# EXAMINATION OF SOME MORPHOLOGICAL PROPERTIES OF DOMESTIC AND INTRODUCED DURUM WHEAT VARIETIES (TRITICUM DURUM DESF.) IN THE AGRI-ENVIRONMENT CONDITIONS IN STRUMICA, REPUBLIC OF MACEDONIA

**Dragica Spasova, D. Spasov, Biljana Atanasova, M. Ilievski, M. Georgievski ***
**"Goce Delcev" University - Stip, Faculty of Agriculture, Goce Delcev bb, 2400 Strumica, R. Macedonia. dragica.spasova@ugd.edu.mk; dusan.spasov@ugd.edu.mk; biljana.atanasova@ugd.edu.mk; mite.ilievski@ugd.edu.mk*

## ABSTRACT

The researches were conducted for two years (2009/10 and 2010/11), of eight winter durum wheat genotypes, including 2 domestic durum wheat varieties (*angela* and *mina*), one durum wheat variety introduced from Serbia (*pobeda* - 2) and 5 varieties durum wheat introduced from Bulgaria (*predel, zvezdica, viktorija, progres* and *bugaria*).

In two years of research, the smallest spike length had a variety *victorija* (6,4 cm in 2009/10 and 6,6 cm in 2010/11), and the highest had variety *zvezdica* (7,6 cm 2009/10 and 8,5 cm in 2010/11). The lowest number of spikelets in the spike had variety *progres*, and most had a variety *zvezdica*. In two years of research, the lowest grain number in the spikes had variety *angela* (34.6 in 2009/10 to 35.5 in 2010/11), and the most had variety *predel* (46.96 in 2009/10 and 46.1 in 2010/11).

The grain yield in spikes, in both years of research, statistically, the highest is at variety *predel* (2,6 g in 2009/10 and 2,5 g in 2010/11). High grain yields reached also variety *victorija* (2,4 g in 2009/10 and 2,3 g in 2010/11).

***Key words:*** *durum wheat, variety, grain, spike length, yield*

## INTRODUCTION

Durum wheat (*Triticum durum* Desf.) takes approximately 8 % of the production of wheat in the world (Decev B. et al., 2010). In R. Macedonia, durum wheat is grown on about 5 % of the total area under wheat (Vasilevski G., 2004). Regardless of the limited spaces, durum wheat is an economically important crop, because of the final product obtained from it. It features with hardwood grain, intersection is glassy, it has high protein content and healthy gluten, with high extensibility and elasticity, contributing durum wheat to be an important resource for the pasta industry.

According to many authors, increasing the yield and quality of durum wheat depends on complex factors, including variety (Lalev et al., 1995), agri-environmental conditions, technology of cultivation and collection of wheat (Kolev et al., 2004), and the quality of the grain (Kolev et al., 2008), because of what, is necessary in a given area, to be grown the most productive varieties of durum wheat (Kolev et al., 2000).

The production is better if there are as many varieties as there are, because there is a greater choice, both in terms of productivity and in terms of quality properties for specific agro-ecological conditions. The use of multiple varieties in production in the same area provides successful opposition to limiting environmental factors, which achieves stable yield.

Given the above, the purpose of our investigation was to determine the production potential of many domestic and introduced durum wheat varieties in agro - ecological conditions of Strumica, to mention and recommend the most promising to the producers, breeders and industry in the country and roll as stable yielding and quality.

## MATERIAL AND METHODS

The researches were conducted in field and laboratory conditions. The field trials were set up at the Faculty of Agriculture - Strumica, University "Goce Delchev" - Stip. The researches were conducted for two years (2009/10 and 2010/11), of eight winter durum wheat genotypes, including

2 domestic durum wheat varieties (*angela* and *mina*), one durum wheat variety introduced from Serbia (*pobeda* - 2) and 5 varieties durum wheat introduced from Bulgaria (*predel, zvezdica, viktorija, progres* and *bugaria*).

The experiment was consisted of 8 variants in three iterations, allocated by the method of random block system, with the dimension of the basic parcel of 5 $m^2$. The distance between the variants was 0,50 m, and between repetitions - 1,0 m. The distance between the rows was 20 cm.

The seeding rate was 550 grains per 1$m^2$, ie 5.5 million grains of 1ha. In all the years of research, the pre culture of wheat was potato.

In two years of research the soil was prepared in the same way. The main treatment was plowing at a depth of 35 cm, followed by fertilization by methodological principle. So, on the surface provided for the experiment, artificial granulated NPK 15:15:15 fertilizer was inflicted, in an amount of 300 kg/ha. Sowing was performed manually, in rows at a depth of 5-6 cm. During the vegetation standard agrotechnique for field wheat production was used. Top fertilization was done with KAN 27 %, in amount of 150 kg/ha, in the tillering stage of the wheat.

Before harvest, from each parcel, material of 1$m^2$ of for laboratory analysis was taken.

In laboratory the following features were analyzed: the length of class, number of the spikelets in the spikes, grain number in the spike and grain yield per spike.

The results were statistically processed by the method analyses of variance and the differences were tested by LSD- test.

**CLIMATIC CONDITIONS**

During the two-year researches the meteorological indicators for the monthly average temperatures in degrees Celsius and monthly sums of precipitation in millimeters were monitored.

The mean annual temperature in Strumica valley (table 1), for a period of ten years 1998/2008, was 13,1 °C. For a period of ten years 1998/2008 in Strumica valley, the average precipitations are 599,9 mm (Table 2) .

Schedule of precipitation (Table 2) by months and seasons is quite unbalanced. December has the most precipitations, with an average amount of 71,0 mm. Driest month, with the lowest average amount of rainfall is August, with e 32,8 mm.

According to the data in Table 1, it can be concluded that the monthly average air temperatures during the vegetation of wheat, in both years of research are lowest in the first months of each year, ie in January and February (from 1,8 to -5,4 °C), and highest in July and August (23,7-26,5 °C).

Average monthly temperatures that are prevailing in the vegetation period are considered good for growing wheat. Winter wheat is known as a culture that does not set specific requirements to heat and is considered as resistant to low temperatures.

According to Vasilevski G., (2004), the temperatures higher than 25 °C and lower than 14 °C, between the tillering and maturing stages, slowing the growth of plants. At temperatures above 28 °C, warm wind and low relative humidity, comes to the so-called heat stroke. The most critical period for the occurrence of heat stroke is milky maturity stage when the yield can be reduced more than 50 %.

Best results the wheat gives in areas with 650-800 mm annual rainfall. According Jevtich S., (1992), from eco-geographical aspect, wheat thrives in areas with very different amounts of rainfall and schedule.

In Table 2 we can see that the annual amounts of rainfall in the Strumica region during the research period is within the optimal needs of wheat.

According to Vasilevski G., (2004), a critical period for water for the wheat is 15 days before and 6 days after the ear appearance.

From the data in Table 2, it can be noted that in 2011, during the vegetation period of wheat, the biggest deficit of rainfall has seen in April (only 14,8 mm). In the other months and years, the

distribution of rainfall is relatively good for meeting the water requirements for wheat, so there was no need for intervention irrigation.

**Table 1. Average monthly temperatures in degrees Celsius**

| Year | Months | | | | | | | | | | | | Annual amount of temp. | Aver. ann. temp. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | | |
| **2009** | 1,8 | 3,4 | 7,6 | 13,2 | 18,9 | 21,8 | 24,9 | 23,7 | 19,3 | 13,4 | (8,5 | 6,0 | 4444,5 | 12,2 |
| **2010** | 3,7 | 5,4 | 8,6 | 13,9 | 18,5 | 22,1 | 24,5 | 26,5 | 19,7 | 11,6 | 11,6 | 3,7 | 5180,3 | 14,2 |
| **2011** | 2,5 | 3,9 | 8,4 | 12,9 | 16,8 | 22,3 | 25,8 | 25,4 | 22,1 | 11,4 | 3,9 | 2,4 | 4818,9 | 13,2 |
| **1998/2008** | 1,3 | 3,8 | 7,7 | 13,2 | 18,6 | 22,7 | 25,6 | 24,9 | 18,9 | 14,0 | 7,3 | 2,7 | 4795,5 | 13,1 |

**Table 2. Amount of monthly rainfall in mm**

| Year | Months | | | | | | | | | | | | Annual amount of rainfall in mm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | |
| **2009** | 87,8 | 20,1 | 91,0 | 31,6 | 67,1 | 72,3 | 17,5 | 101 | 13,0 | 96,0 | 29,8 | 113,8 | 741,0 |
| **2010** | 28,1 | 86,6 | 53,2 | 36,2 | 22,9 | 57,9 | 49,0 | 0,7 | 85,5 | 196,5 | 37,6 | 94,6 | 748,8 |
| **2011** | 25,2 | 20,6 | 43,2 | 14,8 | 53,6 | 25,8 | 14,7 | 26,5 | 49,9 | 29,8 | 7,5 | 45,9 | 357,5 |
| **1998/2008** | 39,9 | 37,8 | 38,2 | 42,6 | 57,9 | 56,8 | 37,1 | 32,8 | 58,5 | 70,5 | 56,8 | 71,0 | 599,9 |

**RESULTS AND DISCUSION**

The results for the spike length in durum wheat (Table 3), we can see that, in both years of research, there was no statistically valid difference between varieties. In two years of research, the smallest spike length had a variety *viktorija* (6,4 cm in 2009/10 and 6,6 cm in 2010/11), and the largest had variety *zvezdica* (7,6 cm in 2009/10 and 8,5 cm in 2010/11).

In studies of other authors, also is present an increase in the length of the spike at different durum wheat varieties (Kolev et al., 2010; Decev et al. 2010).

The number of spikelets in the spike (Table 3), in both years of research, is statistically different among different varieties. In the two years of research, the lowest number of spikelets in the spike had variety *progres* (16.6 in 2009/10 to 16.8 in 2010/11), and most had variety *zvezdica* (22.6 in 2009/10 and 23.0 in 2010/11).

According to Kolev et al., 2012, who was examining four Austrian varieties and one standard Bulgarian variety - *progres*, the number of spikelets in the spike was higher among Austrian varieties compared with the standard variety.

According to Dzhugalov (2011), the density of sowing has statistically proven impact on the number of spikelets in the spike.

The number of grains per spike (Table 3), in both years of research is statistically different among different varieties. In two years of research, the lowest number of grains in the spike had variety *angela* (34.6 in 2009/10 to 35.5 in 2010/11), and most had variety *predel* (46.96 in 2009/10 and 46.1 in 2010/11) .

In studies of other authors an increase in the number grains per spike, in different durum wheat varieties, is present (Kolev et al., 2012; Kolev et al., 2010; Dzhugalov, 2011).

The grain yield in the spike, in both years of research, is statistically the highest at variety *predel* (2,6 g in 2009/10 and 2,5 g in 2010/11). High grain yields reached variety *viktorija* (2,4 g in 2009/10 and 2,3 g in 2010/11).

In studies of other authors an increase in grain yield of spikes at different durum wheat varieties is present (Kolev et al., 2012; Kolev et al., 2010; Dzhugalov, 2011).

Table 3. Average values of some morphological properties of durum wheat production by years

| Variety | Spike length in cm | Number of spikelets in spike | Number of grains in spike | Grain yield per spike in g |
|---|---|---|---|---|
| **2009/10** | | | | |
| *predel* | 7,1 | 20,0 | 46,9 | 2,6 |
| *zvezdica* | 7,6 | 22,6 | 37,8 | 2,2 |
| *viktorija* | 6,4 | 21,0 | 42,9 | 2,4 |
| *progres* | 6,6 | 16,6 | 41,2 | 2,1 |
| *bugarija* | 7,2 | 19,2 | 36,3 | 1,9 |
| *angela* | 7,5 | 19,2 | 34,6 | 1,9 |
| *pobeda-2* | 7,5 | 19,5 | 38,2 | 2,1 |
| *mina* | 6,7 | 21,0 | 36,2 | 2,0 |
| LSD 0,05<br>0,01 | 0,89<br>ns | 0,48<br>0,74 | 0,12<br>1,36 | 0,21<br>0,33 |
| **2010/11** | | | | |
| *predel* | 7,7 | 21,2 | 46,1 | 2,5 |
| *zvezdica* | 8,5 | 23,0 | 37,3 | 2,1 |
| *viktorija* | 6,6 | 21,8 | 41,1 | 2,3 |
| *progres* | 7,5 | 16,8 | 40,7 | 2,1 |
| *bugarija* | 6,8 | 19,5 | 37,2 | 2,0 |
| *angela* | 8,2 | 19,7 | 35,5 | 2,0 |
| *pobeda-2* | 7,2 | 20,0 | 37,6 | 2,0 |
| *mina* | 8,0 | 21,5 | 35,7 | 1,9 |
| LSD 0,05<br>0,01 | 0,21<br>0,33 | 0,38<br>0,58 | 0,70<br>1,07 | 0,21<br>0,33 |

## CONCLUSION

Based on two years of research on some morphological characteristics of domestic and introduced durum wheat varieties, in agri-environmental conditions of Strumica, the following conclusions can be drawen:

- In two years of research, the smallest spike length had a variety *victorija* (6,4 cm in 2009/10 and 6,6 cm in 2010/11), and the highest had variety *zvezdica* (7,6 cm 2009/10 and 8,5 cm in 2010/11).
- The lowest number of spikelets in the spike had variety *progres*, and most had a variety *zvezdica*.
- In two years of research, the lowest grain number in the spikes had variety *angela* (34.6 in 2009/10 to 35.5 in 2010/11), and the most had variety *predel* (46.96 in 2009/10 and 46.1 in 2010/11).
- The grain yield in spikes, in both years of research, statistically, the highest is at variety *predel* (2,6 g in 2009/10 and 2,5 g in 2010/11). High grain yields reached also variety *victorija* (2,4 g in 2009/10 and 2,3 g in 2010/11).

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