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THE INFLUENCE OF THE VARIETY AND THE SOWING DENSITY ON THE YIELD AND SOME QUALITY CHARACTERISTICS ON THE BARLEY

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Abstract

During 2006/07 and 2007/08 surveys were performed to analyze the influence of different genotypes and the seeding rate on the yield and some quality characteristics of winter barley forms.Tests were performed on three barley varieties (line ZJA J/ 31, Hit and Reh). The experiment in the two years of examination is set by the "split-plot" method, in four iterations, with the size of a trial parcel of 10 m^2 (10m x 1m).

The highest average yield in both experimental years was obtained from variety Reh (5945 kg/ha and 6108 kg/ha) and lowest of the variety ZJA J/31 (5499kg/ha and 5608kg/ha). The seeding rate showed no statistically significant difference in the level of yields, nor significant interaction "variety x sowing norm" of the grain yield is proven.

The tested varieties and the seeding rate showed a significant difference on the absolute and hectoliter mass (d" 0.01). The highest average absolute and hectolitermass was obtained from variety Hit. Also, significant interaction "variety x variety" and "variety x seeding rate" for the absolute and hectoliter mass is proven.

Key words: variety, yield, seeding rate, absolute mass, hectoliter mass

INTRODUCTION

Barley is one of the oldest crops in the world. It is believed that the first mash and bread were made of barley. According to Vasilevski (2004) barley in Egypt was grown 7000 years ago, and was known to the ancient Assyrians and Babylonians. Even today, in some areas of the world, where the remaining bread cereals can not be cultivated, the barley grain is used to produce bread.

One of the main tasks of plant breeding, for increasing of the barley production, is creation of new genotypes with inherent potential for high and stable yield, expressed through high quality grain in different agro-ecological conditions. The agricultural value of variety depends not only on the genetic potential for grain, but also from the ability to reach their genetic potential under different conditions of cultivation – Mladenov et al. (1998).

Barley comes in different proportions in the production of concentrates for livestock and poultry. The green sheet is used for animal feed, as a pure crop or in mixture with cattle peas. Quality hay or silage can be produced from the barley. As best quality crops cattle barley plant serves as fodder unit in balancing meals to feed livestock – Đekić et al. (2011).

Barley has special significance as an industrial crop because it comes as an important raw material: bear, alcohol, textile, leather, pharmaceutical and confectionery industry, and in the production of starch and oil.

It should be emphasized that the two rowed barley, to be a good raw material for the production of beer, the barley grains should be a uniform size, shape and color, fully mature, with thin and delicate glumes, high absolute and hectolitre weight and high germination – Vasilevski (2004).

The aim of our investigations was to analyze the impact of different genotypes and the norm of sowing on the yield and some quality characteristics of winter barley beer forms.

MATERIAL AND METHODS

The examinations were performed during 2006/ 07 and 2007/ 08, in field conditions at the experimental field of Agricultural Faculty in Strumica of the "Goce Delcev" – University, Stip.

In the two years of investigation the experiment was set according to the "split-plot" method, in four iterations, with the size of the main parcels of 10 m^2 (10m x 1m). The size of subparcels was 2,5 m^2 (2,5m x 1m). In the main parcels, the test included three barley varieties (line ZJA J/31, Hit and Reh) and for the subparcels seeding rate of 400, 450, 500 and 550 seeds / m^2.

The distance between the variants was 0,50 m, and between repetitions – 1,0 m. The distance between rows was 20 cm. The sawing was performed by hand in rows at a depth of 4-5 cm. During the vegetation standard agrotechnics for field barley production is used. The grain yield is calculated in kg/ha from the weight of grain produced from each parcel, reduced to unit area. Before harvest, material from 1m^2 of each parcel is taken to laboratory analysis, where the absolute and hectoliter mass was analyzed.

The results were calculated according to statistical analysis of variance method and tested according to LSD-test.

RESULTS AND DISCUSSION

The calculated values for yield of grain per year, varieties and sowing norm are shown in Table 1. Analyzed by year (Table 1), higher grain yield of all seeding rates and in all tested varieties was produced in the second year of testing. The

Table 1. Grain yield (kg/ha) by years, varieties and seed rate

Variety	Seed rate/m^2				
	400	450	500	550	Просек
2006/2007					
ZJA J/31	5 366	5 833	5333	5466	5 499
Hit	5 533	6 333	6 200	5 500	5 891
Reh	5 833	6 200	5 666	6 100	5 949
Average	5 577	6 122	5 733	5 688	**5 780**
2007/2008					
ZJA J/31	5 533	6 000	5 333	5566	5 608
Hit	6 000	6 333	6 166	5 900	6 099
Reh	6 033	6 300	5 900	6 200	6 108
Average	5 855	6 211	5 799	5 888	**5 938**

average grain yield in this year of examinations is absolutely for 150 kg/ha or relative for 2.7 % higher than the grain yield in the first year of the investigation. In both years of examinations, the highest grain yield was obtained from variety Reh (average 6028 kg/ha), and the lowest of ZJA J/31. The yield is quite variable feature that largely depends on the genotype, soil and climatic conditions and agro-technical measures applied. Significant variation in the grain yield depending on the influence of genotype and year of research found also Đekićet al. (2011) and Marinkovic (2004/2005).

The analysis of the results of four different seeding rates shows that in both years of examinations the highest grain yield was obtained by the seeding rate of 450 grains/m^2 (average 6 166,5 kg/ha). In both years of testing, with the smallest difference, the grain yield was down in the fourth seeding rate (550 grains/m^2), which is an average of 5788 kg/ha or 6.2 % less than the second seeding rate (450 grains /m^2). The decline in yield is more marked in the first seeding rate (averaging 5716 kg/ha or 7.4 % less than the second seeding rate).

The results of the analysis of variance (Table 2) shows that the seeding rate showed no statistically significant difference in the level of income, nor significant interaction variety x seeding rate of the grain yield was not proven. Our results are consistent with the results of Đekićet al. (2011) and Lalić et al (2009).

Table 2. Analysis of variance for grain yield

Source of variance	Degree of free	Sum of squares	Middle of squares	Fe (experimental)	F theoretical	
					0,05	0,01
Total variance of the variety	8	3,57	0,45			
Repetition	2	0,76	0,38	0,66ns	3,16	5,09
Variety	2	0,53	0,27	0,51ns		
Error of the cariety	4	2,28	0,57			
Seed rate	3	0,30	0,10	0,62ns	2,93	4,58
Variety x Seed rate	6	0,27	0,05	0,31ns		
Error of seed rate	18	2,93	0,16			

The results for 1000 grain weight per year, varieties and sowing norm are shown in Table 3.

Table 3. Absolute mass (g) by years, varieties and seed rate

Variety	Seed rate/m^2				
	400	450	500	550	Просек
2006/2007					
ZJA J/31	40,7	40,6	40,9	41,4	40,9
Hit	45,2	42,6	44,0	50,6	45,6
Reh	42,7	43,4	37,5	42,4	41,5
Average	42,9	42,2	40,8	44,8	**42,7**
2007/2008					
ZJA J/31	41,1	41,0	41,2	41,8	41,3
Hit	45,5	43,5	44,5	50,8	46,1
Reh	44,0	44,0	38,9	43,0	42,5
Average	43,5	42,8	41,5	45,2	**43,3**

Analyzed by years, higher absolute mass in all seeding rates and in all tested varieties, was produced in the second year of testing. The average value of the absolute mass is about 0,6 g absolute or 1.4 % relative, greater than the absolute mass in the first year of testing. During the two years of testing, the highest absolute mass is got from the variety Hit (average 45,9 g), and the lowest of ZJA J/31 (average 41,1 g). Absolute mass is characteristic of the species and variety, so different genotypes resulted with different variations in tests of – Jelić et al (2002) and – Đekić et al. (2010).

Table 4. Analysis of variance for absolute mass

Source of variance	Degree of free	Sum of squares	Middle of squares	Fe (experimental)	F theoretical	
					0,05	0,01
Total variance of the variety	8	163,9	20,5			
Repetition	2	5,33	2,69 ns	2,95	3,16	5,09
Variety	2	154,8	77,42**	85,1		
Error of the cariety	4	3,7	0,91			
Seed rate	3	69,7	23,2**	10,32	2,93	4,58
Variety x Seed rate	6	96,53	16,1**	14,37		
Error of seed rate	18	20,4	1,12			

Table 5. Hectolitre mass (kg/hl) by years, varieties and seed rate

Variety	Seed rate/m^2				
	400	450	500	550	Просек
2006/2007					
ZJA J/31	56,08	56,46	55,80	56,60	56,23
Hit	62,10	63,40	61,91	62,66	62,52
Reh	62,66	63,18	58,83	62,21	61,72
Average	60,28	61,01	58,85	60,49	**60,16**
2007/2008					
ZJA J/31	56,50	56,80	56,70	57,00	56,75
Hit	62,80	63,50	62,70	63,50	63,12
Reh	63,10	63,50	61,00	62,90	62,62
Average	60,80	61,30	60,13	61,13	**62,83**

Table 6. Analysis of variance for hectoliter mass

Source of variance	Degree of free	Sum of squares	Middle of squares	Fe (experimental)	F theoretical	
					0,05	0,01
Total variance of the variety	8	291,41	36,42			
Repetition	2	1,71	0,85 ns	1,54	3,16	5,09
Variety	2	294,62	147,3**	267,8		
Error of the cariety	4	2,2	0,55			
Seed rate	3	18,12	6,04**	24,16	2,93	4,58
Variety x Seed rate	6	19,63	3,27*	13,08		
Error of seed rate	18	4,6	0,25			

Analysis of results from four different seeding rates shows that in both years of testing the highest absolute mass is obtained by the seeding rate of 550 grains/ m^2 (average of two years is 45,0 g). In two years of testing with the smallest difference, the absolute mass has fallen in the first seeding rate (400 grains/m^2), which is an average of 43,2 g or 4 % less than the fourth seeding rate(550 grains/ m^2). The decline in absolute mass is more marked in the third seeding rate (average is 41.1 or 7.7 % less than the fourth seeding rate).

Tested varieties and the seeding rate showed a significant difference in absolute mass (dH 0.01). The highest average absolute mass is obtained from the Hit variety. Significant interaction variety x seeding rate for the absolute mass is proven. Our results are consistent with the results of Guberacet al. (2008).

Results for hectolitre mass (kg/hl) by years, varieties and sowing norm are shown in Table 3. Analyzed by year, higher hectoliter mass in all used seeding rates and in all tested varieties was obtained in the second year of testing. The average value of the hectoliter mass this year is absolutely for 2,67 kg/hl or relatively for 4.4 % higher than the hectoliter mass in the first year of the testing. In both years of testing, the highest hectoliter mass is got from the Hit variety (average 62, 82 kg/hl), and the lowest of ZJA J/31 (average 56,49 kg/hl). Hectoliter mass as a physical property is characteristic of the species and variety, so different genotypes resulted with different variations. The obtained average values for this property in our research were lower than the results of the tests (Đekić et al., 2010; Đekić et et al., 2011).

The analysis of the results from four different seeding rates shows that in both years of testing the highest hectoliter mass is obtained with the second seeding rate 450 grains/m^2 (average of two years is 61,15 kg/hl). In two years of testing with the smallest difference the hectoliter mass has fallen in the fourth seeding rate (550 grains/m^2), which is an average of 60,81 kg / hl or 0.6 % less than the second seeding rate (550 grains/m^2). The decline in hectoliter mass is more marked in the third seeding rate (average 59,49 kg/hl or 2.8 % less than the second seeding rate.

Tested varieties and seeding rate showed significant difference of hectoliter mass. Highest average hectolitre mass was obtained from variety Hit. Significant interaction variety x seeding rate for the hectoliter mass was proven. Our results are consistent with the results Lalić et al. (1999) and Kovačević et al. (2009).

CONCLUSIONS

Based on two years of research and results, the following conclusions can be made:

- Analyzed by year, the highest grain yield, the highest absolute mass and the highest hectoliter mass in all the seeding rates and in all tested varieties was obtained in the second year of testing.
- The highest average yield in both experimental years was obtained from Reh variety (5949 kg/ha and 6108 kg/ha, respectively by years) and the smallest average yield of the line ZJA J/31 (5 499 kg/ha and 5 608 kg/ha, respectively by years).
- The seeding rate showed no statistically significant difference in the level of income and no significant interaction variety x seeding rate of the grain yield was proven.
- Tested varieties and the norm of sowing did not show a significant difference in absolute and hectoliter mass.

• The highest average absolute and hectoliter mass was obtained from Hit variety.

• Significant interaction variety x seeding rate for the absolute and hectoliter mass was proven.

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