INFLUENCE OF SEED SIZE GRADE ON SUNFLOWER PLANT HIGH

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ABSTRACT

The seed size is one of the seed quality components which affect the performance of the crop. In order to equalize the quality, the seeds are processed and packed by grade where seeds are separate by size and specific weight. The objective of this study was to examine the effect of seed processing and grading on sunflower plant height at bud stage. The field experiment was carried out during the growing seasons of 2010 and 2011, with six seed grade of hybrid Sremac at the experimental fields of Institute of Field and Vegetable Crops at Rimski šančevi and Zrenjanin Agricultural Advisory Services. Data were analyzed using three-way ANOVA for a split-split-plot design. Based on obtained results it can be concluded that the effect of all three observed factors - locality, growing seasons and seed grade on sunflower plant height at bud stage was statistically highly significant as well as interaction year x locality, while other interactions did not show statistical significance. Also, significant differences were observed between bigger and smaller grades, where the plant height proportionally decreased with seed size.

Key words: Plant Height, Seed Size, Sunflower

INTRODUCTION

Seed quality is a collection of properties that are considered to have a significant impact on the seed value which is used for sowing (FAO, 1999). The seed size is one of the seed quality components which affect the performance of the crop, and therefore on the yield (Singh et al., 2010; Adebisi et al., 2013).

In the sunflower seed production the most important is to get a high quality seed as a final product. The quality, and therefore the seed size, primarily is determined by growing conditions and it is necessary to cultivate crop in optimal plant density, the more fertile soils, with timely and quality execution of all other agro-technical measures (Crnobarac, 1992). On the other hand, seed quality depends not only on field conditions and cultural practices applied but also on seed processing (Miklič et al., 2012). During processing, unwanted ingredients are removed from the natural seeds by applying various technological processes, based on differences in the seed characteristics (Prole et al., 2011).

Commercially seed are rarely uniform in size, and in one lot can be found the seeds of different sizes and different quality (Komba et al., 2007). The goal of seed processing is to prepare seed material in form and condition suitable for sowing, by separation seeds by size

(Štatkić et al., 2007). Pucarić (1992) considered it necessary make seed calibration because it affects the uniform germination, emergence and early growth of plants, and therefore provides a higher yield. Similar attitudes present Pucarić and Ujević (1986) and conclude that the corn seed calibration can accomplish 15% higher yields compared to commonly seed processing. Calibration, i.e. equalizing of seed by size and weight, affect seed quality, but also visual appearance on the increasingly demanding market and provides uniform sowing. Global standards do not prescribe calibration parameters, and calibration of sunflower seeds is done by experience (Prole et al., 2011).

Processing can have various and very large impact on seed quality in different sunflower genotypes, and it is necessary to know the specific characteristics of each genotype, especially in the case of seeds with lower quality (Miklič et al., 2012).

The objective of this study was to examine the effect of seed processing and grading on sunflower plant height at bud stage.

MATERIAL AND METHODS

The research was carried out on seed of hybrids Sremac, conventional oil hybrid created in the Institute of Field and Vegetable Crops from Novi Sad. The seed is produced within the seed production by applying agro-technical measures required by the technology of sunflower hybrid seed production.

Natural seed was pre-cleaned, and after processing separated into six grades. First, seed was graded with a *Cimbria Heid* type *ZS 500* cylinder grader, with the screens set to make two grades, small seeds of 2.8 -3.5 mm and large seeds of 3.5-5.0 mm. After that, both grades were run through a *Cimbria Heid* type *GA 200* gravity table to separate seeds by specific weight. 1000-seed weight was determined for each grade (Table 1).

Table 1. Seed grade of hybrid Sremac

Seed grade	Diameter (mm)	1000-seed weight (g)
I	3.0 – 5.0	66.4
II	3.0 – 5.0	71.8
III	3.0 – 5.0	57.1
IV	3.0 – 5.0	54.1
V	2.8 – 3.0	50.5
VI	2.8 – 3.0	47.7

After processing seed was chemically treated with Cimbria *Heid* type *CC 50* centrifugal duster with fungicide *Apron XL 350 EC* (300 ml per 100 kg seed) and insecticide *Cruiser 350 FS* (1 l per 100 kg seed), with addition of polymer Sepiret (500 ml per 100 kg seed), that allows a better adhesion of pesticides for seed. Seed processing and treatment, as well as sample preparation was conducted in the Oil Crops Department of Institute of Field and Vegetable Crops in Novi Sad.

The field experiment was carried out during the growing seasons of 2010 and 2011, at the experimental fields of Institute of Field and Vegetable Crops at Rimski šančevi and Zrenjanin Agricultural Advisory Services according to the *split-plot* model design with three replications.

Plant height was measured by a graduated stick, and parameter values are expressed in cm. The measurement was carried out in the bud stage (R2), according to Schneiter and Miller (1981).

Statistical analysis of data was performed by analysis of variance (ANOVA) of the tri-factorial trial using the statistical package *STATISTIKA 10.0* for *split-split-plot* design model. Table of analysis of variance shows the probability of significance of differences by F-test, and based on the participation in the treatment sum of squares, percentage ratio of each factor was calculated in the total variability. LSD values at 1% and 5% were computed to compare differences between treatments of the observed factor.

RESULTS AND DISCUSSION

The results of ANOVA showed that the interaction year x locality had the greatest influence on plant height in bud stage, with a participation of 65% in the total variation of these properties. Also, a highly significant influence had all the examined individual factors although their participation was a smaller percentage, at seed grade only 7% (Table 2).

Table 2. ANOVA for hybrid Sremac plant height at bud stage

Source of variation	df	SS	% in SS	MS	F	P
Y x L x Rep.	8	1291.00	-	161.38	3.72	0.002**
Year (Y)	1	3500.06	13	3500.06	80.79	<.001**
Locality (L)	1	3253.56	12	3253.56	75.10	<.001**
Seed grade (G)	5	1997.17	7	399.43	9.22	<.001**
Y x L	1	17734.72	65	17734.72	409.34	<.001**
Y x G	5	331.78	1	66.36	1.53	0.202ns
L x G	5	304.28	1	60.86	1.40	0.243ns
Y x L x G	5	184.44	1	36.89	0.85	0.522ns
Error	40	1733.00	-	43.33	-	-
Total	71	30330.00	100	-	-	-

**significant at the 1% level of probability; *significant at 5% level of probability; ns not significant

On average, highly significantly higher plant height was measured in 2010 (130.31 cm), and at the locality Rimski šančevi (130.06 cm). The reason for these results we can see on the interaction year x location, where is in the locality of Zrenjanin in 2011 the highly significantly lowest plant height was measured (93.94 cm). Also, highly significantly lower height had plants at Rimski šančevi in 2010 in relation to Zrenjanin in 2010 and Rimski šančevi in 2011, where no statistically significant difference was found (Figure 1).

Looking at the seed grades, we can see that the plant height, on average, decreased proportionally the seed size (Figure 2). Therefore, the largest plant height was measured in I grade, and the lowest in VI, and this difference was highly significant. Plant height of I grade was significantly higher compared to other tested grades, except in relation to II grade, where the difference was not statistically significant. Also, significant differences were observed between II grade and other tested grades, among which no statistically significant difference was found. Almost identical results can be noted for the first order interactions - year x seed grade and location x seed grade, for both investigation years and both localities.

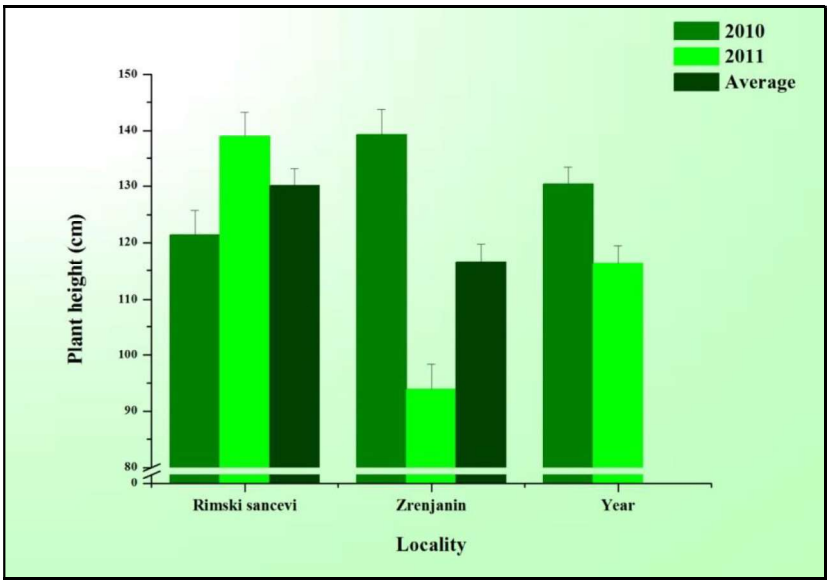

Figure 1. The effect of locality and production year on hybrid Sremac plant height at bud stage

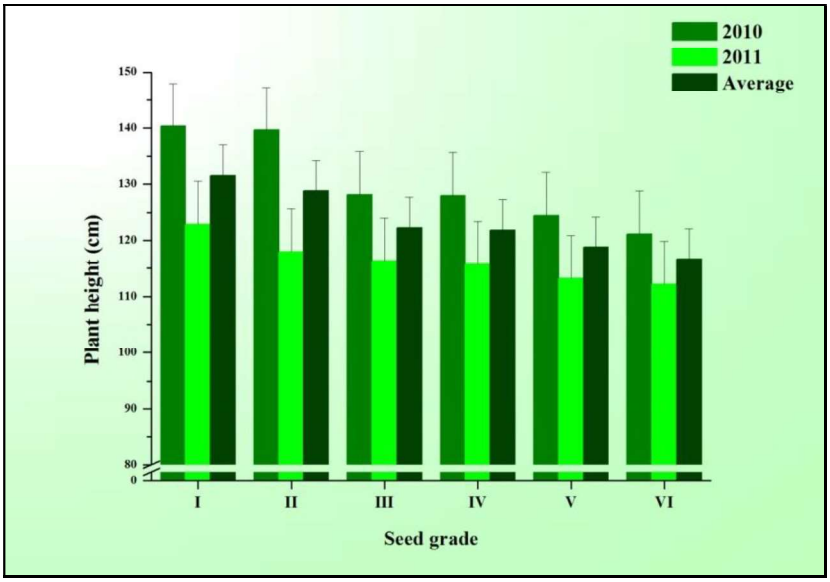

Figure 2. The effect of seed grade and production year on hybrid Sremac plant height at bud stage

Plant height mostly depends on genotype (Velasco et al., 2003; Mijić et al, 2005) and cropping practices and especially soil moisture content (Human et al., 1990; Iqbal et al., 2013) and growing spaces (Hall et al., 2010; Sposaro et al., 2010). Results from our research are in compliance with previous statement, plant height is significantly dependent on locality and year of trial. For hybrid Sremac year and locality had similar part in total variation, with difference of 1%. The third factor, seed grade, had significantly influenced plant height although it had only 7% in total variation. Rogers and Lomman (1988) obtained similar results. Usage of seed smaller size resulted in delay of the initial plant growth and

development in comparison with plants grown using larger seed. In this research plant height was negatively correlated to seed size.

Results from other researchers are confirming that seed size influence yield and plant development. In the research of Haskins and Gorz (1975) plants of same variety but growing using large seed were much stronger. They confirm statement made by Kaufmann (1958) that plants from large seed were stronger and pointed that seed size as source of variation. Fenner (1983) proved that seedlings develop from large seed easily penetrates deeper in soil, which helps early plant growth.

Mishra et al. (2008) research gave conclusion that usage of seed larger in size is much better considering field emergence well as plant performance then use of middle size seed. Same authors recommended avoidance of use of seed small in size. Explanation for these results, according to Jevtić (1981), is that large seed have larger endosperm, higher auxin content which positively influence development of young seedlings root and enhance plant growth.

CONCLUSION

Based on obtained results it can be concluded that the effect of all three observed factors - locality, growing seasons and seed grade on sunflower plant height at bud stage was statistically highly significant as well as interaction year x locality, while other interactions did not show statistical significance. Also, significant differences were observed between bigger and smaller grades, where the plant height proportionally decreased with seed size.

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