Weed Community Dynamics under Conservation Agriculture in Zimbabwe

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Introduction

- High weed infestation by a few dominant weeds in Conservation Agriculture (CA) remains a major constraint on crop productivity.
- Fewer, more diverse weeds could be less competitive with crops and provide ecosystem services.
- Integrating legumes into maize-based systems is one promising Sustainable Intensification option for sustainable weed management.

Objective: **To assess the effects of different cropping systems and fertiliser levels on weed species communities, with different effects on crop yield.**

Materials and Methods

- Field experiment on two contrasting soil types
- Split plot design with four replicates
- Six main treatments (cropping systems; Figure 1) and two sub treatments (fertilizer applied or not)
- Weeds were sampled in 50 x 50cm quadrats, three times in the season
- Data collected included weed species richness and evenness, weed biomass and density, and crop grain yield and crop biomass
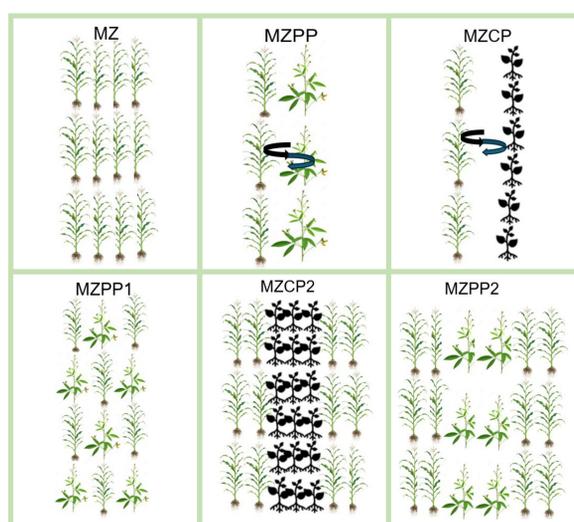- Data was analysed in R using mixed models

Figure 1: The six cropping systems tested in this study. MZ = sole maize, MZ-CP = maize-cowpea rotation, MZ-PP = maize pigeon pea rotation, MZPP1 = traditional alternate row intercropping with pigeon pea, MZCP2 = maize-cowpea double row strip cropping, MZPP2 = maize-pigeon pea double row strip cropping (see also Figure 4).
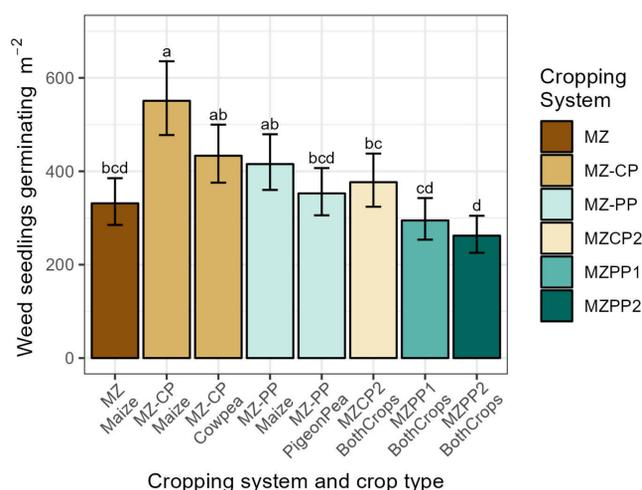

Figure 2: Mean weed seedling density for each cropping system, averaged across both fertiliser levels, both sites, and all years.
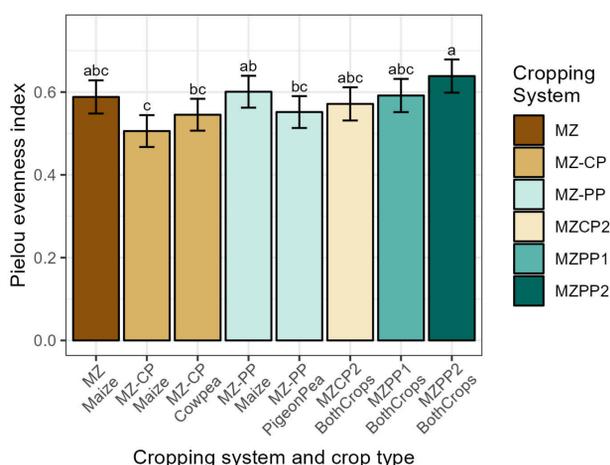

Figure 3: Mean species evenness (Pielou index) for each cropping system, averaged across both fertiliser levels, both sites, and all years.
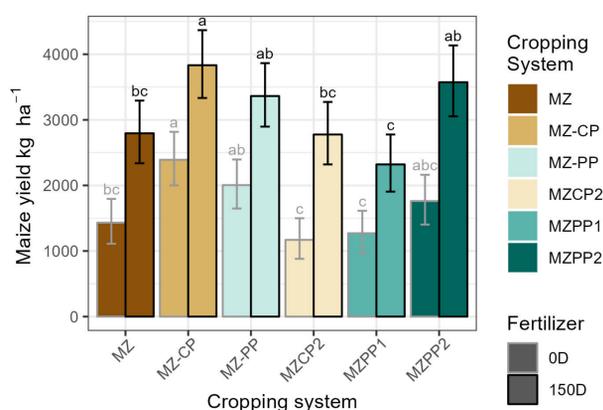

Figure 4: Mean maize grain yield for each cropping system and fertiliser level, across both sites and all years.

Figure 5: The maize-pigeon pea double row strip crop, MZPP2.

Results and Discussion

- Although not significantly different from other cropping systems, Maize-pigeon pea double row strip crop had the lowest density of weeds seedlings emerging whilst Maize-cowpea rotation had the highest (Figure 2). This confirms with (Hepperly and Diaz, 1983) and (Viteri and Linares-Ramírez, 2024) who reported that pigeon pea had more allelopathic effects than cowpea that inhibit weed seeds emergence.
- Also, Maize-pigeon pea double row strip crop had highest Pielou evenness index (Figure 3).
- Fertilized Maize-cowpea rotations resulted in a higher maize yield than other systems, although not significantly different from Maize-pigeon pea rotations and Maize-pigeon pea double row strip crop (Figure 4).

Conclusions

- Overall, cropping systems that had higher weed density had the lowest Pielou evenness index, indicating that a few species were dominating.
- Maize-pigeon pea double row strip crop could reduce weed densities and increase weed species evenness and diversity, thereby improving food and feed yields. It could therefore be a rewarding cropping system for rain-fed CA maize systems.
- Optimizing CA practices with correctly diversified cropping systems can help to manage weed pressure, whilst also contributing to food and nutrition security, and sustainable and resilient smallholder agroecosystems.

References

HEPPERLY, P. & DIAZ, M. 1983. The allelopathic potential of pigeon peas in Puerto Rico. *J. Agric. Univ. PR*, 67, 453-63.

VITERI, D. M. & LINARES-RAMÍREZ, A. M. 2024. Registration of indeterminate and photoperiod-insensitive IIPG-7 and IIPG-11 pigeonpea germplasm. *Journal of Plant Registrations*.