Research of maize hybrids from Croatia of the agro - ecological conditions of Kosovo

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Abstract
Ten maize hybrids F_1 generation from Croatia were tested, during the growing season, in agro - climatic condition of Kosovo. The investigation has been performed in micro trials set up at the two most important agro production sites of Kosovo, Peja and Pestova, in which trials has been investigated the yield, crude, protein, content and other relevant traits of.
Maize (*Zea mays* L.) is one of the most important field crops that are regularly cultivated each year in Kosovo with an area 70000 - 90000 ha with some oscillation [3]. Grain yield per surface unit is one of the most important trains that influence directly for arent ability and economic production [9].The average grain yield of maize in the last years the main agro-production localities of Kosovo is very low ranging from 4.0 - 5.5 t/ha. For an economic and sustainable production of maize there is necessary to have high yield hybrids, optimal agro-climatic conditions, modern agriculture mechanization and application of proper plant protection measures the yield is very complex trait that depends by genotype of maize and environment conditions, as well [1], [2]. During the cropping season the micro trials were established in two most important agro - production localities of Kosovo to investigate the performance of ten maize hybrids from the region with the aim of their introduction into the national list of varieties Kosovo. The perspective maize hybrids. The obtained result showed that there are statistically significant differences among the maize hybrids compared with standard check, with regard to the grain yield, crude, protein contents and other traits. Such statistically significant differences have been observed between localities as well.
Key Words: Phenological traits of maize hybrids, Grain Yield kg /plot,, grain yield, crude protein content.

MATERIAL AND METHODS

During cropping season of 2017 there were evaluated ten maize hybrids originated from the region (OSSK 403, Drava 404, OS 430, OSSK 515 , OSSK 552, Tomasov, OSSK 617,OSSK 635 while as standard check was used hybrid NS 444 , NS 640 which is among the most used hybrids in Kosovo [17]. The evaluation was conducted at two different localities of Kosovo known foot different agro climatic and pedologic characteristics (Peja - Research Station of Kosovo Institute of Agriculture and Pestova - private agriculture company). The experimental design was a complete randomized block design in three replications [5.6.7]. Each hybrid was sown in plots 10 m long and 0.7 m wide with 1m space distant each other. Previous crop in trials set up in Peja was winter wheat, while in Pestovo was potato [10]. The sowing was done manually within optimal time (third decade of April) in both of localities, with the sowing distance of 25cm within a row according to the FAO group of maturity .each experimental plot received the following amount of fertilizer: 350 kg/ha (NPK 10:30:20), as a basal application, 130 - 150 kg//ha (Urea) and 50 - 70 kg/ha (KAN) respectively, split in two top dressing application, furrow irrigation was applied twice (at first and third decade of June) in both of respective localities evaluation has been performed in the field (plant height, the height of the first cob within the plant and cobs number/plant),and in the laboratory conditions (grain yield, crude protein content), according to the ISTA regulations [8]. The obtained data were statistically processed using MSTAT-C program (Crop and soil sciences Dept., Michigan St. Univ., USA), ANOVA was computed as well as a LSD test for the level of significance of 1 and 5%.

RESULTS AND DISCUSSION

Territorial and Climatic Conditions (Temperatures)
As shown in the Chart (No.2) and in the following diagram (No.1) temperatures for experimental period (January - december) fluctuate between - 3.80^0C and 23.4^0C [12]. Ten days with cold periods coincide with - 6.2^0C, and is the second ten days of the month with cold (January) [13]. The extreme temperatures oscillate between – 9.3^0C and + 33.4^0C, respectively in January and July. In the case of our study, it was estimated that temperatures are such that do not constitute any obstacles in the normal development of the processes that interested us [14].
Regarding the case, these processes can be: mineralization, nitrification, DE nitrification and immobilization of nitrogen. Thus, the average air temperatures in Peja, during the intensive growing months (April, May, June) varies between 8 and 21^0C [16]. Temperatures are slightly lower compared with the same period of the previous years: They vary between -3.8^0C (average temperatures in December) and 23.4^0C (monthly average in July). In the period of April - June have approximately the same view (respectively $7.7.-14.7^0$ and 20.3^0C).
The following chart below describes in details (divided into quarterly) the average temperatures and average rainfalls of the ten days in Peja station, where the experiment has been done [15].
Biometric investigation of phenological parameters was done during the whole cropping season for all hybrids in experimental plots while the results are presented in Table 1.
With regard to the plant height all of maize hybrid little differs from the standard check (NS 640), with the lowest value recorded to the hybrid OSSK 403 (226.0 cm) and the highest to the hybrid OSSK 617 (265.5 cm).

The height of the first cob in the plant was different as well for all of maize hybrids under evaluation, compared to standard check. Most of the hybrids were higher than NS 640, with the lowest one recorded to hybrid OSSK 403 (96.0 cm) and the highest one to hybrid OSSK 617 (113.5 cm). As for the number of the cobs per plant, which is considered among the most important yield components [13], the studied hybrids were highly variable with respect to this characteristic, from 1.10 cobs/plant (Drava) to 1.60 (OSSK 515), whereas for standard check the number of combs per plant was 1.15 -1.30.

According to ANOVA (Table 2) there were statistical differences of different level of significance with regard to grain yield with respect to the hybrids, localities and interactions of factors (hybrids x localities). Comparing to standard check NS 640 the lower grain yield was realized with hybrids Tomasov (17.05) and OSSK 552 (17.53) whereas the other gave higher grain yield with the highest being to hybrid OSSK 617 (19.51 kg/plot). Statistically highly significant differences were shown with respect to the hybrids sown in different localities, the highest grain yield obtained with hybrids sown in Peja (18.63 kg/plot). These differences to some extent were anticipated, taking into account different climatic and pedologic conditions that were more favorable for maize cultivation in Peja. According to ANOVA (Table 2) there were statistical differences of different level of significance with regard to the interaction of factors, hybrid x locality.

Crude protein content in the gain of maize hybrids varied and standard check (Table 3). According to ANOVA it was shown that there are statistically significant differences of different level of significance between hybrids and standard check with the highest content of crude protein to hybrid OSSK 617 (13.7%) and the lowest one to hybrids OSSK 515 and OSSK 552(9.9 %). Statistically significant differences were shown as well between hybrids sown in different localities. The highest percent of crude protein content was obtained with hybrids sown in Peja (11.7%) compared with those sown Pestovo (11.6%). Statistically significant different were shown as well concerning the interactions of factors, hybrids locality (Table 3).
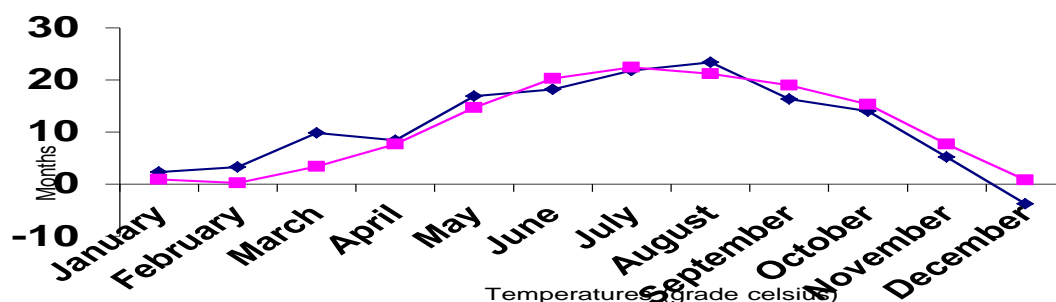

Figure 1.The average monthly temperature variations in Peja – Kosovo

Table 1. Phenological traits of maize hybrids at two localities in Kosovo

Nr.	Hybrid	Locality	Plant height (cm)	Height of the first cob in plant (cm)	No. of cobs per plant
1.	OSSK 403	Peja	226.0	96.5	1.15
		Pestova	230.0	96.0	1.15
2.	Drava 404	Peja	250.0	110.0	1.10
		Pestova	248.5	108.0	1.10
3.	OS 430	Peja	250.0	103.3	1.15
		Pestova	250.0	103.5	1.15
4.	OSSK 515	Peja	255.5	106.6	1.60
		Pestova	254.0	106.5	1.60
5.	OSSK 552	Peja	250.5	106.6	1.15
		Pestova	255.0	105.0	1.15
6.	Tomasov	Peja	260.5	110.0	1.15
		Pestova	258.0	110.5	1.15
7.	OSSK 617	Peja	265.5	113.3	1.25
		Pestova	265.0	111.0	1.25
8.	OSSK 635	Peja	260.0	103.3	1.15
		Pestova	258.5	103.5	1.15
9.	NS 444	Peja	258.0	110.0	1.15
		Pestova	260.0	110.5	1.15
10.	NS 640	Peja	260.0	113.3	1.30
		Pestova	260.5	110.0	1.30

Table 2. Grain Yield kg /plot of maize hybrids at two localities in Kosovo

Nr.	Hybrid (A)	Locality (B)	Year (C)	Average (A)
1.	OSSK 403	Peja	18.96	18.23
		Pestova	17.50	
		Average (A x C)	18.23	
2.	Drava 404	Peja	19.26	18.36
		Pestova	17.46	
		Average (A x C)	18.36	
3.	OS 430	Peja	18.83	17.98
		Pestova	17.13	
		Average (A x C)	17.98	
4.	OSSK 515	Peja	19.23	18.18
		Pestova	17.13	
		Average (A x C)	18.18	
5.	OSSK 552	Peja	18.13	17.53
		Pestova	16.93	
		Average (A x C)	17.53	
6.	Tomasov	Peja	17.70	17.05
		Pestova	16.40	
		Average (A x C)	17.05	
7.	OSSK 617	Peja	19.40	19.51
		Pestova	19.63	
		Average (A x C)	19.51	
8.	OSSK 635	Peja	18.66	19.18
		Pestova	19.70	
		Average (A x C)	19.18	
9.	NS 444	Peja	17.26	17.85
		Pestova	18.50	
		Average (A x C)	17.85	
10.	NS 640	Peja	18.90	17.85
		Pestova	16.80	
		Average (A x C)	17.85	
	Average (B x C)	**B1**	18.63	**Average (B)**
		B2	17.72	18.1783
	Factor	**A**	**B**	**AB**
LSD	1 %	0.9403	1.3841	1.3546
	5 %	0.6864	1.0149	0.9919

Table 3. Crude protein content (%), of maize hybrids at two localities in Kosovo

Nr.	Hybrid (A)	Locality (B)	Year (C)	Average (A)
1.	OSSK 403	Peja	11.4	11.1
		Pestova	10.9	
		Average (A x C)	11.1	
2.	Drava 404	Peja	10.5	10.9
		Pestova	11.4	
		Average (A x C)	10.9	
3.	OS 430	Peja	13.1	12.5
		Pestova	11.9	
		Average (A x C)	12.5	
4.	OSSK 515	Peja	10.0	9.9
		Pestova	9.7	
		Average (A x C)	9.9	
5.	OSSK 552	Peja	9.6	9.9
		Pestova	10.2	
		Average (A x C)	9.9	
6.	Tomasov	Peja	12.3	12.4
		Pestova	12.5	
		Average (A x C)	12.4	
7.	OSSK 617	Peja	13.8	13.7
		Pestova	13.6	
		Average (A x C)	13.7	
8.	OSSK 635	Peja	12.8	12.5
		Pestova	12.3	
		Average (A x C)	12.5	
9.	NS 444	Peja	12.1	12.0
		Pestova	11.9	
		Average (A x C)	12.0	
10.	NS 640	Peja	11.8	11.5
		Pestova	11.3	
		Average (A x C)	11.5	
	Average (B x C)	**B1**	11.7	**Average (B)**
		B2	11.6	11.6
	Factor	**A**	**B**	**AB**
LSD	1 %	0.9403	1.3841	1.3546
	5 %	0.6864	1.0149	0.9919

CONCLUSIONS

The results obtained after only one growing season, we can give partial indication of hybrids performances that has been undoubtedly influenced by climatic conditions recorded during the year of 2017. The results have shown that there were statistically significant differences among investigated hybrids compared to standard check grain yield and crude protein content. Comparing to standard check NS 640 the lower grain yield was realized with hybrids Tomasov (17.05) and OSSK 552 (17.23), whereas the higher grain yield was recorded to hybrids OSSK 617 (19.51 kg/plot). Statistically highly significant differences were shown with respect to the hybrids sown in Peja (18.63 kg/plot). The highest content of crude protein was recorded to hybrids OSSK 617(13.7%) and the lowest one for hybrids OSSK 515 and OSSK 552 (9.9%), whereas the highest percent of crude protein content was obtained with hybrids sown in Peja (11.7%) compared with those sown in Pestovo (11.6%). Finally most of evaluated maize hybrids showed very high level of adaptability in agro-climatic condition of Kosovo those most of the evaluated hybrids will be proposed for their introduction into national variety list of Kosovo.

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