# THE INFLUENCE OF TILLAGE SYSTEMS ON SOME PRODUCTIVE TRAITS OF MAIZE HYBRIDS

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***Abstract:*** *Tillage is a very important agricultural measure that ensures the appropriate conditions for germination, emergence and growth of plants and it has a great significance in the productivity of cultivated plants. The soils which have a heavy mechanical composition, demand a cultivation system that prevents the degradation processes in the soil and that will preserve the natural fertility of soils. The paper presents the results of some morphological and productive traits of maize depending on the tillage system. The experiment was carried out in the vicinity of Pozega during 2014 and 2015 on the smonitza soil type. The experiment included four tillage systems (CT – Conventional Tillage: autumn plowing + disc harrowing + seedbed conditioner),; RT – Reduced Tillage: disc harrowing + seedbed conditioner),; RT 1 – disc harrowing ; NT- Direct seeding – No tillage) and three maize hybrids (ZP 427; ZP 555 and AS 603). Hybrids were sown in optimal densities. The experiment was set up in a randomized block system with three replications. The following parameters were monitored: the number of plants at harvest, the absolute grain mass and grain yield with 14% humidity. The Number of plants in harvest was determined just before the harvest, counting plants with 14.28 m and multiplying by 1,000 in 5 repetitions.The Results are presented as a two-year average, they were statistically analyzed by analysis of variance and the statistical significance was assessed by an LSD test. Research results show that the number of plants at harvest and yield significantly varied depending on the tillage system, the absolute grain mass showed significantly less variation. The highest average yield (8.87 t ha$^{-1}$) was achieved with conventional tillage, and the lowest (5.41 t ha$^{-1}$) with direct seeding (no tillage). Hybrids ZP 555 and AS 603 had statistically significant differences in grain yield in all tillage systems.*

***Key words:*** *conventional tillage, reduced tillage, direct seeding, maize, productive traits.*

## INTRODUCTION

The aim of tillage is to create optimal physical conditions for germination, emergence and growth of the next crop using different tools for processing. The treatment is therefore a very important agro-technical measure which provides the appropriate planting layer for crops and helps fighting the weeds (BUTORAC et al.,2006.). The basic objective of conservation tillage is soil protection. Conventional tillage system is characterized by upturn of furrowand plowing as the first operation (NOZDROVICKY,2008.), which has a negative effect on soil structure. DEPRSCH (2000.) states that reduced tillage and direct seeding is not an ideologybut the consequence of economic and environmental decision-making process. Each percentage of cost reduction and energy savings in the production of maize makes a significant item, given that its representation is on over 50% of arable land in Serbia. A large number of researchers, both domestic and foreign have examined the impact of reduced and conservation tillage on the yield of maize and other field crops (KOVACEVIC et al., 2009.; MOMIROVIC et al., 2011.; VIDENOVIC et al., 2011.; TOLIMIR M. and KRESOVIC BRANKA, 2009.; NAJAFINEZHAD H. et al., 2005.; ALI REZA SABERI et al.,2014.; KOSUTIC S.,2005.; BUTORAC et al., 2006.; SABO et al., 2006.;Jug,2006.) The aim of the research was to examine the effect of different tillage systems on some productive characteristics of different maize hybrids.

## MATERIAL AND METHODS

The experiment was carried out in the vicinity of Pozega, during 2014 and 2015, on the smonitza type of soil. The experiment included four tillage systems (CT – Conventional Tillage : autumn plowing + disc harrowing + seedbed conditioner; RT – Reduced Tillage : disc harrowing + seedbed conditioner; RT1: disc harrowing; NT – No Tillage : direct sowing) and three maize hybrids (ZP427, ZP555 and AS603). Hybrids were sown in optimal densities. The experiment was set up at block system with 3 replications. The following parameters were assessed: the number of plants in the harvest, the absolute grain mass and grain yield with 14% humidity. The number of plants in the harvest was determined just before the harvest counting plants from 14.28m and multiplying by 1,000 in 5 repetitions. The absolute grain mass was determined by weighing 100 seeds in 5 repetitions for each tillage system and each hybrid. Grain yield was determined from the entire surface for each tillage system and each hybrid and reduced to 14% humidity. The results are presented as a two-year average, they were statistically analyzed by using the analysis of variance and the statistical significance was assessed by an LSD test.

### Soil and Weather Conditions

The experiment with maize was carried out on heavy smonitza type of soil. In the upper layers of soil from 0 to 30cm, the soil solution pH value is 7.2. The humus content is 3.1% which represents a good supply. The nitrogen content amounted to 1.85%. The content of phosphorus of 10.7mg/100g and of potassium of 20mg/100g in soil represents the transition of poor and middle supply, i.e. the transition of middle and good supply of these elements. Thus, according to the characteristics of this soil, we believe that a very successful maize production can be organized on it.

*Table 1.*

Chemical traits of the soil

| Depth (cm) | pH | | Humus | N | $P_2O_5$ | $K_2O$ |
|---|---|---|---|---|---|---|
| | $H_2O$ | KCl | % | % | mg/100 g | mg/100 g |
| 0-30 | 7.2 | 5.80 | 3.1 | 1.85 | 10.7 | 20.0 |

*Table 2.*

Monthly precipitation sum (mm) and the average monthly temperature ($^0$C) for 2014/2015. Pozega

| Year | Temperat (°C) Rainfall (mm) | Months | | | | | | | Average/ Sum |
|---|---|---|---|---|---|---|---|---|---|
| | | IV | V | VI | VII | VIII | IX | X | |
| 2014 | (°C) | 10,6 | 14,1 | 18,1 | 20,2 | 19,7 | 15,5 | 10,6 | 15,5 |
| | (mm) | 169,1 | 188,7 | 109,5 | 103,4 | 98,6 | 169,1 | 54,9 | 893,3 |
| 2015 | (°C) | 10 | 16,6 | 18,2 | 22,4 | 21,6 | 17,6 | 11 | 16,7 |
| | (mm) | 52,1 | 75 | 131,3 | 11,1 | 39,5 | 66,2 | 65,8 | 441 |

The average air temperatures during the growing season in 2015 were slightly higher (an average of 1.2$^0$C) than in 2014, but they were not the limiting factor in the production of maize. Unlike the temperature, the total precipitation was twice as high as in 2015. In 2014 there were some heavy floods that have made the problems in the production of maize, so the total amount of rainfall during the growing season of 898.3 mm did not have a positive effect on the yield of maize. The total amount of precipitation in 2015, during the growing season amounted to 441mm, but their schedule was rather uneven and insufficient, particularly in July and August, which will be reflected on the yield of maize.

## RESULTS AND DISSCUSION

### The number of plants in the harvest

The number of plants per unit of the area is a basic component of the yield. To take the advantage of the potential of hybrid maize yield it is necessary to achieve the recommended number of plants in the harvest.

*Table 3.*

The influence of tillage systems on the number of plants in the harvest (2014-15)

| A. Hybrids | B. Tillage systems | | | | Average A |
|---|---|---|---|---|---|
| | CT | RT | RT1 | NT | |
| ZP 427 | 53 888 | 52 089 | 45 274 | 32 016 | 45 817 |
| ZP 555 | 43 996 | 40 165 | 41 583 | 32 270 | 39 503 |
| AS 603 | 40 707 | 35 364 | 33 138 | 26 143 | 33838 |
| Average B | 46 197 | 42 539 | 39 998 | 30 143 | 39 719 |
| LSD | A5%- 2330<br>1%- 3110 | B 5%- 2630<br>1%- 3160 | AxB 5% - 2980<br>1% - 3870 | | |

The tillage system had a very significant effect on the number of plants in the harvest. Thus, the highest average number of plants (46,197 b/ha) was noted for CT system, and it declined very significantly for RT, RT1 and NT systems and it amounted to 30,143 b/ha for NT system. Hybrid ZP427 at CT system had the highest number of plants in the harvest (53,888 b/ha). Also, the hybrids had a very significant differences in the average number of plants in the harvest, so the hybrids from the later maturity group had a significantly lower number of plants in the harvest, GAGRO M. and HERCEG N. (2005) point out in their research that the lowest number of plants in the harvest is in the smallest density set, while the increasing density set increases the number of plants in the harvest.

Our results are in agreement with the results achieved by GAGRO M. and HERCEG N. (2005).

### The absolute grain mass

1000 grain mass is an indicator of size or grain size and it represents the ratio between the weight and the number of grains. It is an important component of yield which depends on genotype, and it is significantly affected by agro-ecological and agro-technical conditions.

*Table 4.*

The influence of tillage systems on the absolute grain mass (g) (2014-15)

| A. Hybrids | B. Tillage systems | | | | Average A |
|---|---|---|---|---|---|
| | CT | RT | RT1 | NT | |
| ZP 427 | 400 | 390 | 340 | 310 | 360 |
| ZP 555 | 370 | 370 | 350 | 330 | 355 |
| AS 603 | 390 | 390 | 350 | 330 | 365 |
| Average B | 387 | 384 | 347 | 324 | 360 |
| LSD | A5%-24<br>1%-31 | B 5%- 26<br>1%- 35 | AxB 5% - 31<br>1% - 39 | | |

The lowest average absolute grain mass (324) was noted in NT system and it was very significantly lower compared to CT and RT system, while between NT and RT1 there were no significant differences. Hybrid ZP427 had the highest absolute grain mass (400g) at CT system. There were no statistically significant differences in the absolute grain mass among the tested hybrids.

**Maize grain yield**

The yield is the most important agronomic trait and the main reason for growing maize, which depends on the genotype and agro-ecological conditions.

*Table 5.*

The influence of tillage systems on maize grain yield (t $ha^{-1}$) with 14%humidity (2014-15)

| A. Hybrids | B. Tillage systems | | | | Average A |
|---|---|---|---|---|---|
| | CT | RT | RT1 | NT | |
| ZP 427 | 8,52 | 7,47 | 7,13 | 4,91 | 7,01 |
| ZP 555 | 8,90 | 8,10 | 8,00 | 5,46 | 7,61 |
| AS 603 | 9,20 | 7,20 | 7.45 | 5,85 | 7,43 |
| AverageB | 8,87 | 7,59 | 7,53 | 5,41 | 7,35 |
| LSD | A5%-0,41<br>1%-0,55 | B 5%- 0,51<br>1%- 0,76 | AxB 5% - 0,85<br>1% - 1,15 | | |

Grain yield was significantly influenced by tillage systems. The highest average yield (8.87 t $ha^{-1}$) was at theCT system, and the lowest (5.41 t $ha^{-1}$) at the NT system. The average yield achieved at the CT system was very significantly higher than the yields achieved at the other tillage systems. There were no statistically significant differences in grain yield of maize between RT and RT1 system.

Hybrid AS at CT system had the highest yield (9.20 t $ha^{-1}$). Hybrids ZP555 and AS603 had a significantly higher average yield compared to hybrid ZP427, while between them there were no statistically significant differences in grain yield.

Our results are in agreement with the results of KRESOVIC BRANKA and TOLIMIR MIODRAG (2009) who point out in their research that the best results of maize yields are achieved at conventional tillage, than at the reduced tillage and the lowest at direct sowing.

Also, VIDENOVIC et al., (2011.) achieved the highest yields of maize grain at the conventional tillage system, while the average at the reduced tillage and direct sowing was lower, which is in accordance with our results.

## CONCLUSION

Based on the results, the following can be concluded:

-Tillage system had a very significant effect on the number of plants in the harvest, so that the highest average number of plants was recorded at the CT system and it was very significantly higher than at the RT, RT1 and NT systems;

-The lowest average absolute grain mass was recorded at NT system and it was very significantly lower compared to CT and RT system, while between NT and RT1 system there were no significant differences;

-The highest average yield was at CT system and the lowest at NT system. The average yield achieved at CT system was very significantly higher than the yields achieved at other tillage systems.

-Among hybrids there were statistically significant differences in the number of plants in the harvest and yield, while differences were not detected in the absolute grain mass.

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