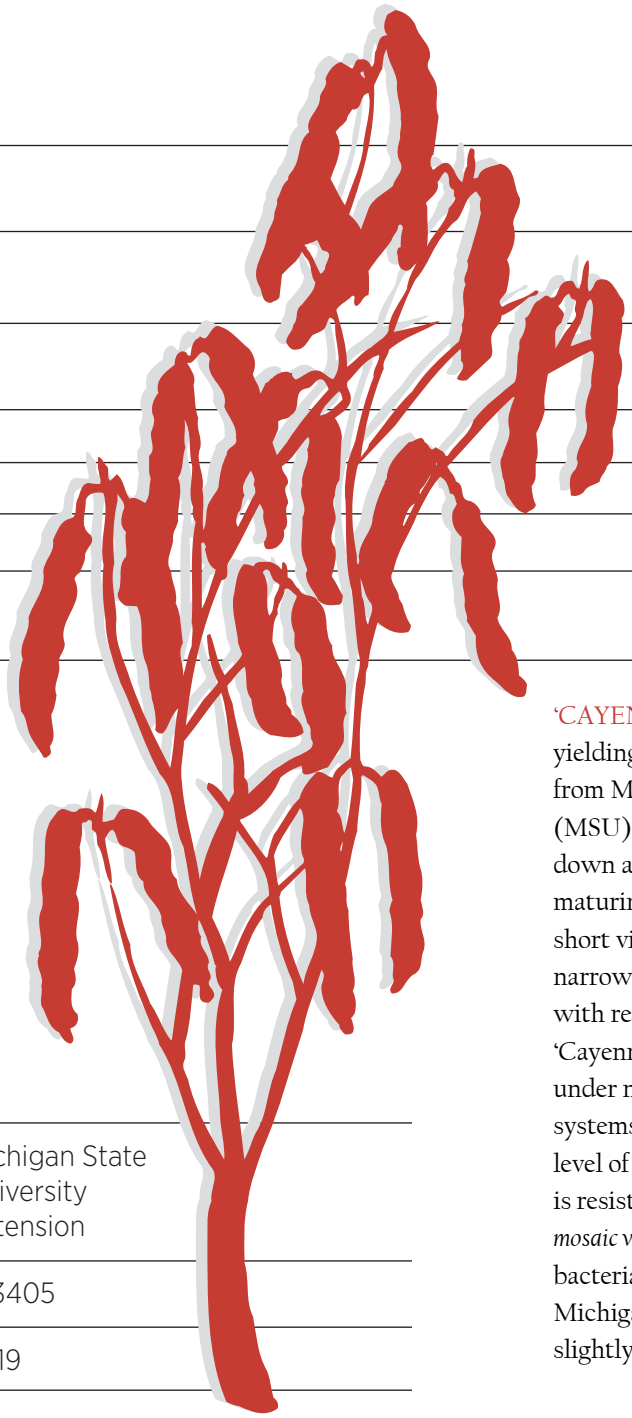
NEW from MSU

'CAYENNE'

A New Small Red Bean Variety *for Michigan*



- New full-season small red bean variety with improved direct harvest.
- Produced yields in excess of 35 hundredweight per acre (cwt/acre).
- Matures in 97 days, three days earlier than 'Merlot' and Viper."
- Exhibits uniform maturity coupled with excellent dry down.
- Good white mold avoidance due to upright plant habit.
- Attractive small red bean seed, slightly smaller than 'Merlot'
- Possesses excellent canning quality, retains red color following canning.

'CAYENNE' is a new erect, high-yielding small red bean variety from Michigan State University (MSU) that exhibits excellent dry down at maturity. This full-season maturing variety has an upright, short vine growth habit. The upright narrow plant profile combined with resistance to lodging makes 'Cayenne' suitable for direct harvest under narrow row production systems. 'Cayenne' exhibits high level of avoidance to white mold and is resistant to strains of *bean common mosaic virus* (BCMV) and common bacterial blight (CBB) present in Michigan. The seed of this variety is slightly smaller in size than 'Merlot', but is significantly larger than 'Viper' and 'Ruby'. Following canning, 'Cayenne' retains the red color better than current small red bean varieties such as 'Viper' and is equivalent to the industry standard, 'Merlot,' in canning quality.

Origin and Breeding History

'Cayenne', tested as MSU small red bean breeding line R12844, was developed from the cross of two small red bean breeding lines: SR9-5 x R09508. SR9-5 was a breeding line from the U.S. Department of Agriculture – Agriculture Research

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Service (USDA-ARS) program at Prosser, Washington, that possessed good seed quality and BCMV resistance but had a prostrate plant habit, unsuitable for direct harvest. MSU breeding line R09508 was an upright red bean with resistance to CBB. The cross was made to improve the canning quality and disease resistance of future small red bean cultivars while retaining high yield potential, erect architecture and uniform maturity.

Agronomic and Disease Information

'Cayenne' exhibits the upright type-II indeterminate short vine growth habit combined with good resistance to lodging (1.8 on a 1–5 scale, Table 1). Other small red varieties lodge more than 'Cayenne', making them more prone to white mold infection. Plants average 21 inches in height, similar to the heights of 'Merlot' and 'Viper'. 'Cayenne' is a full-season bean, maturing 97 days after planting. The range in maturity is from 93 to 105 days, depending on season and location. It matures three days earlier than 'Merlot' and 'Viper', and two days earlier than 'Ruby'. 'Cayenne' has demonstrated excellent uniform maturity and dry down compared with 'Merlot', and 'Viper' that exhibit green stem at maturity, requiring crop desiccation prior to harvest. 'Cayenne' has a high agronomic acceptance rating based on its upright growth habit, resistance to lodging, excellent pod load and favorable high pod placement in the plant canopy.

'Cayenne' has been tested for seven years (2012–2018) in 40 locations by MSU researchers in cooperation with colleagues in Michigan, Washington and Ontario. The combined yield data comparisons with other small red cultivars are shown in Table 1. Over 40 locations, 'Cayenne' yielded 30.0 cwt/acre and significantly out-yielded 'Merlot' by 14% and 'Ruby' by 9%, and was 5% less than 'Viper'. Yield ranged from a high of 48.4 cwt/acre in Sanilac County, Michigan, in 2016, to a low of 14.4 cwt/acre under severe white mold conditions in Montcalm County, Michigan, in 2017.

Planted in narrow rows (20 inches) and combined with direct harvest, 'Cayenne' has produced competitive yields in excess of 30 cwt/acre in Michigan and appears well adapted to a range of production systems in Washington (41 cwt/acre), where small red beans are grown commercially. 'Cayenne' appears to be well adapted to this increasingly popular management system. Growers should follow current recommended practices for fertility and weed control in growing 'Cayenne' beans. Recommendations can be found online from the Saginaw Valley Research and Extension Center *(https://www.canr.msu.edu/saginawvalley/)* and MSU Weed Science *(www.msuweeds.com)*.

'Cayenne' possesses the single recessive *bc-1*^{2} gene, which confers resistance to seed-borne BCMV. All the small red varieties listed in Table 1 possess the same resistance gene. 'Cayenne' exhibits improved tolerance to white mold compared with other small red bean varieties. Percent white mold was 33% compared with 'Merlot' (63%) and 'Viper' (67%), and 'Ruby' (77%) in heavily infected field trials. Data is supported by national field and greenhouse trials. 'Cayenne' is partially resistant to CBB when compared with other small red varieties in naturally infected field trials in Michigan.

Quality Characteristics

'Cayenne' has a typical small red bean seed, averaging 36 g/100 seeds and a size range from 33 to 40 g/100 seeds. The seed is slightly smaller in size than 'Merlot' (38 g), is larger than 'Viper', (30 g) and 'Ruby' (33 g), and resembles 'Merlot' in overall appearance.

In canning trials, 'Cayenne' has been subjectively rated by a team of trained panelists as being excellent in cooking quality. This evaluation is based on whole bean integrity (no splitting or clumping), uniformity of size (uniform water uptake), cooked seed color (limited color leaching) and clear brine (no starch extrusion into canning liquid). 'Cayenne' rated 3.8 on a scale of 1 to 5 where 5 is best and 3 is mid-scale (neither acceptable nor unacceptable). Within the commercial small red bean class, 'Cayenne' was rated highest in visual appearance (3.8) when compared with 'Merlot' (3.6), 'Viper' (3.0) and 'Ruby' (2.7). Data on a-color (green to red scale) of cooked beans showed that 'Cayenne' was reddish (20.4) in color compared to 'Viper' (16.9). Texture for 'Cayenne' (40 kg) is similar to 'Merlot', the industry standard, and is within the acceptable range of 30 to 60 kg/100 g for processed small red beans.

Release and Research Fee

'Cayenne' was released by MSU with the option that 'Cayenne' 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 the production location (east or west of the continental divide). Plant Variety Protection (PVP) from the USDA Agricultural Marketing Service is anticipated. Parties interested in licensing 'Cayenne' may contact MSU Technologies (http://technologies.msu.edu) by phone at 517-355-2186 or by email at msut@msu.edu.

Table 1. Comparison of yield, agronomic, disease and canning characteristics of 'Cayenne' with three other small red bean varieties over 7 years testing (2012–2018) in Michigan, Washington and Ontario.

Traits	Varieties			
	'Cayenne'	'Merlot'	'Viper'	'Ruby'
Agronomic traits				
Days to flower	45	44	46	46
Days to maturity	97	100	100	99
Height in inches	21	21	21	20
Lodging score[a] Average (1–5)	1.8	2.4	2.2	3.2
Agronomic index[b] Average (1–7)	4.6	3.8	4.2	3.8
100-seed weight in grams	36.1	38.4	30.2	32.6
Mean yield[c] (cwt/acre)	30.0	25.9	31.5	26.7
Yield percentage	100	86	105	91
Disease resistance traits[d]				
BCMV[e]	R	R	R	R
Common bacterial blight(1–5)[f]	1.5	2.5	3.0	3.0
White mold percentage[g]	33	63	67	77
Canning quality traits				
Color a-scale[h]	20.4	20.1	16.9	19.1
Texture[i] (kg/100g)	40	40	36	32
Visual rating[j]	3.8	3.6	3.0	2.7

a Lodging: 1 = Erect, 5 = Prostrate

b Agronomic index: 1 = Worst, 7 = Excellent

c Yield was averaged over 40 locations from 2012 to 2018

d Diseases: R = Resistant, S = Susceptible

e BCMV = Bean common mosaic virus

f CBB: 1=Highly resistant, 5= Highly susceptible

g White mold: Percentage of disease incidence and severity

h Visual color: a-scale; green negative to red positive color scale

i Texture: Kg of force needed to compress 100 g canned beans

j Visual rating: 1 = Very undesirable, 3 = Average, 5 = Very desirable

Acknowledgments

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