# THE INFLUENCE OF NO TILLAGE TECHNOLOGY ON PLANT HEIGHT, SOIL MOISTURE AND YIELD OF CORN

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## ABSTRACT

No tillage technology is the future of field agriculture in the world. In our country, the spreading of this technology was impeded by the fact that researchers and farmers did not understand the role of the mulch layer on yield. Lot of researches unfolded in our country did not accounted this aspect. Our researches began in 2016 and they have emphasized the role of the mulch layer on the overall development of corn plants and, finally, on the yield. The data presented in this article represent determinations of the corn plant height and soil moisture at two dates, 1 of june and 10 of july. These results emphasize the importance of the mulch layer on plants height and on soil moisture. This way, the no till treatment with mulch layer consisting of pea debris has been superior to the classic technology based on plowing. The no till variant without mulch layer, practically, gave no yield.

## INTRODUCTION

Water is the key element in the success of the no-tillage system. Lot of research effort is devoted nowadays for reduced tillage. The new no-till technology brings about changing and challenges. More and more farmers have been adopting it throughout the world (50 times increase in latest years in Latin America). Agronomists became aware of the benefits of this system and try to make it suitable for different soil-clime conditions. Soil organic matter, mineralization, erosion, compaction and last but not least, the high energy requirements are the main disadvantages of the plow-based agriculture. The no till system has disadvantages, too: soil temperature decreasing, higher leaching, difficult low soluble fertilizer incorporation but its advantages strongly overpass them. They can be summarized as follows: increasing soil organic matter content reducing the fuel, labor consumption and machinery requirements, almost stopping the soil water erosion, increasing the yield by approx. 20%, increasing the surface that can be worked by a farmer and enhancing the benefit [2;3;4;5].

All aspects of the reduced tillage are related with the soil water keeping capacity. The more the soil can keep its water, the larger is the water quantity that is used by the plant roots instead to be lost by evaporation. More water into the soil means more diversity of soil life and fertility. With a certain soil, more water through the plant means more nutrients carried within.

Our former researches on reduced and no-till have proven that the success of these technologies highly depends on the soil water keeping capacity. While the surface tillage help creating a shallow layer of air, large porosity that decrease the access of the water from beneath to the soil surface where is susceptible to lose by evaporation, the untilled bare soil forms a compacted shallow layer due rainfall that “attract” the water from below and lose it into the atmosphere. The mulch layer simply cover the soil surface protecting it against evaporation by colder air between the residue parts that do not require much water vapors. The present paper tries to measure the amount and the speed of water loss by these mechanisms [5].

## MATERIAL AND METHOD

The experiment was located at the Botanic Garden of University of Craiova in 2018 year and comprised three variants of soil tillage in 3 replications. The treatments were: v1= plowed soil in autumn and drilled after seedbed preparation by harrowing, v2= no till soil and drilling in the spring with seedbed preparation only on the row of plants without any mulch layer, v3= no till with mulch layer of pea cover crop. The tillage have been done manually as well as the sowing. There were planted no cover crops in autumn or in the spring. The plots with pea crop mulch layer used the mulch from previous year. This mulch layer is very rich in nitrogen and provides the corn plants with this important nutrient. Moreover, during the decomposition process it formed a layer of small debris that has large pores which reduces the access of water from beneath to the soil surface where it will rapidly lost by evaporation. The seedbed was prepared only on the width of 10 cm and a depth of 10 cm. There was applied Adengo herbicide (isoxaflutol 225 g/l + tiencarbazon-metil 90 g/l + ciprosulfamide (safener) 150 g/l) when the corn plants reached 10 cm height. This herbicide did not controlled Digitaria sanguinalis weed. During the vegetation period there were made soil moisture determinations at two dates: 1 of june and 10 of july. There were, also, made soil bulk density determinations and. At harvest the corn plants were measured as height. The yield was weighted by plots and the results have been statistically interpreted by Fisher analysis of variance.

***Figure 1. The no till with mulch variant at 1st of june***

## RESULTS AND DISCUSSIONS

The sowing operation was made manually, at 30 april. There were lots of rain in that period, so the corn plants emerged very soon and they developed well in the first two weeks. This year we applied Adengo herbicide during early postemergence of corn. This herbicide has two active ingredients but they did not controlled Digitaria sanguinalis weed so there was a high degree of weeding with this weed, especially with no till plots without mulch layer.

***Figure 2. No till without mulch variant at 10 of july***

The soil mosture was determined by direct method, using small aluminium recipients which were weighted before and after drying into the oven. The soil moisture at two dates, in function of tillage are presented bellow.

*Table 1*

**Soil moisture in function of tillage**

| Treatment | Soil depth (cm) | Soil moisture | |
|---|---|---|---|
| | | At 1 st june | At 10 July |
| V1 - plowed | 0-10 | 12,5 | 14,4 |
| | 10-20 | 12,9 | 14,8 |
| V2 – no till without mulch | 0-10 | 11,7 | 13,2 |
| | 10-20 | 12,0 | 13,5 |
| V3 – no till with pea mulch | 0-10 | 13,4 | 15,4 |
| | 10-20 | 14,2 | 16,3 |

From these data we can observe that the no till variant with pea mulch layer has kept the soil water best and the second variant has recorded the lowest levels of soil moisture.

***Figure 3. No till with pea mulch at 10 July***

The tillage helps keeping the water into the soil by creating a layer of soil with larger pores than below the depth of tillage. This is the reason why the plowed soil gives good yields. The no till bare soil records the lowest soil moisture data because of losing water quickly. The phenomenon that conducts to this result

is explained by smaller pores into the shallow layer of 3-5 cm that extracts the water from below, where the soil pores are larger. This fact determines the rapid loss of soil water, tough soil, poorly developed root system and reduced or no yield.

***Figure 4. Plowed variant at 20 june.***

At 14 September the experimental plots have been harvested and the yield has been weighted for each treatment. There also have been made height measurements of the harvested corn plants. The results are presented in the table below.

*Table 2*

**The corn yield and the plants height in function of tillage and the species of cover crop at Botanic Garden of University of Craiova in 2017**

| Treatment | Plant height, cm | Yield, kg/ha | % | Difference, kg/ha | Signification |
|---|---|---|---|---|---|
| V1 – plowed | 210 | 6.845 | 100 | Ctrl. | - |
| V2 – no till without mulch | 120 | 540 | 7.8 | - 6305 | 000 |
| V3 - no till with pea mulch | 220 | 7.250 | 105 | 405 | * |

DL 5%= 225 kg/ha; DL 1%=480 kg/ha; DL 0.1%=680 kg/ha

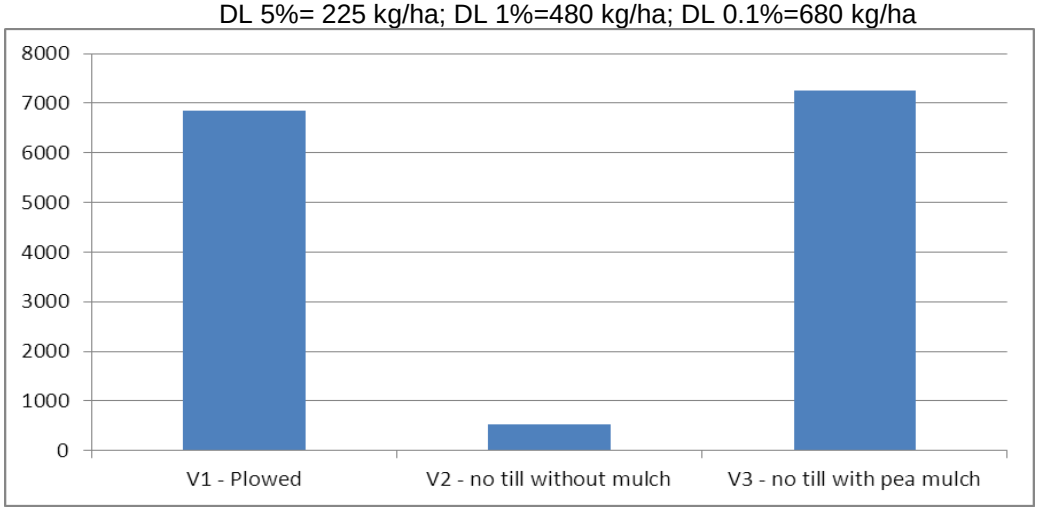


***Figure 5. The corn yield in function of tillage***

From these results we can conclude that no till with pea mulch layer gave the best results this year, better than plowed variant. The no till without mulch variant almost gave no yield, this year.

***Figure 6. No till with pea mulch at harvest.***

## CONCLUSIONS

1. Water plays the most important role in no till technology.
2. The variant with pea mulch layer from previous year gave better results as plant height and yield than plowed variant.
3. No till without mulch layer almost gave no yield this year because of worst soil moisture condition.

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