

PROGRESS REPORT TO THE NEBRASKA DRY BEAN COMMISSION

Project Title

Identification of sources of bacterial wilt resistance in common beans

(Phaseolus vulgaris L.)

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Investigators: Carlos A. Urrea, PI, PHREC, Scottsbluff
Bob Harveson, PHREC, Scottsbluff

Technicians: John Thomas, PHREC, Scottsbluff
Kathy Nielsen, PHREC, Scottsbluff
Ann Koehler, PHREC, Scottsbluff

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INTRODUCTION

Bacterial wilt, caused by *Curtobacterium flaccumfaciens* pv. *Flaccumfaciens*, was one of the more problematic diseases of dry bean (*Phaseolus vulgaris* L.) throughout the irrigated High Plains (Colorado, Nebraska, and Wyoming) in the 1960s and early 1970s. In recent years, bacterial wilt has reemerged as a problem and as of 2006 it has been detected in more than 300 fields in Nebraska, Colorado, and Wyoming. Affected fields were planted with dry beans from multiple seed sources and market classes, including yellow, great northern, and pinto beans. Bacterial wilt reduces seed quality, and in severely infected fields up to 10% of total yield was discolored. This pathogen is considered an A2 quarantine pest for Europe and is subject to phytosanitary regulations in some countries. Restrictions on seed movement between countries and even within states in the US as well as health concerns make it difficult for the Nebraska dry bean industry to commercially utilize affected beans. Very few sources of bacterial wilt resistance have been reported. Emerson, which has a large bright white seed coat, was released in 1971 by the University of Nebraska and has some resistance to bacterial wilt, halo blight, brown spot, and bean common mosaic virus.

With funding from a Layman Award, the University of Nebraska dry bean breeding program screened 424 accessions from the National Plant Germplasm System (NPGS) US dry bean collection and most of the great northern cultivars currently grown in western Nebraska for resistance to bacterial wilt during 2007. Trials were conducted in the Panhandle Research and Extension Center (PHREC) greenhouse facilities. Results from three inoculations showed that 92.5% of the US dry bean core collection was susceptible to bacterial wilt, and only 7.5% showed variability across the evaluations. This suggests that either no resistance is found in these lines, or that they may be segregating for resistance to the disease. The current cultivars Marquis, Orion, Beryl, 99-131, 99-136, and La Paz were susceptible in all three inoculations. These results

emphasize the need to identify sources of bacterial wilt resistance and incorporate them into commercial lines.

OBJECTIVES

- Screen the dry bean core collection (*Phaseolus vulgaris* L.) from the International Center for Tropical Agriculture (CIAT).
- Screen the *Phaseolus coccineus* (scarlet runner beans) core collection from CIAT.
- Transfer bacterial wilt resistance into Nebraska elite great northern and pinto bean lines.

METHODOLOGY

In September 2008, we began screening 1700 accessions from the International Center for Tropical Agriculture (CIAT) dry bean core collection [1374 *Phaseolus vulgaris*, 42 *Phaseolus coccineus*, 40 *Phaseolus dumosus*, and 244 *Phaseolus actutifolius* (*tepany beans*)] for resistance to bacterial wilt in the PHREC-Scottsbluff greenhouse facilities. The accessions were planted in an augmented block design with Orion and Emerson planted in each block as susceptible and resistant checks, respectively. Two seeds of each accession were planted in individual pots. Because of the large number of accessions, planting dates were staggered. Temperature in the greenhouse was maintained at 82°F.

Plants were inoculated at the V2 stage of development using a virulent bacterial wilt isolate from a Nebraska great northern bean field. For each accession, one plant was punctured between the first and second node with a needle that had been dipped in a 48-hour-old bacterial culture. The other was punctured with a sterile needle in the same manner to serve as a negative control. Following inoculation, plants were evaluated for the presence or absence of bacterial wilt symptoms at 7 day intervals up to 49 days. Disease status was scored using a 1-9 scale, where 1= immune and 9 = very susceptible. Koch's postulates were verified by re-isolation of the pathogen from symptomatic plants. The inoculations were replicated two times. A promising wild bean accession was inoculated three times with seven bacterial wilt isolates () with favorable results.

RESULTS AND DSICUSSION

One wild bean from the US Dry Bean collection shows resistance to bacterial wilt. Two more inoculations will be done to verify its true resistance. If resistance is verified, it will be crossed to elite Nebraska lines. Because the seed size of the wild bean is pretty small (26,000 seeds/pound), it will take at least seven generations of backcrosses to recover the normal seed size of commercial value.

Nineteen entries of CIAT's core collection (inoculated twice), and 9 entries (inoculated once) show resistance to bacterial wilt. These entries will be inoculated at least 3 times to verify their resistance. A set of 80 lines that did not germinate will be planted again to evaluate their reaction to bacterial wilt.

PRESENTATIONS

Presentation to the Cuban, Dominican Republic, and Japanese bean trade missions entitled 'Dry bean breeding in Nebraska' at the PHREC-Scottsbluff, NE, on 07/30/08, 09/18/08, and 09/29/08, respectively.

PUBLICATIONS

Research or Extension Bulletins/NebGuides

- (1) Urrea, C.A., R.M. Harveson, K. Nielsen, and J. Venegas. 2008. Identification of sources of bacterial wilt resistance in dry beans. *The Bean Bag* 26(1):12 & 14.
- (2) Urrea, C.A., R.M. Harveson, K. Nielsen, and J. Venegas. 2008. Identification of sources of bacterial wilt resistance in dry beans (*Phaseolus vulgaris* L.). *Annu. Rept. Bean Improv. Coop.* 51:56-57.

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