Utilizing Exotic Germplasm in Breeding For Root Rot Resistance

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The problems of breeding for resistance to root rot inciting pathogens (E.G. Fusarium solani, Rhizoctonia Solani, Pythium Spp. and others) in beans, Phaseolus vulgaris L., have not diminished despite extensive research. Although resistant breeding lines have been developed and released, few if any resistant snap bean cultivars and only 4-5 resistant dry bean cultivars are currently available in the U. S. Since most sources of resistance possess poor horticultural type, procedures that allow optimum use of exotic germplasm should be considered. Exotic germplasm is defined here as plant materials not commercially usable in their present form, and which require major genetic alteration to become useful.

Five primary constraints to the development of root rot resistant cultivars are suggested: (1) multiple pathogens, (2) variable testing procedures, (3) limited sources of resistance, (4) complex inheritance and low heritability, and (5) lack of suitable breeding procedures for developing resistant breeding lines and cultivars.

Multiple pathogens acting either singularly or in a complex cause difficulty in defining the problem thus affect the testing procedures, identification of resistant sources, genetic analysis of host reaction and breeding methodology. A set of host cultivars having differential responses to pathogens is being developed to assist in identifying the important pathogens in different situations.

Testing procedures used to identify resistance to a specific pathogen or the complex must be accurate, efficient and broadly useful by breeders. A standard laboratory seedling test and a field testing design for each pathogen or the complex should be developed to allow better exchange of materials and interpretation of results.

While the number of sources of resistance were limited prior to 1970, there have been at least 10 reports of resistance since that time, with most sources being exotic plant introductions. This suggests there is adequate material to allow extensive interchange, testing and transfer of genes into useful material provided effective breeding procedures are used.

Somewhat discrete segregation patterns have been observed in studies to determine the inheritance of resistance, but non-genetic variation is usually large enough to produce low heritability and slow response to selection. For 2-6 genes have been suggested, depending on source of resistance, parents used and testing procedures.

The low heritability and low levels of resistance preclude the efficient use of the conventional backcross method to transfer resistance from exotics into breeding lines and from breeding lines into the wide arrary of cultivars used by commercial breeders. Breeding methods which allow replicated family selection such as modified pedigree selection (using single seed descent) and recurrent selection should be considered. Some progress in developing improved resistant populations has been made, but resistance is still lower than desired and horticultural type is unsatisfactory.

FIELD PERFORMANCE OF FAMILIES RESULTING FROM TWO CYCLES OF RECURRENT SELECTION FOR RESISTANCE TO FUSARIUM SOLANI AND THE ROOT ROT COMPLEX

Families	Disease Index 1976	Disease Index 1977	Hortic. Index 1977
---------- Original Parents ----------			
Cascade	58	88	0
Falcon	89	99	1.0
N203	32	43	12.0
State Half Runner	49	50	5.5
Mean	57	70	
-------- 9 First Cycle Selections ----------			
Mean	52	61	6.7
Range	35-80	37-90	4-9.2
---------10 Second Cycle Selections ----------			
Mean	36	63	5.7
Range	26-46	28-88	4.5-7.5
Susc. Snap Bean Check	80	91	

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