



SOYBEAN YIELD AND VEGETATION INDEX IN RESPONSE TO IRRIGATION AND TILLAGE

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Abstract: Soybean (*Glycine max (L.) Merr.*) cultivation in Central Europe faces increasingly difficult challenges due to water scarcity and climate variability. For this reason, the application of new agronomic techniques is important to achieve stable yields. This study investigated the effect of different tillage methods and irrigation on the physiological status and yield of soybean (in Hungary). The field experiment was conducted in 2024. Four different tillage methods (conventional tillage, minimum tillage with disc harrow and tine tillage, and strip-tillage) and irrigated and non-irrigated plots were separated in a randomized design with three replications. The physiological state of the plants was measured by a vegetation index, called Normalized Difference Red Edge Index (NDRE). The yield was calculated based on the yield components. Statistical analysis was performed using two-way ANOVA. The results showed that irrigation significantly improved the NDRE value and the yield, while the effect of tillage alone was less significant. For NDRE values, a significant interaction was measured between irrigation and tillage, showing that the response of plants to irrigation depended on the applied tillage system. The highest yield was measured in the irrigated minimum tillage (disc) treatment (4.22 t/ha^{-1}), while the non-irrigated treatments showed significantly lower results ($1.53\text{--}3.18 \text{ t/ha}^{-1}$). Overall, irrigation proved to be the best factor influencing soybean performance under the conditions tested, however, this was strongly influenced by tillage methods. The results highlight that the combination of moderate soil disturbance and appropriate irrigation can improve yield stability in drought-prone environments.

• Introduction

Soybean production is increasingly challenged by climate variability and the need for sustainable practices. Vegetation indices such as NDRE provide insight into crop physiological status, while yield reflects overall productivity. This study examines how irrigation and different tillage systems influence NDRE and yield in soybean.

• Material and method

A field experiment was conducted in 2024 in Szarvas, Hungary, using four tillage systems: conventional tillage (deep ploughing), minimum tillage with disc, minimum tillage with tine, and strip-tillage. Each treatment was applied under irrigated and non-irrigated conditions with three replications. NDRE was measured using a leaf spectrometer, while yield was determined based on yield components

• Results and discussions

Irrigation significantly increased NDRE values, indicating improved chlorophyll content and plant condition, while tillage alone had no significant effect, but their interaction was notable. The strongest NDRE improvement was observed in the min-till (tine) system under irrigation. Yield increased in all irrigated treatments, with the highest value observed in the irrigated min-till (disc) system (4.22 t/ha). The results indicate that irrigation is the dominant factor, but its effectiveness depends on the applied tillage method

• Conclusions

Both NDRE and yield confirmed that irrigation improves soybean performance, especially when combined with appropriate tillage. The most effective system was irrigated minimum tillage (disc), highlighting the importance of optimized soil and water management for sustainable soybean production.

