
INVESTIGATION OF SOME PARAMETERS OF SOME CROATIAN WINTER WHEAT CULTIVARS IN AGRO-ECOLOGICAL CONDITION OF KOSOVO

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Abstract: Yield and quality of winter wheat were of interest of a lot locally and abroad investigation. With that respect six Croatian winter wheat varieties, Kralica, Katrina, Vulkan, Lucija, Rebeka, Super zitarka whereas the standard was taken from Europe 90. were tested in small-scale trials in Kosovo during cropping season (2014, 2015, 2016.) established in the two most important agro-production localities were was investigated number of plants(m²), yield (kg/ha), 1000 gram weight (gr), plant height (cm), hectoliter weight (kg), protein content (%).

The results obtained have shown that there were statistically significant differences of different levels for the investigated traits to all cultivars included in trials compared to standard check (Evrope 90) and within the localities. Six Croatian wheat cultivars (Kralica, Katrina, Vulkan, Lucija, Rebeka, Super zitarka) were examined in climatic conditions of Kosovo on microchips, whereas the standard was taken from Europe 90. The research was conducted on two locations in Kosovo where different agro-climatic and pedagogical (Peja - Research Station of the Agricultural Institute of Kosovo and Pestova Private Farming Estate "Pestova"). The microcrops were placed with the random allocation of blocks and parcels in three repetitions. The basic plot area was 10 m² (10 m x 1.0 m). Preceding crop: corn in potatoes and potatoes in Pestova. Sowing was done in the optimal period (in the third decade of October) in both sites, experimental seedlings of type Hege 80.

Wheat (*Triticum aestivum* L.) is one of the most important crops in Kosovo, which is regularly grown on a surface of about 90.000 ha per year with low oscillations. Grain yield per unit area is one of the most important elements affecting profitability and economy of production. Average yield of wheat in recent years in Kosovo's main production areas is very low and ranges from 3.5 - 4.0 t / ha. For the successful and stable production of wheat, the responsive high yield varieties (Ghandi, et al., 2016) are essential, the agro-ecological conditions, the application of modern agrotechnical measures and the contemporary planting of plants.

The rational use of fertilizers is based on the biological needs of the plant and the cultivator, in the expected production, but also in the degree of fertility of the land where it will cultivate the agricultural culture and, in our case, the wheat. While the first two factors are known in advance and depend on the knowledge of the wheat arming culture and our productivity forecast that we seek to obtain, soil fertility is recognized by conducting a variety of chemical analyzes.

Keywords: Number of plants (m²), Stalk height (cm), winter wheat, yield, 1000 gram weight, Hectoliter mass (kg), protein content (%).

1. INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important crops in Kosovo, which is regularly grown on a surface of about 90.000 ha per year with low oscillations. Grain yield per unit area is one of the most important elements affecting profitability and economy of production. Average yield of wheat in recent years in Kosovo's main production areas is very low and ranges from 3.5 - 4.0 t / ha. For the successful and stable production of wheat, the responsive high yield varieties (Ghandi, et al., 2016) are essential, the agro-ecological conditions, the application of modern agrotechnical measures and the contemporary planting of plants. Yield is a very complex characteristic which is conditioned not only by wheat genotype but also by external conditions (Petrović Sofija et al., Drezner et al., 2016, Musa, Kelmendi et al. 2018, Borojević 2017, Denčić et al 2017) During the vegetation season (2014, 2015, 2016), Polish microchips were set up in two of the most important agro-productive areas of Kosovo, where six Croatian wheat cultivars were examined with the aim of introducing them into the national sort list of Kosovo.

2. MATERIAL AND METHODS

Six Croatian wheat cultivars (Kralica, Katrina, Vulkan, Lucija, Rebeka, Super zitarka) were examined in climatic conditions of Kosovo on microchips, whereas the standard was taken from Europe 90. The research was conducted on two locations in Kosovo where different agro-climatic and pedagogical (Peja - Research Station of the Agricultural Institute of Kosovo and Pestova Private Farming Estate "Pestova"). The microcrops were placed with

the random allocation of blocks and parcels in three repetitions. The basic plot area was 10 m² (10 m x 1.0 m). Preceding crop: corn in potatoes and potatoes in Pestova. Sowing was done in the optimal period (in the third decade of October) in both sites, experimental seedlings of type Hege 80. Fertilization for each cultivar and in each site was equal to the standard of 400 kg / ha (NPK 15:15:15) in autumn and spring 150 kg / ha (KAN) and 50 kg / ha (Urea) in the split application. Tests were carried out in the field (number of plants per 1m², stability level) and in laboratory conditions (yield, mass of 1000 grains, hectoliters weight, protein content), according to the rules of the ISTA International Seed Society 1996 (International Seed Association, 2016). The data collected were processed using variance analysis through F-est., whose significance for P <0.0 and P <0.01 levels was assumed as a prerequisite for comparing LSD variants.

2.1. Land analysis

The rational use of fertilizers is based on the biological needs of the plant and the cultivator, in the expected production, but also in the degree of fertility of the land where it will cultivate the agricultural culture and, in our case, the wheat. While the first two factors are known in advance and depend on the knowledge of the wheat arming culture and our productivity forecast that we seek to obtain, soil fertility is recognized by conducting a variety of chemical analyzes. For carrying out these analyzes in the land where our field trials were taken, the relevant soil samples were taken, at depth 0-30 cm, which were subjected to the respective analysis for the determination of the content of various chemical elements, as follows:

- Organic matter (Humus),
- General nitrogen,
- Phosphorus,
- Potassium,
- Calcium,
- Magnesium, and
- Groundwater Reaction (pH).

The land where the study of wheat cultivars in Peja was raised is reddish brown on reddish sediments, while in Pestovo the soil of the mushroom type, which represents almost 25% of Kosovo's lands. Regarding the chemical content, based on the analyzes performed in function of this paper, both parcels of field tests have approximate values

Tab.1 Data on soil chemical analysis in Peja and Pestovo

Lokacion	p H	CaCO ₃ (%)	Azote mineral (mg/100 g)		Humus (%)	Feeder element (mg/100 g)			
			N ⁻ NH ₄	N ⁻ NO ₃		P ₂ O ₅	K ₂ O	Ca	Mg
Peja	5.6	5	0.425	0.375	4.0	15.4	26.8	202.7	15.2
Pestovë	5.9	6	0.820	0.315	3.6	13.2	17.6	360.5	42.0

From soil analysis it turns out that both lands were generally rich in humus, average in phosphorus and potash, and rich in calcium and magnesium. On the basis of these data, doses of fertilizer in nitrogen, phosphorus and potash were determined, while no need for calcium and magnesium fertilization.

2. 2 Results and Discussion

Biometric researches of some phenological parameters in all varieties included in microchips were performed throughout the entire vegetation season and the results obtained (three-year mean value 2014 - 2016) are presented in the tables below.

Table 1. Number of plants (m²) of wheat cultivars examined

Varieties	PEJA	PESTOVA
Kralica	527	532
Katarina	528	530
Vulcan	538	557

Lucija	573	548
Rebeka	563	560
Super zhitarka	553	552
Evropa 90	515	523

The investigated wheat varieties differ very little in terms of plant and plant height compared to standard species (Europe 90), so that the plant line ranges from 515 (Europe 90) to 573 (Lucija) plants / 1 m².

Table 2. Stalk height (cm) wheat cultivar testing

Varieties	PEJA	PESTOVA
Kralica	91.0	90.0
Katarina	80.0	77.8
Vulcan	76.2	76.5
Lucija	75.2	74.8
Rebeka	77.8	81.0
Super zhitarka	75.0	76.0
Evropa 90	81.0	82.0

The investigated wheat varieties differ very little in terms of plant and plant height compared to standard species (Europe 90) while the plant height is ranges from 74.8 cm (Lucija) to 91.0 cm (Kralica).

Table 3. Mass of 1000 grains (gr), examined wheat varieties

Varieties	PEJA	PESTOVĚ
Kralica	50.9	54.9
Katarina	41.6	41.5
Vulcan	47.5	46.0
Lucija	42.1	41.6
Rebeka	44.9	46.5
Super zhitarka	46.3	47.5
Evropa 90	47.3	57.9

In laboratory conditions the mass of 1000 grains (gr) was investigated, where the differences in the examined varieties were compared with the standard variety. The lowest mass of 1000 grains was included in the Katarina variety in both test sites (41.5 gr or 41.6 gr), while the highest in the Kralica variety (54.9 gr or 50.9 gr).

Table 4. Hectoliter mass (kg), examined wheat

Varieties	PEJA	PESTOVĚ
Kralica	82.9	82.5
Katarina	81.7	79.8
Vulcan	83.1	81.0
Lucija	82.1	81.5
Rebeka	82.0	81.8
Super zhitarka	82.2	82.3
Evropa 90	80.5	79.4

As far as the hectoliter weight (kg) is concerned, very small differences have been found between the examined wheat cultivars compared to the standard variety (Table 4), so that the smallest hectoliter mass found in Europe 90 in Pestova (79.4 kg), while the largest in the Vulcan variety Stoves (83.1 kg). It should be noted that the mass of 1000 grains and the hectoliter mass for some authors are genetic varieties but which are influenced by external conditions (Mladenov et al.2018).

Table 5. Grain yield of examined wheat varieties, kg / ha, (ANOVA)

Varieties (A)	The site (B)	Year(C)			Mid (AxB)	Mid (A)		
		2014	2015	2016				
Kralica	Pejë	7029	6974	7250 **	7084 **			
	Pestovë	6737	6476	7113	6775	6930 **		
	middle (AxC)	6883	6725	7182 **				
Katarina	Pejë	6928	6729	6532	6730			
	Pestovë	6001	6025	6222	6083	6406 Ns		
	middle (AxC)	6465	6378	6378				
Vulcan	Pejë	6177	5948	6009	6045			
	Pestovë	6021	5822	5776	5873	5959 **		
	middle(AxC)	6099	5885	5893				
Lucija	Pejë	6233	5917	4970	5707 **			
	Pestovë	5866	5944	5898	5903	5805 **		
	middle (AxC)	6050	5931	5434 **				
Rebeka	Pejë	7072	6670	6379	6707			
	Pestovë	6076	6003	7090	6390	6548 *		
	middle (AxC)	6575	6337	6735				
Super zhitarka	Pejë	6166	5972	6301	6147			
	Pestovë	5990	5924	5896	5937	6042 **		
	middle (AxC)	6079	5948	6099				
Evropa 90	Pejë	6090	6243	6665	6333			
	Pestovë	6496	6291	6172	6320	6326		
	middle (AxC)	6293	6267	6419				
Middle (C)		6349 Ns	6210 Ns	6305 Ns				
			C ₁	C ₂	C ₃	Mid (B)		
Middle (BxC)	B ₁	6528 **	6351	6301	B ₁ 6393 **	B ₂ 6183 **		
	B ₂	6170	6069 **	6310	Interaction (AxBxC) **			
FACTOR	A	B	C	AB	AC	BC	ABC	
LSD	1 %	239.55	94.58	267.17	315.22	1015.63	414.59	2263.18
	5 %	174.87	71.85	202.97	219.39	670.42	304.61	1232.91

** = Very Significant, * = Significant, Ns = Not Significant

Various variants were statistically significant between varieties, localities, and interaction of the x locality x (Table 5). The highest yield of grain was found in the Kralica variety (6930 kg / ha), while the lowest in the Lucija variety (5805 kg / ha). Compared to the standard variety in all examined varieties except for the Katarina variety, statistically significant differences of different significance levels were found. In terms of the grain yield of varieties cultivated on certain localities, there are statistically significant differences between Peja and Pestova sites so that the highest yield was found in sorghum sown in Peja (6393 kg / ha) while the smallest on the locality Pestova (6183 kg / ha). As far as wheat cultivars are concerned, no statistically significant differences have been reported for years of experimentation. Statistically very significant differences of different levels were also determined with the inertial factor of the x locality factor, (Table 5).

Table 6. Ingredient of Crude Protein Wheat Varieties, % (ANOVA)

Varieties (A)	The site (B)	Year (C)			Mid (AxB)	Mid (A)
		2014	2015	2016		
Kralica	Pejë	15.20	14.70	15.10	15.00	
	Pestovë	15.10	16.60	16.10	15.93	15.47 **
	middle(AxC)	15.15	15.65	15.60		
Katarina	Pejë	15.30	15.50	15.80	15.53	
	Pestovë	15.60	16.90	17.60 **	16.70 **	16.12 **
	middle(AxC)	15.45	16.20	16.70 **		

Vulcan	Pejë	15.10	14.30	15.50	14.97			
	Pestovë	15.10	15.30	15.90	15.43	15.20 **		
	middle(AxC)	15.10	14.80	15.70				
Lucija	Pejë	15.30	12.30 **	14.20	13.93 **			
	Pestovë	15.40	13.20	14.80	14.47	15.63 **		
	middle(AxC)	15.35	12.75 **	14.50				
Rebeka	Pejë	15.10	13.90	15.60	14.87			
	Pestovë	15.20	14.90	16.30	15.47	14.97 **		
	middle(AxC)	15.15	14.40	15.95				
Super zhitarka	Pejë	14.70	14.10	15.40	14.73			
	Pestovë	14.90	14.90	15.80	15.20	15.17 **		
	middle(AxC)	14.80	14.50	15.60				
Evropa 90	Pejë	15.50	14.80	16.90	15.73			
	Pestovë	15.70	15.20	15.70	15.53	14.20		
	middle(AxC)	15.60	15.00	16.30				
Middle (C)		15.23 **	14.76 **	15.76 **				
Middle (BxC)		C₁	C₂	C₃	Mid (B)			
	B₁	15.17	14.23 **	15.50	B₁ 14.97 **	B₂ 15.53 **		
	B₂	15.29	14.29	16.03 **	Interaction (AxBxC) **			
FACTOR	A	B	C	AB	AC	BC	ABC	
LSD	1 %	0.2150	0.1917	0.3100	0.3212	1.2390	0.4213	2.4521
	5 %	0.1540	0.0140	0.2472	0.2306	0.7811	0.3518	1.2120

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The content of crude protein in wheat grain in the examined cultivars was different from the standard variety, Table 6. The highest percentage of protein was found in the Katarina variety (16.12%), while the lowest percentage in the European variety (14.20%). With respect to the content of protein of varieties grown on certain sites, there are statistically significant differences between the Peja and Pestova sites. The highest percentage of protein content was found in sorghum sown in the locality of Pestova (15.53%), while the smallest in Peja locality (14.97%). Statistically very significant differences of different levels were also determined with factor inertia (sort x locality x years).

3. CONCLUSION

- The investigated wheat varieties differ very little in terms of plant and plant height compared to standard species (Europe 90), so that the plant line ranges from 515 (Europe 90) to 573 (Lucija) plants / 1 m², while the plant height is ranges from 74.8 cm (Lucija) to 91.0 cm (Kralica).
- In laboratory conditions the mass of 1000 grains (gr) was investigated, where the differences in the examined varieties were compared with the standard variety. The lowest mass of 1000 grains was included in the Katarina variety in both test sites (41.5 gr or 41.6 gr), while the highest in the Kralica variety (54.9 gr or 50.9 gr).
- As far as the hectoliter weight (kg) is concerned, very small differences have been found between the examined wheat cultivars compared to the standard variety (Table 4), so that the smallest hectoliter mass found in Europe 90 in Pestova (79.4 kg), while the largest in the Vulcan variety Stoves (83.1 kg). It should be noted that the mass of 1000 grains and the hectoliter mass for some authors are genetic varieties but which are influenced by external conditions (Mladenov et al.2018).
- Various variants were statistically significant between varieties, localities, and interaction of the x locality x (Table 5). The highest yield of grain was found in the Kralica variety (6930 kg / ha), while the lowest in the Lucija variety (5805 kg / ha). Compared to the standard variety in all examined varieties except for the Katarina variety, statistically significant differences of different significance levels were found. In terms of the grain yield of varieties cultivated on certain localities, there are statistically significant differences between Peja and Pestova sites so that the highest yield was found in sorghum sown in Peja (6393 kg / ha) while the smallest on the locality Pestova (6183 kg / ha). As far as wheat cultivars are concerned, no statistically significant differences have been reported for years of experimentation. Statistically very significant differences of different levels were also determined with the inertial factor of the x locality factor, (Table 5).

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