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## **THE IMPORTANCE OF A CROP ROTATION ON MAIZE PRODUCTIVITY**

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### **Abstract**

One of important measures in agriculture is a crop rotation. It is known that a crop rotation is associated with high yields, and suppressing of pathogens and weeds. It is a cheap measure – only decision is needed. On the other hand, a crop rotation gives possibility to use different crops and different pesticides (herbicides), what could be beneficial in anti-resistant strategy. The aim of this work was to evaluate maize growing in a crop rotation with winter wheat and maize monoculture. The field trial was set up in 2009 on an experimental field of the Maize Research Institute "Zemun Polje" in Serbia. This paper presents the results from 2017– after eight years of growing maize in monoculture and after four maize-winter wheat rotations. Maize hybrids ZP 677 and ZP 606 were tested in the experiment. Herbicide combination of isoxaflutole and s-metolachlor was applied (in recommended and ½ of recommended dose) for weed control. The effects of the crop rotation on maize were evaluated by observing the leaf area and plant height (at the anthesis stage), as well as the grain yield. In the crop rotation treatments the leaf area and plant height were significantly higher when compared to maize grown in monoculture. Irrespective to unfavourable meteorological conditions, both hybrids had higher yields when grown in rotations with winter wheat, in comparison to monoculture.

**Keywords:** *Maize, maize-wheat rotation, monoculture*

### **Introduction**

Integrated Weed Management System (IWMS) implies a holistic approach that can integrate a large number of methods and measures that place plants in much better position than weeds (Harker and O Donovan, 2012). It means that, in case of weeds, do not use only herbicides for weed suppression, but also others tools – nonchemical tools for weed suppression. Usage of IWMS gives long-term advantages in weed control, avoiding or delaying some negative effect of herbicides application (e.g weed resistance, soil contamination etc.). According to Swanton and Weise (1991) herbicides should be one of the solutions in weed management strategy, not the only one. Crop rotation is one of the method for weed suppression and it gives a huge advantages when is applied. Advantages of crop rotation are: preserving land quality, reducing herbicide usage and provides higher grain yields achieving (Liebman et al., 2001). In case of weeds, crop rotation influence directly on weeds by reducing their number. According to Bastiaans (2010) weeds life cycle and spreading are lower in crop rotation compared to monoculture. On the other hand, cultivating plants in monocultures can lead to changes in the floristic composition, contributing to the spread of resistant and therefore harmful weeds (Stefanović et al., 2011). The aim of this research was to examine potentially positive effects of crop production in relation to cultivation of corn in monoculture using herbicides, by maize measuring leaf area, plant height and grain yield.

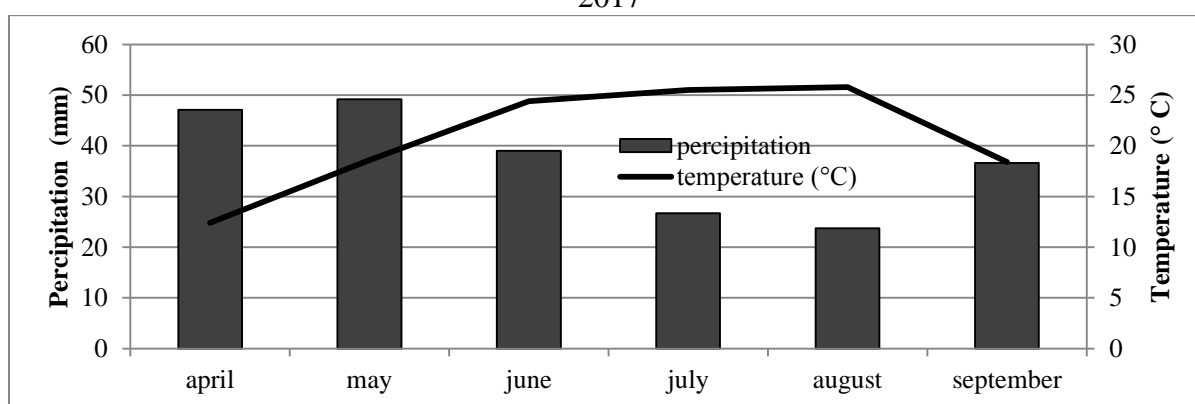
### **Material and Methods**

The study of the effects of maize growing in monoculture and crop rotation with winter wheat began in 2009 at the field of the Maize Research Institute in Zemun Polje, on weak-carbonate chernozes. The experiment examined the influence of maize cultivation in monoculture and crop rotation with wheat. This paper presents the results obtained in 2017, that is, after eight

years of corn cultivation in monoculture and crop rotation. In each field, two hybrids of corn, hybrid of the older generation - ZP 677 and newer generations - ZP 606 were sown. The weeds in the experiment were suppressed by the herbicidal combination of isoxaflutol (Merlin flexx) and s-metolachlor (Dual Gold) in the recommended dose (RD) and ½ recommended doses. In the control variant, herbicides were not applied and it remained stunted until the first weed count. Influence of different growing systems on maize were tested by measuring leaf area, plant height in anthesis stage and grain yield after harvest.

The meteorological data are presented in Graph 1. The year 2017 was very warm, with high spring temperatures and optimal precipitation. The second part of the vegetation season was extremely warm, while the precipitation was insufficient for corn growing and developing. Obtained data were statistically processed by ANOVA and differences between means were tested by LSD test

Graph 1. Meteorological conditions in Zemun Polje during the vegetation period in 2017



### Results and Discussion

According to obtained data, significant influence of applied treatments on maize parameters were recorded (Table 1). Leaf area and plant height values were significantly higher for both hybrids grown in crop rotation compared with maize monoculture. In treatment with ½ of RD maize hybrid ZP 677 had the highest values of leaf area, while the highest leaf area in ZP606 was recorded in RD treatment. Similar results were observed on maize height. Also, maize growing in crop rotation with winter wheat shows positive effects on tested parameters even in control treatments. Positive effect of maize growing in crop rotation with winter wheat was reported by Spasojević (2014). In his research, significant influence of crop rotation were observed on maize parameters, compared to maize grown in monoculture.

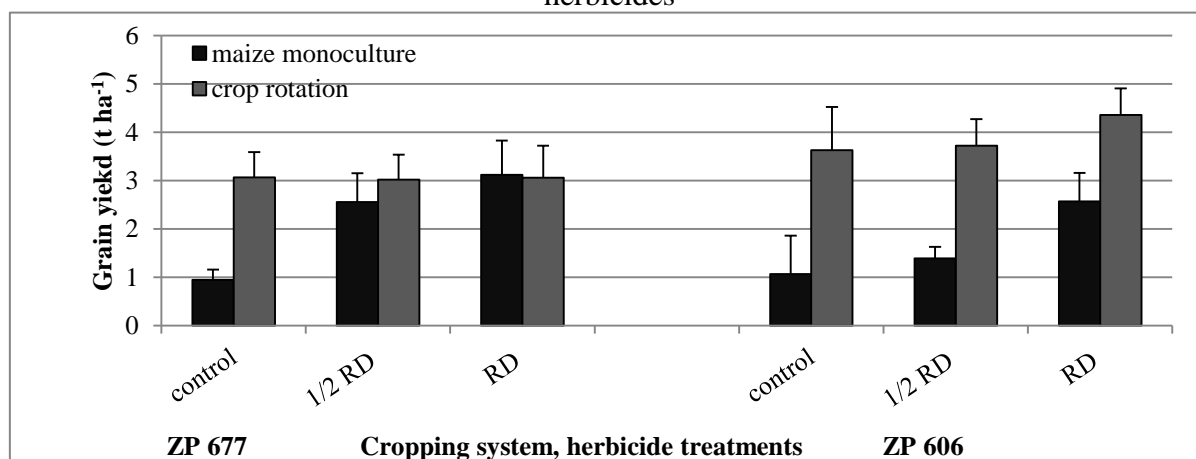
Table 1. Effects of applied treatments on maize parameters

	Leaf area (cm <sup>2</sup> )			Maize height (cm)		
	control	½ RD	RD	control	½ RD	RD
ZP 677	Herbicide treatment					
Monoculture	1719.0	3903.6*	3870.7*	92.3	177.5*	183.4*
Crop rotation	3036.2	6496.6*	5099.6*	93.4	181.1*	178.8*
	Leaf area (cm <sup>2</sup> )			Leaf area (cm <sup>2</sup> )		
ZP 606	Herbicide treatment					
Monoculture	1730.2	4282.1*	4223.6*	175.1	224.5*	213.8*
Crop rotation	4099.2	6453.1*	6942.0*	163.4	216.0*	215.6*

\* - p<0,05 – statistical significant difference, RD – recommended dose

In the study year, meteorological conditions, especially in the second part of the vegetation, had an impact on the grain yield of both maize hybrids. The advantage of growing in crop rotation for hybrid ZP 677 was recorded in control treatments (3 t ha<sup>-1</sup> in relation to 1 t ha<sup>-1</sup> in monoculture). Unlike hybrid ZP 677, the hybrid of the newer generation ZP 606 had a significantly higher grain yield on all treatments in crop rotation, compared to the monoculture. Even with this hybrid, meteorological conditions influenced the reduction in yield, but to a lesser extent compared to ZP 677. The highest yield was recorded in the treatment of the recommended dose of herbicides (4.2 t ha<sup>-1</sup>) (Graph 2). Among other things, the yield of maize to a great extent depends on the presence of weeds. Reduction in yield can also be over 90% if we do not apply weed control measures, and at global level, the average global loss caused by weeds is about 10% (Oerke, 2006). The decrease in the presence of weeds is directly related to the increase in yield, which is the direct effect of fertility and the application of herbicides (Simic et al., 2016). Kovačević et al. (2008) claim that the use of crop rotation in corn leads to a reduction in the presence of weeds, and therefore an increase in yield.

Graph 2. Grain yield of corn hybrids depending on the breeding and application system of herbicides



LSD<sub>0.05</sub> (hybrid): 1,29; LSD<sub>0.05</sub> (cropping system):1,24; LSD<sub>0.05</sub> (treatment): 1,00

### Conclusions

Maize growing in crop rotation with winter wheat gives huge advantages and can be one of the solutions in IWMS. All tested parameters, leaf area maize height and grain yield, had the higher values in treatments included crop rotation. Herbicide application helped by weed suppression, so even ½ of recommended rate of pre-em herbicides can significantly influence on weeds. This means that simple crop rotation of maize with winter wheat can be an important tool for achieving higher yields, and off course solve problem with weeds.

### Aknowledgements

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