

Compendio

Los días para la floración y resistencia a la bacteriosis fueron analizados en algunas variedades comerciales, y también en algunas líneas resistentes a la bacteriosis, obtenidas por el cruce de esas variedades con "Great Northern Nebraska n^o 1, Sel. 27". Las variedades comerciales fueron susceptibles a la bacteriosis, en tanto que los cruces de estas mismas variedades con Great Northern Nebraska 1, 27, resultaron en segregantes con mayor nivel de resistencia que sus padres, y de un modo general mantuvieron su periodo de floración semejante al de sus variedades comerciales de origen. Entretanto, algunos segregantes presentaron una floración precoz o tardía. Los resultados indicaron que no hubo correlación entre los días de floración y tolerancia a la bacteriosis. Mayores evidencias de este hecho aparecen en las poblaciones F₂ de cruzamientos entre líneas precoces susceptibles con líneas normales tolerantes, donde la correlación entre el periodo de floración y tolerancia a la bacteriosis fue no significativa. Se obtuvieron segregantes precoces, tolerantes a la bacteriosis, sugiriendo este resultado que tales características son recombinables. Este tipo de combinación podrá ayudar a la evolución de variedades de frijol adecuadas para la rotación de cultivos.

Introduction

Common blight of beans is one of the most serious seed transmitted diseases of dry beans in many countries. As satisfactory chemical control has not been achieved, for the short term control of the disease, emphasis is placed on the use of disease free seed, crop rotation and other cultural practices. The long term control, however, depends on breeding varieties with resistance to this disease.

There are several reports dealing with sources of tolerance, methods of inoculation, pathogenic variation and incorporation of blight resistance in commercial varieties (5). Among the several aspects of breeding for resistance to this disease studied in detail, a negative correlation between early flowering, or early maturity, and blight tolerance was reported (1).

In the present work the days to flowering and blight reaction of commercial varieties and the

resistant selections obtained from the crosses of these varieties with Great Northern Nebraska n^o 1, Sel. 27 was studied for any possible indication of strong correlation between lateness in flowering and blight resistance. Also the correlation between precocious flowering and blight resistance was analysed in a cross between precocious blight susceptible, and normal flowering blight resistant breeding lines in order to explore the possibility of developing precocious, blight resistant lines.

Materials and methods

The commercial varieties "Iguaçu", "Moruna" and "Carioca", a promising line H₂₄C₁₇₂₇ and 11 blight resistant selections obtained from crosses of these with "Great Northern Nebraska 1, Sel. 27", were planted in the field in 4 rows of 3 meters length at 50 cm row spacing, during September 1979. At the flowering stage two pairs of trifoliolate leaves per plant of the 2 central rows were inoculated with *Xanthomonas phaseoli* (E.F.S.) Dows. (isolate 822 A-1) with an inoculum of 2 day old culture approximately at a concentration of 10⁶ cells/ml, using multiple needle method (3). The evaluation for blight reaction was made 2 weeks after the inoculation on

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a scale of 1-5, the details of which are given in Table 1. The number of days to flowering and disease reaction were recorded for each of these materials.

In the second part of the study F_2 population of a cross between a precocious (flowering 28 days from planting) blight susceptible line and a normal (flowering 35 days from planting) blight resistant selection were analysed for the number of days to flowering and disease reaction, under greenhouse conditions. The blight resistant selection was obtained from a cross between cv. 'Rosinha' and 'G. N. Nebraska 1, Sel. 27'. The method of inoculation and evaluation was the same as in the first experiment. The data were subjected to statistical analysis (4).

Results

The data on number of days to flowering and the blight rating for certain commercial varieties, 'Great Northern Nebraska 1, Sel. 27' (source of blight tolerance) and blight resistant selections are presented in Table 1. The commercial varieties were

Table 1. Days to flowering and blight rating of certain commercial varieties and breeding lines.

Identification of germplasm	Days to flowering	Blight rating*
Iguaçu	44	5.0
Sel. 1/61	43	3.5
$H_{24} C_{1727}$	44	5.0
Sel. 10/70	46	2.0
Sel. 713	46	2.5
Moruna	43	5.0
Sel. 11/71	43	2.5
Sel. 15/75	43	2.5
Sel. 16/76	55	2.5
Carioca	47	4.5
Sel. 18/78	47	2.0
Sel. 22/82	46	2.5
Sel. 37/97	41	2.5
Sel. 39/99	47	2.0
Sel. 41/101	47	1.5
Great Northern Nebraska nº 1 Sel. 27	41	3.0

* Blight rating is based on the mean of 20 inoculated leaves per variety or breeding line.

Scale of rating: 1. Resistant - no visible symptoms on the inoculated area 2. Highly tolerant - slight necrosis with restricted chlorotic border. The lesion 1-5% of the inoculated leaf area. 3. Moderately tolerant - pronounced necrosis and chlorosis occupying up to 20% of inoculated leaf area. 4. Susceptible - spreading lesion with extensive necrosis and chlorosis, the lesion occupying 30-40% of leaf area inoculated. 5. Highly susceptible - severe necrosis and chlorosis extending to major part of the inoculated leaf causing wilting and defoliation.

all susceptible to blight with slight differences in the rate of secondary spread. The source of resistance utilized in this study, 'Great Northern Nebraska 1, Sel. 27', exhibits good level of resistance in comparison with the commercial varieties. In general, as seen from the data, the selections besides having superior level of resistance than either of the progenitors, maintained the number of days to flowering, similar to the parents. The only exception where blight resistance is observed in a late flowering selection is Sel. 16/76. This breeding line, though flowers 12 days later than the cv. 'Moruna' under hot long day conditions, flowers earlier under short day conditions and seems to be photoperiod sensitive. The selection 39/99 and 41/101 have far superior level of blight resistance but maintain similar cycle as the parental cv. 'Carioca'. The data did not indicate correlation between higher level of blight tolerance and late flowering.

In the second experiment, the cross between precocious blight susceptible and normal flowering blight resistant parents, precocity was dominant in the F_1 , where all the plants flowered as early as precocious parent (28 days after planting). The individual F_2 plants were studied for blight reaction and days to flowering. The data were subjected to statistical analysis and no significant correlation was obtained between days to flowering and blight resistance (Table 2). Higher levels of blight resistance were observed in early, medium and late flowering segregants, indicating that blight resistance is not linked with late flowering.

Discussion

A significant negative phenotypic correlation was reported between blight tolerance and earliness in 2 *P. vulgaris* crosses involving early maturing susceptible and late maturing tolerant selections (1). However, the low correlation value obtained in their study indicated the possibility of combining earliness with blight resistance. Linkage between delayed flowering under long photoperiod and high temperature with blight tolerance was reported (2). In the screening of *P. vulgaris* germplasm for blight tolerance no correlation was observed between foliage and pod reaction with flowering or maturity periods (6).

The present study does not indicate any evidence of strong correlation between blight resistance and late flowering. Among the several intervarietal crosses made between commercial varieties and Great Northern Nebraska 1, Sel. 27, aimed at developing the blight resistant breeding lines, blight resistant segregants were recovered with early, normal as well as late flowering, indicating no correlation between days to flowering and blight reaction.

Table 2. Correlation between days to flowering and blight tolerance in F_2 population of normal flowering blight tolerant x precocious blight susceptible cross.

Days to flowering	Blight rating								Total n ^o of plants	
	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5		5.0
28			1	3	9	6		*		19
29			3	8	6	10	1	1		29
30		1	7	5	14	9	4			40
31			5	6	7	5	2			25
32			2	8	8	8	2			28
33			4	7	7	6				24
34										
35		1	+2	3	9	8	1			24
36				1	2	1				4
37			1	2	3	1				7
Total n ^o of plants		2	25	43	65	54	10	1		

+ and * are the parental lines utilised in crossing
Coefficient of correlation (Kendall) = -0.0696 n.s. at 5%.

In the later part of the study involving precocity and blight resistance, the results indicate that these two characters can be combined. This is encouraging in view of the necessity to develop precocious, blight resistant varieties to suit for different planting dates and also in intercropping. The recovery of blight resistant segregants with different growth periods offers the scope for developing varieties suitable to different crop rotations in intensive land use agriculture.

Summary

The days to flowering and blight resistance were analysed for certain commercial varieties and blight resistant selections obtained from the crossing of these varieties with Great Northern Nebraska n^o 1, Sel. 27. The commercial varieties were susceptible to blight, while the crosses of these varieties with G. N. Neb 1, Sel. 27 resulted in segregants with higher levels of blight resistance than the progenitors and in general maintained the flowering period similar to the parental commercial variety, though a few segregants were recovered with early or late flowering. The results indicate that there is no correlation between days to flowering and blight rating. Further evidence of this comes from the study of F_2 population of a cross between precocious blight susceptible x normal blight resistant breeding lines where the correlation between time of flowering and blight rating was non

significant. Precocious, blight resistant segregants were obtained suggesting that these two characters can be combined. Such a combination will help evolving bean varieties suited for crop rotation.

Resumo

As dias para floração e resistência à bacteriose foram analisados para algumas variedades comerciais e linhagens resistentes à bacteriose, obtidos pelos cruzamentos dessas variedades com Great Northern Nebraska n^o 1, Sel. 27. As variedades comerciais foram suscetíveis à bacteriose, enquanto os cruzamentos dessas mesmas variedades com Great Northern Nebraska 1, 27 resultou nas segregantes com nível de resistência maior que dos progenitores e de maneira geral, manteve o período de floração semelhante ao das variedades comerciais originais. Entretanto algumas segregantes foram precoces ou tardias na floração. Os resultados indicam que não houve correlação entre dias a floração e tolerância à bacteriose. A maior evidência deste fato foi obtida na população F_2 de cruzamento entre linhagem precoce e susceptível à bacteriose e linhagem com ciclo normal e tolerante à bacteriose, onde a correlação entre o período de floração e tolerância à bacteriose foi não significante. Segregantes precoces e tolerantes à bacteriose foram obtidas sugerindo que estes caracteres são recombináveis. Esse tipo de combinação ajudaria para evoluir as variedades de feijoeiro adequadas para rotação de culturas.

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