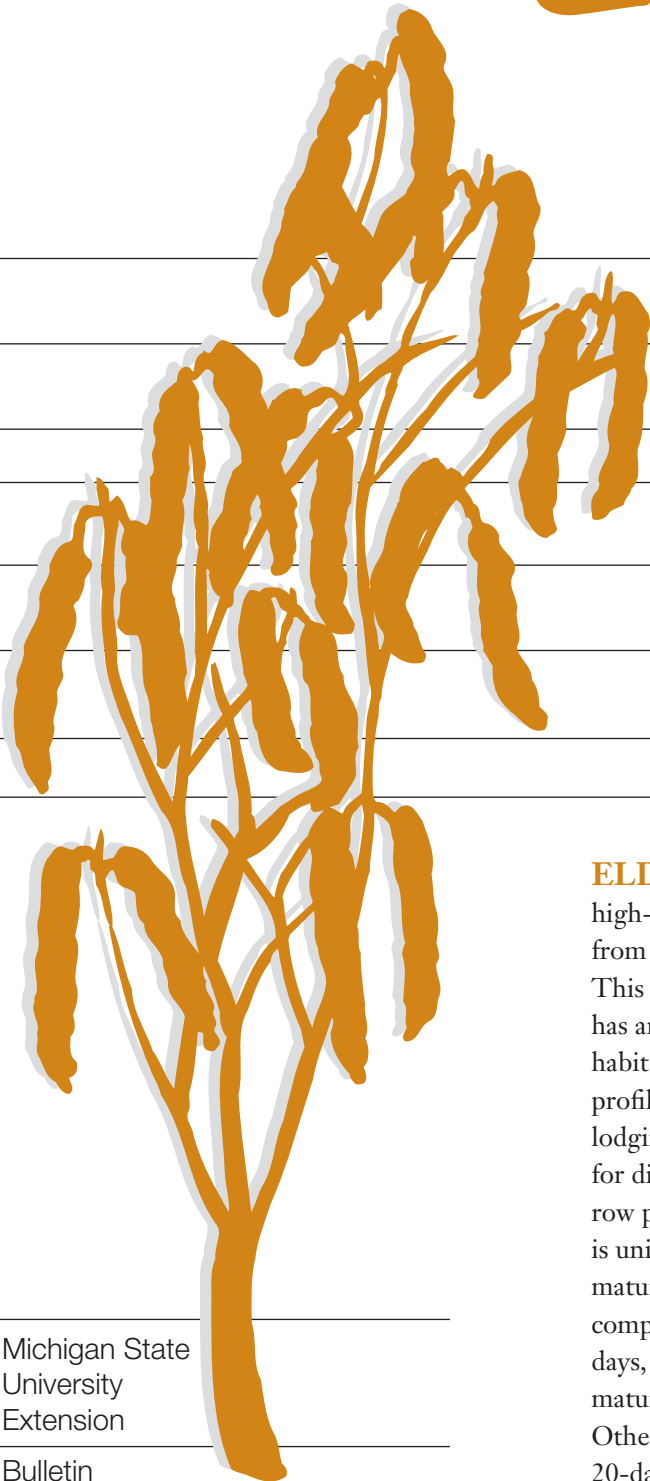


**NEW from
MSU**

Eldorado

A NEW PINTO BEAN
for Michigan



- New high-yielding, upright pinto bean variety suited for direct harvest.
- Highest yielding bean in Michigan over past three seasons (2009-11).
- Matures in 98 days, three days later than La Paz pinto.
- Retains leaves and remains green through 90 days; matures in one week.
- Excellent white mold avoidance and yields under white mold pressure.
- Resistant to common strains of rust and mosaic virus in Michigan.
- Large pinto bean seed with acceptable canning quality.

ELDORADO is a new erect, high-yielding pinto bean variety from Michigan State University. This full-season-maturing variety has an upright, short vine growth habit. The upright, narrow plant profile, combined with resistance to lodging, makes Eldorado suitable for direct harvest under narrow-row production systems. Eldorado is unique in its progression to maturity. It remains green with complete leaf retention until 90 days, when it drops its leaves and matures uniformly in one week. Other pinto beans go into a 15- to 20-day maturity phase when leaves turn yellow and eventually drop. Eldorado is highly tolerant of white

mold and is resistant to strains of bean rust and bean common mosaic virus present in Michigan. Seed is larger than the seed of La Paz, and it possesses acceptable canning quality.

Origin and breeding history

Eldorado, tested as breeding line P07863, was developed from the cross of two pinto bean breeding lines: AN-37 and P02630. AN-37 was released by the USDA-ARS program in Washington as pinto bean breeding line USPT-WM-1 with tolerance to white mold. It was derived from the cross of Aztec pinto variety with NDSU navy bean breeding line ND88-106-04,

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which derived tolerance to white mold from the Bunsu navy bean variety. MSU breeding line P02630 was a midseason, upright pinto line with good canning quality, but it lacked adequate levels of resistance to white mold. The purpose of the cross was to combine desirable agronomic traits from P02630 with the white mold tolerance of AN-37 for future erect, high-yielding pinto bean varieties suitable for direct harvest. The cross, made in 2004, was advanced to the F6 generation and entered into yield trials in 2007 under the code number P07863.

Agronomic and disease information

Eldorado exhibits the Type-IIb upright, indeterminate short vine growth habit combined with moderate resistance to lodging (Table 2). Plants average 21 inches in height, equivalent in height to La Paz, Lariat and Stampede (Table 2). These varieties are significantly taller than Santa Fe, Othello and Buster. Among the Type-IIb varieties, the lodging resistance of Eldorado is equivalent to that of La Paz and Stampede and is slightly better than that of Lariat and Santa Fe. Eldorado has a much superior architecture to that of the decumbent Type-III pinto varieties. Eldorado is a full-season bean maturing 98 days after planting. The range in maturity is from 85 days under drought to 106 days, depending on season and location. It matures two days later than Lariat, three days later than La Paz, four days later than Stampede and 13 days later than Othello. Eldorado remains green with complete leaf retention until 90 days, when it drops its leaves and matures uniformly in one week. Other pinto beans go into a 15- to 20-day maturity phase when leaves turn yellow and eventually drop. Eldorado has a high agronomic acceptance rating equivalent to that

of other type-II pinto bean varieties because of its upright habit, resistance to lodging, and excellent pod load and favorable high pod placement in the plant canopy.

Eldorado was tested for five years (2007-11) over 45 locations by MSU in cooperation with colleagues in Michigan, Colorado, Nebraska and North Dakota. Over all 45 locations, P07863 yielded 30 cwt/acre and significantly exceeded the yield of all other entries except La Paz at the locations tested. Yield ranged from a high of 53.7 cwt/acre at Montcalm in 2008 to a low of 12.3 cwt/acre at Fort Collins, Colo., in 2010. Over the locations tested, Eldorado outyielded all the commercial check varieties by the margins shown in parentheses: Santa Fe (20 percent), La Paz (5 percent), Lariat (10 percent), Stampede (20 percent), ND 307 (8 percent), Othello (19 percent) and Buster (15 percent). Under the high-input conditions of irrigation and fertility used at Montcalm to promote the spread of white mold, Eldorado yielded 39.2 cwt/acre compared with test mean yields of 31 cwt/acre in eight experiments over five years. In the same five-year period, Santa Fe yielded 32.6 cwt/acre, and the susceptible check variety Beryl yielded 23.7 cwt/acre. Eldorado topped yield tests in Montcalm from 2007 to 2009, was second in 2010-11, and was the top-yielding entry in statewide trials in 2010 (38.2 cwt/acre) and 2011 (38.6 cwt/acre). In 18 trials conducted on MSU research farms, Eldorado was among the top five entries 13 times and the top entry in eight out of 18 trials. Eldorado appears to be well-adapted to the increasingly popular management system of narrow row widths (15 to 20 inches) combined with direct harvest. Growers should follow current recommended practices for fertility

and weed control in growing Eldorado beans, found at: <http://agbioresearch.msu.edu/saginawvalley/index.html>; www.msuweeds.com.

Eldorado possesses the single dominant hypersensitive *I* gene, which confers resistance to seed-borne bean common mosaic virus (BCMV). All the pinto varieties listed in Table 2 possess the same resistance gene except Othello, which carries the *bc-2²* gene. Eldorado exhibits its tolerance to white mold compared with other pinto bean varieties (Table 2). Percent white mold was 30 percent compared with Santa Fe (42 percent), La Paz (59 percent), Lariat (72 percent) and Stampede (46 percent) in irrigated trials over three years. It exhibits field avoidance based on a combination of upright architecture and the stay-green trait that persists to harvest. None of the type-III pinto varieties were evaluated in white mold trials because they would behave similarly to the susceptible check, Beryl GN (90 percent). Eldorado exhibits a range of reactions to other pathogens similar to those of commercial pinto bean varieties. It is susceptible to race 73 of anthracnose and to common bacterial blight; it possesses resistance to some races of rust but is susceptible to rust race 22:2, now prevalent in Michigan.

Quality characteristics

Eldorado has a large pinto bean seed, averaging 43 g/100 seeds; size ranges from 38 to 47 g/100 seeds. The seed is equivalent in size to that of Lariat, slightly larger than seeds of Santa Fe and Stampede, and larger than those of other type-III pinto varieties: Buster (39g), Othello (38g) and ND307 (39g). In canning trials, Eldorado has been subjectively rated by a team of panelists as being acceptable in cooking quality. Eldorado rated 3.3 on a scale of 1 to 7, where 7 is best and 4 is midscale

(neither acceptable nor unacceptable). Data on L-color (lightness scale) of cooked beans showed that there was no difference in color between pinto varieties. No differences were observed for hydration ratio, and the higher values are due to the overnight soak used to leach out pinto mottle color. The texture of 70 kg/100g was similar to that of Santa Fe and La Paz and firmer than that of Othello (40 kg). These values were within the acceptable range of

45 to 75 kg/100 g for processed pinto beans. Eldorado has an acceptable visual score. Within the commercial pinto bean class, Othello demonstrated the best overall canning quality; Buster consistently exhibits inferior canning quality.

Release and research fee:

Eldorado was released by Michigan State University with the option that Eldorado 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 either foundation seed or certified seed sold, depending on production location. Plant variety protection (PVP) is anticipated. Parties interested in licensing Eldorado may contact MSU Technologies by phone at (517) 355-2186 or on the Internet at <http://technologies.msu.edu>.

Table 1. Mean yield (cwt/acre) of eight pinto bean varieties grown for five years (2007-2011) at 45 locations in Michigan and the Upper Midwest.

No. locations	Eldorado	Santa Fe	La Paz	Lariat	Stampede	ND307	Othello	Buster
45	30.0							
31	30.9**	24.8						
25	28.4		26.8					
27	29.4**			26.3				
21	29.4**				23.5			
15	27.7**					25.5		
19	28.5**						23.1	
19	26.0**							22.0
Yield percent	100	80.3	94.5	89.7	80.2	92.2	80.8	84.7

** Significant difference at P<0.01 level.

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Table 2. Comparison of agronomic, disease and canning quality characteristics of Eldorado with those of other pinto bean varieties.

Varieties	Eldorado	Santa Fe	La Paz	Lariat	Stampede	ND307	Othello	Buster
Agronomic traits								
Growth habit	----- Type II b -----						---- Type-III ----	
Days to flower	42	41	43	42	41	39	38	39
Days to maturity	98	93	95	96	94	93	85	89
Height (inches)	21	19	21	21	20	19	16	18
Lodging score	1.9	2.2	1.9	2.4	1.5	2.0	3.0	2.6
Agronomic index	4.9	4.8	4.5	4.1	4.6	4.4	3.1	3.1
100 seed weight (g)	42.9	41.3	39.6	42.3	40.3	39.4	38.1	38.8
Yield percent	100	80	95	90	80	92	81	85
Disease resistance traits								
BCMV	R	R	R	R	R	R	R	R
Anthraxnose Race 73	S	S	S	S	S	S	S	S
Rust Race 22:2	S	S	S	S	S	S	S	S
CBB	S	S	S	S	S	S	S	S
Percent white mold	29.8	42.4	59.3	72.1	45.9	—	—	—
Canning quality traits								
Color L-scale	40.8	41.4	40.7	—	—	—	41.1	—
Hydration ratio	2.1	2.2	2.0	—	—	—	2.1	—
Texture (kg)	70	69	65	—	—	—	40	—
Visual rating	3.3	3.2	3.0	3.0	2.6	2.4	4.0	2.4

Lodging: 1 = erect, 5 = prostrate; 100 seed weight – grams.

Agronomic index: 1 = worst, 7 = excellent; texture – kg/100g.

Diseases: BCMV = bean common mosaic virus; CBB = common bacterial blight; R = resistant, S = susceptible.

White mold: percent disease incidence and severity.

Visual rating: 1 = very undesirable, 4 = neither desirable nor undesirable, 7 = very desirable.