RESPONSE OF DRY BEANS TO DEFICIT DAILY SPRINKLER IRRIGATION AS RELATED TO SOIL TEXTURE

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For the past three years deficit daily sprinkler irrigation studies were conducted with dry beans ('Pink 6R-122') using the line source technique. The line source is a single line with sprinkler heads 4.5 m apart. Irrigation water is applied at a maximum rate of about 2.3 cm per hour at the line, with rates decreasing linearly with distance to zero 14 m away from the line.

Studies were conducted on a Warden loam, with good water holding ability, and on a Quincy sand, with low capacity to retain water. On both soils we uniformly irrigated with solid set sprinklers, until the crop canopy was nearly closed, about eight weeks after planting. At this time, the soil was near the upper limit of available water. A line source was then installed and daily irrigations applied at rates ranging from one equivalent to estimated evapotranspiration (ET) at the line to zero at the plot edge.

Results from the two soils were much different, due to the differences in water holding capacities. On the sand, yields increased with irrigation rate up to estimated ET. On the loam soil, irrigation rates were reduced to about 1/3 estimated ET before yields were reduced. Soil water was used to supplement the irrigation deficit, but total water used, including soil water depletion, was reduced by deficit irrigation. On the loam, severe injury from Sclerotinia white mold occurred toward the line source and probably reduced yields. The disease was not a problem on the sandy soil.

NEW SOURCES OF RESISTANCE TO THE DELTA RACE OF ANTHRACNOSE

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In 1976 the delta race of anthracnose (Colletotrichum lindemuthianum) was identified in dry bean seed fields in S. W. Ontario. Since all commercial dry bean cultivars are susceptible, breeding programs were initiated in Ontario and Michigan to transfer the known resistance from Cornell 49-242 into commercial varieties. The urgent need for delta anthracnose resistance varieties, dictated a backcross breeding strategy making use of the dominant "Are" gene rather than searching for resistance in lines with more favorable plant and/or seed type characteristics.
However, in a visit to the Campbell navy bean breeding plots Dr. Aylesworth (then at Harrow) was interested in the use and value of the Nep-2 cultivar as a source for improved plant architecture. He decided to test its reaction to delta and Nep-2 proved resistant. This prompted the screening of all progeny with Nep-2 parentage and the high frequency of resistance in these lines suggested that resistance is either a simply inherited dominant trait or is linked with plant architectural characters. Advanced navy breeding lines with favorable plant architecture and delta anthracnose resistance are now available.

Since Nep-2 originated as a EMS mutant from the tropical black variety San Fernando, a group of tropical black lines and cultivars were screened and the results are listed below:

MODERATELY RESISTANT: ICA-Pijao, Jamapa (Venezuela)
SUSCEPTIBLE: ICA-Tui, Porrillo Sintetico.

These lines were not tested for their reaction to the other races of anthracnose nor were they compared genetically with the "Are" gene in Cornell 49-242. Presently studies are underway at Michigan State University to complete the testing of these cultivars and study the genetic inheritance of resistance if it proves different than the Cornell source.

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YIELD RESPONSE OF SEVERAL BEAN TYPES TO A COMPLEX OF COLD SOIL, WHEAT CROP DEBRIS, DROUGHT, AND FUSARIUM ROOT ROT

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The first part of the 1980 growing season in central Washington was exceptionally cold and much of the ground surface was covered on May 18 with 1 to 7 cm of volcanic ash from Mt. St. Helens, before or after plant emergence. The ash, being almost white, reflected the sun's rays and thus contributed to the lowering of soil temperatures. Pink beans, 'Viva' and 'Roza' generally produced good yields in spite of the ash and cold soil. Most other beans suffered severe root rot and lower yields in the areas of ash fall.

The low soil temperatures at Prosser also, presumably, caused the residues of a previous wheat crop (usually very beneficial to a succeeding bean crop) to be toxic to bean roots or in some other way to aggravate Fusarium root rot. These beans were also stressed for soil moisture prior to the first post emergence rill irrigation and between subsequent irrigations. Some beans, especially Pink beans and some Great Northern and Pinto selections with Pink bean parentage produced high yields in spite of these conditions. Red Kidney, Red Mexican, Pinto, black, and small white bean selections grown in this field, with few exceptions, were severely reduced in yield by root rot. Yields among 57 Pink selections ranged from 1650 to 4500 lb/A with an average of 3150/A. Yields among 87 Great Northern selections ranged from 590 to 3460 lb/A, with an average of 1600 lb/A. Among 48 Red Kidney selections the yield range was 450 to 2550 lb/A, with an average yield of 850 lb/A. Only a few of the other classes of beans mentioned above were grown in this field.