Inheritance and Transfer of Root Rot (Pythium) Resistance to Bean Varieties

OTSYULA REUBEN[1], Robin Buruchara[2] George Mahuku and Patrick Rubaihayo[3].

[1]Kenya Agricultural Research Institute, P.O. Box 169 Kenya
[2]Centro Intenacional de Agriculture Tropical, Pan Africa Bean Research Alliance Kawanda Research Station P.O. Box 6247, Kampala, Uganda
[3]Department of Crop Science, Makerere University, P.O. Box 7062, Kampala, Uganda

Background

Bean root rot caused by several Pythium species is a relatively recent problem in East and Central Africa that is increasing in importance. Yield losses of up to 70% in popular commercial bean cultivars have been reported in Rwanda. In order to curb the effects of this disease, identification of resistance and transfer of resistance to bean genotypes preferred by resource poor small holder farmers is an important consideration.

Root rot symptoms in the field

Objectives

To identify sources of resistance within major market class, determine the nature of inheritance and through breeding transfer the resistance into well-adapted market class bean cultivars.

Materials and Methods

Populations have been developed between resistant and susceptible well adapted cultivars (Fig.1). F_2 populations of SCAM 80-CM/15, RWR 719 and MLB 4989A were used in this study.Evaluation of bean plants was done in a root rot hot spot nursery in Vihiga Western Kenya in August 2001. F_2 progenies alongside their parents were evaluated for root rot severity in a CRBD based on a 1-9 CIAT scale (Abawi and Pastor-Corrales., 1990). Fifty plants from each plot were sampled from parental plots while 150 plants were sampled from F_2 generations. Chi- square values (X^2) were calculated based on actual number of plants counted in each of the resistant and susceptible categories.

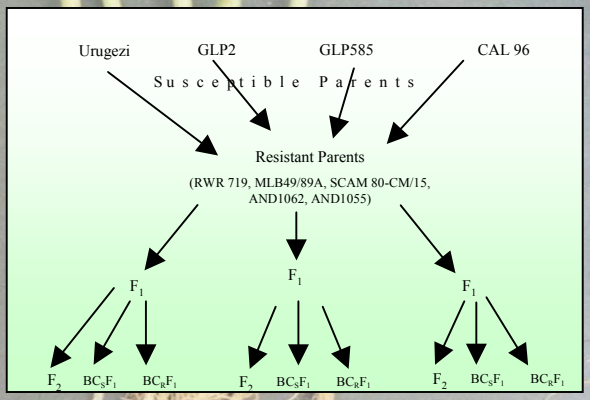

Fig. 1. Population development between resistant and susceptible genotypes

Results

Table 1. Number of plants that showed resistant and susceptible reaction to bean root rot in the field

Susceptible ▼	Resistant →	RWR 719		SCAM 80-CM/15		MLB 49-89 A	
	Generation	Resistant	Susceptible	Resistant	Susceptible	Resistant	Susceptible
	P1	50	-	50	-	50	-
GLP 2	P2	8	42	8	42	6	44
GLP 585	P2	2	43	8	42	8	42
CAL 96	P2	4	46	2	48	3	47
URUGEZI	P2	2	48	0	50	4	46
GLP 2	F2	108	38	120	25	103	29
GLP 585	F2	124	28	104	22	98	46
CAL 96	F2	105	33	95	48	107	32
URUGEZI	F2	109	42	90	31	115	30

P1 = resistant parent and 2 = susceptible parents

Table 2. Chi-square values for segregation ratios of theF2 derived from crosses of resistant and susceptible genotypes

Susceptible ▼	Resistant →	RWR 719		SCAM 80-CM/15		MLB 49-89 A	
	Ratio tested	X^2	P	X^2	P	X^2	P
GLP 2	3:1	0.22**	0.70 – 0.50	4.94^{NS}	0.05 - 0.10	3.05**	0.10 – 0.05
GLP 585	3:1	3.74**	0.10 – 0.05	7.55^{NS}	0.01 - 0.001	3.71**	0.10 – 0.05
CAL 96	3:1	1.24**	0.20 – 0.10	5.55^{NS}	0.05 - 0.01	1.28**	0.20 – 0.10
URUGEZI	3:1	0.57**	0.05 – 0.03	6.00^{NS}	0.05 - 0.10	1.74**	0.20 – 0.10

^{NS} = values significant at 1 degrees of freedom, 95% confidence level and $X^2 < 3.84$

Conclusion

Bean root rot score of F_2 plants from crosses involving resistant parents RWR 719 (KK22) and MLB 49-89 (KK15) segregated in the ratio approximately 3:1. The segregation of F_2 progenies derived from resistant parent SCAM- 49-89 A (KK8) did not fit any expected ratio in all the crosses. This indicated that the resistant gene in RWR 719 and MLB 49-89A is most likely a single dominant gene. The mode of resistance in SCAM-cm/15 could not be predicted. Further evaluation in the screen house and laboratory (using protein and DNA polymorphism) involving the parents, F_1, F_2 and backcrosses is underway and will provide useful information for mechanisms of resistance in the studied genotypes. More field screening of the $F_{2\text{-}3}$ families of resistant progenies derived from RWR 719 and MLB 49-89A to check goodness of fit for the ratio 1:2:1 (resistant : segregating: susceptible) would be confirmatory for the mechanism of resistance in the two cultivars that could be utilized in a breeding program

Reference:

Abawi, G.S. and Pastor-Corrales, M.A.; (1990). Root rots of bean in Latin America and Africa: diagnosis, research, methodologies and management strategies. CIAT, Cali, Colombia, 114 pp. Abawi, G.S. and Pastor-Corrales, M.A.; (1990). Abawi, G.S. and Pastor-Corrales, M.A.; (1990).

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