

VARIETY SPECIFICITY OF TWO ROWS BARLEY IN REPUBLIC OF MACEDONIA

**Dragica Spasova, Sasha Mitrev, Dushan Spasov,
Biljana Atanasova, Mite Ilievski**

Faculty of Agriculture, Goce Delcev University –
Stip, Strumica, Republic of Macedonia

Abstract

During the 2012/2013 and 2013/2014 surveys were performed to analyze variety specificity of different two rows barley genotypes in Republic of Macedonia.

The experiment was performed on five barley varieties (line ZJA J/31, line ZJA J/2, Hit, NS 293 and Egej). The greatest average height of two rows barley plants in two-year trials, regardless of year of examination, had a variety Egej (123.9 cm), and the lowest, in two years of examination, line ZJA J/1 (112.1 cm). Compared between varieties, there are statistically significant differences.

The lowest length of the class had variety Egej (10.2 cm in 2012/2013 and 9.8 cm in 2013/2014), and the highest, line ZJA J/1 (11.8 cm 2012/2013 and 11.6 cm in the 2013/2014).

Grains number per a spike in both years of testing is statistically different for different varieties. The lowest number of grains in the class had a line ZJA J/2 (28.2 to 27.2 in 2012/2013 and 2013/2014) and most had the domestic line ZJA J/1 (30.4 in 2012/2013 and 29.7 in the 2013/2014).

The grain yield in the spike, in both years of testing is statistically the highest at the line ZJA J/1 (1.78 g to 1.69 g 2012/2013 and the 2013/2014). Compared between varieties, there are statistically significant differences. The highest average yield, regardless of the year of examination, gave line ZJA J/1 (7240 kg/ha), and the lowest (5500 kg/ha) variety Hit. Compared between varieties, there are statistically significant differences at the level of 0.05.

Key words: variety, line, yield, spike length, grain weight per a spike

INTRODUCTION

Barley (*Hordeum vulgare* L.) is one of the oldest crops, which according to world production of cereals, belongs to the group of the four most important economic crops, after wheat, rice and maize – Kanbar (2011). This culture has a wide range of distribution, primarily because of its flexibility and the possibility of growing in different ecological-climatic conditions – Lalević et al. (2012).

Nowadays, mostly, barley is used in the industry for malt and beer and in the industry for the production of animal feed. Very little is used in human nutrition. Bread produced from barley flour has no good quality, has a bad odor and dries quickly, so it is desirable to mix with wheat and rye flour.

Barley comes in different proportions in the production of concentrates for livestock and poultry. As best quality crop for producing animal feed barley plant serves as animal unit balancing meals fed to livestock – Đekić et al. (2011).

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

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

The aim of our investigations was analyzing variety specificity of morphological, biological and production features of several recognized varieties and promising lines of two rows barley, in R. Macedonia.

MATERIAL AND METHODS

The experiment was carried out for two years as follows: 2012/2013 and 2013/2014. The analyses were performed in field conditions in the experimental field of the Faculty of Agriculture in Strumica, Goce Delchev University, Stip. The laboratory tests were performed in the laboratories of the Faculty of Agriculture. Five genotypes of winter, two rows barley, from which 3 registered varieties (Hit, NS 293 and Egej) and two promising lines (line ZJA J/1 and ZJA J/2) were used for analyses.

Varieties Hit and Egej are selections of Agricultural Institute – Skopje, variety NS 293 is a selection of Institute for crop and vegetable production in Novi Sad, and the lines are selections of the Faculty of Agriculture, of the University Goce Delcev, Stip.

Experiment consisted of five variants in three repetitions, distributed by the method of random block system, with dimension of the main parcel 5 m².

The distance between the variants was 0.50 m, and between repetitions – 1.0 m. The distance between rows was 20 cm.

Sowing was performed manually, in rows, at a depth of 4-5 cm. During the vegetation, standard agrotechnics for field production of barley was used.

The height of all barley plant, 20 plants from each iteration, was measured, and the average was taken from 60 plants (3 x 20 plants). The yield of the grain is calculated in kg/ha, based on the weight of the grains obtained from each parcel, reduced to a unit area.

Before harvest, from each parcel, material from 1 m² for laboratory analysis was taken. In the laboratory were analyzed: length of class, number of grain in class and grain yield in the class.

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

CLIMATIC CONDITIONS

During the two years trials meteorological parameters for average monthly air temperature in degrees Celsius and monthly amounts of precipitation in millimeters were monitored.

The average annual temperature in Strumica valley (Table 1), for a period of ten years 2001/2011 amounted to 13.4°C. For a period of ten years 2001/2011, the Strumica valley fall 548.1 mm average rainfall (Table 2).

The schedule of precipitation (Table 2) after months and seasons is quite unbalanced. In a period of ten years, the month of October had most precipitation,

Table 1. Average monthly temperatures in degrees

| Year | Months | | | | | | | | | | | | Annual sum of temp. | Aver. ann. temp. |
|-----------|--------|-----|------|------|------|------|------|------|------|------|-----|-----|---------------------|------------------|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | | |
| 2012 | -0.3 | 0.8 | 9.1 | 13.5 | 17.7 | 24.0 | 27.6 | 25.1 | 20.6 | 15.3 | 9.6 | 1.5 | 5000.5 | 13.7 |
| 2013 | 3.4 | 6.1 | 8.8 | 15.3 | 20.1 | 22.0 | 23.6 | 25.8 | 19.0 | 13.5 | 9.8 | 1.9 | 5146.5 | 14.1 |
| 2014 | 4.7 | 7.5 | 10.2 | 12.8 | 17.4 | 21.7 | 24.1 | 24.0 | 18.2 | 13.8 | | | | |
| 2001-2011 | 2.1 | 3.9 | 8.0 | 13.0 | 18.5 | 22.7 | 25.5 | 24.9 | 19.0 | 13.5 | 7.3 | 3.0 | 4783.5 | 13.4 |

Table 2. Amount of monthly rainfall in mm

| Year | Months | | | | | | | | | | | | Annual sum of rainfall in mm |
|-----------|--------|-------|------|-------|-------|-------|-------|------|-------|------|------|------|------------------------------|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | |
| 2012 | 40.9 | 50.0 | 35.5 | 48.2 | 155.4 | 15.3 | 30.4 | 67.4 | 97.8 | 77.2 | 32.6 | 53.3 | 704.0 |
| 2013 | 75.3 | 162.5 | 62.3 | 51.3 | 42.8 | 129.3 | 28.6 | 1.0 | 37.0 | 52.8 | 71.6 | 30.8 | 745.3 |
| 2014 | 42.1 | 13.1 | 71.0 | 125.5 | 78.7 | 56.3 | 344.0 | 56.9 | 100.7 | 54.6 | | | |
| 2001-2011 | 43.7 | 36.8 | 42.7 | 41.9 | 56.9 | 52.3 | 33.6 | 41.6 | 60.2 | 83.2 | 44.5 | 78.8 | 548.1 |

with an average amount of 83.2 mm. The lowest average rainfall had July with e 33.6 mm.

According to the data in Table 1 it can be concluded that the average monthly air temperatures during the vegetation of barley, in both years of testing, are lowest in the first months of each year, or in January (from 3.4 in 2013 to 4.7°C in 2014), and highest in July (23.6 in 2013 to 24.1°C in 2014).

The average monthly temperatures prevailing in the vegetation period is considered as good for growing barley. Well hardened in winter barley plants serving low temperatures from -10 to -12°C – Vasilevski (2004) and is known as a culture that does not put special requirements to heat and is considered as resistant to lower temperatures.

According to Vasilevski (2004), the ice at the end of the winter, at temperature of -10 to -12°C causing harm. During the vegetation barley well bear high temperatures.

From the data in Table 2, it can be noted that in the years of the examination schedule of rainfall is relatively good to meet the needs of barley for water, so there is no need for intervention irrigation.

RESULTS AND DISCUSSION

Morphological features

The height of the stem is important variety characteristic which depends on the genotype, on the environmental conditions in which the variety is grown and applied agrotechnology.

The most suitable varieties for achieving high and stable production are those with medium height of the plants. In our tests, measuring the height of the plants was done under full maturity of barley.

The results of the height of plants in the production of two rows barley are shown in Table 3.

Table 3. Average values of some morphological features in production of two-line barley by year

| Variants | Plant height (cm) | Class length (cm) | Number of grains in class | Grain yield per class (g) | Grain yield (kg/ha) |
|-----------|-------------------|-------------------|---------------------------|---------------------------|---------------------|
| 2012/2013 | | | | | |
| ZJA J/1 | 105.3 | 11.8 | 30.4 | 1.78 | 7320 |
| ZJA J/2 | 114.0 | 10.6 | 28.2 | 1.55 | 7060 |
| Hit | 117.6 | 11.2 | 29.0 | 1.52 | 5800 |
| NS 293 | 106.0 | 10.4 | 29.0 | 1.49 | 6200 |
| Egej | 122.6 | 10.2 | 29.2 | 1.52 | 6560 |
| LSD 0.05 | 6.7 | 1.05 | 0.98 | 0.06 | 660 |
| 0.01 | 11.0 | 1.73 | 1.62 | 0.10 | Ns |
| 2013/2014 | | | | | |
| ZJA J/1 | 119.0 | 11.6 | 29.7 | 1.69 | 6960 |
| ZJA J/2 | 121.0 | 10.0 | 27.2 | 1.50 | 6760 |
| Hit | 119.3 | 11.1 | 27.9 | 1.46 | 5200 |
| NS 293 | 121.6 | 9.8 | 27.7 | 1.41 | 5660 |
| Egej | 125.3 | 9.8 | 28.3 | 1.47 | 6400 |
| LSD 0.05 | ns | 1.15 | 0.92 | 0.05 | 780 |
| 0.01 | ns | 1.89 | 1.51 | 0.09 | ns |

In the first year of the examination (2012/2013), the greatest height of the plants had a variety Egej (122.6 cm), and the lowest (105.3 cm) line ZJA J/1.

Compared between varieties, there are statistically significant differences.

In the second year of the survey (2013/2014), the greatest height of the plants had variety Egej (125.3 cm), and the lowest (119.0 cm) line ZJA J/1.

The greatest average height of plants in two rows barley from two-years trials, regardless the year of examination, had a variety Egej (123.9 cm), and the lowest in two years of examination, line ZJA J/1 (112.1 cm).

From the results for spike length in two rows barley (Table 3), it can be seen that in both years of testing there is statistically valid difference between varieties. In two years of testing, the smallest spike length had a variety Egej (10.2 cm in 2012/2013 and 9.8 cm in the 2013/2014), and the highest spike length had line ZJA J/1 (11.8 cm 2012/2013 and 11.6 cm in the 2013/2014).

Grains number per a spike (Table 3) in both years of testing is statistically different for different varieties. In two years of testing, the smallest number of grains in the spike had a line ZJA J/2 (28.2 to 27.2 in 2012/2013 and 2013/2014), and most had a domestic line ZJA J/1 (30.4 in 2012/2013 and 29.7 year in the 2013/2014).

In studies of other authors an increase of the numbers of grains per spike is present in different two rows barley varieties – Pržulj. et al. (1996); Đekić et al. (2011).

The yield of grain in class in both years of testing statistically is the highest at line ZJA J/1 (1.78 g to 1.69 g 2012/2013 and the 2013/14). Compared between varieties, there are statistically significant differences.

In studies of other authors an increase in grain yield of spike is present in different varieties of two rows barley – Đekić et al. (2011); Lalić et al. (2012).

The yield that is obtained from cultivated plants has always been the center of attention in humans. Therefore, in most scientific papers, yield is a parameter from which meaningful conclusions can be received and made. The yield is very variable feature that mostly depends on soil and climatic conditions, the applied agro-technical measures and genotype.

The results of the grain yield in the production of two rows barley are shown in Table 3.

The highest average yield, regardless of the year of examination, gave line ZJA J/1 (7240 kg/ha), and the lowest (5500 kg/ha) variety Hit. Regardless the year of examination and weather conditions, high average grain yield gave line ZJA J/2 (6910 kg/ha). These varieties can serve as a future major genetic material in the plant breeding to create varieties in which we want to emphasize this property.

It can be concluded that the differences that occur between varieties under the same conditions of cultivation are due to the variety specificity and the specific genetic characteristics that possess the tested genotypes.

Significant variations in the grain yield, depending on the impact of genotype and year of research, found also Đekić et al. (2011) and Mladenov et al. (1998).

CONCLUSIONS

Based on two years of research, about the variety specificity of the two row barley, in Republic of Macedonia, one can draw the following conclusions:

Compared between varieties, there are statistically significant differences in plant height between two rows barley varieties tested. The greatest average height of two rows barley plants from two-year trials, regardless the years of examination, had variety Egej (123.9 cm), and the lowest, line ZJA J/1 (112.1 cm).

In two years of research, the smallest class length had variety Egej (10.2 cm in 2012/2013 and 9.8 cm in 2013/2014), and the highest spike length had line ZJA J/1 (11.8 cm 2012/2013 and 11.6 cm in the 2013/2014).

Grains number per spike in both years of testing is statistically different for different varieties. In two years of testing, the smallest number of grains in the class had a line ZJA J/2 (28.2 to 27.2 in 2012/2013 and 2013/2014), and most had a domestic line ZJA J/1 (30.4 in 2012/2013 and 29.7 year in the 2013/2014).

The yield of grain per spike in both years of testing statistically is the highest at line ZJA J/1 (1.78 g to 1.69 g 2012/2013 and the 2013/2014). Compared between varieties, there are statistically significant differences.

The highest average yield, regardless of the year of examination, gave line ZJA J/1 (7240 kg/ha), and the lowest (5500 kg/ha) variety Hit.

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