

Professional paper

*Стручни рад*

UDC 631.153:[633.11+633.15](497.11)“2007/2016“

DOI: 10.7251/AGREN1803199G

University of Banjaluka, Faculty of Agriculture

*Agro-  
knowledge  
Journal* **A**

## Comparison of Maize and Wheat Production in Serbia During the 2007-2016 Period

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### Abstract

The objective of this paper is to show and compare the production of maize and wheat in Serbia from 2007 to 2016. This paper presents an analysis of the production of maize and wheat in the Republic of Serbia, by applying the method of comparison and using the data on previous years and comparing them with the 2016 data. The data are available on the website of the FAOSTAT statistical database and on the website of the Statistical Office of the Republic of Serbia (RZS), which were used for comparison and analysis. The record year when it comes to the harvest of maize was 2014, in the period from 2007 to 2016, with its production over 7.951.583 tonnes. The highest production of wheat was in 2016, and it amounted to 2.884.537 t. The year 2016 recorded the highest production of wheat in the last decade while corn advanced in comparison to the previous year, the best production having been achieved in 2014. We can say that, as far as production is concerned, the situation is improving with minor fluctuations.

*Key words:* maize, wheat, production, Serbia

## Introduction

Compared to all other agricultural crop species in Serbia, wheat and maize are grown the most. Wheat is sown in Serbia in the area of 500,000 ha, while maize covers the area of about 1,000,000 ha, with greater or lesser variation. In 2016, Serbia took the 18<sup>th</sup> place in terms of total maize production in the world according to the FAOSTAT data, whereas Serbia is not among the top 20 countries when it comes to wheat production. Over 70% of the world population consumes wheat bread. Wheat bread is a high-calorie food (9,000 J), with a high content of proteins 16-17%, carbohydrates 78% and fats 1-1.5%. The most important indicator of wheat quality is the quantity and quality of proteins in wheat grains.

The international standard of protein content in grains is 13.5%. However, the protein content considerably varies depending on the region (climate, soil) and fertilization. The wheat grown in the east and the south has a higher protein content than the wheat grown in the western and northern regions (Todorović et al., 2003). In order to maximize the yield, semi-dwarf wheat genotypes are increasingly grown in Serbia, as well as around the world (Grčak et al., 2017). Corn (maize) is the most important crop species in Serbia, and in recent years, it has been the main export product of this country. Corn is used in human nutrition, domestic animal feed, and in industrial production. The Republic of Serbia participates with about 1.5% in the world's corn export. For example, in 2013 the export value of corn totalled 210,724 dollars (Zlatanović, 2016). It is particularly important when it comes to corn seeds, especially the so-called high category seeds which include inbred lines. New varieties or hybrids are the cheapest innovations in agriculture, because they comprise about 50% in the yield, and only up to 5% in the costs, with price of breeding and seed production calculated in (Hojka and Kumbarić, 2011).

When it comes to the average yield of wheat in Serbia, it is 4.53 t/ha, while it amounts to 5.77 t/ha in the EU, 3.14 t/ha in the US, 2.54 t/ha in Russia, and 1.97 t/ha in Australia. Serbia participates with 0.26% in the total planted area under wheat in the world, and with 0.36% in the total yield of the world's wheat, which implies realistic possibilities of Serbian impact on global wheat production and price movements in the world. Serbia is at the 17<sup>th</sup> place when it comes to wheat production in Europe (Žita Srbije, 2017).

Wheat, along with maize and rice, underpins the world's food supply, providing 44% of total edible dry matter and 40% of food crop energy consumed in developing countries (Lantican et al. 2005).

Maize is nowadays one of the most widely grown crops, and it is cultivated from the equator to the approximately 50° north and south, and at an altitude starting from the sea level to 3000 m above sea level (Morris, 2002).

Although maize is cosmopolitan in nature, it is the major staple food of several countries of Latin America, Eastern Africa, Central America and South-east Asia including China (Christensen, 2002).

One of the most sensitive crops to drought is corn, regardless of the fact that it is a plant with high speed photosynthesis and a relatively low rate of transpiration. In Serbia, drought has significantly affected the reduction of grain yield in maize, especially in the last decade. Therefore, the main breeders' task is to create the maize tolerant to drought so it could successfully cope with negative consequences of global warming (Andelkovic et al., 2012). Global climate change is evident in the Republic of Serbia and is confirmed by a large number of observations.

Average global temperature has increased by 0.8°C relative to the pre-industrial period, and by more than 1.5°C in Belgrade since the measurements started in 1888. The highest growth was actually recorded after 1970 and the last decade was the hottest so far (Pejanović, 2016).

The aim of this study is to show and compare the production of wheat and maize in Serbia from 2007 to 2016.

## Material and Methods

In order to determine which direction the production of maize and wheat in Serbia has taken in the past decade, we have used the data available on the FAOSTAT website.

Given that the 2017 data were not available on the website during the writing of this paper, the data we collected refer to the period from 2007 to 2016. These data gave us insight into the harvested area and total yield in the previous years (Table 1).

We also collected data from the Statistical Office of the Republic of Serbia (RZS) for the period from 2007 to 2016 (Table 2) in order to determine whether there are differences between the two sources.

After collecting and sorting the data, we performed an index comparison of the data and determined how much the production of maize and wheat in previous years differed in relation to 2016.

Tab. 1. The harvested area and total yield of maize and wheat according to the data available on the FAOSTAT website

*Пољњевена површина и укупан принос кукуруза и пшенице према подацима присутним на интернет адреси FAOSTAT-a*

Year	Maize - area harvested (ha)	Maize - production (tonnes)	Wheat - area harvested (ha)	Wheat - production (tonnes)
2007	1.201.832	3.904.825	559.257	1.863.811
2008	1.273.910	6.158.120	487.399	2.095.400
2009	1.208.640	6.396.262	567.654	2.067.555
2010	1.223.579	7.207.191	484.205	1.630.404
2011	1.258.437	6.479.564	493.006	2.076.237
2012	976.020	3.532.602	603.275	2.399.225
2013	980.334	5.864.419	631.640	2.690.266
2014	1.057.877	7.951.583	604.748	2.387.202
2015	1.010.227	5.454.841	589.922	2.428.203
2016	1.010.097	7.376.738	595.118	2.884.537

Tab. 2. The harvested area and total yield of maize and wheat according to the data available on the RZS website

*Пољњевена површина и укупан принос кукуруза и пшенице према подацима присутним на интернет адреси РЗС*

Year	Maize - area harvested (ha)	Maize - production (tonnes)	Wheat - area harvested (ha)	Wheat - production (tonnes)
2007 <sup>*1</sup>	1.201.832	3.904.825	559.257	1.863.811
2008 <sup>*1</sup>	1.273.908	6.158.122	487.399	2.095.403
2009 <sup>*1</sup>	1.208.640	6.396.262	567.654	2.067.555
2010 <sup>*2</sup>	1.223.573	7.207.191	484.242	1.630.546
2011 <sup>*2</sup>	1.258.437	6.479.564	493.006	2.076.237
2012 <sup>*3</sup>	976.021	3.532.602	603.275	2.399.224
2013 <sup>*3</sup>	980.334	5.864.419	631.640	2.690.266
2014 <sup>*3</sup>	1.057.877	7.951.583	604.748	2.387.202
2015 <sup>*4</sup>	1.010.227	5.454.841	589.922	2.428.203
2016 <sup>*4</sup>	1.010.097	7.376.737	595.118	2.884.537

Source: RZS

\*1 <http://publikacije.stat.gov.rs/G2010/Pdf/G20102002.pdf>

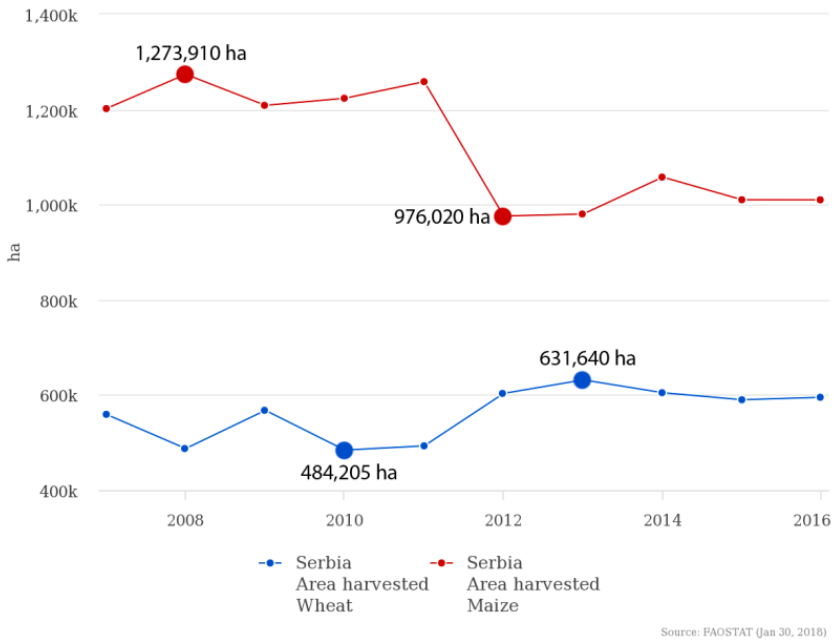
\*2 <http://publikacije.stat.gov.rs/G2012/Pdf/G20122007.pdf>

\*3 <http://publikacije.stat.gov.rs/G2015/Pdf/G20152016.pdf>

\*4 <http://publikacije.stat.gov.rs/G2017/Pdf/G20172022.pdf>

## Results and Discussion

By analysing the collected data, we were able to notice that the fluctuations in the total production of maize were more expressed in relation to the total wheat production in the past decade (Graph 2). This can also be seen in the data relating to the harvested area (Graph1) in the 2007-2016 period.



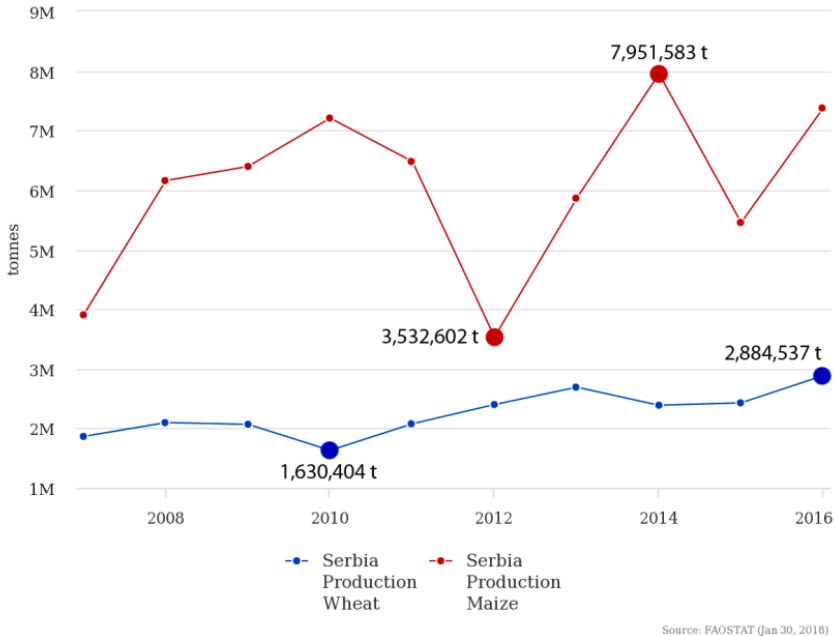
Graph 1. Harvested area under maize and wheat for the given period of time according to the FAOSTAT

*Пожњевена површина кукуруза и пшенице за дати период, према FAOSTAT-у*

Based on the data shown, we can determine when Serbia had the largest cultivated area under maize and wheat and what the exact values were. In 2008, Serbia had 1,273,910 ha of harvested area under maize, which was the maximum in relation to all the years in the period from 2007 to 2016. However, the minimum was reached in 2012, when Serbia merely had 976,020 ha of harvested area under maize.

As for wheat, based on Graph 1, we can conclude that it was grown to a much lesser extent in Serbia, compared to maize. In 2013, Serbia reached the maximum value in terms of the harvested area under wheat.

This value was 631,640 ha. The minimum value of the harvested area under wheat was registered in 2010 and it amounted to 484,205 ha.



Graph 2. The maize and wheat yields in Serbia for the given period of time according to the FAOSTAT  
*Принос кукуруза и пшенице у Србији за дати период, према FAOSTAT-у*

By comparing these data, we can conclude that the area under maize decreased in relation to 2007, while the area under wheat increased slightly. When it comes to the yields achieved, greater oscillations can again be observed in maize, while the yield of wheat had a relatively stable increase after 2010. The highest yield of maize was registered in 2014, when it amounted to 7,951,583 t, while the lowest yield was registered in 2012, when it reached 3,532,602 and when the area under this crop was the smallest in the period from 2007 to 2016.

Wheat achieved the highest yield in 2016, when it amounted to 2,884,537 t. The lowest yield of wheat was registered in 2010, when the harvested area was the smallest and the yield reached 1,630,404 t.

An index comparison of production- related data collected from the FAOSTAT and the Statistical Office websites was carried out (Graph 3, Graph 4, Graph 5 and Graph 6). The index comparison was performed according to the 2016 data, when the total yield of maize was 7,376,738 t and the total yield of wheat was 2,884,537 t and that year was used as zero value.

The yield of cereals, e.g. corn, is largely dependent on weather conditions, fertilization, hybrids, the corn cultivation system (monoculture, two- and three-field system), irrigation (Latković et al., 2009; Gošić-Dondo, 2014; Ostić and Radanović, 2012).

In addition to these factors, the achievement of higher yields, better quality and adaptation to various environmental conditions are influenced by grain refinement (Knežević et al., 2016; Jocković et al., 2009; Palaveršić et al., 2012).

By comparing the data presented in the graphs (Graphs 3 and 4), we can conclude that there are no major differences between the FAOSTAT data and the RZS data.

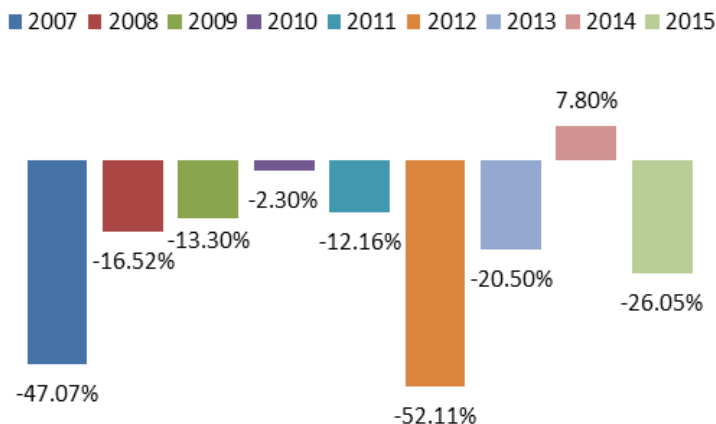
According to the FAOSTAT and RZS data, we can see that the maize production in 2007 was 47.07% lower than in 2016. In 2008, according to the FAOSTAT data, the total production was 16.52% lower than in 2016, and the same is evident from the RZS data. The data for the period from 2009 to 2016 vary to a very small extent, e.g. by 0.01% in 2013. In 2010, maize production was very similar to the production in 2016, with better production by only 2.3% even though the harvested area was bigger in 2010.

Based on the graph, we can conclude that in 2012, when the lowest total yield was harvested, the production was around 52% lower compared to 2016 and harvested area was the smallest. The maximum total yield of maize in the monitored period was achieved in 2014 and was by 7% higher than the total yield in 2016. In that year the harvested area was slightly bigger and measured 1,057,877 ha, while in 2016 harvested area was 1,010,097ha.

As for the index comparison of data relating to the wheat yield, very minor deviations between the FAOSTAT data and the RZS data can also be noticed. According to the FAOSTAT and RZS data, the yield in 2016 was by 35.39% higher than the yield in 2007.

The data regarding the minimum and maximum values have remained relatively the same in both sources. The lowest total production of wheat was registered in 2010 and it was around 43% lower than the production in 2016. The best result was accomplished in 2016 when the production of wheat was measured at 2,884,537 t.

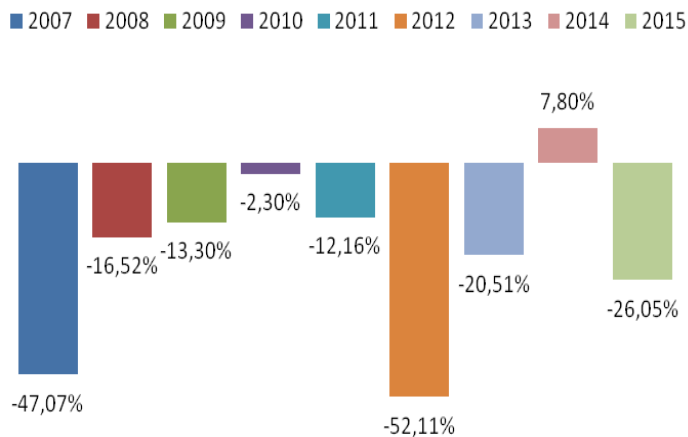
## Production of maize



Graph 3. Index of maize production compared to 2016 according to the FAOSTAT data.

*Индекс производње кукуруза у односу на 2016. годину према подацима FAOSTAT-а*

## Production of maize

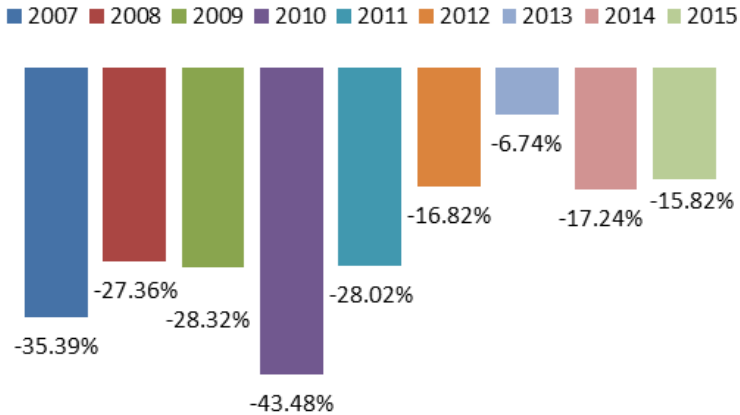


Graph 4. Index of maize production compared to 2016 according to the RZS data

*Индекс производње кукуруза у односу на 2016. годину према подацима РЗС*



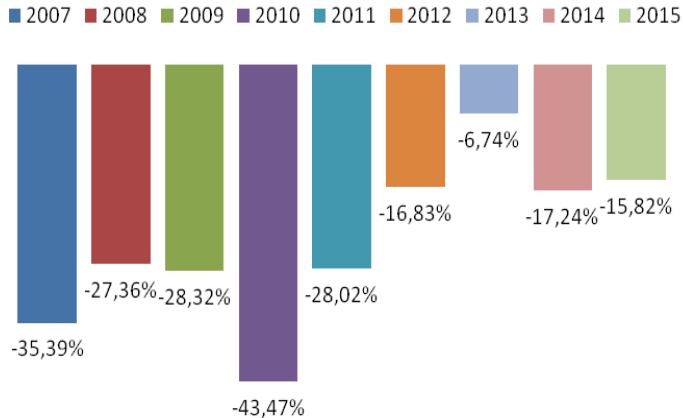
## Production of wheat



Graph 5. Index of wheat production compared to 2016 according to the FAOSTAT data.

*Индекс производње пшенице у односу на 2016. годину према подацима FAOSTAT-а*

## Production of wheat



Graph 6. Index of wheat production compared to 2016 according to the RZS data.

*Индекс производње пшенице у односу на 2016. годину према подацима РЗС*

## Conclusion

Based on the data presented and the index comparison, it can be concluded that the wheat production in Serbia has been rising slightly, especially since 2010, when the minimum for the entire research period was achieved. These results are promising, as well as the results that show that the area under this crop has been gradually increasing. Maize, on the other hand, had more fluctuations when it comes to the yield and harvested area. However, the results achieved in 2014 and 2016 are a good indicator that the total yield could be increased even though the area under maize was significantly smaller in this period than the area in the period from 2007 to 2011.

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# Компарација производње кукуруза и пшенице у Србији у периоду 2007-2016

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## Сажетак

Циљ рада је приказати и упоредити производњу кукуруза и пшенице у Србији у периоду 2007-2016. Овај рад представља анализу производње кукуруза и пшенице у Републици Србији, путем метода компарације података из претходних година са подацима за 2016. годину. Ови подаци, кориштени за компарацију и анализу, доступни су на интернет страници FAOSTAT статистичке базе података и на интернет страници статистичког завода Републике Србије (РСЗ). Када је у питању берба кукуруза, рекордна година у периоду 2007-2016 је била 2014., са укупном производњом кукуруза од преко 7,951,583 тона. Највећа производња пшенице била је 2016. године, са укупно 2,884,537 тона. У 2016. години забиљежена је највећа производња пшенице у посљедњој деценији, док је највећа производња кукуруза забиљежена у 2014. години. Када је у питању укупна производња, може се рећи да постоји тенденција раста са мањим флукуацијама.

*Key words:* кукуруз, пшеница, производња, Србија.

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Received: February 5, 2018  
Accepted: October 23, 2018