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CULTIVAR DESCRIPTION

Mist common bean

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Abstract: Mist is an indeterminate navy bean (*Phaseolus vulgaris* L.) variety with full season maturity, high yield potential, and resistance to common bacterial blight caused by *Xanthomonas axonopodis* pv. *phaseoli*. Mist is adapted and recommended for bean growing areas in southwestern Ontario.

Key words: Phaseolus vulgaris L., navy bean, common bacterial blight resistance.

Résumé : Mist est une variété de haricot (*Phaseolus vulgaris* L.) tardive à croissance indéterminée. Ce cultivar se caractérise par un rendement potentiel élevé et la résistance à la brûlure bactérienne causée par *Xanthomonas axonopodis* pv. *phaseoli*. La variété Mist est acclimatée aux régions du sud-ouest de l'Ontario où on cultive le haricot, pour lesquelles on la recommande. [Traduit par la Rédaction]

Mots-clés : Phaseolus vulgaris L., haricot, résistance à la brûlure bactérienne.

Introduction

Mist is a high-yielding full season variety and is resistant to common bacterial blight (CBB). Mist was developed at the University of Guelph, Guelph, ON, Canada, and tested in the Ontario White Bean Registration and Performance Trials in 2010 and 2011. Mist was registered at the Variety Registration Office, Canadian Food Inspection Agency, Ottawa, ON, on 14 May 2013 (Registration no. 7388).

Pedigree and Breeding Methods

Mist was developed at the University of Guelph from an F_5 family from a conical cross (Bett and Michaels, 1994) (modified 8-way cross), spscbbr136/PI207262//ICB-10/Vax4///OAC Speedvale/Avanti//OAC 99-1/OAC Rex, to improve yield and other agronomic traits including upright growth habit plant type. Spscbbr136 was a single plant selection for resistance to bacterial blight from the OAC Rex/OAC Seaforth population. OAC Seaforth originated from a cross and subsequent backcrosses of Seafarer with PI 326418, the donor parent used as the source of *Are* gene for resistance to several races of anthracnose (Beversdorf and Buzzell 1984). PI207262 is a plant introduction with anthracnose resistance gene *Co-4*^{3} and *Co-9* (Balardin et al. 1997). ICB-10 is a small shiny black bean derived from interspecific hybridization between Great Northern #1 and *Phaseolus coccineus*, with an intermediate Type-II upright growth habit and moderate resistance to CBB (Miklas et al. 1999). VAX-4 was a CBB resistant line from CIAT with XAN263 in its pedigree, which was derived from tepary bean (Singh et al. 2001). OAC Speedvale, developed from Seafarer/PI 324685, is an Ontario registered navy bean variety with a determinate, type-I growth habit, early maturity, and good yield (Beattie et al. 2003). Avanti is an indeterminate short vine variety with midseason maturity and excellent seed and canning quality (Kelly et al. 1998). OAC99-1 was an elite line entered in the registration trials in 1999 with pedigree OAC Gryphon/W72988. OAC Rex was derived from the cross between HR20-728 and MBE7 (Michaels et al. 2006). MBE7 has ICA Pijao in its

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Table 1. Yield, days to maturity, lodging resistance, and seed weight of navy bean cultivars AC Compass, Lighting, and Mist from Ontario White Bean Registration and Performance Trials in Ontario from 2010 and 2011.[a]

	Yield (kg ha^{-1})		Maturity		Lodging resistance (1–5)[b]		100-seed weight (g)	
Cultivar	2010	2011	2010	2011	2010	2011	2010	2011
AC Compass (CK[c])	3122	2618	90.5	96	2.3	2.9	19.8	23
Lightning (CK)	3237	2796	93.7	99.9	1.3	2.6	21.9	21.9
CK mean	3180	2707	92.1	98	1.8	2.8	20.9	22.5
Mist	**3776**	**3178**	**96**	**104**	**1.4**	**2.4**	**21.7**	**23.1**
LSD (0.05)	154	184	1.2	1.1	0.3	0.3	0.5	0.6

[a]Test locations were Brussels, Elora, Granton, Kippen, St Thomas, and Woodstock in 2010 and Brussels, Elora, Highbury, Kippen, St Thomas, and Woodstock in 2011.
[b]Lodging resistance is determined at maturity using a 1 to 5 scale, from 1 = upright plants, 3 = partially upright plants, to 5 = plants lodged due to weak stem.
[c]CK, check cultivar.

Table 2. Cooking quality of canned beans of Mist compared with commercial check cultivars grown in the Ontario White Bean Registration and Performance Trials in 2010 and 2011.

							Texture measurement[d]			
	Hydration coefficient[a]		Degree of packing (1–5)[b]		Washed drained wt. (%)[c]		Plateau force (N)		Firmness (N mm^{-1})	
Cultivar	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
AC Compass (CK[e])	NA	2.3	3	1	58.8	56.4	255	196	18.3	10.7
Lightning (CK)	NA	2.3	3	1	59.1	57.8	270	169	20.3	11.5
CK mean	—	2.3	3	1	59.0	57.1	263	183	19.3	11.1
Mist	**NA**	**2.3**	**3**	**2**	**59.6**	**59**	**247**	**253**	**17.1**	**13.6**
LSD	NA	0.1	0.3	1	1.1	1.7	39	79	2.6	3.4

[a]Soaked wt. (blanched in 88 °C water for 45 min) divided by dry weight (determined for 500 g of beans).
[b]Scored visually; 1: no clumping and 5: over half clumped.
[c]Weight of beans after washed and drained on a screen, presented as percentage of unwashed-undrained weight.
[d]Texture of canned beans was measured on Instron Texture measurement system using wire extrusion cells.
[e]CK, check cultivar.

pedigree, which has an indeterminate upright growth habit (Type-II), purple flowers, resistance to bean common mosaic virus (BCMV), and tolerance to bean golden mosaic virus (Singh et al. 2013).

The conical cross was made in a growth room of the Department of Plant Agriculture, University of Guelph in the winters of 2001 and 2002. The population was advanced to the F_5 generation at the Elora Research Station, ON, using a bulk population advancement approach, where the population was harvested by a combine and bulked to plant the next generation. The F_5 bulk population was planted in the summer of 2005 at the Elora Research Station, ON. In the F_5 generation, 30 single plants were selected, and the selected 30 $F_{5:6}$ plant-rows were grown in the Elora Research Station in 2006. The main selection criteria for single plants and plant-rows were resistance to anthracnose, high yield potential, and desirable plant type with the upright architecture. Seed of the selected single plants and plant-rows were examined for seed size, shape, and colour, and for visual conformity with the standards of the navy bean market class. The lines were further tested and selected in replicated preliminary yield trials at the Elora Research Station in 2007. The lines were entered into advanced yield trials at the Elora Research Station and a field location near St. Thomas, ON, in 2008.

Performance

Mist was entered into the Ontario White Bean Registration and Performance Trials as ACUG 10-6 and was evaluated in multi-location yield trials across Ontario in 2010 and 2011. These tests are performed under the guidelines set by the Ontario Pulse Crop Committee (www.gobeans.ca). Test locations with coefficient of variation (CV) values lower than 15% were considered valid tests used for variety registration. Agronomic

Table 3. Response of Mist to bean common mosaic virus (BCMV) and common bacterial blight (CBB) compared with commercial check cultivars.

	BCMV[a]		
Cultivar	Race 1	Race 15	CBB[b]
OAC Rex	R	R	R
Lightning	R	R	S
Rexeter	R	S	R
Lighthouse	R	R	R
Mist	**R**	**R**	**R**

[a]Reactions against bean common mosaic virus race 1 and 15 were assessed after artificial inoculation under controlled condition.

[b]Common bacterial blight (CBB) score (0–5) was recorded in replicated trials in the artificially inoculated common bacterial blight nursery in the field where 0 = no symptoms, 1= <5%, 2 = 5%–10%, 3 = 10%–25%, 4 = 25%–50%, and 5 = 50%–100% (Yu et al. 2000). Cultivar with a score of 0 – < 2.5 were considered as resistant (R) and a score of >2.5 as susceptible (S).

data such as, yield, (adjusted to 18% moisture after combine harvest), days to maturity, and seed weight (estimated for 100 seeds) were collected for each plot in each location. The data were subjected to analysis of variance to estimate least square means for each entry from each location and least significant difference (P = 0.05) between the entries. A composite seed sample was prepared from each location by mixing approximately 200 g of seed of each entry in each replication. These samples were processed in the Food Pilot Plant at Agriculture and Agri-Food Canada, Lethbridge Research and Development Center, Lethbridge, AB, and evaluated for cooking and canning quality parameters.

Agronomy

Mist was compared with other navy bean cultivars 'Lighting', and 'AC Compass'. These check cultivars are widely grown and adapted to the Southern Ontario growing areas representing the majority of hectares planted. Across 12 location-years, 2010 and 2011, Mist had significantly higher yield than the mean of the checks (Lighting and AC Compass; Table 1). Mist required significantly more days to mature as compared with both checks. Its lodging resistance was consistently better in both years. The seed weight of Mist was significantly higher than the mean check 100 seed weight in both years (Table 1).

Canning Quality

The hydration coefficient for Mist was 2.3 and similar to the check cultivars in the year 2011 (Table 2). Mist had a degree of packing score similar to check cultivars in 2010, but it was significantly higher in 2011. Washed drained weight was similar to the check cultivars in 2010, but was significantly higher than the check mean in 2011. For the texture measurements, Mist had lower scores for plateau force and texture firmness than the check mean in 2010, but had a higher plateau force than the check means in 2011 (Table 2). Overall, Mist had acceptable canning and cooking characteristics.

Diseases

Mist was evaluated for disease reaction against anthracnose, common bacterial blight (CBB), and bean common mosaic virus (BCMV). For BCMV inoculation, three to five BCMV, race 1 and race 15, infected leaves were ground using mortar and pestle in a 0.01 molar phosphate buffer (pH = 7.0) with the addition of carborundum powder (Fisher Scientific, Pittsburgh, PA). A detailed diseases evaluation method is described in Khanal et al. (2016).

Mist had a CBB reaction similar to OAC Rex (Table 3). It is positive for the SU91 SCAR marker, which has a significant association with CBB resistance. CBB severity in Mist was much lower than that in the susceptible check Lighting. It was susceptible to the race 73 of anthracnose. It is also resistant to races 1 and 15 of BCMV and possesses the SCAR marker SW13 (Melotto et al. 1996).

Other Characteristics

Mist has an indeterminate Type-II growth habit and an upright plant type with short vine and high podding nodes. It has a green hypocotyl and white flowers. The pods are light tan coloured when ripe. Seeds are white with a dull seed coat luster and a white hilum.

Maintenance and Distribution of Pedigreed Seed

Mist was planted in isolation plots in a seed borne disease free environment in Idaho in 2010 for pre-breeder and breeder seed production. The University of Guelph, Guelph, ON N1G 2W1, Canada, will maintain the breeder seed. Pedigreed seed will be distributed by Hensall District Co-operative, 1 Davidson Drive, P.O. Box 219, Hensall ON N0M 1X0, Canada, Phone: 519-262-3002, Fax: 519-262-2317.

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