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Do we need dedicated maize breeding program for perennial groundcover systems?

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Introduction

To create well-adapted perennial ground cover (PGC) systems for a range of farm operations that require low labor inputs, provide significant ecosystem benefits, increase row crop resiliency, and have similar economic profiles as conventional row crop practices.
When maize is cultivated in PGC systems we face challenges related to competition between cash and cover crops for light, nutrients, and water.
Understanding how different maize hybrids respond to these conditions, as well as the interactions between genotype (G), environment (E), and management (M) is critical for optimizing yield and ensuring long-term sustainability.

Objectives

To evaluate the ranking of maize testcross hybrids for grain yield in conventional and PGC environments, aiming to determine whether dedicated maize breeding is necessary for PGC systems.

Material and Methods

Each year, an experimental lattice design was utilized, involving 52 BS39 Double Haploid (ISU) experimental hybrids as well as 2 Corteva check hybrids.

Over two years (2023-2024), 69 test-cross genotypes were screened to explore ranking differences in grain yield between conventional and PGC systems.

The experiments were conducted with two perennial ground cover species near Ames, IA: untreated (mowed) Kentucky Bluegrass (KBG) and Poa bulbosa (PB).

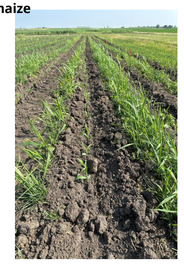
While grain yield was the target trait, various yield-related physiological traits such as plant and ear height, flowering date, leaf angle and SPAD were also measured.

a) The plant height of late stage in conventional vs PGC systems in 2023-2025

Maize and PGC

Conventional maize

b) Perennial Ground Cover Crops fields after planting maize



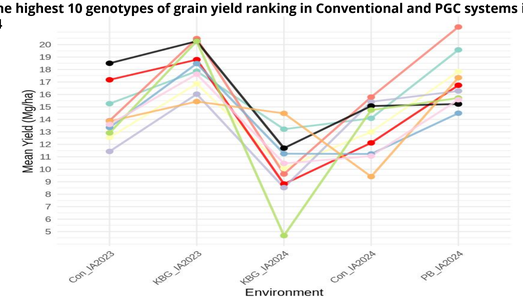
Kentucky bluegrass

Poa bulbosa

Figure. 1 The genotypes plant height performance in in Conventional and PGC systems and perennial ground cover crops fields after planting maize.

Results

a) The highest 10 genotypes of grain yield ranking in Conventional and PGC systems in 2023-2024



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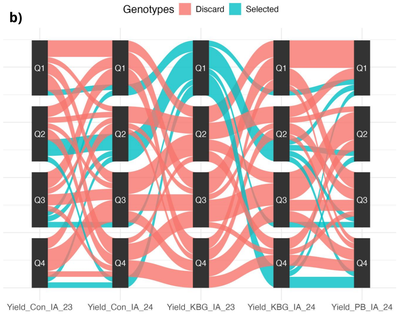
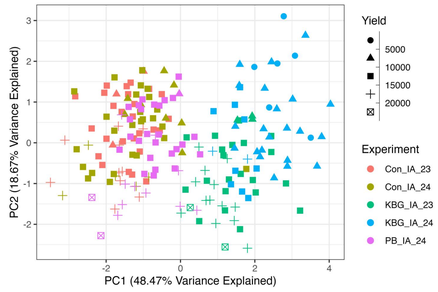


Figure. 2 The genotypes performance and ranking outcomes in Conventional and PGC systems.
a) The highest 10 genotypes of grain yield ranking in Conventional and PGC systems in 2023-2024.
b) 54 genotypes selection in conventional and PGC systems. c) The Principal Component Analysis (PCA) and genotypes performers of grain yield in all environments in 2023-2024 d) Correlation of environments

c)



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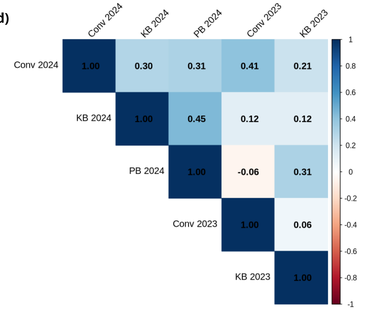

Conclusion

1. The ranking of our hybrids for maize grain yield and plant height was significantly different under conventional and PGC conditions.
2. A closer correlation (0.45) between KBG and PB compared to conventional methods. PB is predictable.
3. To develop maize suitable for PGC systems, breeders should prioritize selecting hybrids based on performance in PGC environments rather than conventional ones, with a focus on grain yield.
4. However, summer dormant and during summer “brown” PGC like PB (or treated KBG) appeared more promising, and more similar to conventional experiments, but PB was only recently established.

Acknowledgment
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