

THE EFFECTS OF AGRICULTURAL TECHNOLOGY ON MAIZE YIELD IN SOMBOR REGION IN SERBIA IN 2013-2022 PERIOD

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Abstract

The most cultivated crop in the area of Northwestern Serbia is maize. In the Sombor region maize is grown on about 60,000 ha each year, and in Serbia it is grown on more than 1,000,000 ha, which makes Serbia a significant producer of this cereal. The Agricultural Extension Service Sombor has been monitoring the correlation between agrotechnical measures and maize yield for several decades. The following agrotechnical measures are monitored: time of primary tillage, impact of previous crop, use of mineral fertilizers, time of sowing and selection of hybrids. Each of these measures are in the hands of agricultural producers and through these measures, producers effect the level of maize yield. The primary tillage in dry condition preserves the necessary soil moisture and it is one of the most important moments in production given climate change. Proper usage of mineral fertilizers, the choice of the appropriate pre-crop and sowing time also has a very significant impact on yield. Also, the choice of maize hybrids according to FAO groups and production orientation (mercantile or silage maize, sweet maize, popcorn) has a great influence on yield.

Keywords: *maize, sowing time, fertilizer, previous crop*

1. INTRODUCTION

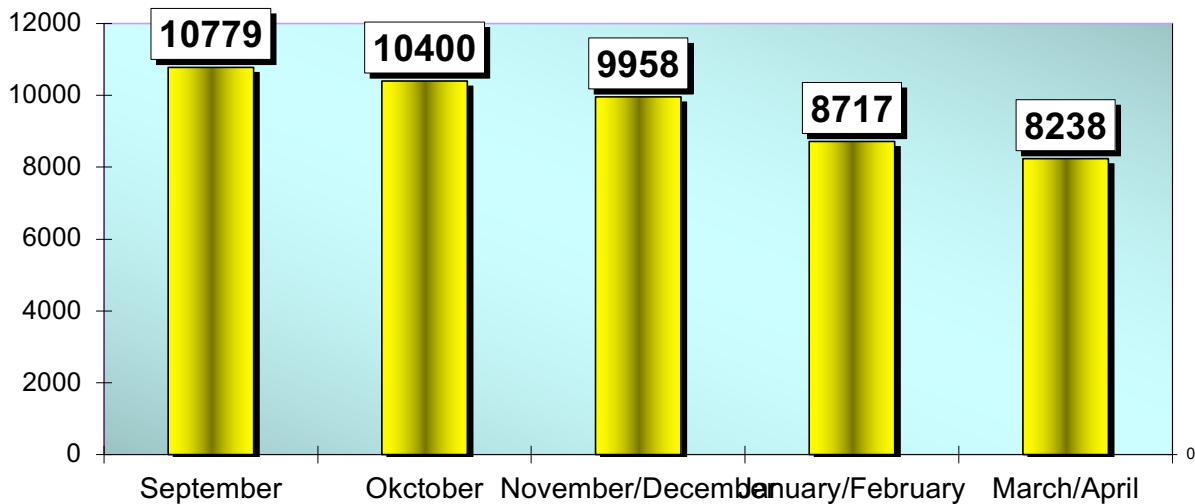
Maize (*Zea mays*) is the most important field crop in Serbia. In the Sombor region maize is grown on about 60,000 ha each year, and in Serbia it is grown on more than 1,000,000 ha, which makes Serbia a significant producer of this cereal. The large spread of maize and the tendency of further increase the area under this crop results from its economic importance, and the economic importance of this crop is determined by the use value of corn. It is used for three main purposes: in human nutrition, in livestock nutrition and as a raw material for the production of large number of industrial products. Due to its versatile use, maize is of great importance for export. This versatile use of maize allows it to be mostly consumed on the farms where it was produced, either directly as human food in less developed countries, or, which is more often the case, as feed for domestic animals in developed countries.

2. MATERIAL AND METHODS

PSS Sombor has been monitoring agricultural production in the Sombor region for several decades. The region of Sombor has 144820 ha under field and vegetable crops. Areas under maize for the observed period of 10 years ranged from 55.000 to 65.000 ha. In the last few years, the area is above 60.000 ha, which is about 41,43% of the total area. PSS Sombor, in cooperation with agricultural companies and producers, collects data on production technology. For this research, sample of 65.244 ha was observed on which maize was sown, and it refers to the period from 2013 to 2022 (a total of 10 years). The agrotechnical measures monitored are: time of primary tillage, impact of previous crops, use of mineral fertilizers, sowing time and choice of hybrids. The data collection method is an insight into the field book of companies and producers who have participated in the monitoring and analysis of maize production for 10 years. Every year after collecting data in the field, the data were processed by dedicated statistical software. The data are included in a detailed analysis of production each year. Production analysis is presented to producers each year. Based on the results of the production analysis, producers had recommendations for improving maize production. By observing the results obtained from the field, the influence of every agrotechnical measure, their quality and timely performance, give us most realistically seen how to reach on the height and stability of yield.

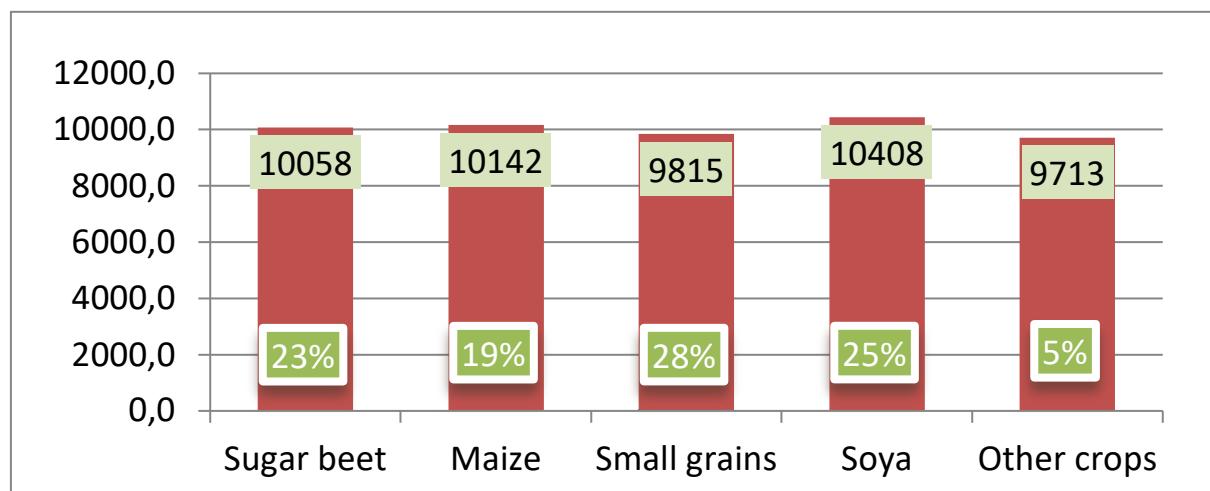
3. RESULTS AND DISCUSSION

1. Time of primary tillage - Plowing is an obligatory agrotechnical measure for maize production. Plowing must be done in the fall, which precedes the production of maize in the next vegetation season. The future yield of maize is directly dependent on the time of primary tillage. The period for primary tillage, is from September to June next year. For the analysis, this period is divided into four periods: I period (01.Sep. - 30. Sep.), II period (01. Oct. - 31. Oct.) , III period (01.Nov – 31.12.Dec) and IV period (spring tillage). It is desirable that the primary tillage is done in the first three periods. These three periods are in autumn and the beginning of winter. During that period, the soil soaks by the rain and freezes when temperature is under 0, and a crumbly soil structure is formed by spring. The soil prepared in this way provides the possibility of quality sowing, uniform germination, undisturbed growth of maize plants and high and stable yield. The fourth period includes early and late spring basic tillage. The land on which the primary tillage is applied in this period does not have good properties and a crumbly structure. The water-air regime of the soil is bad. The final yield was lower over 10 years on the areas plowed in the fourth period compared to the first three periods. **Graph 1.** shows the declining trend of yield in the direction from I to IV period. The highest yield was achieved when the primary tillage was done during the first period (01.Sep. - 30. Sep.).



Graph 1. Time of primary tillage

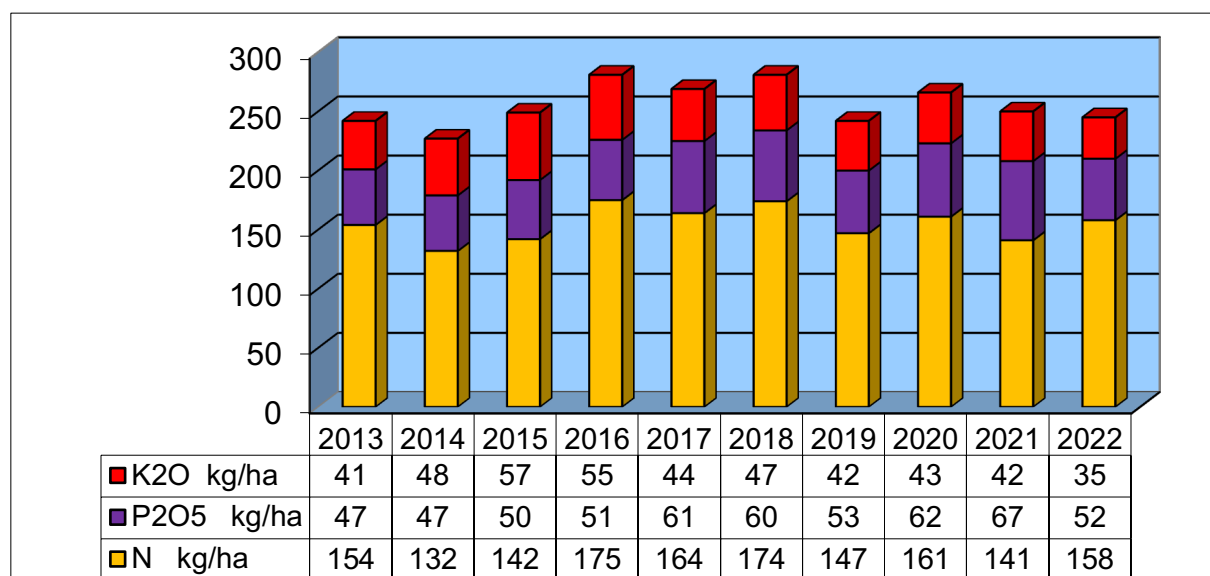
2. **Impact of previous crop** is large and significantly affects future yield. Therefore, it is necessary to choose the best previous crop. However, producers cannot choose too much because in the sowing structure, maize and small grains occupy the largest percentage of areas. However, the most important thing is not to sow maize in repeated sowing. However, from the data it can be concluded that the share of repeated sowing is high - as much as 19 %. Soybeans, small grains and sugar beet are the most common previous crops.



Graph 2. Impact of previous crop

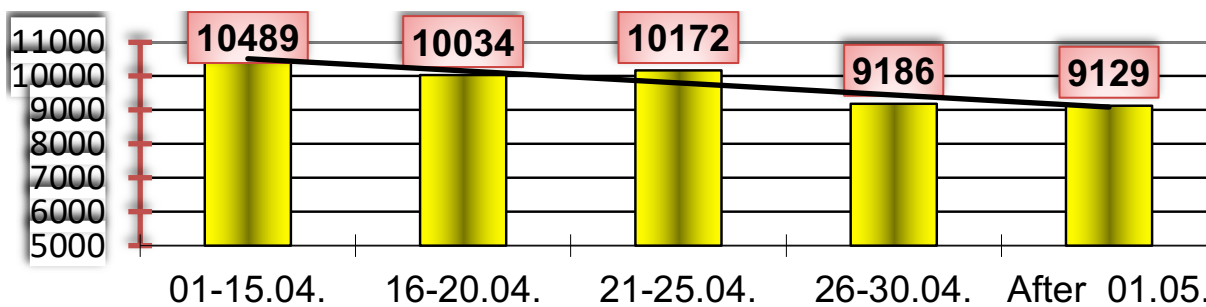
The best yields were achieved when the soybean was previous crop. An average yield of 10.408 kg/ha was achieved. It is interesting that a very good result was achieved in the repeated sowing of corn. With a yield of 10.142 kg/ha, repeated sowing is in second place. Small grains (9.815 kg/ha) and sugar beet (10.058 kg/ha) follow. The "other" category achieved a yield of 9.713 kg/ha, but it is too heterogeneous a category, occupying only 5% of the total area.

3. **The use of mineral fertilizers** is necessary for the successful production of maize. Maize achieves a large grain yield, but also forms a large biomass. In this sense, it is necessary to balance the optimal mineral nutrition. The use of fertilizers depends on economic circumstances, the price of fertilizers, previous crops, the use of organic fertilizers, etc. The analysis observed the use of fertilizers through basic fertilization in autumn (NPK) and the use of fertilizers before sowing. Quantities are expressed in kg / ha of active substance: nitrogen (N), phosphorus (P2O5) and potassium (K2O). The entire amount of phosphorus and potassium and part of the nitrogen was used in the fall with primary tillage. Only nitrogen was used before sowing. Nitrogen amounts are shown collectively regardless of the time of use. In Chart 3, it can be seen the use of fertilizers during the previous decade . It is very important to use fertilisers according to soil analysis.



Graph 3. Use of mineral fertilizers expressed in kg of active substance per ha

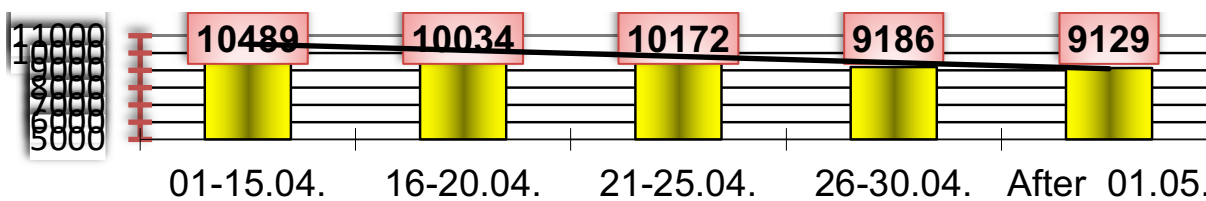
4. **Sowing time** – This research looks at the sowing time from April to June. This time of 70 days is divided into 4 periods, namely: I period (April 1 - April 15), II period (April 16 - April 20), III period (April 21 - April 30) and IV period (May 1 - June 30). Graph 4 shows that the best yield (10,123 kg/ha) was achieved when maize was sown in period III (April 16 - April 20). However, the largest percentage of area was sown in the first period (April 1 - April 15), 49.2% with a yield of 10489 kg/ha, which is the most successful sowing period.



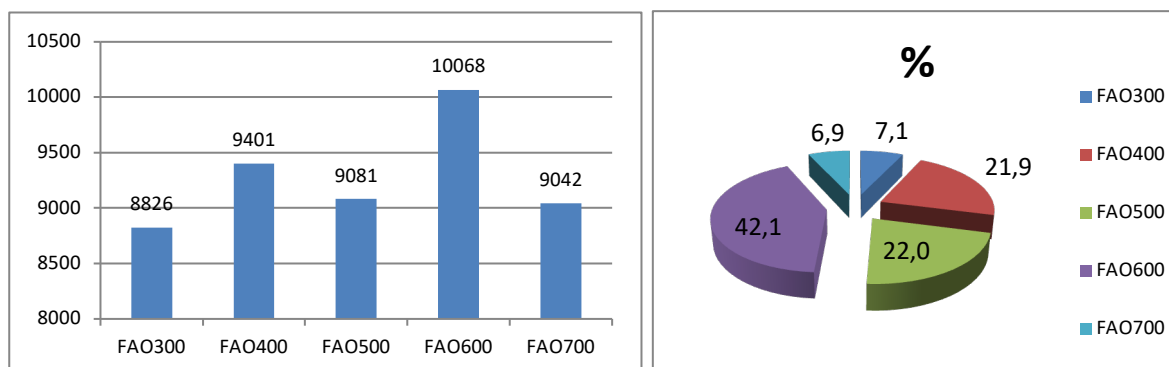
Graph 4. Sowing time

5. **Choice of hybrids** – The choice of maize hybrid depends on the size of the farm. Small farms can sow hybrids from one FAO group. Larger farms with larger areas choose hybrids from more FAO groups to have successive harvesting and better yields.

In the conditions of the Sombor region, good yields are achieved by FAO 300 - FAO 700, with the emphasis that FAO 600 achieves the highest yield.



Graph 5. Yield of hybrids (kg/ha)



Graph 6. Hybrid share (ha)



Picture 1. Field day in PSS Sombor

CONCLUSION

From a large number of agrotechnical measures, this research has for analysis five agrotechnical measures on which producers have a decisive influence. Based on a multi-year analysis, the best periods of primary tillage, sowing dates, the best previous crop, fertilization amounts and the choice of hybrids were determined. Any deviation from this leads to a decrease of maize yield.

This research determined that the best period for primary tillage is during September when average yield of 10,779 kg/ha was achieved.

The best previous crop is soybean. After soybean an average yield was 10408 kg/ha .

The use of mineral fertilizers should be based on the agrochemical analysis of the soil. With the increase in the use of mineral fertilizers, the yield increased year by year. However, excessive use of fertilizers is not good either, because it is not profitable or leads to harmful effects on the soil and plants.

Sowing is best done in the period from April 1st to 15 th. The areas sown in that period yielded an average of 10,489 kg/ha, which is the highest yield compared to other sowing periods.

Proper selection of hybrids, along with other agrotechnical measures, contributes to stable and high yields. The sowing of hybrids of the FAO 600 group is dominant with 42.1% of the total sowing. At the same time, hybrids of the FAO 600 group achieved the highest average yield of 10,068 kg/ha.

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