

S U M M A R Y

INFLUENCE OF DIFFERENT SOIL TILLAGE SYSTEMS ON YIELD AND QUALITY OF THE MAIZE CROP GROWN IN SOUTH-EASTERN BĂRĂGAN

PhD-student: CHIȚOI G. Claudiu Florin

Scientific coordinator: *PhD Professor*: CIONTU Costică

KEY WORDS: *Zea mays* L., minimum tillage, conventional tillage, weeding, grain yield, protein yield, economic efficiency.

Maize is a plant of global importance, with agronomic, commercial and economic implications, being among the top five cultivated cereals. In this context, defining, testing and improving specific elements of the maize crop technology have, over time, inspired scientists, farmers and economic agents.

The issues concerning the effects of different soil tillage systems on maize yield, as well as in terms of soil conservation and economic efficiency have been addressed by numerous international and national authors over the past decades, but research results continue to vary, mostly among distinct geographic areas. The causes of these differences were explained in relation to the soil and weather conditions specific to each research area. Therefore, the purpose of this research was to analyze the behavior and yield of a range of maize hybrids under the combined influence of different soil tillage types and crop management measures applied under the influence of the climatic and soil conditions characteristic to the South-East of the Bărăgan Plain (Gălățui, Călărași County).

The paper is structured in two parts. The first part with a number of 21 pages presents the study of the research topic, highlighting through the obtained results the necessity of customizing a research to a specific area, in the light of climatic and soil influences, and limiting the implementation of specific technological elements to similar areas. Part II, with a volume of 115 pages, presents the purpose and objectives of the research, the materials and methods used and the results obtained in the South-East of Bărăgan, com. Gălățui, Călărași County, highlighting the optimal soil tillage types applicable to the maize crop in the research area, both in terms of yield, production quality, and economic efficiency.

First chapter illustrates the stage of knowledge related to the researched theme, detailing the importance of maize as a globally grown cereal, the expansion degree of the crop at national and international level, as well as technology elements associated to soil tillage applied for maize crops, both at national and international level.

Chapter II details the purpose and objectives of research, while **Chapter III** presents the framework of the research, the biological material and the methods used. The doctoral stage was held at the **Doctoral School for Engineering and Management of Vegetable and Animal Resources of the University of Agronomic Sciences and Veterinary Medicine Bucharest**. The field research was conducted in **Gălățui village, Călărași County**, at **Canadianu Gălățui SRL** farm, where a polyfactorial experience was established, with the following factors: Factor A, soil tillage types, with six graduations: a₁ – Plow 20 cm; a₂ - Plow 30 cm (conventional tillage system), a₃ – Scarifier 30 cm, a₄ - Scarifier 40 cm, a₅ - Tiger (3MT) 20 cm, a₆ - Tiger (3MT) 30 cm (minimum tillage system); Factor B, maize hybrids with three graduations: b₁ - DKC 4590, b₂ - PP 9911, b₃ - Olt; Factor C, mechanically harrowing with two graduations: - c₁ – harrowed, - c₂ – non-harrowed.

Chapter IV shows the influence of the researched factors on maize plants vegetative development, on weeds development, on maize grain yield and on grains physical indicators in the **agricultural year 2014-2015**. Under the influence of the **soil tillage system**, both maize **plants' height** and **leaf area index** recorded lower values for the minimum tillage system compared to the conventional one, with statistically assured differences for both indicators. The influence of the **soil tillage type** on plant's height and leaf area index is reflected in the highest values obtained for plowing at 30 cm, and the lowest values recorded for tiger tillage, both on harrowed and non-harrowed variants. The minimum tillage system has increased **the number of weeds** per square meter by 63.4% to 73.8% compared to the conventional tillage system. All maize hybrids recorded the highest **yields** for **Plow 30**, both for harrowed and non-harrowed variants, with values ranging from 8,110.0 kg/ha (PP 9911, non-harrowed variant) to 10,003 kg/ha (DKC 4590, harrowed variant). The use of minimum soil tillage types, lead to yield reduction with statistically assured values. Considering the influence of the hybrid, it is noted that the hybrid DKC 4590 recorded the highest yield for all of the researched soil tillage types, with values between 6,780.0 kg/ha (Tiger 20, non-harrowed variant) and 10,003 kg/ha (Plow 30, harrowed variant). Both 1,000 seeds weight and hectoliter mass were influenced by soil tillage, the lowest values being recorded when soil tillage was carried out using tiger (MMB - 268,3 g, MH - 74,2 g / hl), and the highest for plowing at 30 cm.

In **Chapter V**, the results of the research obtained in the agricultural year **2015-2016** are presented, analyzing the individual and combined influence of the researched factors on the elements of vegetative development specific to maize plants

and on maize's crop yield. Analyzing the influence of the **soil tillage type** and implicitly of the **soil tillage system (minimum vs. conventional tillage system)** on maize plants' vegetative development, we can see that the highest values regarding the plants height and leaf area index were obtained for the Plow 30. The conventional tillage system provided superior values for the two indicators, with distinct and statistically significant differences compared to minimum tillage. Analyzing **weeds development** (number of weeds/m²) recorded for conventional and minimum tillage systems we can see that the number of weeds/m² when minimum tillage system was applied was 98.4% to 139.3% higher compared to conventional tillage system. Considering the **influence of the soil tillage systems on maize yield**, it was found that higher yields were recorded for conventional soil tillage, while minimum tillage yield represented 76.4% of the conventional tillage yield for the harrowed variant, and 82.2% of the conventional tillage yield for the non-harrowed variant. The **influence of the soil tillage type** on maize crop yield is highlighted by obtaining the highest values (7,678.6 kg/ha for the harrowed variant, and 6,977.7 kg/ha for the non-harrowed variant) for Plow 30. DKC 4590 hybrid recorded the highest yields, with values between 4,560.7 kg/ha and 8,065.3 kg/ha. Soil tillage also influenced hybrid's 1,000 seeds weight, and hectoliter mass, the highest values being obtained for Plow 30.

Chapter VI details the influence of the factors investigated in the agricultural year 2016-2017 on the vegetative development of maize plants, on weed development, and on maize grain yield and its physical indicators. The **influence of the soil tillage system** on the **vegetative development** of maize is highlighted by higher values recorded for conventional tillage, both for plants height and leaf area index. Under the **influence of the soil tillage type**, plants' height and leaf area index recorded the highest values for Plow 30, while for Tiger 20 the lowest plants' heights, but also the lowest LAI were recorded. Under the **influence of soil tillage system**, the number of weeds / m² increased with values between 4.9 weeds/m² and 6.9 weeds/ m² in the minimum tillage system compared to the conventional system. In terms of yield, the highest values were recorded in the conventional tillage system, for plowing at 30 cm, ranging between 7,460.7 kg/ha for PP 9911 hybrid for the non-harrowed variant and 9,040.4 kg/ha for DKC 4590, for the harrowed variant. This hybrid has also recorded the highest yields for all types of soil tillage applied. Soil tillage type also significantly influenced the physical yield indicators, the highest values being obtained for Plow 30 (1,000 seeds weight - 313,4 g, hectoliter mass - 75,9 kg/hl).

Chapter VII presents the average results of the period 2015-2017. Analyzing the influence of **soil tillage systems and soil tillage types** on **plants' height**, it is observed that higher values were obtained in the conventional system for plowing at 30 cm, 211.7 cm for the harrowed variant and 196.5 cm for the non-harrowed variant. The **influence of the soil tillage type** on crops' **leaf area index** is evidenced by

obtaining the smallest values for Tiger 20 (2.02 for the harrowed variant, 1.71 for the non-harrowed variant) and the highest values (3.04 for the harrowed variant, 2.77 for the non-harrowed variant) for Plow 30. The minimum tillage system allowed the development of an average number of 9.0 – 16.2 weeds/m² with a fresh biomass of 77.4 - 179.5 g and a dry matter yield of 29.6 – 47.6 g, these values being significantly higher compared to the conventional tillage system. Analyzing the influence of the soil tillage type on maize grain yield, it is observed that the highest yields were recorded in the conventional system for Plow 30, with values ranging from 7,510.4 kg/ha (PP 9911, for the non-harrowed variant) and 9,036.2 kg/ha (DKC 4590, for the harrowed variant). DKC 4590 hybrid recorded the largest yields for all tillage types. Soil tillage influenced 1,000 seeds weight, but also the hectoliter mass, the highest values being recorded for plowing, while the tillage carried out using tiger determined the lowest values of the two physical indicators. Each of the three hybrids recorded the highest protein yields for Plow 30, with values ranging from 904.8 kg/ha (DKC 4590, for the non-harrowed variant) and 1.064.2 kg/ha (DKC 4590, for the harrowed variant). **Harrowing** provided higher values of both biometric parameters and maize yield.

In **Chapter VIII** the result of the economic efficiency analysis was presented, considering the interaction between the soil tillage type and the researched hybrids.

The highest profit was recorded in the conventional system (2097 Ron), this soil tillage system but with a slightly smaller return (0.62 Ron) compared to the value recorded in the minimum tillage system (0.63 Ron).

The most profitable soil tillage was Scarifier 40, which generated an average profit of 2335 Ron/ha and a return of 0.88 Ron profit per 1 Ron, spent with the establishment, maintenance and harvesting of the crop. At the opposite end, the lowest average profit was recorded for Tiger 20, with a value of 1280 Ron/ha and a return of 0.44 Ron.

The highest profit was generated by the DKC 4590 hybrid, Scarifier 40 variant, with a value of 2658 Ron/ha and a return of 1.00 Ron. The lowest value of the profit, of 1190 Ron/ha, was obtained by the hybrid PP 9911 for the Tiger 20 variant, with a return of 0.41 Ron.

Chapter IX outlines the conclusions and recommendations generated based on the results of the research:

1. Under the **influence of the soil tillage system**, for 2015-2017, the average number of weeds and average biomass of weeds recorded in the corn crop were lower in the conventional tillage system than in the minimum tillage system
2. Under the **influence of the soil tillage system**, the average yield of the corn hybrids obtained in the period 2015-2017 in the Gălățui area (Călărași County) was significantly reduced in the conditions of the using of the minimum soil tillage system for the harrowed version, as well as for the non-harrowed version.

3. **The average yield of hybrids where minimum tillage was applied was 6,528.2 kg/ha in the harrowed variant**, with -1,635.3 kg/ha less than the value recorded for the conventional tillage system. For the non-harrowed variant, the average yield in the minimum tillage system was 6,264.3 kg/ha, with -1,336.5 kg/ha lower than the conventional system.

4. **The influence of the hybrid** on the corn yield recorded between 2015 and 2017 was reflected by superior values of the DKC 4590 hybrid. This hybrid recorded the highest yield for all soil tillage types researched.

5. **Lack of mechanical harrowing caused the yield to diminish compared to the variant where mechanical harrowing was applied**, the average recorded differences were between -190.0 kg/ha and -695.8 kg/ha and statistically ensured for all types of soil tillage.

6. Scarifying the soil at a depth of 40 cm is the most profitable type of soil tillage, with an average profit of 2335 Ron/ha and a return of 0.88 Ron profit per Ron spent with the establishment, maintenance and harvesting of the crop

7. **The highest profit was generated by the hybrid DKC 4590 for Scarifier 40 variant**, with a value of 2658 Ron / ha and a return of 1.00 Ron.