Scientific Papers, Series B, Horticulture, Vol. LVI, 2012
ISSN Online 2286-1580, ISSN-L 2285-5653

STUDY OF THE MAIN QUANTITATIVE CHARACTERS VARIABILITY AT COMMON BEAN MAURA VARIETY OBTAINED AT V.R.D.S. BUZĂU

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Abstract

Common bean Maura variety was obtained at Vegetable Research and Development Station Buzău in 2010 by C. Vînătoru and E. Teodorescu. The variety was introduced into production both for protected areas and open field in climbing system since 2010. Research towards obtaining this variety started in 1996 when were obtained as well two other dwarf bean yellow pod varieties, Ioana and Anisia. The study of the quantitative characters variability and correlation between them is very important for breeding process and conservative selection. The conservative selection scheme for each species it cannot be applied without knowing quantitative characters variability for each variety making easier the breeder activity in the selection process. Along with the culture introduction and conservative selection of the variety, a special attention was paid to maintaining the quantitative and qualitative characters variability limits focusing on assuring distinctness, homogeneity and stability. The objective of this study was to present the variability of the main Maura variety characters and their importance in conservative selection works.

Key words: breeding, diversity, homogeneity, selection, stability.

INTRODUCTION

Romanian varieties deficit at these species imposed a special research program at V.R.D.S. Buzău started since 1990. This program aimed at modern breeding of this species for obtaining valuable varieties adapted to the environmental conditions of our country and to the consumers and growers requirements.

Presently, considering our research, the station owns a rich germplasm collection consisting of 200 genotypes and 2 approved varieties of dwarf bean with yellow pod, Anisia and Ioana. The first variety creation with indeterminate growth was finished in 2010, registered by Maura name, variety presented in this study (photo 1). Once registered, this variety was incorporated into crop production, both in open field and protected grounds used in pallisate system. To protect the genetical heritage of this species, it was rigorously investigated in the conservative selection process.

As the phenotypical characters values are influenced by environmental conditions and biological material used, it is necessary to undertake research in the same environmental conditions as the breeding works took place.[1] Studying and knowing quantitative characters and the correlations between them give opportunity to conservative selection responsible to know better his own biological material. He can also apply indirect selection for some characters for easing the selection process. Conservative selection phases applied to the variety were used according to selection sheme publicshed in [3]. Experiment setting and experimental parameters evaluation were according with Saulescu A. and Saulescu N. presented method in [2].

MATERIAL AND METHOD

Research considering main quantitative characters variability of Maura variety were carried out at V.R.D.S. Buzau in 2008-2012. Evaluations and investigations were conducted during an identity preservation experiment in the selection field (SF) and progeny test field (PTF). The experiment took place in the research field of our station, in high tunnel solaria type polygon, on an alluvial medium developed type

of soil with 6,5-6,8 pH and 2,4% humus content. The crop was set in open solaria using their metallic structure to pallisate plants. The land was shaped at 1,4 cm, sowed in 70 cm distance equidistant rows and 30 cm space between plants/row. Previous year obtained super elite (SE) category seed was used as biologic material for selection field and for PTF (progeny test field) were used elites seeds obtained in the selection field. In the selection field were maintained and studied 1800-2000 plants and 400 lines for progeny test field. Phenological and biometrical investigations were performed during vegetation period according to identity preservation plan.

The studied parameters were: pod lenght, pod width, number of pods per plant, number of seeds per pod, number of seeds per plant. For a correct study of characters variability assesed in the selection plan two samples were tested: one at the pods technical maturity and one at the pods physiological maturity. The samples contained 400 individuals randomly chosen from the two populations (SF and PTF).

The main statistical indices were: arithmetic average ($\bar{x}$), standard deviation (s), variation coefficient (vc %), variation amplitude, class variation frequency and standard selection range (x+s). Considering our determinations, we estimate the studied characters variability and selection works were performed.

RESULTS AND DISCUSSIONS

Pod lenght character variability (Photo 1) is manifested by calculated statistical parameters (table 1). Arithmetic average determined in five years was at FS level of 19,9 cm with 19,2 and 20,4 cm variation. PTF value was close to FS (19,6 cm) with a variation between 19,3 and 19,9 cm.

Variation coefficient (VC%= S/$\bar{x}$ *100) values were small demonstrating clearly that this character confers variety distinctness and it is genetic stable contributing obviously at the variety identity.

Table 1. Pod length variability (cm)

Para-meters	Field	Year					Year avg.	Avg. SF and PTF
		2008	2009	2010	2011	2012		
$\bar{x}$	SF	20,4	19,2	20,1	20	19,8	19,9	19,7
	PTF	19,6	19,9	19,7	19,9	19,3	19,6	
S	SF	1,2	2	1,7	1,8	2,1	1,7	1,7
	PTF	1,2	1,7	1,9	1,9	1,9	1,7	
CV %	SF	5,8	10,4	8,4	9	10,6	8,8	8,7
	PTF	6,1	8,5	9,6	9,5	9,8	8,7	
$\bar{x}$ ±S	SF	19,2-21,6	17,2-21,2	18,4-21,8	18,2-21,8	17,8-21,8	18,1-21,6	18-21,5
	PTF	18,4-20,8	18,2-21,6	17,8-21,6	18-21,8	17,4-21,2	17,92-1,4	

Plants measured to determine pod length character variability were the same measured for pod width variability (Table 2).

This parameter also registered a small variability between fields or year by year. Arithmetic average value of five years of study was 18,2 mm for SF and 18 mm for PTF.

Variation coefficient values were small with a general average of 7,7 mm.

$\bar{x}$ ± S limits are 16,7-19,3 mm and there are not significant differences between the two fields.

Photo 1. Pod length evolution (2-19,7 cm)

Table 2. Pod width variability (mm)

Para-meters	Field	Year					Year avg.	Avg. SF and PTF
		2008	2009	2010	2011	2012		
$\bar{x}$	SF	18,9	19,1	18,2	19,2	15,7	18,2	18,1
	PTF	18,8	17,2	19,2	19	16,2	18	
S	SF	1,3	1,5	1,6	1,4	1,5	1,4	1,3
	PTF	1,6	1	1,6	1,6	1	1,3	
CV %	SF	6,8	7,8	8,7	7,2	9,5	8	7,7
	PTF	8,5	5,8	8,3	8,4	6,1	7,4	
$\bar{x}$±S	SF	17,6-20,2	17,6-20,6	16,6-19,8	17,8-20,6	14,2-16,6	16,7-19,5	16,7-19,3
	PTF	17,2-19,6	16,2-18,2	17,6-20,8	17,4-20,6	15,2-17,2	16,7-19,2	

The number of pods per plant character is the main character reflecting variety productivity. The evaluations of five years of study presented in table no. 3 show that the average number of pods per plant was 34,2. In the same year, there are not significant differences between the two fields (SF and PTF). Concerning standard deviation, a high coefficient was manifested with a value over 20%. Also $\bar{x} \pm S$ interval, considered standard for selection, had values between 28,1 and 40,3 which corespond a number of 22 and 48 pods per plant. Assesing these registered values we ascertain that these year by year yield fluctuations are generated by less favorable weather conditions (Photo 2).

Table 3. Number of pods per plant variability

Para-meters	Field	Year					Year avg.	Avg. F and PTF
		2008	2009	2010	2011	2012		
$\bar{x}$	SF	37,7	33,2	36	40,4	27,6	34,9	34,2
	PTF	37,2	32,6	32,8	37,9	27,2	33,5	
S	SF	6,2	5,6	6,2	8,2	4,8	6,2	6
	PTF	6	5,4	6	7,5	5	5,9	
CV %	SF	16,4	16,8	17,2	20,2	17,3	17,5	17,6
	PTF	16,1	16,5	18,2	19,7	18,3	17,7	
$\bar{x} \pm S$	SF	31,5-43,9	27,6-38,8	29,8-42,2	32,2-48,6	22,8-34,4	28,7-41,1	28,1-40,3
	PTF	31,2-43,2	27,2-38	26,8-38,8	30,4-45,4	22,2-32,2	27,5-39,5	

Evaluating the registered values in table no. 4 we ascertain the seeds number per pod variability had close values for the two fields, SF and PTF. Significant differences are shown year by year.

Average value obtained in five years of selection was of 7,1 seeds per pod respectively 7,2 SF and 7,1 PTF. And for lines at $\bar{x} \pm S$ level was 6-8,3.

According to these results appropriate elites and lines for selection process were obtained. The ones which not correspond this interval were eliminated. This operation was performed for every field and each year.

Table 4. Number of seeds per pod variability

Para-meters	Field	Year					Year avg.	Avg. SF and PTF
		2008	2009	2010	2011	2012		
$\bar{x}$	SF	7,5	6,6	8	7,3	7	7,2	7,1
	PTF	7,3	6,8	7,8	7,5	6,5	7,1	
S	SF	1,5	1,4	1,2	1,1	0,8	1,2	1,1
	PTF	1,5	1,4	1,2	1,1	0,7	1,1	
CV %	SF	20	20,5	15	15	11,4	16,3	16,3
	PTF	20,5	20,5	15,3	14,6	10,7	16,3	
$\bar{x} \pm S$	SF	6-9	5,2-8	6,8-9,2	6,2-8,4	6,2-7,8	6-8,4	6-8,3
	PTF	5,8-8,8	5,4-8,2	6,6-9	6,4-8,6	5,8-7,2	6-8,3	

Number of seeds per pod parameter variability is large, VC=20,8%. This reflects that the character is in direct correlation with number of pods per plant, which had also a large variability (Photo 3).

The two fields average value for five years was 255,2 seeds per plant with $\bar{x} \pm S$ limits variation between 201,4 and 309,1. In 2012 this parameter dramatically diminish for the same reason mentioned at average number of pods per plant.

The selection of elites and lines for progeny was made respecting $\bar{x} \pm S$ interval for every field and year.

Table 5. Number of seeds per plant variability

Para-meters	Field	Year					Year avg.	Avg. SF and PTF
		2008	2009	2010	2011	2012		
$\bar{x}$	SF	289,6	286,5	235	305,6	180,8	259,5	255,2
	PTF	285,5	272,6	226,7	297,2	173,4	251	
S	SF	57,2	59,7	48,8	67,2	34,6	53,5	53,8
	PTF	56,7	60,2	48,5	71	34,8	54,2	
CV %	SF	19,7	20,8	20,7	21,9	19,1	20,4	20,8
	PTF	19,8	22	21,3	23,8	20	21,3	
$\bar{x} \pm S$	SF	232,4-346,8	226,8-346,2	186,2-283,8	238,4-372,3	146,2-215,4	206-313	201,4-309,1
	PTF	228,8-342,2	212,4-332,8	178,2-275,2	226,2-368,2	138,6-208,2	196,8 305,3	

Photo 2. Number of pods per inflorescence = 4 (varies between 3-6). Number of pods per plant=34,2 (average)

Photo 3. Number of seeds per pod = 7,1 (average)

CONCLUSIONS

Maura variety obtained at V.R.D.S Buzău is an homogeneous population that manifests genetic stability concerning the main quantitative parameters, it qualifies for distinctness, homogeneity and stability normal criteria.
The studied quantitative characters record the following average values and variation limits ($\bar{x} \pm S$):

- pod length:
  $\bar{x}$ = 19,7 cm; $\bar{x} \pm S$=18-21,5 cm
- pod width:
  $\bar{x}$ = 18,1 mm; $\bar{x} \pm S$=16,7-19,3 mm
- number of pods per plant:
  $\bar{x}$ = 34,2; $\bar{x} \pm S$=28,1-40,3
- number of seeds per pod:
  $\bar{x}$ = 7,1 ; $\bar{x} \pm S$=6-8,3
- number of seeds per plant:
  $\bar{x}$ = 255,2 ; $\bar{x} \pm S$=201,4-309,1

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PLANT PRODUCTION SYSTEMS


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