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PRODUCTIVE OPTIONS IN BULGARIAN WINTER WHEAT VARIETIES IN MACEDONIA

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Abstract
In the period 2010-2011 were conducted investigation on the productivity in five Bulgarian winter wheat varieties (*pobeda, momchil, carevec, fermer* and *guiness*) in agro climatic conditions of the Republic of Macedonia. The results show that the investigated varieties are suitable for cultivation in our production conditions. In the two years of testing the best average yield is obtained from varieties *momchil, guiness* and *pobeda*. The yield achieved in these varieties is statistically higher than the yield achieved in the domestic standard variety *mila*. The yield from varieties *fermer* and *carevec* doesn't show a significant statistical difference compared to the standard variety.
Key words: winter wheat, variety, productive characteristics.

INTRODUCTION

Winter wheat (*Triticum aestivum* L.) is one of the most important cereal crops in Macedonia. With the average planted area of about 100.000 ha per year, this crop covering 50 % of the total area under cereals. Average yields in recent years range from 2,5 – 3,2 t/ha^{-1}, and do not provide the total domestic demand for wheat. The main limiting factors in production are unfavorable agro-ecological conditions that occur with different intensity in different regions and years, as the poor economic condition of farmers, leading to incomplete and incorrect application of agro-technical measures in production.

The grain yield is a complex quantitative property controlled by polygenes. The external factors have great influence on this property (Milovanović et al. 2002, Musa et al. 2003, Denčić et al. 2006, Drezner et al. 2006, Rekanović et al. 2007). For maximum utilization of cultivation conditions and achieve better yields per unit area, are needed varieties with good biological plasticity, which means varieties with good adaptability in different agro-ecological conditions. Current sorting of wheat production in Macedonia consist of domestic local and newly created varieties, and approved foreign varieties.

The purpose of conducted researches is to determine the production characteristics of the tested varieties in terms of Ovce pole region and to determine the most suitable for the region.

MATERIALS AND METHODS

In this paper are examined the production opportunities of five Bulgarian varieties soft wheat in agro-ecological and production conditions in Macedonia. As a material were used varieties *pobeda*, *momchil*, *carevec*, *fermer* and *guiness*, which are a selection of Institute for Plant Genetic Resources Sadovo in Bulgaria, compared with domestic variety *mila*, selection of research center "Uniservis agro" Strumica, Faculty of Agriculture, University "Goce Delchev" – Stip. *Mila* variety is dominant domestic variety in sorting production in our country and from the Bulgarian varieties, variety *momchil,* starting from 2007, is on the national variety list as a foreign variety approved for production in Macedonia.

The researches were conducted during the vegetation period in 2010/2011 and 2011/2012, on the areas of the production unit "Uniservis agro" Faculty of Agriculture, University "Goce Delchev" – Stip, in Amzabegovo place.

The experiment was set by random block system, the size of experimental plots was 5 m^2, with three replications. Before sowing the experimental area was barley. Standard technology for production was applied, except the sowing, which is done after the optimal time, in early December. Fertilizer was applied at the rate of 76 kg/ha^{-1} N, 30 kg/ha^{-1} P_2O_5 and 30 kg/ha^{-1} K_2O (200 kg/ha^{-1} NPK 15:15:15 and 100 kg/ha^{-1} Urea 46 %) before sowing, and 92 kg/ha^{-1} N during spring nourishment (200 kg/ha^{-1} Urea 46 %).

From this research is analyzed the grain yield and its main components, height of stem, length of spike, number of grains per spike and weight of 1000 grain. The following parameters were computed: the average value (X), the error of mean (S_X) and the standard deviation (S).

The results were processed with the statistical program SPSS. The differences between varieties in terms of yield were tested by the LSD-test.

SOIL AND CLIMATIC CONDITIONS

According to the obtained results of chemical analysis performed on the soil surface, the same belongs to the soil type smolnica with stable mechanical structure and favorable structure that provides optimal wet, air and heat mode. According to the chemical composition, the soil is well supplied with total nitrogen (0,98 mg/100 g soil), medium provided with readily available phosphorus (24,19 mg/100 g soil) and highly secured by readily available potassium (74,1 mg/100 g soil), whit a neutral to slightly basic pH reaction (pH in H_2O = 7, the KCL = 7,90). The content of humus in the surface layer is small (2,50 to 2,79 %).

According to Filipovski et al. (1996), the Republic of Macedonia is divided into eight climate-vegetation – soil areas. Ovce pole valley, which includes the Amzabegovo place where are performed the researches (altitude 230 m), belongs to the second group with moderately continental and negative components of a Mediterranean climate. The openness of the valley from all sides also affects the specific climatic conditions, mostly on wind. Consequently of this, the valley is characterized by large temperature fluctuations and uneven arrangement of rainfall throughout the year.

The data in Figure 1 and 2 show that in the period of tests there are not registered extreme variations of temperature conditions, except for December, which at first year was characterized by much higher values compared to the second year of trials. The amount of precipitation is with negative schedule by

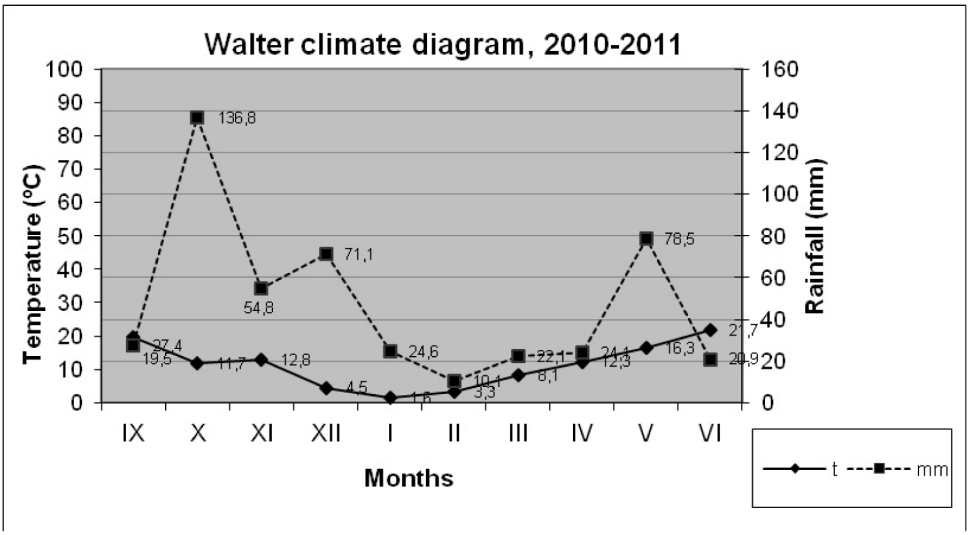

Figure 1. Walter climate diagram, 2010-2011

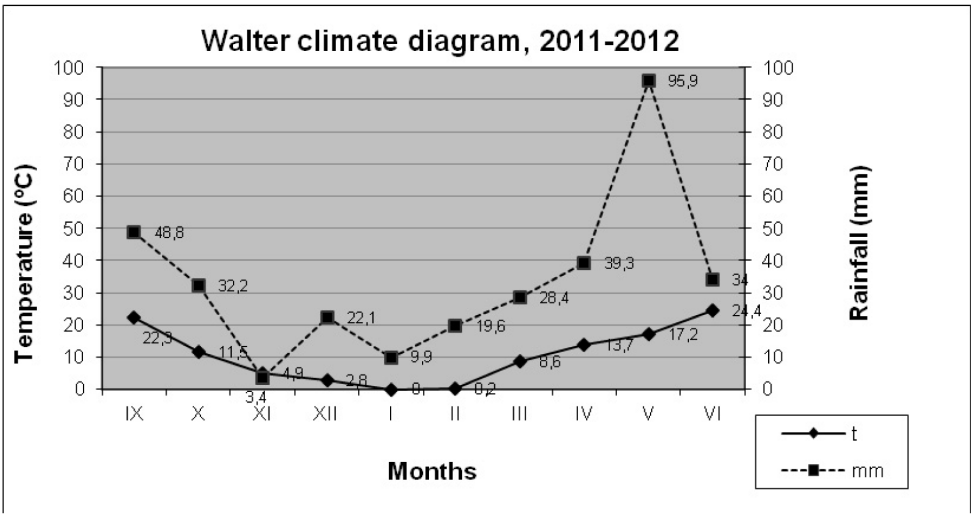

Figure 2. Walter climate diagram, 2011-2012

months. The driest month is November in the second year of trials. But particularly negative impact on yield have months March, April and June, which are relatively dry. A key role in the improvement of crops in both years of investigations had rainfall in May.

RESULTS AND DISCUSSION

Estimates of the value of a given variety are mainly based on assessment of its morphological – biological and production properties. High yield potential and good quality are the basic technological features to be recommended one variety of production. Special significance has their stability, ie the ability of a genotype in different agro-ecological conditions to maintain similar values for these properties, or to what extent the properties vary under the influence of year (Ilieva et all., 2008).

Average values of grain yield at examined varieties wheat grown in Ovce pole region during 2010/11 and 2011/12 are shown in Table 1. Analysis of the results shows that in the both years of tests, all tested varieties have a higher grain yield than the standard variety. The highest yield in both years was obtained from a variety *momchil* (5,733 t/ha^{-1} in 2010/11 and 5,533 t/ha^{-1} in 2011/12). After variety *momchil* follow: *guiness*, (5,667 t/ha^{-1} in 2010/11 and 5,533 t/ha^{-1} in 2011/12), *pobeda*, (5,333 t/ha^{-1} in 2010/11 and 5,267 t/ha^{-1} in 2011/12), *fermer* (5,067 t/ha^{-1} in 2010/11 and 5,150 t/ha^{-1} in 2011/12) and *carevec*, (4,867 t/ha^{-1} in 2010/11 and 4,833 t/ha^{-1} in 2011/12). The obtained average yield of standard variety *mila* amounts 4,600 t/ha$_{-1}$ in 2010/11 and 4,533 t/ha^{-1} in 2011/12.

Table 1. Average values of grain yield of wheat varieties tested (2010-2012)

Property	Variety	2010/2011			2011/2012			Average		
		X	S	S_X	X	S	S_X	X	S	S_X
Grain yield (t/ha^{-1})	Mila	4,600	0,600	0,346	4,533	0,503	0,290	4,566	0,047	0,033
	Pobeda	5,333**	0,115	0,067	5,267**	0,058	0,033	5,300	0,046	0,033
	Momchil	5,733**	0,115	0,067	5,533**	0,058	0,033	5,633	0,141	0,100
	Carevec	4,867	0,115	0,067	4,833	0,115	0,066	4,849	0,023	0,016
	Fermer	5,067	0,115	0,067	5,150*	0,132	0,076	5,108	0,058	0,041
	Guiness	5,667**	0,115	0,067	5,533**	0,208	0,120	5,599	0,094	0,066
Level of importance (LSD)	2010/11	0,05 0,01	0,512 0,729							
	2011/12	0,05 0,01	0,468 0,665							

Higher yield at varieties *momchil, guiness* and *pobeda*, is statistically significantly higher than standard variety, for both tested levels of importance in both experimental years. The yield of the variety *fermer* is statistically significant higher only for the level of probability 0,05 in 2011/12. At variety *carevec* positive difference terms to standard variety is not statistically significant in both years of researches. *Guiness* variety is suitable for growing in dry conditions (Mangova & Kolev, 2011).

In table 2 are given the obtained results of the examination of some of the major structural components of yield.

The plant height is significant property because the high varieties in most cases are more inclined to loading. In these studies all examined varieties are higher than the standard variety. In average, plant height ranges from 95,58 cm in variety *carevec* to 110,33 cm in variety *pobeda*, in 2010/11 and 96,83 cm also at the variety *carevec* to 115,07 cm in variety *pobeda*. In both years of testing not observed loading in the tested varieties.

Table 2. Average values of observed traits with wheat varieties tested (2010-2012)

Properties	Veriety	2010/2011			2011/2012			Average		
		X	S	S_X	X	S	S_X	X	S	S_X
Plant height (cm)	Mila	81,27	3,08	0,80	82,66	3,96	1,02	81,97	0,98	0,70
	Pobeda	110,33	8,78	2,27	115,07	4,73	1,22	112,70	3,35	2,37
	Momchil	105,50	5,32	1,53	108,08	5,20	1,50	106,79	1,82	1,29
	Carevec	95,58	4,08	1,18	96,83	4,57	1,32	96,34	0,69	0,49
	Fermer	103,17	3,04	0,88	105,92	3,42	0,99	104,55	1,94	1,38
	Guiness	105,33	4,85	1,25	101,20	7,40	1,91	103,27	2,92	2,07
Spike length (cm)	Mila	10,00	0,65	0,17	10,53	0,74	0,19	10,27	0,70	0,18
	Pobeda	9,40	0,63	0,16	9,33	0,82	0,21	9,37	0,05	0,04
	Momchil	8,87	1,13	0,29	8,73	0,70	0,18	8,80	0,10	0,07
	Carevec	10,20	0,56	0,14	9,33	0,96	0,25	9,77	0,62	0,44
	Fermer	9,07	0,88	0,23	10,13	0,74	0,19	9,60	0,75	0,53
	Guiness	9,66	0,62	0,16	9,60	0,99	0,25	9,63	0,04	0,03
Number of grains per spike	Mila	31,20	6,23	1,61	29,93	5,28	1,36	30,57	0,90	0,64
	Pobeda	39,40	8,34	2,15	47,66	10,50	2,71	43,53	5,84	4,13
	Momchil	36,87	6,83	1,76	31,93	5,91	1,53	34,40	3,49	2,47
	Carevec	29,13	9,03	2,33	31,40	5,36	1,38	30,23	0,98	1,13
	Fermer	38,60	6,14	1,59	40,20	7,61	1,96	39,40	1,13	0,80
	Guiness	42,47	7,33	1,89	44,87	8,75	2,26	43,66	1,70	1,20
1000 grain weight (g)	Mila	43,97	4,72	2,73	40,35	4,36	2,52	42,16	4,54	2,62
	Pobeda	44,97	2,00	1,15	40,91	5,78	3,34	42,94	3,89	2,25
	Momchil	49,91	2,73	1,57	50,64	1,35	0,78	50,27	2,04	1,18
	Carevec	46,55	2,83	1,64	43,88	3,65	2,11	45,21	3,24	1,87
	Fermer	44,65	0,04	0,02	44,10	1,71	0,99	44,37	0,88	0,51
	Guiness	41,53	6,79	3,92	39,58	1,69	0,98	40,55	4,24	2,45

The greatest spike length in 2010/11 were characterized variety *carevec* (10,20 cm), and in 2011/12 standard variety *mila* (10,53 cm). *Momchil* variety has the smallest spike length in both years (8,87 cm in 2010/11 and 8,73 cm in 2011/12). The obtained results show inversely proportional relationship between grain yield and spike length.

Among the most important structural elements of yield are the number of grains per spike and 1000 grain weight. In 2010/11 the highest average number of grains per spike has a variety *guiness* (42,47), while in 2011/12 variety *pobeda* (47,66). According to the average values of the both years the most grains per spike has variety guiness (43,66), and the smallest variety *carevec*. The number of grains per spike in the standard variety *mila* amounts to 31,20 in 2010/11 and 29,23 in 2011/12.

Data for 1000 grain weight showed that in both years of testing, the variety *momchil* achieve the highest value for this property (49,91 g in 2010/11 and 50,64 g in 2011/12), compared to the other tested varieties. The smallest average value of 1000 grains as in the first and in the second year of tests has variety *guiness* (41,53 g in 2010/11 and 39,58 g in 2011/12). All tested varieties have greater mass of 1000 grains in the first year of researches, accept the variety *momchil*, which the mass of 1000 grains scored in the second year.

Analyzing all the results together, at some varieties may have noticed a certain distortion between some of the examined properties, especially between yield and other traits. Because the yield is characteristic of variety, whose values influence many other factors, the reason for this may be another factor or characteristic that has not been studied in this research (such as the number of plants and productive spike per unit area).

CONCLUSIONS

Based on the conducted researches can be made the following conclusions:

– In terms of the test area the yield of all tested varieties exceeded the yield of the standard variety *mila*;

– Overcoming yield in terms standard variety, an average of both years of investigation ranges from 6,20 % for the variety *carevec*, to 23,37 % for the variety *momchil*;

– All tested varieties suited to growing in soil – climatic and production conditions Ovce pole area, especially varieties *momchil*, *guiness* and *pobeda*, whose positive differences in terms of standard variety *mila* are statistically significant in both years of examination.

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