Maize and weed development and spectral signature as affected by competition with cover crops

Maize and weed development and spectral signature as affected by competition with cover crops

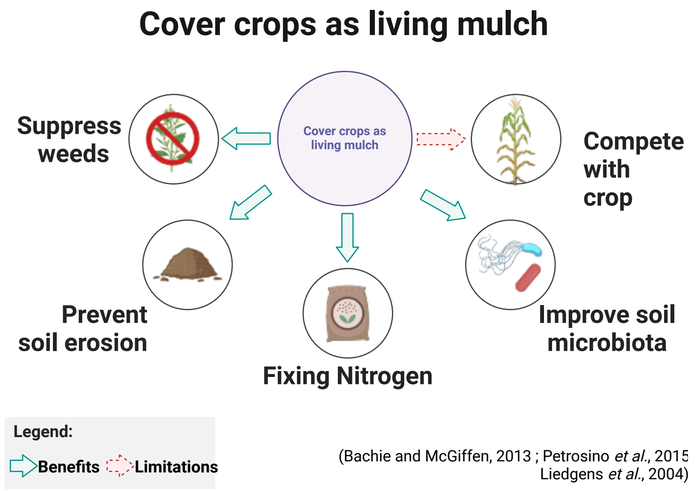
Bennani Z. , Papandrea G., Fogliatto S., Beltramo A. , Di Furia I., Vidotto F.

Università di Torino, Dipartimento di Scienze Agrarie, Forestali e Alimentari (DISAFA) Grugliasco, Italy

zineb.bennani@unito.it

Workshop of the WG 'Physical and Cultural Weed Control' Wageningen, The Netherlands
19 – 21 May, 2024

INTRODUCTION



(Bachie and McGiffen, 2013 ; Petrosino *et al.*, 2015 Liedgens *et al.*, 2004)

The aim of the study was to evaluate the impact of cover crops used as living mulch on the development and physiology of maize and selected weeds.

METHODS

The study consisted of a pot trial carried out in the summer season of 2023, in Grugliasco (Northwest Italy).

The cover crops assessed were: clover, Italian ryegrass, rye, or vetch

Cover crops were sown in 0.33m diameter pots with 10 seeds each in a circular manner with one central plant maize or a weed **(Figure 1**). Five replicates were evaluated,

Each combination of cover crop and maize or weed was replicated 5 times, as were the control pots, where the central plant was left to grow alone.

Development parameters such as **height, growth stage**, and **SPAD index** of both the cover crops and the central plants were assessed at the middle and the end of the season.

The physiological status of the central plant at the end of the season was evaluated by measuring the **plants' reflectance** using a spectroradiometer.

<u>Central plant</u>
Maize
Amaranthus retroflexus
AMARE
Chenopodium album
CHEAL
Echinochloa crus-galli
ECHCG
Digitaria sanguinalis
DIGSA

<u>Cover crops</u>
Italian ryegrass
Lolium multiflorum
Rye
Secale cereale
Common vetch
Vicia sativa
Egyptian clover
Trifolium alexandrinum

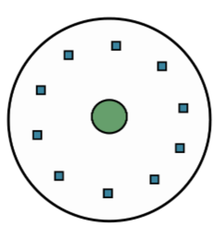


Figure 1. Seeding pattern adopted in the pot trial

RESULTS

The impact of cover crops on the central plants' biomass was highly significant (**Figure 2**). Rye and Italian ryegrass caused biomass reduction of at least 70% for both maize and the tested weeds.

Vetch and Clover enhanced maize biomass by 3% and 11% respectively while significantly causing a reduction for AMARE, CHEAL, and DIGSA.

The spectral signatures showed clear variation in the visible spectrum 400 - 700 nm (**Figures 3 - 7**).

When grown with I. ryegrass, plants showed a higher reflectance in the range 550 nm to 650 nm, which corresponds to a lower photosynthetic activity. This is confirmed with the SPAD values **(Figure 8)**.

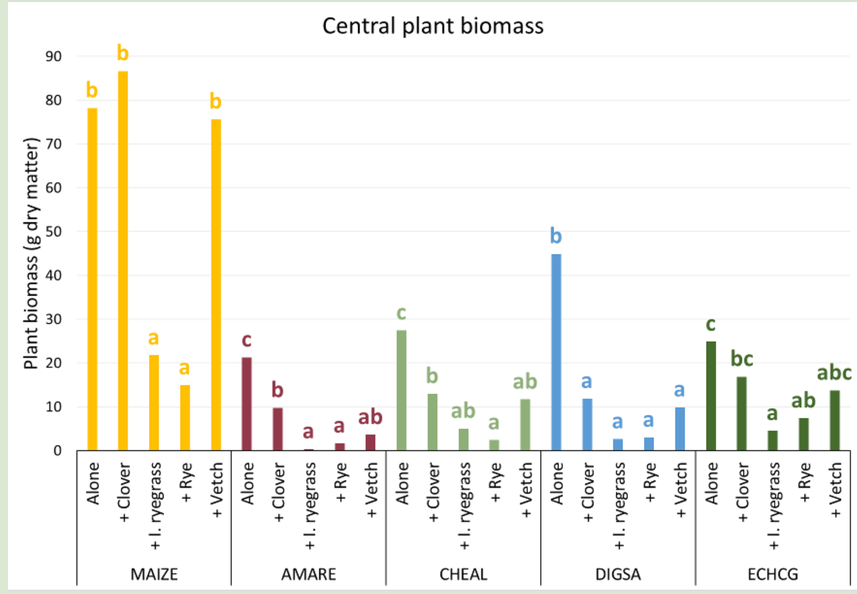


Figure 2. Dry biomass of maize and weeds as affected by the cover crops at the end of the trial. For each central plant, the letters indicate homogeneous statistical groups.

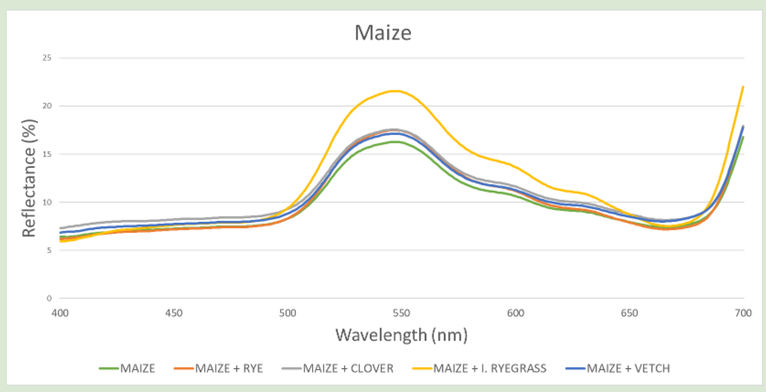


Figure 3. Average light reflectance of maize

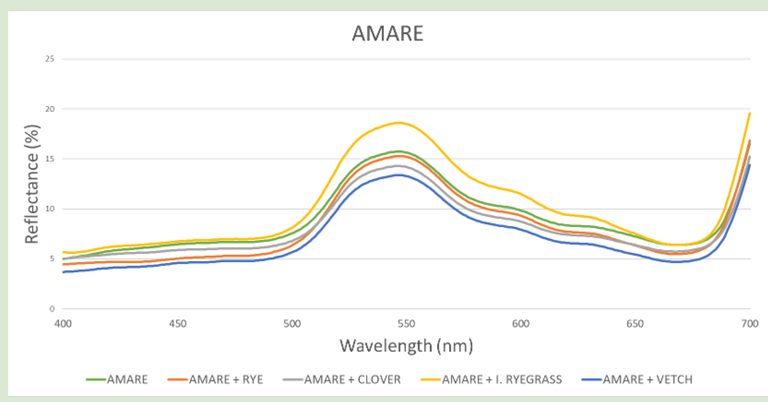


Figure 4. Average light reflectance of *Amaranthus retroflexus*

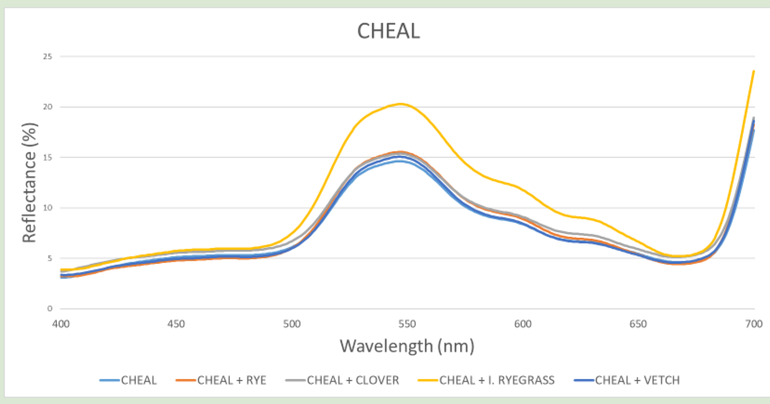


Figure 5. Average light reflectance of *Chenopodium album*

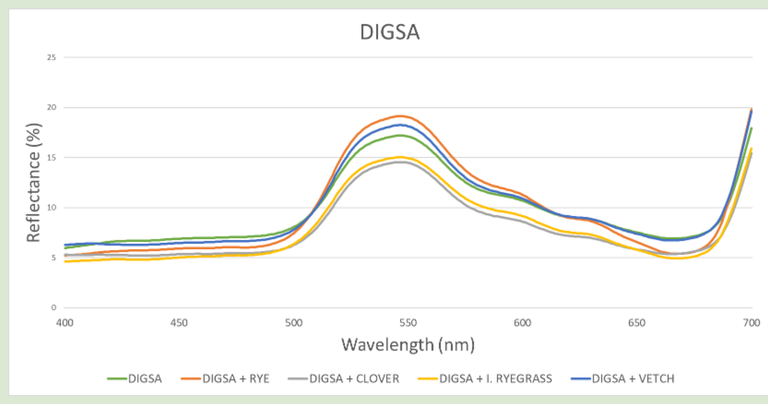


Figure 6. Average light reflectance of *Digitaria sanguinalis*

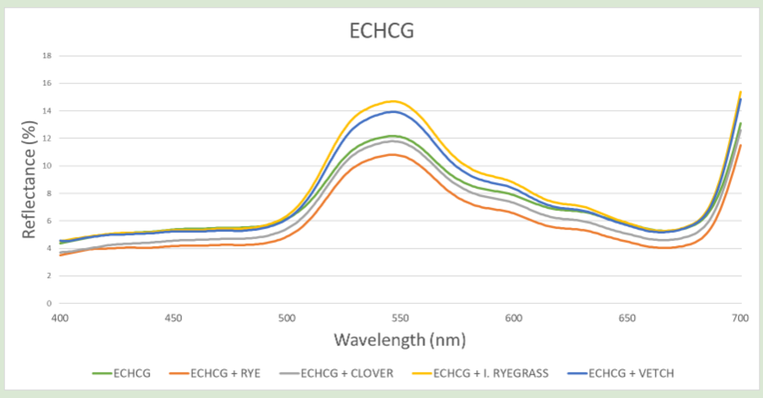


Figure 7. Average light reflectance of *Echinochloa crus-galli*

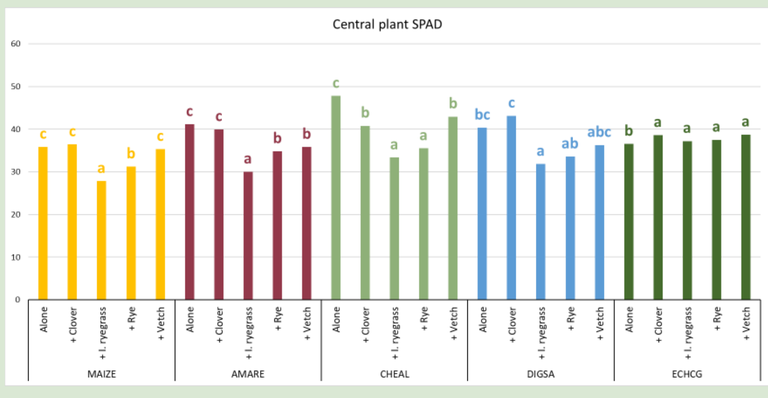


Figure 8. Average SPAD values for maize and weeds as affected by the cover crops at the end of the trial. For each central plant, the letters indicate homogeneous statistical groups.

CONCLUSION

Grass cover crops can effectively suppress weeds but also reduce maize development, while legume cover crops are less effective but promote maize development at the same density.

REFERENCES

Bachie, O., and M.E. McGiffen. 2013. Effects of summer cover cropping on weed population density and biomass in a subsequent broccoli crop. p. 31–36. In: International Conference on Sustainable Environment and Agriculture. IPCBEE 57:31–36.

Petrosino, J.S., J.A. Dille, J.D. Holman, and K.L. Roozeboom. 2015. Kochia suppression with cover crops in southwestern Kansas. Crop Forage Turfgrass Manage. 1:2014-0078. doi:10.2134/ cftm2014.0078

Liedgens, M., Soldati, A. and Stamp, P. 2004. Interactions of maize and Italian ryegrass in a living mulch system: (1) Shoot growth and rooting patterns', Plant and Soil, 262, pp. 191–203

Acknowledgements

This work was supported by the grant Agritech National Research Center funded by European Union Next-GenerationEU (PIANO NAZIONALE DI RIPRESA E RESILIENZA (PNRR) – MISSIONE 4 COMPONENTE 2, INVESTIMENTO 1.4 – D.D. 3175 18/12/2021, CN00000022).