

### Registration of Partial White Mold Resistant Pinto Bean Germplasm Line USPT-WM-1

Pinto bean (*Phaseolus vulgaris* L.) germplasm line USPT-WM-1 (Reg. no. GP-262, PI 642448) was developed by USDA-ARS in cooperation with the North Dakota State Agricultural Experiment Station and the Agricultural Experiment Station of Michigan State University and released in 2005. This line was bred specifically for resistance to white mold caused by the fungal pathogen *Sclerotinia sclerotiorum* (Lib.) deBary. White mold is the major economic disease problem of dry bean production in the USA and is a particularly severe problem in pinto beans because of their high degree of susceptibility to the disease. White mold is endemic in all production regions of the USA and is most problematic under moist conditions resulting from rainfall or excessive irrigation during the flowering and midpod fill stages. The partial resistance in USPT-WM-1 derives from 'ICA Bunsii' navy bean (synonymous with 'Ex Rico 23' in Canada), which is a well-known source of resistance to white mold (Tu and Beversdorf, 1982).

USPT-WM-1 (previously tested as AN-37) derives from a recombinant inbred population (Miklas et al., 2004) from the cross 'Aztec'/ND88-106-04. Aztec is a semi-upright pinto bean cultivar from Michigan State University that is susceptible to white mold (Kelly et al., 1992). ND88-106-04, from the cross N85007/ICA Bunsii, is an upright navy bean breeding line from North Dakota State University with resistance to white mold putatively derived from ICA Bunsii. USPT-WM-1 is an F<sub>5</sub>-derived bulk from an individual F<sub>2</sub> plant that underwent generation advance by random single-seed descent method for four generations from F<sub>2</sub> to F<sub>5</sub>.

USPT-WM-1 was selected on the basis of partial resistance to white mold and agronomic characteristics across four white mold field environments in North Dakota and Washington in 2001 and 2002 (Miklas et al., 2004). Across environments, mean disease score based on a subjective scale from 1 to 9, where 1 is no visible infection and 9 is a completely susceptible reaction, was 3.7 for USPT-WM-1 compared with 6.8 for Aztec and 5.0 for ICA Bunsii. The line exhibits disease avoidance characteristics: upright Type IIb growth habit; open canopy score of 2.4, where 1 is a completely open and 5 a completely closed canopy, compared with scores of 2.7 for Aztec and 3.7 for ICA Bunsii; taller canopy height of 49 cm, compared with 41 and 44 cm for Aztec and ICA Bunsii; and reduced lodging score of 3.9, where 1 is no lodging and 9 completely lodged, compared with 6.2 Aztec and 6.3 for ICA Bunsii. The line has midseason 94-d maturity, compared with 90 d for Aztec and 96 d for ICA Bunsii. USPT-WM-1 exhibits the stay-green stem trait with a score of 2.6, where 1 = 0 to 20% and 5 = 80 to 100% stay-green stem, compared with 1.8 and 3.8 scores for Aztec and Bunsii, respectively. The stay green trait is described as pods reaching harvest maturity while the branches remain green. Thus, the plant is still likely to be physiologically active and engaged in plant defense response (Miklas et al., 2004). Seed size based on weight of 100 seeds was 33.6 compared with 33 g for Aztec; however, in the absence of white mold disease pressure, weight of 100 seeds for USPT-WM-1 was 4 g less than that of Aztec. Yield was 2610 kg ha<sup>-1</sup> compared with 2290 kg ha<sup>-1</sup> for Aztec in a yield trial conducted at Othello, WA, in 2004.

USPT-WM-1 performed well in the National Sclerotinia Nursery in 2003 and 2004 (Steadman et al., 2004, 2005), where average mean ranking for resistance among 13 entries across

12 separate greenhouse and field tests in 2003 was 5.1, and for 16 tests in 2004 was 6.7, compared with 6.2 in 2003 and 6.6 in 2004 for ICA Bunsii. In a white mold nursery conducted in Michigan in 2004, USPT-WM-1 yielded 3920 kg ha<sup>-1</sup>, second among 64 entries, and was significantly higher than 'Buster' (3230 kg ha<sup>-1</sup>), the next highest yielding pinto bean cultivar in the trial. The weight of 100 seeds in this trial was 35 g compared with 34 g for Buster. Harvest maturity was 93 d, 1 d later than Buster. The mean white mold disease score based on percentage infection was 41% for USPT-WM-1 compared with 37% for ICA Bunsii and 56% for Buster.

Although seed appearance for USPT-WM-1 is within the parameters for the pinto bean market class, the shape is more rounded and the background color is darker than commercial cultivars. The darker color may be due, in part, with presence of the *I* gene for resistance to *Bean common mosaic virus* being derived from the navy bean parent ND88-106-04. The *I* gene and its tight association with the *B* locus, depending on source, is known to cause seed darkening in pinto, red, and pink bean market classes. The line was susceptible to bean rust [caused by *Uromyces appendiculatus* (Pers.) Unger var. *appendiculatus*] Race 53 in a greenhouse pathogen test conducted at North Dakota State University and exhibited moderate susceptibility to *Beet curly top virus* in Washington.

USPT-WM-1 will be most useful for incorporating partial resistance to white mold primarily in the pinto bean market class but also in the medium-seeded great northern, pink, and small red market classes as well. Seed will be maintained by USDA-ARS at Prosser, WA, and provided in small quantities on written request. We ask that appropriate recognition of source be given when this germplasm contributes to the development of a new cultivar or germplasm line.

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