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EFFECT OF DIFFERENT TILLAGE METHODS ON THE SOIL RESISTANCE AND THE PHYSIOLOGICAL PARAMETERS OF MAIZE

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Abstract: *The aim of this research was to find an answer to the question of how minimum tillage differs from conventional tillage in an irrigated system? The experiment was made in the area of Szarvas (Hungary) in 2022. The crop culture was early maturing maize. The weather throughout the year was very dry. We separate irrigated and non-irrigated parcels with minimum and conventional tillage. The irrigated treatments were watered four times. During the Leaf Area Index measurement, we did not find any significant difference between tillage types, but between irrigations the research showed significant changes. The same result could be obtained from the Soil Plant Analysis Development (SPAD). In the case of yield the maize reached maximum of 6,88 tonnes/hectare in irrigated treatments. Yields ranged from 3 to 4 t/ha in the parcels where we did not irrigate. The soil resistance represented us that in the minimum-tillage parcels, the resistance was much higher in than the conventional tillage at the same depth. So, summarizing my measurements, I can conclude that irrigation has a positive effect on maize in many respects. From the comparison of the tillages, I concluded that there was no significant difference between minimum and conventional tillage in most cases. However, min-till is economically much reasonable than conventional tillage. Therefore, the use of minimum-tillage in maize cultivation is recommended.*

• Introduction

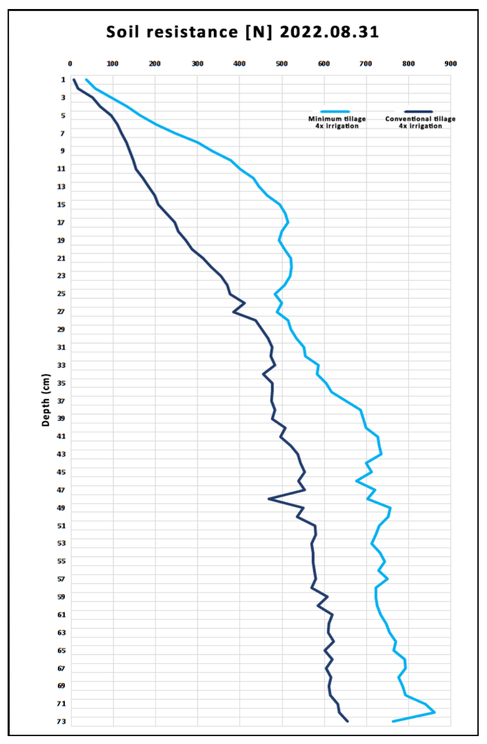
In the crop production the maize (Zea mays L.) has great impact, because of the versatility of use. In this way, maize is becoming one of the three most important cereal crops all over the word. Irrigation plays a vital role in maize grain production. Irrigation is important to make maize economically viable. Diverse soil tillage methods induce distinct impacts on the soil's physical and chemical properties. These variations in the soil's characteristics subsequently influence the growth and development of plant life, thereby affecting agricultural productivity

• Material and method

Our experiment took place in Szarvas, Hungary in the year 2022. The year was really dry. We compared two tillage methods with different irrigation rates. These two methods were conventional and minimum tillage, which were combined with irrigation. And these plots were divided into three categories too: unirrigated, twice and four times irrigated. Total of 6 types of treatment could be distinguished in 3 replicates, so the total experimental area consisted of 18 plots. The type of the soil was chernozem, slightly acidic and with a medium content of humus. The crop culture was early maturing maize (FAO 350). The conventional tillage was ploughed in November 2021 and the minimum tillage method was completed in March 2022 using a disc harrow. Maize sowing was made on 10 May 2022. Sowing was carried out at the usual 76.2 cm row spacing and at a rate of 70,000 t/ha per seed. In the first irrigation, 30 mm of water was applied to all plots except the unirrigated ones. In the second irrigation, only the specific plots received 30 mm of water. After the third time, again all plots (except the unirrigated) were irrigated with 30 mm of water. Eventually, for the fourth irrigation time, again only the specific were irrigated with 30 mm of water. We used hose reel drum with console to irrigate in our experiment. During the growing season we measured leaf area index and chlorophyll content. Later at harvesting we calculated the yield from the samples. At the end of the season we measured the changes in soil resistivity.

• Results and discussions

Leaf Area Index: The minimum tillage plot irrigated four times achieved the highest LAI value of 2.8. This means that the maize stand is relatively dense . This high LAI value usually indicates good yields.
Chlorophyll content: The highest average values were obtained for maize after four irrigations. The chlorophyll content was 58.22 for conventional and 58.83 for minimum tillage in these plots. The lowest value was obtained in the unirrigated minimum tillage plot.
Yield: In the case of yield, the highest result (6.88 t/ha) was observed in the minimum tillage irrigated (4x) plot. In the conventional tillage (same 4x irrigation) plot, the yield was slightly lower (6.6 t/ha). The lowest plots were those that had not been irrigated. However, the minimum tillage plots demonstrated a bit higher yield (4 t/ha) than the conventional tillage plots (3.2 t/ha) without water. So irrigation has a major effect on yield, but the tillage did not make a significant difference.
Soil resistance: The soil resistance was at the end of August. An average of the unirrigated parcels the soil resistance was 600 N at 13 cm in minimum-tillage plots. In the case of conventional tillage the same 600 N was a bit deeper, at 20 cm. In the twice irrigated plots, the 600 N soil resistance was a bit deeper, but the difference was the same between tillages. On the four irrigated plots, minimum tillage reached 500 N at 16 cm depth, whereas ploughing only reached 500 N at 40 cm depth. This means that the soil resistance is higher at a lower depth with minimum tillage than with conventional tillage.



• Conclusions

Several conclusions can be drawn from our experiment. These experiment involved different irrigation time and two contrasting tillage systems. Our measurement of leaf area index (LAI) showed that irrigation increased maize stand density and thus leaf area. However, there was no significant difference between the tillage treatments. We also measured the chlorophyll content (SPAD) and we found a significant increase in chlorophyll content in the irrigated plots compared to the non-irrigated plots. However, there were no significant differences between the tillage treatments in these cases. The irrigation had a significant effect on yield, but tillage did not make a significant difference. Finally, soil resistivity showed that at a depth of about 20-25 cm, conventional tillage resulted in lower resistance than minimum-tillage.
So, summarising my measurements, I can conclude that irrigation has a positive effect on maize in many respects. It is worth irrigating up to four times during the critical phenological phase. A comparison of tillage practices revealed that there was no significant difference between minimum and conventional tillage in most cases, with the exception of soil resistance.
However, min-till is economically much more reasonable than conventional tillage, and my results show that in many cases there is no significant difference between them. Therefore, the use of minimum-tillage in maize cultivation can be recommended.