUAL RATING: 1 = VERY UNDESIRABLE, 4 = NEITHER DESIRABLE NOR UNDESIRABLE, 7 = VERY DESIRABLE.						

Table 2. Comparison of Yield of Zorro with other black bean varieties over 5 years testing (2004-08) in Michigan, New York and Ontario.

No. LOCATIONS	ZORRO	JAGUAR	CONDOR	T-39	ECLIPSE	DOMINO
MEAN YIELD (CWT/ACRE)						
35	27.8					
31	26.4	24.2				
32	27.0		24.7			
23	25.9			22.5		
19	27.6				24.5	
15	25.7					23.7
YIELD PERCENTAGE	100	92	91	87	89	92

race 53 and to the new rust race 22:2 that was isolated in Michigan in 2007. Zorro exhibits improved levels of tolerance to white mold (46 percent) compared with Condor (62 percent) and has expressed levels of avoidance similar to Jaguar (48 percent) because of its upright architecture. Zorro has shown moderate levels of resistance to CBB in Michigan, Nebraska and Puerto Rico. In field trials at Othello, Wash., in 2007, Zorro displayed resistance to root rot pathogens. Plant stands were nearly perfect compared with other varieties being tested in the same nursery. Zorro is resistant to anthracnose race 7 but susceptible to race 73.

Quality Characteristics

Zorro has a typical small, opaque black bean seed averaging 21 g per 100 seeds. Size ranges from 19 to 24 g per 100 seeds. The seed is equivalent to T-39 in size, shape and color. In canning trials, Zorro was subjectively rated by a team of pan-

elists as being average in cooking quality. Zorro rated 3.8 on a scale of 1 to 7, where 7 is best and 4 is midscale (neither acceptable nor unacceptable). This evaluation is based on whole bean integrity (no splitting or clumping), uniformity of size (uniform water uptake), black color (limited leaching) and clear brine (no starch extrusion into canning liquid). Data on cooked color exhibited no differences between Zorro and other commercial black bean varieties. The texture of 55 kilos per 100 g was equivalent to that of other commercial black bean cultivars except Domino, which had a firmer texture (69 kg). Values are within the acceptable range of 45 to 75 kg per 100 g for processed black beans. Zorro exhibited acceptable color retention compared with most commercial black bean varieties. Within the commercial black bean class, Zorro was equivalent to Jaguar in visual appearance, though Condor demonstrated the best overall canning quality.

Release and Research Fee

Zorro was released by Michigan State University with the option that Zorro be sold for seed by variety name only as a class of certified seed under the three-class system used in Michigan (breeder, foundation, certified). A royalty will be assessed on each hundredweight unit of foundation seed sold. The variety is licensed to the Michigan Crop Improvement Association, which will collect the royalty. Plant variety protection is pending.

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