USDA-ARS-PWA
Vegetable and Forage Crops Research Unit
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SUMMARY OF EDIBLE LEGUMES RESEARCH ACCOMPLISHMENTS

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Project Title:
Bean Germplasm Enhancement and Improved Disease Management of Edible Legumes

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Plus – Two Technicians

For the last 50 years, the USDA-ARS scientists in Prosser, WA, have contributed significantly to edible legume production practices by way of: (i) release of numerous new edible legume germplasm lines with resistance to multiple diseases, and improved quality traits; (ii) disease management strategies to help the industry stay economically viable and competitive; (iii) development of disease resistance linked markers and marker-assisted selection strategies.

- Markers developed by the Prosser, WA – ARS scientists have enabled rapid development of resistant germplasm to combat emerging disease problems in other regions of the U.S.A. Pinto bean with resistance to anthracnose was released for the bean industry in the Northern plains. Pinto and kidney bean lines with enhanced resistance to common bacterial blight were released.

- Prosser, WA, ARS scientists contributed to development of snap bean germplasm with resistance to Bean golden yellow mosaic virus for use in Florida.

- During the past 10 years, the Prosser ARS researchers have been involved in the release of more than 100 bean germplasm lines and cultivars with improved traits for sustainable bean production. The contributions on the inheritance and QTL mapping of resistance to white mold are crucial to control this number one disease problem for beans in the U.S. Furthermore, the development of comprehensive genetic linkage maps of disease resistance traits provides a blueprint for breeding multiple disease resistant beans.

- Breeding for bean cultivars with resistance to Beet curly top virus, by the Prosser ARS scientists, enabled the bean seed production industry to flourish in the Pacific Northwest. Over 30 germplasm lines and cultivars with unique combinations of resistance to potyvirus and/or Beet curly top virus have been released, and are requested on a regular basis by the bean research programs throughout the world.

- Recent advances in the legume virus research include: identification of a recombinant strain of Bean common mosaic necrosis virus; identification and development of maker-assisted selection of the Bct gene for resistance to Beet curly top virus; and identification of a new source of resistance to clover yellow vein virus which is plaguing snap bean production in the Great Lakes region.

- Over 20 snap and dry bean cultivars with resistance to fusarium root rot were developed and released. Pink (Roza, Viva), small red (Rufus, NW63), and pinto (NW593) NW 410) cultivars that were released from the root rot resistance breeding program, led by the Prosser ARS Scientists in the 1970's, still contribute significantly to the pedigrees of recently developed pink, red, and pinto bean cultivars.

- Numerous cultivars released in the 1970's are still the most widely grown today. Othello pinto beans released in late 1980 is broadly adapted, tolerant to drought, and has been grown on more acres in the U.S. in the past 20 years than any other pinto bean cultivar developed since then.

- Developed numerous pea germplasm lines with resistance to powdery mildew, fusarium wilt, fusarium root rot, and Aphanomyces root rot that have been used by pea breeders around the world to develop and release resistant cultivars to these pathogens.

- Continued research is critical to develop enhanced legume germplasm lines with resistance to while mold, pea enation, Pea leaf roll, Rhizoctonia root rot and other emerging soilborne pathogens of green peas, chickpeas and lentils.

- Research is ongoing to determine the role of cultural practices, in addition to chemical treatments and other biological control procedures to control the negative effects of root rotting pathogens on legumes.

- Legume crops including common bean cultivars are susceptible to at least seven different viruses in the Pacific Northwest. Similarly green and dry pea, chickpea, and lentil crops may be infected by at least six different viruses in the region. All of these viruses have in the past caused serious yield losses in these crops. The development of new sources of resistance to the viruses is a constant battle and necessity, as viruses can mutate and overcome resistance bred into current varieties.

- Prosser ARS legume Scientists accomplishments represent the only ARS contributions in addressing the common bean and legume viruses. Significant contributions have been made by developing methods for identifying resistance genes in bean to several important viruses by the use of molecular markers, a technique that can significantly expedite the breeding program for developing resistant varieties.

- Contributed to identification of important viruses of pulse crops that are transmitted by aphids and development of an evaluation protocol, by identifying aphids carrying viruses so that early insecticide application decisions can be made at the critical time to prevent the virus outbreak.

- Developed new, rapid and reliable virus detection methods.

- Identified new viruses and new virus strains in the Pacific Northwest and the Great Lakes region of the U.S. that severely impact legume quality and yields, and affect breeding for resistance to specific viruses or strains.