THE INVESTIGATION OF STEAM HEIGHT VARIABILITY FOR SOME UV IRRADIATED BEAN CULTIVARS

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INTRODUCTION

Due to the stratospheric ozone lay depletion, the scientific world researches, focused in the last decades on the study of solar radiations reaching Earth surface, and particular on the effects of UV irradiations on organisms survival. Most of observations were made to establish the way that animal cells react to UV irradiation. A modern question is which are the irradiation effects on vegetal organisms, concerning the influence of radiations at the level of biochemical and genetical processes, and on the variability of characters in the aim of culture plants amelioration.

The choice of *Phaseolus vulgaris* as biological material for investigations, can be explained by the importance of seeds and legumes in humans nutrition, being considered since centuries the poor peoples “meat” because of the increased level of high quality proteins, and the high energetically level, and due to the importance in soil amelioration, being used as very good previous culture plant for many other species. The genotypes used in culture are sensitive for environmental stress factors which reduces productivity, and the possibility to use UV radiation as mutagenic agent to ameliorate cultivars and increase productivity is investigated.

In the present paper, the aim was to present the results of investigations concerning the variability of steam high for some Romanian bean cultivars, as response to UV irradiation.

MATERIAL AND METHODS

Investigations were made in fields belonging to S.C.D.A. Podu - Iloaiei, Iaşi, in the period 2002-2004, on 6 bean cultivars, created in Romania. In field were sawn for each cultivar UV irradiated variants and control, in 3 repetitions, with experimental fields of $5m^2$ using the bifactorial method. The biological material was represented of Diva, Star, Vera, Ami, Avans and Ardeleana cultivars.

The steam high measurements were made on 10 plants/ experimental field/ repetition by harvesting (at physiological maturity). For results interpretation regular statistic methods were used: variability coefficients (s%), variance analysis, limit difference.

Climatic conditions were different in the 3 years of experiments: 2002 was normal, but 2003 and 2004 were arid, not proper for bean culture.

RESULTS AND DISCUSSIONS

There are at least 2 ways to consider variability. Once as individual phenotypic variability in the way of more or less uniformity of individuals which belong to a cultivar and other as variability between distinct cultivars, reflecting genetic difference between genotypes.

The steam high and shape is of a big importance directly in what it means plant resistance to fall and harvesting type and indirectly for seeds and legumes yield.

For the investigated genotypes, plants high, vary depending on cultivar, on genotype, on year of sawn and UV irradiation (Table 1). The average value of bean plants high was situated between 37,0cm (Star) and 50,7cm (Ami- UV).

Plants steam high was variable from one year to the other: 37,0cm (Vera) – 57,3cm (Star– UV) in 2002, 36,7cm (Diva- UV) and 52,1cm (Ami- UV) in 2003, and between 34,0cm (Star) and 44,5cm (Ami –UV) in 2004. For UV irradiated genotypes, the annual average of steam high vary between 39,9cm (2004) and 52,1cm (2002). The multi-annual average of steam high, per experimental series, was 45,6cm. For non irradiated cultivars, the average of steam high for whole experiment was 40,1cm, with annual averages situated between 38,5cm (2004) and 41,9cm (2003).

Regarding the plant steam high average at the species level (considering all genotypes together), the obtained value was 42,8cm, with limits between 39,2cm (2004) and 45,9cm (2002).

It can be noticed that the high of irradiated variants increased comparing with the same non irradiated cultivar, excepting Diva – UV and Avans – UV (2003).

Variability coefficients value (s%), for both irradiated and non irradiated genotypes, were low, (s% ≤ 10%), which proves a reduced phenotypical variability, due to, either cultivars uniformity or the fact that for mutant genotypes the major variations appears in the next generations. To be noticed Vera – UV for which for all related years the steam high variations limits are large (Tab. 1).

Both, the variance analysis on experimental years, and variance analysis on experimental series (2002-2004) shows in detail the difference existing between genotypes, as well as the UV-plant interaction, depending also of the year of experiment (Tab. 2, 3, 4 and 5).

For 2002 and 2003 obtained F samples values are higher than theoretical F values (2,66 – 7,90) showing the existence of real differences between experimental variants. F samples values are showing distinct significant actions for UV irradiation and cultivar factors and a distinct significant interactions between those (Tab. 2, 3). For 2004 F sample value shows a distinct significant action of both factors,without a distinct significant interactions between them (Tab.4).

Regarding the establishment of the significance of differences comparing to average value for controls, for experiments series, we used the methods of limit differences (DL). Because for all variants was calculated an unique estimation of error, the error of difference will be the same for each comparison between different factors combinations.

Like that, in conformity with Tab.5, we can conclude that comparing with the average of plant steam high, Vera – UV, Star – UV and Ami – UV cultivars, had positive and very significant differences for this character, between 10% and 18%. From UV irradiated cultivars, regarding steam high, it can be evidenced Ami – UV. For controls, Avans in 2003 was a very significant positive difference and Ami in 2004 the same.

Table 1.

Plant steam high annual variation (cm) for bean genotypes, SCDA Podu-Iloaiei-2002-2004

Cultivar	Average 02-04		2002		2003		2004	
	Average	s%	Average	s%	Average	s%	Average	s%
Diva – UV	43,8	3,70	55,9	2,98	36,7	5,12	38,9	2,99
Star - UV	47,7	4,31	57,3	4,66	50,2	3,68	35,5	4,60
Vera – UV	47,1	5,30	53,9	5,25	46,2	5,80	41,3	4,85
Ami – UV	50,7	2,93	55,4	2,12	52,1	2,60	44,5	4,07
Avans – UV	43,1	2,63	45,0	2,16	43,7	3,00	40,7	2,73
Ardeleana – UV	41,6	4,31	45,0	2,16	40,6	5,91	39,2	4,87
Average - UV	**45,6**	**3,86**	**52,1**	**3,22**	**44,8**	**4,35**	**39,9**	**4,02**
Diva	39,3	3,36	41,2	2,46	39,0	4,39	37,7	3,23
Star	37,0	2,67	38,9	1,90	38,2	2,42	34,0	3,71
Vera	40,1	3,25	37,0	2,69	42,8	3,01	40,5	4,07
Ami	41,6	2,65	39,2	2,72	43,5	2,09	42,1	3,15
Avans	42,1	2,77	39,0	0,87	48,8	4,07	38,6	3,37

Ardeleana.	40,3	2,93	44,0	1,01	39,0	3,54	38,0	4,26
Average	**40,1**	**2,94**	**39,9**	**1,94**	**41,9**	**3,25**	**38,5**	**3,63**
General average	**42,8**	**3,40**	**45,9**	**2,58**	**43,3**	**3,80**	**39,2**	**3,82**

Table 2.

Variance analysis for poly-factorial experiment placed in random blocks, Podu. Iloaiei- 2002

Variability cause	SP	GL	s^2	Sample F (5%;1%)
Total	1982,87	35	-	
Repetition	25,63	2	-	
Treatment	1339,56	1	1339,56**	485,34 (4,30 ; 7,90)
Cultivar	186,92	5	37,38**	13,54 (2,66 ; 3,99)
Interaction Trat. X Cultivar	369,99	5	73,99**	26,80 (2,66 ; 3,99)
Error	60,77	22	2,76	

Table 3.

Variance analysis for poly-factorial experiment placed in random blocks, Podu. Iloaiei- 2003

Variability cause	SP	GLs	s^2	Sample F (5%;1%)
Total	882,85	35		
Repetition	3,37	2		
Treatment	82,81	1	82,81**	39,81 (4,30 ; 7,90)
Cultivar	438,57	5	87,71**	42,16 (2,66 ; 3,99)
Interaction Trat. X Cultivar	312,26	5	62,45**	30,02 (2,66 ; 3,99)
Error	45,84	22	2,08	

Table 4.

Variance analysis for poly-factorial experiment placed in random blocks, Podu Iloaiei- 2004

Variability cause	SP	GL	s^2	Sample F (5%;1%)
Total	299,36	35		
Repetition	6,61	2		
Treatment	21,16	1	21,16**	19,77 (4,30 ; 7,9)
Cultivar	245,16	5	49,03**	45,85(2,66 ; 3,99)
Interaction Trat. X Cultivar	2,75	5	0,55	0,51(2,66 ; 3,99)
Error	23,68	22	1,07	

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Table.5.

Variance analysis for poly-factorial experiment placed in random blocks, Podu Iloaiei- 2002-2004

Variability cause	SP	GL	S^2	Sample F (5% ; 1%)
Years	830,81	2		
Repetition	35,62	6		
Treatment	843,37	1	843,37**	428,10 (3,98 ; 7,01)
Treatment X Years	600,16	2	300,08**	152,32 (3,13 ; 4,92)
Cultivars	303,38	5	60,67**	30,79 (2,35 ; 3,29)
Cultivars X Years	567,27	10	56,72**	28,79 (1,97 ; 2,59)
Cultivars x treatments	362,17	5	72,43**	36,76(2,35 ; 3,29)
Cultivars x treatment x Years	322,83	10	32,28**	16,38(1,97 ; 2,59)
Error	130,29	66	1,97	

CONCLUSIONS

The improvement of researches on bean is a request for the adjustment of agricultural cultures management on the specific of small private companies from Romania.

The study of steam high variability for some Romanian bean cultivars under UV irradiation, represents the start point for using mutants as initial material in this character amelioration process.

Variability coefficients (s%), for both irradiated and control variants, had low values (s% ≤ 10%), due to cultivars uniformity and because at mutant genotypes, ample variations appear in the next generations. Could be noticed Vera – UV, for which in all experiments years, the steam high variation was increased (s%> 5%).

For variance analysis, samples F shows a significant variation of main factors and for the interaction between those and years of experiments.

Between UV irradiated cultivars, regarding steam high can be noticed Ami – UV, and for control variants Avans, which in 2003 had a significant positive difference, as well as in 2004 Ami cultivar.

Table 6.

Plant steam high annual average variation (cm) for irradiated and non irradiated bean genotypes, SCDA Podu-Iloaiei-2002-2004

Cultivar	2002		2003		2004		2002-2004	
	Average	%	Average	%	Average	%	Average	%
Diva– UV	55,9***	122	36,7°°°	84	38,9	99	43,8	102
Star– UV	57,3***	125	50,2***	116	35,5°°°	90	47,7***	111
Vera– UV	53,9***	117	46,2*	106	41,3*	105	47,1***	110
Ami– UV	55,4***	121	52,1***	120	44,5***	114	50,7***	118
Avans– UV	45,0	98	43,7	101	40,7	104	43,1	101
Ardeleana. – UV	45,0	98	40,6°	93	39,2	100	41,6	97
Diva	41,2°	90	39,0°°°	90	37,7	96	39,3°°°	92

Star	38,9°°°	85	38,2°°°	88	34,0°°°	87	37,0°°°	86
Vera	37,0°°°	81	42,8	99	40,5	103	40,1°°°	94
Ami	39,2°°°	85	43,5	100	42,1**	107	41,6	97
Avans	39,0°°°	85	48,8***	112	38,6	98	42,1	98
Ardeleana.	44,0	96	39,0°°°	90	38,0	97	40,3°°	94
Control average	**45,9**	**100**	**43,3**	**100**	**39,2**	**100**	**42,8**	**100**

DL 5%	= 2,7 cm	2,4 cm	1,7 cm	1,6 cm
DL 1%	= 3,8 cm	3,3 cm	2,3 cm	2,1 cm
DL 0,1%	= 5,1 cm	4,4 cm	3,2 cm	2,7 cm

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