THE EFFECT OF CLIMATIC CONDITIONS AND VARIETY ON SOME MORPHOLOGICAL AND PRODUCTIVITY CHARACTERISTICS OF TRITICALE

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Abstract. *Grain yield and quality reached by small grains are variable and affected by many factors, primarily by genotype, agroecological conditions and the applied production technology. Triticale is a plant species with high genetic potential for yield and favorable nutritional values, so it is consideredas promising. For achieving high and stable yields, it's necessary to have favorable agroclimatic conditions of the locality, variety and advanced agricultural techniques, with a special turn to fertilizing. In this paper is given a review how agroclimatic conditions of the locality and variety influence on some morphological and productive characteristics of triticale. The experiment included two localities with different agroclimatic conditions, as well as two varieties of triticale (KG-20 and Tango). The experiment was set up as block system with three repetitions. Results were processed by analysis of variance. Applied cultural operations during the triticale growing were standard, with using of NPK 80:80:60 fertilizers. Investigations were carried out in Centre for Agricultural and Technological Results of the investigation showed significant influence of the locality on plant's height, spike's length, and number of grains in spike, grain's mass per spike and yield of grains in triticale. All these characteristics had higher values in locality of Zajechar than in locality of Kraljevo. Variety Tango, in both localities, had significantly higher values of the investigated parameters than variety KG-20. The average yield for both varieties, the locality Zajecar was 6.40 t ha^{-1}, and the location of Kraljevo 5.16 t ha^{-1}, a difference of 1.24 t ha^{-1}. Higher yields on the locality Zaječar very significantly higher than at the locality of Kraljevo. Variety Tango, in locality of Zajechar , had about 0.9 t ha^{-1} higher yield than variety KG-20, while in locality of Kraljevo that difference was only 1.05 t ha^{-1} in favor of variety Tango. These differences are result of favorable climatic and soil conditions in locality of Zajechar in regard to locality of Kraljevo. These results are evidence for importance and role of agroclimatic factors and variety in expression of productive characteristics oftriticale.*

Key words**:** triticale, morphological characteristics, productive characteristics, locality, agroclimatic conditions

INTRODUCTION

Triticale is a plant species which is originated by crossing wheat and rye with an idea to unite the high level of wheat protein with a high level of yield and protein quality of rye (RADECKI AND MELLER, 1990).

Many investigators are of the opinion that triticale has the high genetical potential for yield and favourable nutritive values (BOROJEVIĆ, 1981, CVETKOV, 1982, ĐOKIĆ, 1988) so it is considered as perspective plant spieces.

For achieving high and stable yields, it's necessary to have favorable agroclimatic conditions of the locality, variety and advanced agricultural techniques, with a special turn to fertilizing.

In our country acid soils represent the serious problem in plant production. Those are soils of poor water-aero and physical-machanical characteristics and the plant production is

unstable on them. According to ANIOLO and MADEJ (1996) the highest tolerance to acid soils demonstrates rye, then triticale and wheat, while barley is the most sensitive.

According to results of IMPIGLIA (1987) triticale has lower demands in regards to wheat and hihers adaptibility on acid soils, and higher imunity to ordinary diseases, also.

Year conditions have a large inflluence to triticale yield, even larger than at wheat (MILOVANOVIĆ *et al*. 1994).

ĐOKIĆ (1990) emphasizes that, in yield forming the key role has sorts (45%), then agrotechnical measures (40-45 %) and climate factors (10-15 %).

The goal of our researchwas to establish some morphological and productive characteristics of triticale, in accordance of agroclimatic conditions of locality and sort.

MATERIAL AND METHODS

Investigations were carried out in Centre for Agricultural and Technological Investigations in Zajechar and in Agricultural School in Kraljevo, during 2008/09 and 2009/10. The experiment was set up as block system with three repetitions and included two localities with different agroclimatic conditions and two sorts of triticale (KG-20 i Tango). Basic cultivation is performed in a classic manner (do 25 cm dubine) immediately after corn/maize harvest and maize stalks removing. Sowing was carried out in October. The other technology of production which was applied in the experiment was standard, with using of NPK fertilizer, combination 80:80:60.

Triticale harvest was performed in the full mature phase, when was set the plants height, the spike length, number of grains in spike, mass per spike, absolute grain mass and yield of grains.Yield was corrected to 14% of humidity. Results were shown as average two year`s and processed by statistic method of variance analysis.

Soil and climate conditions

The experiment was performed on two localities, so we are giving a review of chemical characteristics of two type of soils in the following table.

Table 1

Chemical characheristics of soil

Zaječar - vertisol					
Depth (cm)	**pH**		**N (%)**	**Easyaccessible (mg/100 g soil)**	
	H_2O	**nKCl**		**P_2O_5**	**K_2O**
0-20	**5.23**	**4.84**	**0.12**	**16.68**	**29.53**
20 - 40	**5.54**	**5.15**	**0.11**	**12.34**	**27.22**
Kraljevo - pseudoglay					
0-20	**5.24**	**4.34**	**0.12**	**6.70**	**7.80**
20 - 40	**5.55**	**4.48**	**0.05**	**6.90**	**9.80**

Soil on Zaječar locality is non-calcareous vertisol and it is characterized by high acidity (pH u KCl-u 4,84 -5.15). The content of nitrogen in profile to 20 cm is 0,12% i it descents with a depth. The content of available phosphorus in profile to 20 cm is 16,68 mg

/100 g, and in deeper leyers is 12.34 mg. This soile is very rich in the accessable potassium (29,53 mg/ 100 g in a plough-field leyer). Those are categories of minute-soils, which means that the optimal period of time for cultivation is very short.

Soil on Kraljevo locality is pseudo glay type. This soil is of very bad phisycal characteristics (compressed, with a high portion of powder and clay particles, low permeable for water) and extremely acid reakcion (pH < 4.5). Quantity of total nitrogen is relatively satisfied, but microbiology activity is weak becouse of inviolable physical characteristics. It is characterized by low content of easy-accessible phosphorus (6.70-6.90 mg 100^{-1} g zemljišta) and potassium (7.80-9.80 mg 100^{-1} g of soil).

Although triticale comes under to group of grains which is medium bearing, extreme values of pH in pseudoglay significantly influenced the reduction of yield.

Repairation measures are needed, in order to yield on them could be satisfactory.

Table 2

Meteorological conditions during the conduct of an experiment (2008-2010)

Months	Zaječar				Kraljevo			
	Average monthly temperature of air (^{0}C)		Monthly sum of precipitation (mm)		Average monthly temperature of air (^{0}C)		Monthly sum of precipitation (mm)	
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
X	11.9	11.0	28.2	106.2	12.8	11.3	39.8	137.9
XI	6.1	7.3	29.9	106.3	8.0	8.2	48.2	63.1
XII	1.8	1.1	98.1	123.1	4.4	3.8	41.1	97.7
I	-1.3	-2.2	67.3	54.1	0.4	1.1	47.0	34.4
II	1.3	0.4	91.1	108.0	2.3	2.7	55.5	81.6
III	6.0	6.0	58.3	64.3	6.6	7.2	72.0	38.6
IV	12.1	11.9	15.4	73.5	13.4	12.1	22.8	100.2
V	17.8	16.6	18.0	58.9	18.1	16.6	36.2	84.0
VI	20.6	20.8	76.4	95.1	20.1	20.2	194.0	136.4
Average / Sum	**8.4**	**8.1**	**482.7**	**789.5**	**9.4**	**9.2**	**556.6**	**738.9**

Average monthly temperature of both localities and in both years were similar, especially in spring and summer part of vegetation. In January and February, in both years, an average monthly temperatures of air were a little bit higher in Kraljevo. So, temperatures didn`t have bigger influence to differences in yield of triticale between localities.

On both localities, the higher sum of precipitation is noted in 2009/10 year, which had influence to higher grain yield in relation to previous year. During October, November and December of 2009/10 year, on Zaječar locality is noted the sum of precipitation of 335.6 mm, which acquired bigger supplies of the winter humidity. On Kraljevo locality, in both years, are noted a little bit higher precipitations in June (194 and 136.4 mm). Considering triticale was in ripening and pouring phase, precipitations so high weren`t favorable to it. On Zaječar locality, precipitations schedule during the vegetation were more symmetrical, which reflected to higher yield. By this, thesis that the whole amount of precipitations during vegetation is not important, but her schedule in individual phenophases is confirmed.

RESULTS AND DISCUSSIONS

Morphological characteristics

Morphological characteristics are mostly sort characteristics, although those are highly dependable of production conditions and agrotechnics. In table 3. are shown some morphological characteristics of triticale in regard to locality and sort.

Table. 3

Some morphological characteristics of triticale in regard to agroecological conditions of locality and variety

Morphological characteristics	*Locality (A)*					
	Kraljevo			**Zaječar**		
	Varieties (B)			***Varieties (B)***		
	KG-20	Tango	**Average**	KG-20	Tango	**Average**
Plant's height (cm)	92.0	102.4	**97.2**	94.0	118.6	**106.3**
Spike's length (cm)	7.5	11.4	**9.4**	9.2	11.9	**10.5**
Number of grains in spike	31	34	**32.5**	36	40	**38**

Plant`s height is sort characteristics and is highly dependable of conditions of production. It is significant for lodging of plants. Plants with lower stem have better resistance to unfavourable weather conditions. An average plant`s height of triticale on Zaječar locality was 106.3 cm, on Kraljevo locality was 97.2 cm.

Spike`s length and number of grains in spike are characteristics which highly influence on forming of plants yield. An average spike`s length on Zaječar locality was 10.5 cm, on Kraljevo locality was 9.3 cm. An average number of grains in spike on Zaječar locality was 38, on Kraljevo locality was 32.5.

Higher values of cited characteristics in Zaječar locality are result of better soil and climatic conditions in regard to Kraljevo locality. Variety Tango in both localities had higher values of investigated characteristics than variety KG-20.

WIEGAND and CUELLAR (1981) emphasize that for yield are very significant the number of spikes and number of grains in spike, becouse favourable wheather conditions in an individual phenophases are necessary.

Productive characteristics

Productive characteristics directly influence to forming of yield. Favourability of agroclimatic factors is especially significant in demonstration of those characteristics.

Grain`s mass per spike is dependable of number of grains and its wight. It is coused by agroclimatic conditions, variety and technology of breeding. An average grain`s mass per spike on Zaječar locality was 1.6 g, on Kraljevo locality was 1.3 g., which is statisticly very significant. Tango variety had highly significant bigger grain`s mass on both localities than KG-20, also. WIEGAND and CUELLAR (1981) emphasize that yield is primarly dependent of grain`s mass.

Besides the number of plants and the number of grains per spike, absolute mass of grains is one of three features of which depends the whole yield. It is dependent of variety, breeding conditions and agrotechnics. Our research didn`t show any statistically significant differences in absolute mass of grains, neither between localities, nor between sorts. Absolute

mass of grains is variety characteristics and it highly depends of exterior environment, especially at times of pouring grains (MILOVANOVIĆ, 1993 and JELIĆ *et al.*,1998).

Table. 4

Some productive characteristics of triticale in dependence of agroecological conditions of locality and variety/sort

	Locality (A)					
	Kraljevo			**Zaječar**		
	Varieties (B)			***Varieties (B)***		
Productive characteristics	KG-20	Tango	Average	KG-20	Tango	Average
Grain's mass per spike (g)	1.2	1.4	**1.3**	1.5	1.7	**1.6**
0.05 (5%)	A	0.14		B	0,15	
0.01 (1%)		0.26			0,17	
Absolute mass of grains (g)	39	41	**40**	41	43	**42**
0.05 (5%)	A	2.43		B	2.62	
0.01 (1%)		3.15			2.94	
Yield of grains (t ha^{-1})	4.64	5.69	**5.16**	5.95	6.85	**6.40**
0.05 (5%)	A	0.55		B	0,43	
0.01 (1%)		0.80			0.77	

Grains yield is a category all manufacturers are striving. It is conditioned by a large number of factors, and the most important are variety, agrotechnics and climate. An average yield for both varieties on Zaječar locality was 6.40 t ha^{-1}, on Kraljevo locality was 5.16 t ha^{-1}, which presents the difference of 1.24 t ha^{-1}. Yield on Zaječar locality is significantly higher than on Kraljevo locality. Variety Tango, on both localities had significantly higher values of researched parameters than variety KG-20. Result of those highly significant bigger differences are sortiment and favourability of agroclimatic conditions of localities. In favor of this goes satisfactory chemical characteristics of soil/smonica on Zaječar locality in regard to characteristics of pseudoglay on Kraljevo locality. Better precipitations schedule on Zaječar locality facilitated this highly visible differences in yield of triticale grains. Higher amounts of precipitations in June in both years on Kraljevo locality (194 i 136.4 mm) made the extended vegetation and weaker pouring of grains, which altogether coused reduction of yield. In that manner, PRŽULJ et al. (1997) emphasize that bad conditions in pouring grains period, which prolongs vegetation, do not lead to extention of pouring grains period and influence to reduction of yield.

CONCLUSION

On basis of study of agroclimatic conditions of locality and variety to morphological and productive characteristics of triticale, we can make the following conclusion:

- Agroclimatic conditions of locality and varieties had significant influenc to morphological and prductive characteristics of triticale.
- Plant`s height, spike`s length and the number of grains per spike, at both varieties, were bigger on Zaječar locality than Kraljevo locality.

- Morphological characteristics parameters at Tango variety, on both localities, were bigger than KG-20.
- Variety showed significant influence to all investigated parameters, exept of absolute mass of grains.
- An average grain`s mass per spike on Zaječar locality was 1.6 g, on Kraljevo locality was 1.3 g.
- Neither between localities, nor varieties, didn`t exist statisticly significant differences in absolute mass of grains.
- An average yield for both varietes on Zaječar locality was 6.40 t ha^{-1}, on Kraljevo locality was 5.16 t ha^{-1}
- Tango variety had for 1.05, or 0.9 t ha^{-1} higher yield than KG-20 on both localities.

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