Weediness of maize in conservation tillage systems under climate change conditions

Bojana Brozović, Irena Jug, Boris Đurđević, Bojan Stipešević, Marija Ravlić, Danijel Jug

Faculty of Agrobiotechnical Sciences Osijek, Vladimira Preloga 1, Croatia; e-mail: bojana.brozovic@fazos.hr

Assessment of conservation soil tillage as advanced methods for crop production and prevention of soil degradation

Josip Juraj Strossmayer University of Osijek
Faculty of Agrobiotechnical Sciences Osijek

Introduction

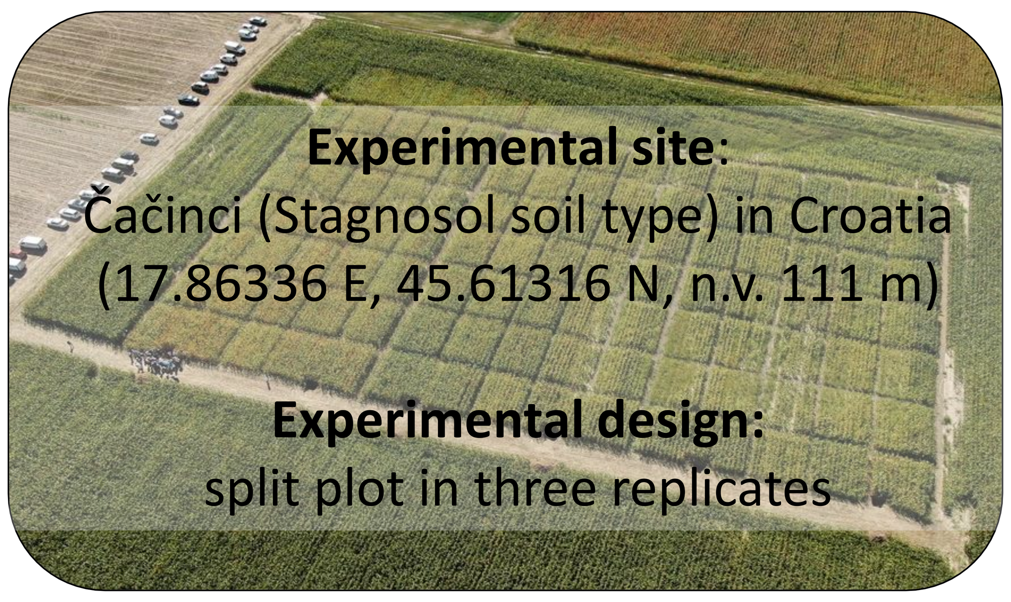
Conservation tillage systems play an important role in mitigating the negative impacts of climate change on crop productivity and soil degradation. By changing a number of soil conditions, conservation tillage affects the change in weed levels which is the dominant biotic factor that most often negatively affects the performance of maize yields. Fertilization can increase the competitive ability of maize what causes a reduction of weeds occurrence and change in the composition of weed flora. Weed species amount, density and biomass play a significant role in maintaining the biodiversity of agroecosystems.

The aim of this study was to investigate the impact of conservation tillage and fertilization on weed infestation in maize

Materials and methods

Main treatment: Soil tillage

CT - conventional, plowing
CTD - conservation, loosening with a minimum of 30% of crop residues on the surface
CTS - conservation, shallow tillage with a minimum 50% of crop residues on the surface



Weed sampling and determination

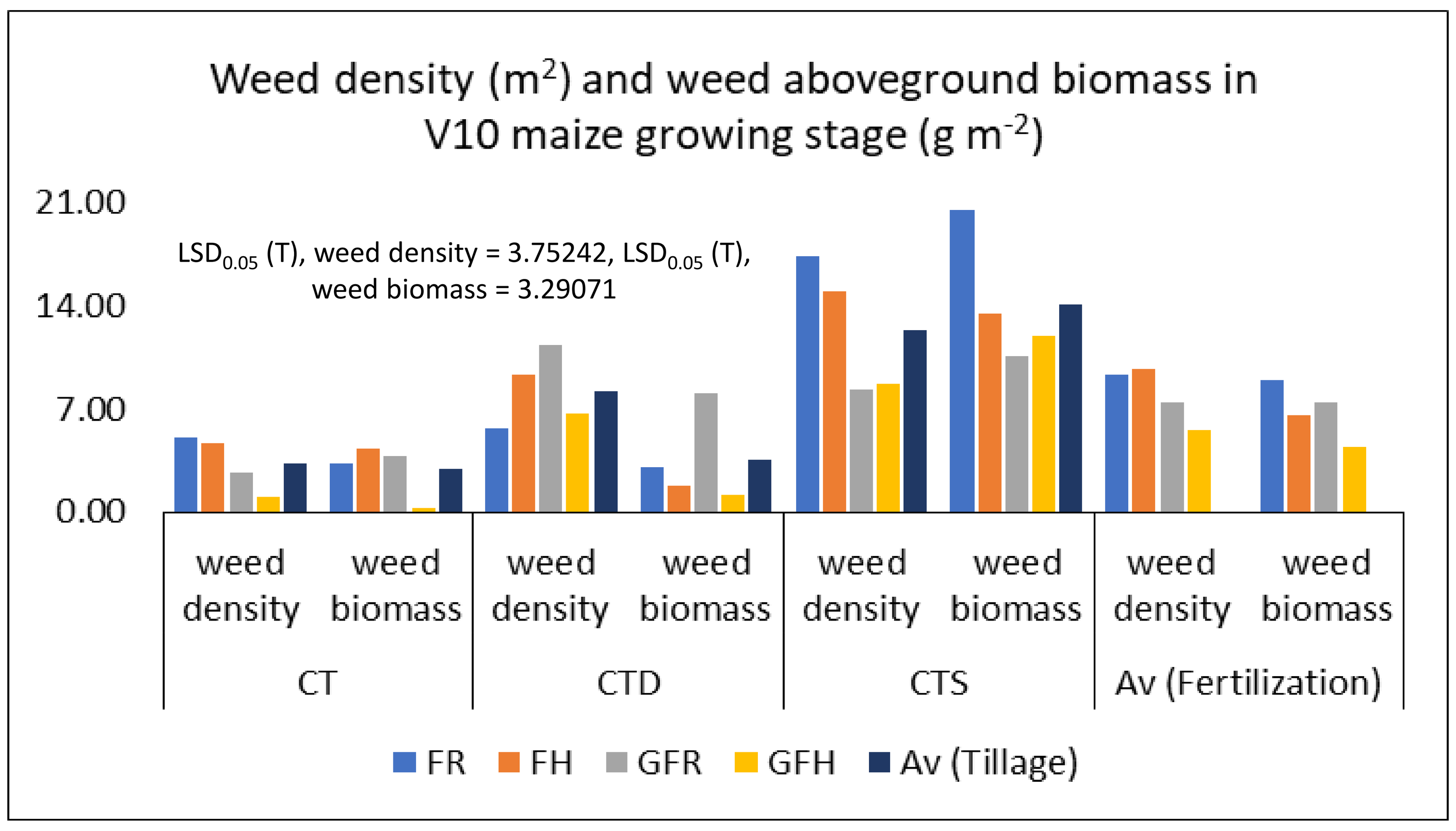
- growth stage of maize: V10, R5
- weed species counting – total weed number (weed density) - 0.25 m^2 in four replicates
- weed species cutting – weed aboveground biomass (drying 60 °C)
- weed coverage – visual assessment

Subtreatment: Fertilization

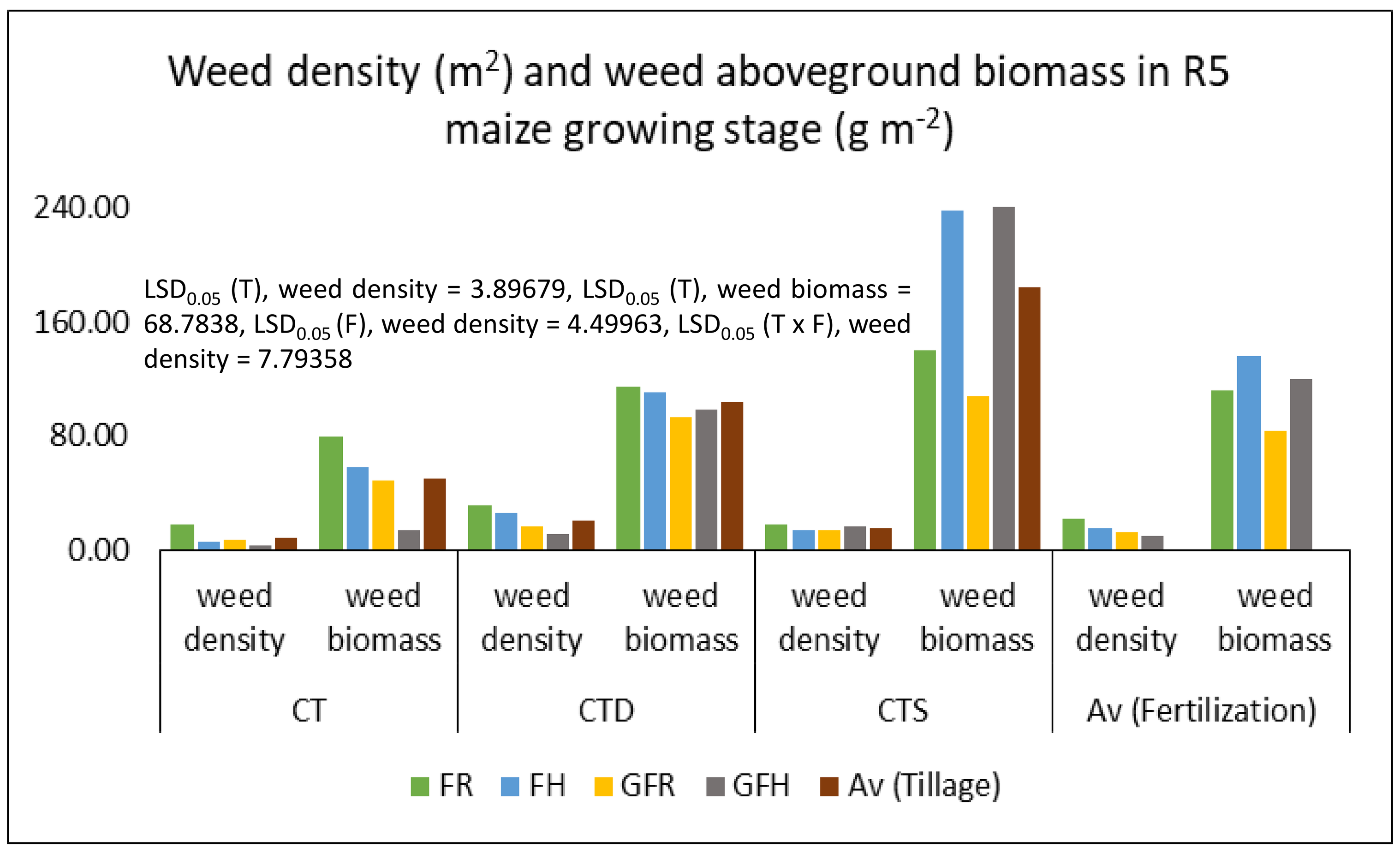
FR - according to the recommendation - NPK 170: 150: 225 kg ha^{-1}, FH - 50% of the recommendation, GFR - according to the recommendation + GeO_2 - biophysiological soil activator, 300 kg ha^{-1}, GFH - 50% of recommendation + GeO_2

Results:

The most numerous weed species were: *Calystegia sephium* (L.) R. Br., *Ambrosia artemisiifolia* L., *Setaria viridis* (L.) P. Beauv. and *Convolvulus arvensis* L.



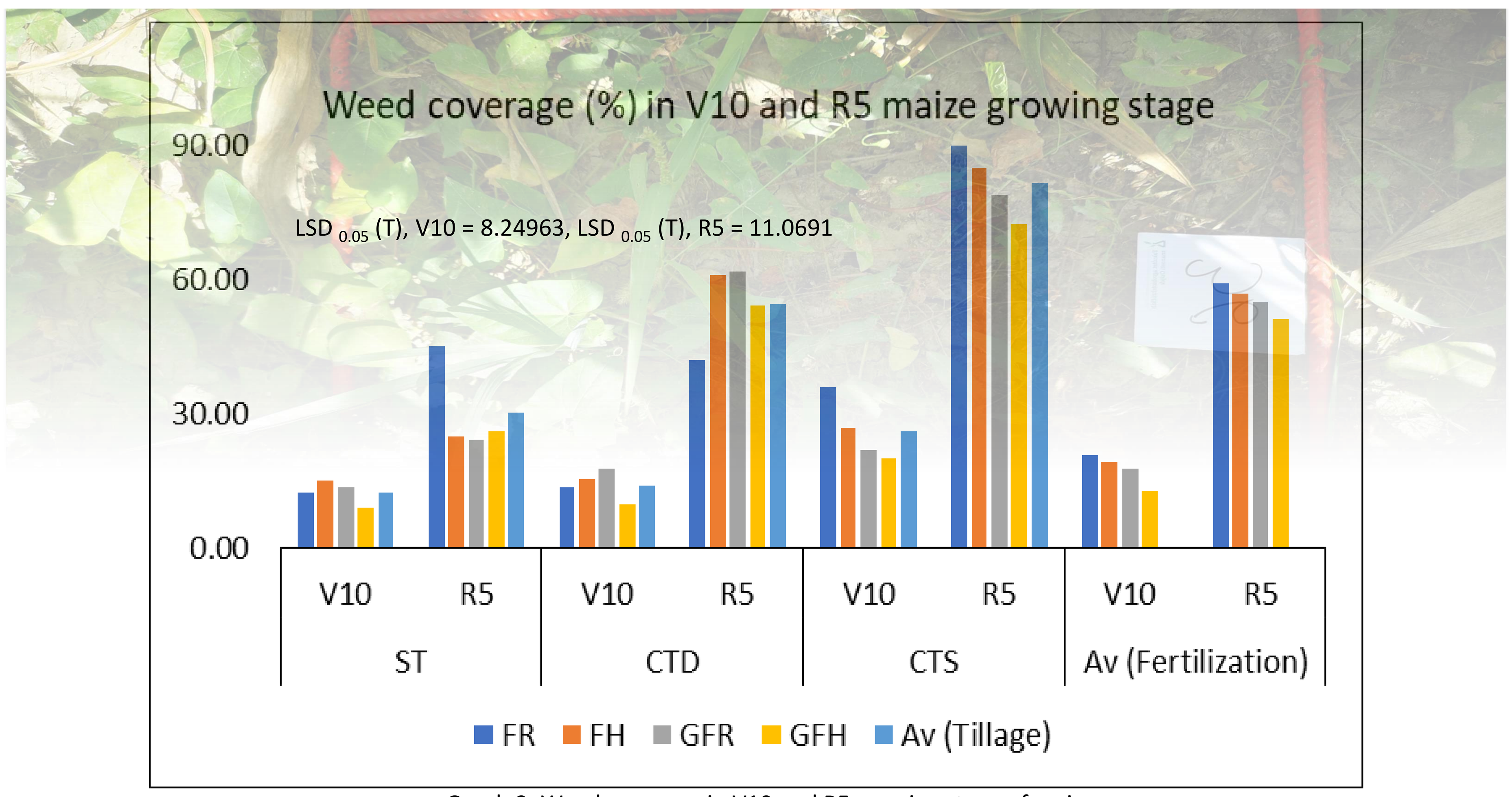
Graph 1. Total weed number (weed density) and weed aboveground biomass in critical weed-free period for maize (V10)



Graph 2. Total weed number (weed density) and weed aboveground biomass in R5 maize growing stage

Tillage significantly affected the total number of weeds – weed density, weed aboveground biomass and weed cover in the first observation (V 10 – critical weed-free period for maize). All investigated indicators in average were the highest at the CTS treatment with significant statistical significance ($p \leq 0.05$) in relation to conventional tillage (CT). The total weed number (12.33/m^2) on CTS treatment was almost four times higher compared to ST (3.34/m^2). Fertilization did not significantly affect the level of weediness, and the average values of all studied indicators were the lowest on the treatment GFH in first observation.

The impact of tillage and fertilization on the total weed number in the second sampling (growth stage R5) was statistically significant ($p \leq 0.05$). Significant interaction between tillage and fertilization was found, and the highest total number of weeds was recorded on control fertilization treatment FR for all tillage treatments. Treatment GFH in average resulted in more than 50% fewer weeds compared to FR (22.3/m^2) with statistically significant difference. The highest total weed number was recorded on CTD tillage treatment (21.25 /m^2). The highest weed aboveground biomass (183.83 g/ m^2) and weed cover (81,75%) were recorded on CTS tillage treatment with a significant statistical difference in relation to CT treatment.



Graph 3. Weed coverage in V10 and R5 growing stage of maize

Conclusion

The results of this study indicate an increase in weediness of maize on conservation tillage systems and the positive effect of reduced fertilization with the addition of biophysiological soil activator to reduce weed levels in the later developmental stages of maize. The suitability of soil conservation systems and optimal fertilization in terms of weed management needs to be further investigated.

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