



## STUDY OF DIFFERENT PHYSIOLOGICAL INDICES IN SOYBEAN UNDER IRRIGATION AND DIFFERENT TILLAGE PRACTICES

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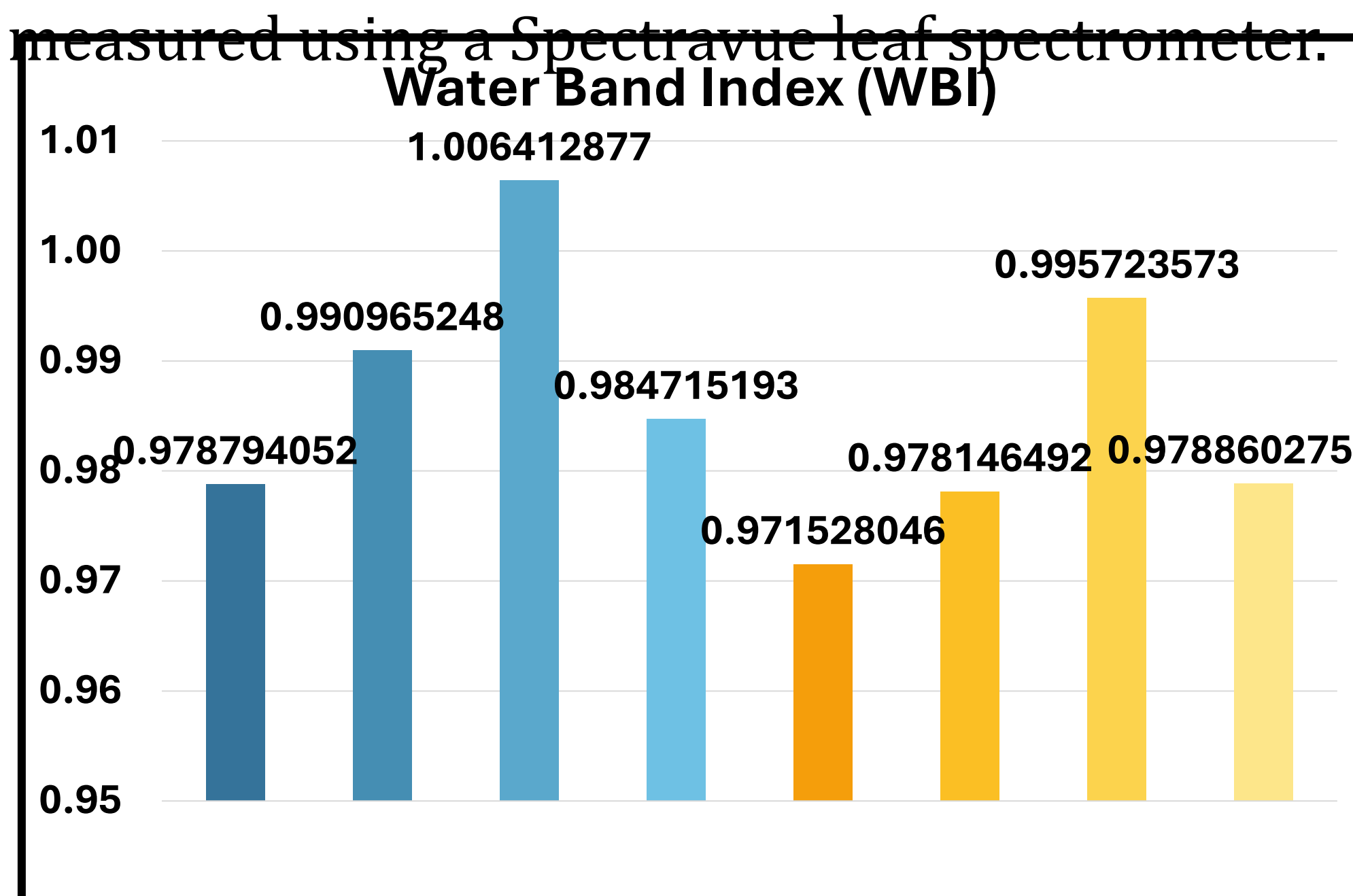
**Abstract:** Soybean (*Glycine max*) is one of the most important agricultural crops. It is grown for a wide range of purposes. The success of soybean production depends largely on accurate monitoring of the health and physiological status of the plant. As a result, several parameters can be used in precision agriculture practices to assess crop conditions and predict yield. In this study, two key physiological indices were investigated using a Spectravue leaf spectrometer: the Water Band Index (WBI) and the SPAD chlorophyll value. The field experiment was conducted in 2024 on the University's experimental site in Szarvas, Hungary. Four different soil tillage treatments were applied: conventional tillage (ploughing); tine tillage using a field cultivator; minimum tillage with a disc harrow; and strip tillage, where only crop rows were cultivated while inter-rows undisturbed. Each tillage method was further divided into irrigated and non-irrigated plots, as well as fertilized and unfertilized plots. In the case of WBI, which reflects plant water status, was higher in irrigated plots, with the highest values observed under strip tillage, exceeding a value of 1. Under irrigated conditions, both strip tillage and conventional tillage resulted in high SPAD values, ranging between 34 and 39. Significant differences were found mainly between irrigation and tillage methods. This was the first year of a long-term experiment.

### • Introduction

Soybean (*Glycine max*) is a high-value crop with increasing relevance in precision agriculture. Its productivity depends on timely and accurate monitoring of plant health and environmental stress. Spectral indices such as SPAD (chlorophyll content) and the Water Band Index (WBI) offer rapid, non-destructive evaluation of physiological status. This study assessed how different tillage systems; irrigation affect these indicators in field-grown soybean under Central European conditions.

### • Material and method

The experiment was conducted in 2024 at the experimental site of MATE, Szarvas (Hungary), on a slightly acidic clay loam soil, moderately saline, with medium humus and excellent phosphorus and potassium supply. The tested soybean cultivar was a widely grown variety in Hungary. Four tillage systems were applied: Conventional tillage; Minimum tillage; Tine tillage; Strip-till. Each tillage method was divided into irrigated and non-irrigated plots. Irrigation was performed using a reel system and sprinkler boom, with 35 mm water per event. Five irrigation events were applied between May and August. SPAD and WBI values were measured using a Spectravue leaf spectrometer.

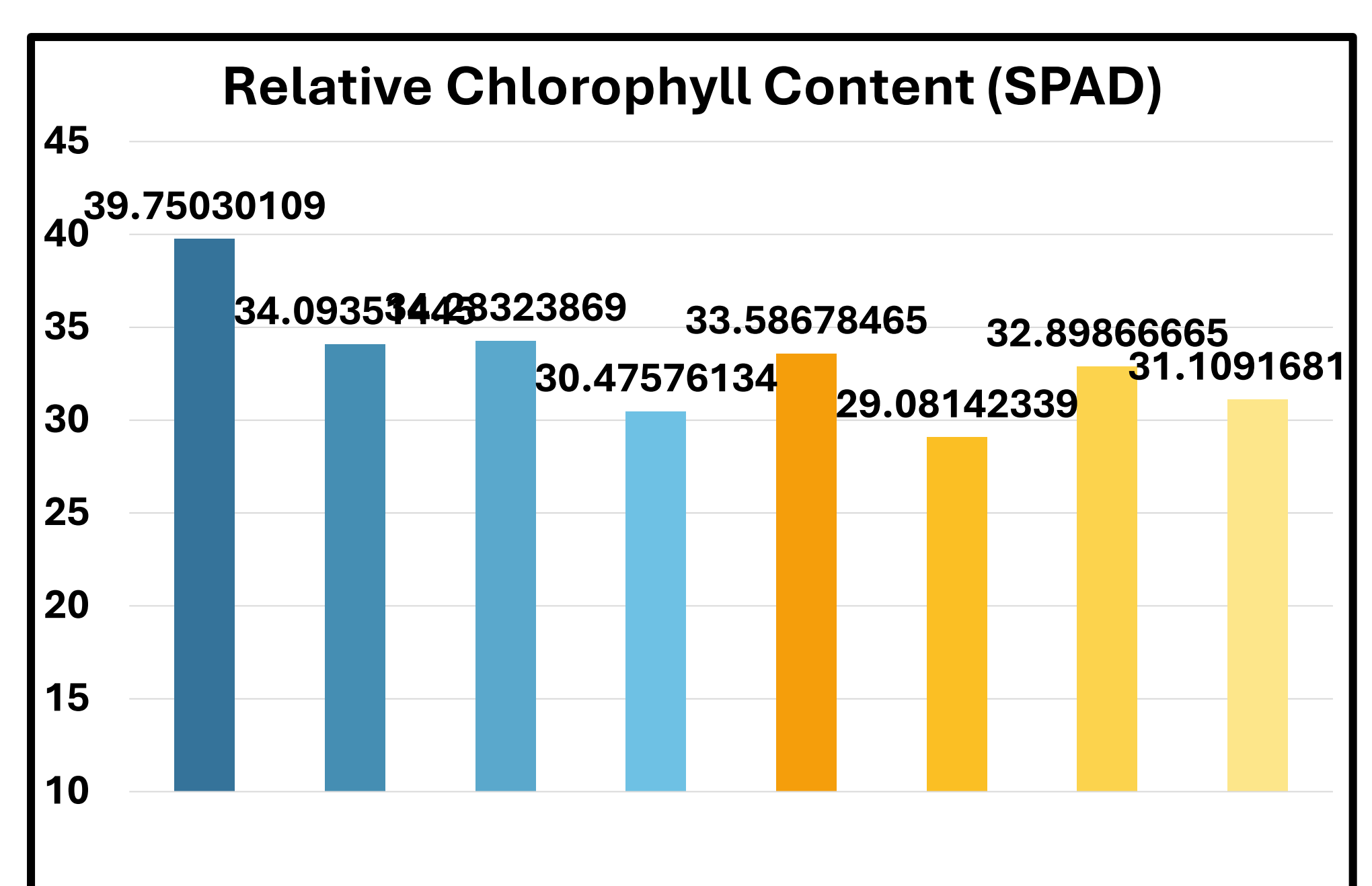


### • Results and discussions

The highest SPAD value (39.75) was observed in irrigated ploughed plots (irrigated, conventional tillage), followed by other irrigated treatments like strip-till (irrigated, strip-till: 34.28). Non-irrigated plots showed lower SPAD, with tine tillage without irrigation (unirrigated, min-till) being the lowest (29.08). For WBI, irrigation increased values across all tillage types. The maximum WBI (1.01) was found in irrigated strip-till plots, indicating improved water status. Non-irrigated treatments consistently recorded lower WBI values, with XH at 0.97.

### • Conclusions

Irrigation had the strongest positive influence on soybean physiological status, as measured by SPAD and WBI. Among tillage systems, strip-till and conventional tillage produced the most favorable results under irrigated conditions. These results support the use of remote sensing indices in optimizing soil and water management strategies in precision soybean production.



**Keywords:** soybean, WBI, SPAD, irrigation, tillage