

**NEW from
MSU**

Fuji

NEW OTEBO (TEBO) BEAN

for Michigan



- New high-yielding bush tebo bean variety.
- Complete resistance to bean common mosaic virus.
- Three days earlier in maturity than Hime tebo.
- Resistance to anthracnose race 73.
- Suitable quality characteristics for use in sweet bean paste.

Fuji is a new Otebo (aka tebo) bean variety from Michigan State University. Fuji is a high-yielding, early-season-maturity variety with resistance to mosaic virus. Fuji has a determinate bush growth habit and meets the quality characteristics for use in sweet bean paste. Tebo beans are a competitive commercial bean class in Michigan and responsive to high management conditions, but production has been limited because of the susceptibility of current varieties to mosaic virus.

Origin and Breeding History

The initial cross — between Hime tebo and Matterhorn great northern bean variety — was made in 2001. The purpose of the cross was to introduce resistance to bean common mosaic virus (BCMV) into the tebo bean class by selecting for the *I*-resistance gene from Matterhorn. Matterhorn was chosen as the donor parent because it is a medium-sized white bean similar to the

tebo class in seed size and color. To retain the characteristics of Hime tebo, four backcrosses were made to Hime, and progeny were selected for virus resistance using marker-assisted selection. In 2005, backcross four (BC₄) breeding lines with G05900 codes were entered in replicated yield trials at Saginaw, Mich., for direct comparison with the check variety Hime. Resistance to virus was confirmed in the greenhouse in East Lansing using direct inoculation, and reaction to race 73 of anthracnose was also confirmed in all advanced lines. The highest yielding lines continued to be evaluated for yield performance, maturity, determinate growth habit and appearance most similar to Hime. On the basis of continued yield performance and phenotypic similarity to Hime in maturity, growth habit and seed size and appearance, G05922 was released as the variety **Fuji**. A seed sample was sent to Japan for evaluation and suitability in the “An” sweet bean paste product.

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Yield Performance

Fuji, tested as G05922, was compared to Hime over four years (2005-08) at six locations in Michigan. In direct comparisons, Fuji yielded 21.5 hundredweight (cwt)/acre and Hime 20.7 cwt/acre (Table 1). Yields ranged from a high of 35.3 cwt/acre in Sanilac County to a low of 9.9 cwt/acre under severe moisture stress in Gratiot County in 2008. No significant differences in yield were observed between Fuji and Hime varieties over four years of testing.

Agronomic Features

Fuji flowers in 43 days and matures in 90 days, three days earlier than Hime (Table 2). Maturity has ranged from 82 to 96 days over years and locations. Seed size of Fuji is 27.6 grams per 100 seeds; it ranged from 23.5 to 32.5 g per 100 seeds. Seed is similar in size to that of Hime, which has shown an equivalent range from 23.9 to 33.6 g per 100 seeds over years and locations. Fuji has a determinate bush habit similar to that of Hime. The determinate growth habit exhibits less recovery from stress than the indeterminate short-vine habit, which would explain some of the range in yield and seed size observed in tebo beans over the years. Fuji averages 18

inches in plant height and has moderate resistance to lodging (2.5, where 1 is erect and 5 is prostrate). Plant height and lodging are similar to those of Hime (Table 2). Fertility and weed management practices used with Hime tebo beans can be used for Fuji beans. Weed control recommendations can be found in Michigan State University Extension bulletin E-434, *Weed Control Guide for Field Crops*.

Disease Resistance

Fuji possesses the single dominant hypersensitive *I* gene, which conditions resistance to seed-borne BCMV; Hime is highly susceptible to BCMV and is a carrier of seed-borne virus. Western seed production of tebo beans risks infection from the temperature-insensitive necrosis-inducing strains of BCMV such as NL 3 and NL 8, known to occur in the Pacific Northwest. Fuji would eliminate any risk of bringing seed-borne mosaic virus to Michigan. Fuji and Hime are resistant to anthracnose race 73 but are susceptible to race 7. Race 73 is the race of anthracnose most often found in Michigan. Both Fuji and Hime are susceptible to common bacterial blight, rust and white mold, exhibiting similar levels of susceptibility to these pathogens.

Quality Characteristics

Tebo beans are marketed to Japan, where they are processed into a sweet bean paste or confectionary known as “An” paste. Azuki beans are used to produce a similar red bean paste. The tebo bean is preferred over similar small, white-seeded navy beans because the internal cotyledon color is white rather than the off-white gray color of navy beans. Tebo beans produce a more desirable paler colored product. Fuji has the same quality characteristics for internal color and starch viscosity as Hime. Samples evaluated in Japan for use in sweet bean paste have been rated as satisfactory.

Release and Research Fee

Fuji was released by Michigan State University with the option that Fuji 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 PFI International Inc., Okemos, Mich., on an exclusive basis for sale in the United States and Canada. PFI International Inc. is in turn working exclusively with the Michigan Crop Improvement Association on the production of breeder and foundation seed classes, with certified seed to be available after 2010. Plant variety protection is anticipated.

Table 1. Combined yield data of two tebo bean varieties, Fuji and Hime, grown over 4 years (2005-08) at six locations in Michigan.

Tebo varieties	Saginaw			Gratiot 2008	Sanilac 2008	Mean 2005-08
	2005	2006	2007			
	cwt/acre					
Fuji	27.0	21.1	23.4	12.2	9.9	21.5
Hime	29.6	19.5	20.5	17.0	5.7	20.7

Table 2. Combined data on agronomic and disease resistance traits of two tebo bean varieties, Hime and Fuji, grown over 4 years (2005-08) at six locations in Michigan.

Tebo varieties	100-seed weight (grams)	Flower (days)	Maturity (days)	Lodging ¹ (1-5)	Height (inches)	Selection index ² (1-5)	Anthracnose race 73	BCMV ³ NL3 & NL4
Fuji	27.6	43	90	2.2	18.0	4.3	Resistant	Resistant
Hime	28.3	44	93	2.5	18.5	4.3	Resistant	Susceptible

¹Lodging 1=erect, 5=prostrate; ²Selection index: 1=inferior, 5= average; ³BCMV = bean common mosaic virus, strains NL 3 and NL 4.

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