Results Regarding Yield Elements Obtained at Different Densities at Certain Soybean Varieties

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ABSTRACT

In general, aside from the soybean variety and adequate fertility, different row spacing and density are a major agronomic factors that significantly influence yield potential.

Soybean plants are influenced by the changes in plant population such as different densities namely the competition. Previous research reached these issues from various aspects, however, there is a lack of information regarding how interplant competition affects the yield components or how Romanian varieties of soybean respond to different plant density environments. The objective of this study was to determine the density effects on soybean yield and yield components.

Keywords: *density, grain yield, morphological characteristics, soybean varieties*

INTRODUCTION

Soybean (*Glycine max* L.) is a species of legume native to Eastern Asia. Among the legumes, the soybean, is classified as an oilseed, is pre-eminent for its high protein content as well as its high oil content (Perkins, 1995).

The optimum plant density with proper geometry of planting is dependent on variety, its growth habit and agro-climatic conditions (Bilal Ahmad et al, 2009). The increase of plant population reduce yield of individual plants but increases yield per unit of area (RA Ball et al, 2000).

To meet the diversity of ecological conditions found in Transylvania Plain, A.R.D.S. Turda has a wide range of early and very early soybean varieties and the soybean varieties created at A.R.D.S. Turda meet all the features and characteristics needed to achieve the aims of the Breeding Program such as high potential production, high insertion of

the basal pods, resistance to lodging, shattering, bacterial blight, downy-mildew, ensures suitable conditions for mechanized harvesting and remarkable qualitative traits, high protein and oil content (Muresanu, 2003, 2011).

MATERIALS AND METHODS

In the study were included nine early and very early soybean varieties created at Agricultural Research and Development Station Turda and four foreign soybean varieties (Tabel 1).

This research was carried out as factorial experiment based on randomized blocks design with two replications during growing season of 2012 at Agricultural Research and Development Station Turda.

At the end of growth season, 10 plants were selected from each plot randomly and measured yield and morphological characteristics such as: plant height, height of the first basal pod, number

of branches per plant, number of pod per plant, number of grain per plant, grains weight per plant, thousand grain weight (TGW). After the extraction of 10 plants randomly all plants were harvested.

RESULTS AND DISCUSSION

The different densities have influenced the response of seed yield and yield components at both the Romanian and foreign soybean varieties. Soybean yield elements obtained at different plant

Tab. 1. The soybean varieties used in the study

No.	Variety	Source
1	Diamant	ARDS Turda
2	Perla	ARDS Turda
3	Safir	ARDS Turda
4	Eugen	ARDS Turda
5	Onix	ARDS Turda
6	Felix	ARDS Turda
7	Darina TD	ARDS Turda
8	Cristina TD	ARDS Turda
9	Mălina TD	ARDS Turda
10	Dekabig	S.U.A
11	Asgrow	S.U.A
12	Condor	Novi Sad SERBIA
13	Balkan	Novi Sad SERBIA

density were determined by the yield elements and in this case we focus on the: plant height, number of branches per plant, grains weight per plant and also on the yield.

Yield elements

Plant height

The study showed that in the case of plant height there were significant differences at the D3 (600 000 seeds/ha) and D4 (750 000 seeds/ha) densities and also at the 25 cm distance between rows. (Tabel 2) We can notice some genotypes with a high plant height such as: Safir (92 cm), Onix (92cm), Condor (89cm). (Tabel 3)

Number of branches per plant

In the case of number of branches per plant was also observed the very significant difference between densities, the most positive difference was notice at the D3 density (600 000 seeds/ha) with 9,9 % more then the average number of branches per plant and the 25 cm distance between rows. (Tabel 4) Varieties like Perla and Felix with a average number of branches of 61 and Eugen with a average of 67 were notice in the study. (Tabel 5)

Grains weight per plant

The study showed that in the case of grains weight per plant the positive difference was at the D3 (600 000 seeds/ha) with 5,5 per cent more then the average weight and also at the 25 cm

Tab. 2. Influence of density and distance between rows of plant height at the soybean varieties studied (Turda, 2012)

Source of variance	Plant height (cm)	Check	%	Difference	Significance
Density					
D1 300 000 seeds/ha	78	80	97,6	-1,90	000
D2 450 000 seeds/ha	80	80	99,6	-0,33	0
D3 600 000 seeds/ha	81	80	101,4	1,13	***
D4 750 000 seeds/ha	81	80	101,4	1,10	***
DL p 5%	0,27				
DL p 1%	0,37				
DL p 0,1%	0,48				
Distance between rows					
50 cm	78	80	97,7	-1,87	000
25 cm	82	80	102,3	1,87	***
DL p 5%	0,19				
DL p 1%	0,26				
DL p 0,1%	0,34				

distance between rows (Tabel 6). We can notice some genotypes with a high grain weight such as: Eugen, Felix and Asgrow (Tabel 7).

The different densities have influenced the response of seed yield and yield components at both the Romanian and foreign soybean varieties.

Soybean yield elements obtained at different plant density were determined by the plant height, height of the first basal pod, number of branches per plant, number of pod per plant, number of grain per plant, grains weight per plant, thousand grain weight. Results indicated that the soybean

Tab. 3. Plant height at the soybean varieties studied (Turda, 2012)

No.	Variety	Average (cm)	Check	%	Difference	Significance
1	Diamant	74	80	92,6	-5,92	000
2	Perla	82	80	102,4	1,92	**
3	Safir	92	80	114,2	11,42	***
4	Eugen	81	80	100,7	0,55	*
5	Onix	92	80	114,2	11,42	***
6	Felix	81	80	101,9	1,55	**
7	Darina TD	73	80	92,0	-6,45	000
8	Cristina TD	84	80	104,9	3,92	**
9	Mălina TD	83	80	103,8	3,05	**
10	Dekabig	69	80	86,2	-11,8	000
11	Asgrow	70	80	87,9	-9,70	000
12	Condor	89	80	110,2	8,17	***
13	Balkan	72	80	89,0	-8,83	000

DL p 5% 0,53
DL p 1% 0,75
DL p 0,1% 1,06

Tab. 4. Influence of density and distance between rows on number of branches per plant at the soybean varieties studied (Turda, 2012)

Source of variance	Number of branches per plant	Check	%	Difference	Significance
Density					
D1 300 000 seeds/ha	53	55	97,1	-1,58	-
D2 450 000 seeds/ha	52	55	94,3	-3,12	00
D3 600 000 seeds/ha	60	55	109,9	5,42	***
D4 750 000 seeds/ha	54	55	98,7	-0,73	-

DL p 5% 0,27
DL p 1% 0,37
DL p 0,1% 0,48

Distance between rows

50 cm	54	55	98,3	-0,94	00
25 cm	56	55	101,7	0,94	**

DL p 5% 0,55
DL p 1% 0,74
DL p 0,1% 0,96

varieties have similar behavior in respect to different densities and row spacing.

We can notice some genotypes from the yield point of view such as Condor (2164 kg/ha), Malina TD and Dekabig both with 2113 kg/ha, Safir, Onix and Cristina TD with a yield around 2000 kg/ha

(Figure 1). The influence of density on yield was significantly positiv in the case of D3 (600 000 seeds/ha) with 2164 kg/ha, 12 % more the the average yield obtained in the conditions of the year 2012 (Tabel 8).

Tab. 5. Number of branches per plant of the soybean varieties studied (Turda, 2012)

No.	Variety	Average	Check	%	Difference	Significance
1	Diamant	56	55	103,1	1,70	-
2	Perla	61	55	112,3	6,70	***
3	Safir	48	55	88,3	-6,42	00
4	Eugen	67	55	123,2	12,70	***
5	Onix	55	55	99,8	-0,11	-
6	Felix	61	55	112,0	6,58	***
7	Darina TD	52	55	94,5	-2,99	-
8	Cristina TD	51	55	93,4	-3,61	0
9	Mălina TD	50	55	90,9	-4,99	00
10	Dekabig	51	55	93,3	-3,67	0
11	Asgrow	51	55	93,3	-3,67	0
12	Condor	56	55	102,9	1,58	-
13	Balkan	51	55	93,1	-3,80	0
DL p 5%		3,23				
DL p 1%		4,53				
DL p 0,1%		6,40				

Tab. 6. Influence of density and distance between rows grains weight per plant at the soybean varieties studied (Turda, 2012)

Source of variance	Grains weight per plant (gr)	Check	%	Difference	Significance
Density					
D1 300 000 seeds/ha	18,4	18,7	98,3	-0,31	00
D2 450 000 seeds/ha	18,2	18,7	97,3	-0,51	000
D3 600 000 seeds/ha	19,8	18,7	105,5	1,03	***
D4 750 000 seeds/ha	18,5	18,7	98,9	-0,20	00
DL p 5% 0,07					
DL p 1% 0,09					
DL p 0,1% 0,12					
Distance between rows					
50 cm	18,4	18,7	98,4	-0,29	000
25 cm	19,0	18,7	101,6	0,29	***
DL p 5% 0,05					
DL p 1% 0,06					
DL p 0,1% 0,08					

Tab. 7. Grains weight per plant at the soybean varieties studied (Turda, 2012)

No.	Variety	Groins weight per plant (gr)	Check	%	Difference	Significance
1	Diamant	19,2	18,7	102,4	0,45	**
2	Perla	18,5	18,7	98,8	-0,23	00
3	Safir	18,0	18,7	96,0	-0,76	000
4	Eugen	20,0	18,7	106,5	1,22	***
5	Onix	18,6	18,7	99,3	-0,13	-
6	Felix	19,5	18,7	103,9	0,74	**
7	Darina TD	18,7	18,7	99,6	-0,08	-
8	Cristina TD	17,9	18,7	99,5	-0,84	000
9	Mălina TD	18,5	18,7	98,6	-0,27	00
10	Dekabig	18,9	18,7	100,6	0,12	-
11	Asgrow	19,2	18,7	102,2	0,42	**
12	Condor	18,6	18,7	99,2	-0,15	0
13	Balkan	18,3	18,7	97,5	-0,46	000
DL p 5%		0,15				
DL p 1%		0,21				
DL p 0,1%		0,29

Fig. 1. Soybean varieties yield, Turda, 2012**Tab. 8.** The influence of density on yield (Turda, 2012)

Density	Yield		Difference (kg/ha)	Significance
	Average (kg/ha)	Relative (%)		
D1 300 000 seeds/ha	1803	93	-136	0
D2 450 000 seeds/ha	1840	95	-99	-
D3 600 000 seeds/ha	2164	112	226	***
D4 750 000 seeds/ha	1949	101	10	-
Mean	1939	100	0.00	mt
LSD (p 5 %)	124			
LSD (p 1 %)	166			
LSD (p 0,1 %)	219			

CONCLUSIONS

These results improve the understanding of correlations between different densities and soybean yield and yield components, also the response of the genotype to different interplant competition.

Soybean yield elements obtained at different plant density were determined by the yield elements and in this case we focus on the: plant height, number of branches per plant, grains weight per plant and also on the yield. The best results were obtained in the case of the characters studied at the 600 000 seeds / ha density and 25 cm distance between rows.

We can notice some genotypes from the yield point of view such as Condor (2164 kg/ha), Malina TD and Dekabig both with 2113 kg/ha, Safir, Onix and Cristina TD with a yield around 2000 kg/ha.

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