UDC 575.222.5: 635.652
Original scientific paper

COMBINING ABILITIES OF INHERITING FIRST POD HEIGHT OF SOME FRENCH BEAN LINES (*PHASEOLUS VULGARIS* L.)

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Zdravković M., J. Zdravković, Lj. Stanković, and N. Pavlović (2005): *Combining abilities of inheriting first pod height of some french bean lines (Phaseolus vulgaris L.)*. – Genetika, Vol. 37, No. 1, 65-70.

First pod height is an important trait, especially for snap bean since it enables the mechanical harvesting. Cultivars with low first pod height may be cut, damaged or not harvested by mechanical harvesting. In our investigation six different snap bean genotypes were used for examination of the first pod height and diallel analysis. The result was obtained by using method 2 model 1 GRIFFING (1956) for analysis of combining abilities. The mode of inheritance was different, as the results showed - from intermediate to super dominance, for both generations (F_1 and F_2). Analysis of combining abilities showed both influence of additive and dominant gene effects. Combination Šumadinka x Zora is suitable for further breeding for first pod height.

Key words: snap bean, inheritance, first pod

INTRODUCTION

The first pod height is an important trait since the height of the first pod enables mechanical harvest, which indirectly influences the production of snap

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bean for processing industry. If the first pod is not high enough, combined harvester will cut, damage or even miss the low pods. Further more, this trait effects the quality of the first pod because when the top of the pod touches the ground in high humidity it provokes rotten and in dry conditions, the first pod changes the natural color. Also, this trait will effect the seed production, since low pods are the first to be effected by diseases and usually in these pods the seed will germinate. In manual harvest, too low pods are not visible enough, so the pickers might miss them. Unpicked pods enable the plant to turn from technological to physiological maturity so the multiple harvests are not possible.

Many authors worked on this subject. DAVIS and FRAIZER (1966) found that the height of forming the first pod is inherited recessively. The first pod height, besides the number of grains per pod and number of pods per grain is the trait that varies the most MIRTANOV, (1981).

Including 6 divergent parents in selection of the first pod height, and establishing general (GCA) and special combinig abilities (SCA) of certain lines, represents good base for further work on breeding and creating new snap bean varieties, suitable for mechanical harvest in technological maturity. We think that we will contribute to solving the problem of mechanized picking of snap bean and that we will be one step further in creating new selections suitable for mechanized picking and other favorable technological traits.

MATERIAL AND METHOD

Six divergent snap bean genotypes have been selected for great number of traits. Genotypes Supernor, Darija and Grinkrop originate from Holand, and Palanačka rana, Šumadinka and Zora originate from Serbia. Varieties Šumadinka, Grinkrop, Palanačka rana, Supernor and Darija belong to determinant genotype group. Except Grinkrop, all varieties are on the List of Agricultural and Forest Plant Varieties and Hybrids of Serbia and Montenegro. Genotypes Supernor, Darija and Grinkrop have green, Palanačka rana and Zora yellow and Šumadinka marble yellow pods.

Controlled hybridization by castrating mother plants and application of pollen from father lines has been performed in warm beds in the Center's greenhouse. Comparative experiment has been conducted by applying standard agrotechnique, on experimental plot of the Center for Vegetable Crops. The sowing has been performed in 60 x 5 cm lines, in random block system with three replicas. Material has been harvested in the technological maturity. The height of the first pod has been measured in the Center's laboratory on dry material and represents the distance from the crown to node with the first pod. Analysis of genetic components has been done according to GRIFFING (1956), method 2, mathematic model 1.

RESULTS AND DISCUSSION

Height of the first pod (Table 1) for selected parents was from 13.86cm (Supernor) to 18.26cm (Grinkrop). In F_1 generation first pod height was from

10.63cm (Supernor x Palanačka rana) to 19.13 cm (Šumadinka x Zora). In F_2 generation it was from 15.05cm (Darija x Grinkrop) to 18.23 cm (Grinkrop x Šumadinka).

Table 1. Mean values and mode of inheritance of the first pod high per snap bean plant

Roditelji Parents		Supernor	Darija	Grinkrop	Pal. rana	Šumadinka	Zora
Supernor	F_1	**13.86**					
	F_2						
Darija	F_1	15.22^{I}	**16.11**				
	F_2	15.95^{D}					
Grinkrop	F_1	13.78^{D}	15.28^{SD-}	**18.26**			
	F_2	15.43^{I}	15.05^{SD-}				
Pal. rana	F_1	10.63^{SD-}	16.50^{H+}	15.50^{D}	**15.51**		
	F_2	15.28^{D}	17.65^{H+}	15.67^{D}			
Šumadinka	F_1	16.08^{I}	17.10^{H+}	14.50^{SD-}	14.75^{SD-}	**17.22**	
	F_2	15.82^{I}	17.50^{H+}	18.23^{D}	16.83^{PD}		
Zora	F_1	11.67^{SD-}	14.25^{SD-}	14.34^{SD-}	11.44^{SD-}	19.13^{H+}	**17.45**
	F_2	15.74^{I}	16.12^{I}	17.65^{PD}	15.15^{SD-}	17.77^{H+}	

Coefficient of variance (CV) was: for parents from 2.09% (Palanačka rana) to 6.33% (Darija). Coefficient of variance for hybrids was from 0.56% (Supernor x Zora) to 9.82% (Darija x Grinkrop). In F_2 generation CV was form 2.67% (Darija x Zora) to 13.72% (Šumadinka x Zora).

Table 2. ANOVA for combining abilities for first pod high per plant

Combining ability Variation	F_1			F_2		F tabl.	
	df	Ms	Fe	Ms	Fe	0.05	0.01
GCA	5	7.34	12.79**	3.57	16.20 **	2.45	3.51
SCA	15	3.86	6.72 **	0.78	3.52**	2.00	2.66
E		0.073		1.90			
GCA/SCA		0.19		4.61			

In F_1 generation intermediate heredity mode was established in two combinations (in both combinations bad parent dominated) and in eleven super-dominations (in 8 combinations heterosis was negative).

In F_2 generation the most common inheritance mode is super-domination, (positive in five and negative in two combinations), intermediate inheritance and domination of one parent in 4 combinations and partial domination of one parent in two combinations.

Analysis of combining abilities. - In inheriting the first pod height in both snap bean generations aditive and non aditive genetic variance are participating, which is proved by highly significant values of GCA and SCA (Table 2).

Table 3. GCA values for first pod hight

Parents		GCA - F_1	Rank	GCA - F_2	Rank
Supernor		-1.39**	6	-1.10**	3
Darija		0.54	2	-0.03	2
Grinkrop		0.47	3	0.48*	4
Palan. rana		-0.80*	5	-0.39	1
Šumadinka		1.23**	1	0.73**	5
Zora		-0.06	4	0.32	6
Se		0.38		0.23	
LSD	0.05	0.76		0.47	
	0.01	1.02		0.64	

Šumadinka is a genotype with highest GCA in both generations and both values are highly significant. The GCA value for Grinkrop in F_2 generation was significant.

Table 4. SCA values for first pod hight

Combinations	F_1	Rank	F_2	Rank
Supernor x Darija	0.89	4	0.69	2
Supernor x Grinkrop	-0.48	7	-0.34	11
Supernor x Palanačka rana	-2.36*	14	0.38	6
Supernor x Šumadinka	1.07	3	-0.20	10
Supernor x Zora	-2.06*	12	0.13	8
Darija x Grinkrop	-0.91	9	-1.79**	14
Darija x Palanačka rana	1.58	2	1.68**	1
Darija x Šumadinka	0.15	6	0.41	5
Darija x Zora	-1.41	11	-0.56	12
Grinkrop x Palanačka rana	0.66	5	-0.80	13
Grinkrop x Šumadinka	-2.33*	13	0.63	3
Grinkrop x Zora	-1.25	10	0.46	4
Palanačka rana x Šumadinka	-0.86	8	0.10	9
Palanačka rana x Zora	-2.87**	15	-1.17**	15
Šumadinka x Zora	2.79**	1	0.33	7
Se	0.93		0.58	
LSD 0.05	1.875		1.163	
0.01	2.510		1.560	

Nine hybrid combinations in F_1 generation and 6 hybrid combinations in F_2 generation had negative SCA in 15 combinations. Highly significant value in F_1 generation had combination Šumadinka x Zora. This is a combination of one good and one not so good general combiner (Table 3). In F_2 generation combination Darija x Palanačka rana (combination of bad general combiners) had significant

SCA. The lowest SCA in F_1 generation had combination Palanačka rana x Zora, and in F_2 generation combination Darija x Grinkrop (Table 4).

Received November 30th, 2004
Accepted February 7th, 2005

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KOMBINACIONE SPOSOBNOSTI NASLEĐIVANJA VISINE PRVE MAHUNE NEKIH LINIJA BORANIJE (*PHASEOLUS VULGARIS* L.)

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Izvod

Visina formiranja prve mahune je važna sortna osobina od koje zavisi mogućnost mehanizovanog ubiranja useva boranije, što je osnova proizvodnje ove biljne vrste za prehrambenu i prerađivačku industriju. Sorte koje nisko formiraju prve mahune, pri mehanizovanoj žetvi, usled nedovoljne visine, bivaju oštećene. U ispitivanje je uključeno 6 divergentnih roditeljskih linija za proces selekcije na povećanje visine formiranja prve mahune. Za utvrđivanje opštih (OKS) i posebnih kombinacionih sposobnosti (PKS) pojedinih linija korišćen je matematički metod 2, model 1 GRIFING (1956). Vrednosti parametara su utvrđivane u F_1 i F_2 generaciji potomstva. Analiza kombinacionih sposobnosti pokazuje delovanje aditivnih i dominantnih genskih efekata. Šumadinka x Zorka predstavljaju najbolju kombinaciju za dalji proces selekcije na povećanje visine prve mahune.

Primljeno 30. XI 2004.
Odobreno 7. II 2005.