Obtaining stable resistance to bean rust, caused by *Uromyces appendiculatus*, is particularly challenging due to the high degree of identified variability and potential for additional variability in the fungus. Monitoring of United States populations of the pathogen has resulted in identification of two additional pathogenic races since 1985 (3) to bring the number of such North American races in the Beltsville collections to 33. Nine additional new races of the pathogen have recently been identified from Tanzanian rust collections (1). Among the more broadly resistant differential cultivars (1,2,3,7), Compuesto Negro Chimaltenango (CNC), Mexico 235, Ecuador 299, Mexico 309, AXS 37, and 51051 are moderately susceptible [intermediate pustule (uredinium) size] or susceptible (large uredinia) (1) to 1,4,5,6,6, and 7 of the 42 available races, respectively. However, two cultivars that have been widely resistant in the United States, Olathe and Aurora, are susceptible to 15 and 18 of these races, respectively. More than one race virulent on Olathe has now been found in Colorado, Florida, Nebraska, North Dakota, and Michigan.

Most currently grown cultivars of green and wax edible podded beans, including Early Gallatin and others, are very susceptible to races 38 and 39, moderately susceptible or moderately resistant (1) to 17 races, and hypersensitive resistant (HR) to races 40,44, 48,49,50,51,54,62,63,64,65,66,69, and 70 (1,2,3). From Beltsville we have jointly released with the New Jersey Agricultural Experiment Station (5,6,) and the Florida Agricultural Experiment Station (4) 15 and two edible podded resistant lines, respectively, since 1984. Four of these lines are waxes and the remainder are green. They are named BARC-Rust Resistant -2 through -18. Several more of these lines are selected for release in early 1988. All of these lines combine the intermediate reactions and HR reactions of many commercial cultivars with the full resistance of Mexico 309 and its black seeded, dry bean derivative B-190. They are HR or resistant (R) (with uredinia predominantly <0.3mm) to 40 of the available races and have moderate resistance (MR) with uredinia smaller than 0.5mm to races 58 and 67. They have at least one resistance gene for each of the 42 available races and more than one for many of these races. They have remained resistant in all rust nursery tests. They are horticulturally close enough to commercial cultivars to potentially permit selection and naming of a cultivar from them or from the progemy of one more cross with them. Each individual line is derived from three to seven backcrosses of the original B-190 cross with popular commercial cultivars. Release of these lines is consistent
with the ARS, USDA policy encouraging release of improved germplasm, but not cultivars, for Phaseolus vulgaris. Commercial and state experiment station breeders are free to use them however they wish in developing new cultivars.

Releases of rust resistant germplasm lines will be made in the next few months jointly with Nebraska for the Great Northern class and with North Dakota for the pinto class of dry beans. All of these lines are HR or R to all available races. They have been selected for appropriate maturities and seed qualities for their classes. The Great Northern lines combine the rust resistance genes of B-190, Olathe, and GN 1140. The pintos combine the rust resistance genes of CNC, Olathe, and Mexico 235 to give three genes for resistance to some races and two genes for resistance to most races. Care will need to be taken, especially with the pintos, to not lose a portion of this extensive rust resistant genetic background through inadequate testing of progeny from crosses with susceptible lines or cultivars.

Essential to stabilizing rust resistance in beans is the incorporation of as many independent resistance genes as possible against each available race. To fully realize the potential for this objective, an intensive search for additional rust resistance in the USDA bean plant introduction collection was started in 1987. Nearly 1,200 of the approximately 8,500 entries (PIs) in this collection were evaluated in 1987. From these PIs, numbers 151385, 151388, 151395, 151396, 151406, 181996, and 189013 have already been identified as having exceptional, comprehensive resistance to all of the so far tested races, including 38, 39, 40, 41, 43, 44, 46, 49, 51, 58, and 67. Results from this partial analysis of the PI collection indicate the PIs will be a rich source for additional rust resistance.

References