

UNITED STATES DEPARTMENT OF AGRICULTURE
AGRICULTURAL RESEARCH SERVICE
WASHINGTON, D.C. 20250
and
IDAHO AGRICULTURAL EXPERIMENT STATION
MOSCOW, IDAHO 83844

RELEASE OF COMMON BACTERIAL BLIGHT RESISTANT PINTO
BEAN GERMPLASM LINES USPT-CBB-5 AND USPT-CBB-6

The Agricultural Research Service, U.S. Department of Agriculture, and the Idaho Agricultural Experiment Station announce the release of USPT-CBB-5 and USPT-CBB-6 pinto bean (*Phaseolus vulgaris* L.) germplasm lines with high levels of resistance to common bacterial blight caused by *Xanthomonas axonopodis* pv. *phaseoli* (*Xap*). Scientists participating in the development of this germplasm were Phil Miklas (USDA-ARS, Prosser, WA), James Smith (USDA-ARS, Stoneville, MS), and Shree Singh (University of Idaho). Common bacterial blight is a major seed-borne disease of common bean worldwide. The disease is endemic to pinto bean production regions in Colorado, Michigan, Minnesota, Montana, Nebraska, North Dakota, and Wyoming. Genetic resistance in the host provides the most effective control of this disease, and planting certified disease-free seed is critical. USPT-CBB-5 and USPT-CBB-6 possess two major QTL and perhaps other minor genes that confer a high level of resistance to *Xap*. Marker-assisted selection for the SAP6 and SU91 markers tightly linked with QTL derived from great northern landrace cultivar Montana No.5 and breeding line XAN 159, respectively, was used in development of USPT-CBB-5 and USPT-CBB-6 for combating this problematic disease of pinto bean in the U.S.

USPT-CBB-5 and -6 are F_{1.5} lines derived from the cross G 17341/'Othello'//VAX 4/'Maverick'/3/89:980. G 17341 (CIAT accession no.) is a small seeded pinto breeding line developed at CIAT from segregating population provided by Dr. R.E. Wilkinson, Cornell University, New York. G 17341 has indeterminate growth habit Type III, with moderate resistance to common bacterial blight and *I* gene for resistance to *Bean common mosaic virus* (BCMV). Pinto Othello has early maturity, drought resistance and wide adaptation. VAX 4, with beige seed, is a germplasm line from CIAT with a high level of resistance to common bacterial blight. VAX 4 possesses both SAP6 and SU91 markers linked with major QTL for common bacterial blight resistance that ultimately derive from Montana No.5 and tepary bean (*P. acutifolius*), respectively. VAX 4 possesses *I* gene for resistance to BCMV. Maverick is a pinto bean well adapted in North Dakota. Maverick possesses *Ur-3* gene for resistance to bean rust, but is susceptible to BCMV. Pinto 98:980 is a breeding line from the University of Idaho with good yield potential and reduced lodging.

Marker-assisted selection was used to identify F₁ plants from the initial four-way cross for the presence of SAP6, SU91, and SW13 markers. The SW13 marker is linked with *I* gene. An F₁ plant from the four-way cross with all three markers was crossed to 89:980. An F₁ plant from this final cross (PS99-113E) with all three markers was advanced to F₂ which was planted in the field at Prosser, Washington, and screened for plant and seed type. Two F_{2.3} progenies (PS99-113E-6 and PS99-113E-4) were tested for reaction to common bacterial blight in leaf inoculation tests conducted at the USDA-ARS Tropical Agriculture Research Station at Mayaguez, Puerto Rico. An individual F₃ plant (PS99-113E-4-5) with high level of resistance to

common bacterial blight was advanced to F₄. The other F₃ progeny was bulk-harvested (PS99-113E-6-B) because of uniform expression of resistance to common bacterial blight. The F₄ progenies were grown in the field at Prosser and harvested in bulk (PS99-113E-6-B-B and PS99-113E-4-5-B). The F₅ bulks were screened for leaf reaction to common bacterial blight in the University of Idaho greenhouse at Kimberly, Idaho. Individual F₅ plants (PS99-113E-6-B-B-1 and PS99-113E-4-5-B-6) with high levels of resistance and later confirmed to possess SAP6 and SU91 markers were selected to produce USPT-CBB-5 and USPT-CBB-6 that were subsequently increased for two generations and evaluated in multiple greenhouse tests for reaction to common bacterial blight and examined in the field for yield, plant type, and maturity.

USPT-CBB-5 and USPT-CBB-6, in a greenhouse leaf inoculation test conducted at Kimberly, ID, in December 2004, had mean disease scores of 4.9 based on a 1 to 9 scale where 1 is no common bacterial blight and 9 is completely susceptible. In comparison, 'Chase' pinto known to possess moderate resistance to common bacterial blight had a mean disease score of 7.2. In a repeated test in December 2005, USPT-CBB-5 scored 3.3 and USPT-CBB-6 scored 4.7 compared to 8.6 for Chase (note: other inoculation tests also indicated that USPT-CBB-5 is slightly more resistant than USPT-CBB-6). Thus, USPT-CBB-5 and USPT-CBB-6 exhibit a much higher level of resistance to common bacterial blight than any commercially available pinto cultivars. Both breeding lines also possess both the SAP6 and SU91 markers linked with major QTL for resistance derived from Montana No.5 (via VAX 4) and tepary bean (via VAX 4), respectively.

USPT-CBB-5 exhibits a Type III indeterminate vine growth habit. Its seed yield was 107% of Othello at Othello, Washington, in 2005. Average weight of 100 seeds was 35 g, the same as Othello. USPT-CBB-5 matured in 87 d, one day later than Othello. Few lines with high levels of resistance to common bacterial blight possess such early maturity, which makes USPT-CBB-5 a unique germplasm. Seed appearance was rated as commercially unacceptable because of blocky shape. USPT-CBB-5 also exhibits a hypersensitive resistance response to the NL-3 strain of *Bean common mosaic necrosis virus* (BCMNV) in Prosser greenhouse tests, which infers presence of the *I* gene for resistance to BCMV. This line is resistant to *Beet curly top virus* (BCTV).

USPT-CBB-6 exhibits a Type III indeterminate growth habit. Its seed yield was 146% of Othello at Othello, Washington, in 2005. Average weight of 100 seeds was 33 g, which is slightly smaller than Othello. USPT-CBB-6 matured in 99 d, compared to 86 d for Othello. This breeding line also performed well in a multiple stress plot at Prosser, Washington, in 2005, yielding 139% of Othello, which indicated resistance to drought. Seed appearance was rated as commercially acceptable. USPT-CBB-6 is susceptible to BCMV and BCMNV, but possesses resistance to BCTV.

USPT-CBB-5 and USPT-CBB-6 will be most useful for incorporating resistance to common bacterial blight in cultivars of pinto market class, but also other medium-seeded market classes of Middle American race Durango. Seed will be maintained by USDA-ARS at Prosser, WA, and provided in small quantities upon 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.

Director, Idaho Agricultural Experiment Station
University of Idaho

Date

Deputy Administrator, Crop Production and Protection
Agricultural Research Service, U.S. Department of Agriculture

Date