Effects of plant leaves and their manure derivatives on *Sorghum bicolor* L. in the Sudano-Sahelian zone of Mali

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Introduction

For millenia productivity of open-parkland systems in the West Africa Sudano-Sahelian region has been maintained through the integration of trees and shrubs in agricultural landscapes. As a consequence of intensification of agriculture, farmers are reducing tree densities to increase crop yields (Biaou et al., 2016). Given high costs of mineral fertilizers farmers are unable to replace nutrients lost through crop yield. Consequently, farmers often apply plant leafy biomass and manure on their cropland to maintain soil productivity (Fig. 1). **The aim of this study was to determine the agronomic performance of sorghum after a single application of plant leaves and their manure derivatives.**

Figure 1. Field application of plant leafy biomass in the Sudano-Sahelian zone of Mali.

Materials and methods

Study site: Koulikoro, Southern Mali

Treatments: Leafy biomass and respective manure derivatives of *Khaya senegalensis, Pterocarpus lucens, Ficus sycomorus, Pennisetum pedicellatum.*

Design: Randomiced Complete Block Design (RCBD).

Application rate: 8 t ha^{-1} in the 1st cropping year (2022) and no amendement in the second cropping year (2023).

Results

Average grain yield in the 1st cropping year was 49% higher than in the 2nd cropping year. In the 1st cropping year (Fig. 2; 2022), *P. pedicellatum* leafy biomass produced the highest grain yield (1,442 kg ha^{-1}). This was 253% higher (p < 0.01) than the lowest grain yield (409 kg ha^{-1}) produced from the unamended control.

In the 2nd cropping year (Fig. 2; 2023), grain yield from *F. sycomorus* plots were 4-times higher (p<0.05) than from control plots. The average fertilizer use efficiency across both cropping cycles was 35-84% higher in leafy biomass than for the respective manure, except for *K. senegalensis* (Fig. 3).

Table 1. Initial chemical composition (C, N and C:N) of plant leafy biomass and manure used in the study

	N	C	C:N
	mg g^{-1}		
Leafy biomass			
F. sycomorus	22.2	421.0	19.0
K. senegalensis	12.7	454.5	35.8
P. lucens	24.2	469.6	21.30
P. pedicellatum	14.2	396.1	27.9
Manure			
F. sycomorus	16.7	444.2	26.5
K. senegalensis	15.6	469.4	30.1
P. lucens	14.4	462.8	32.2
P. pedicellatum	13.7	453.0	33.1

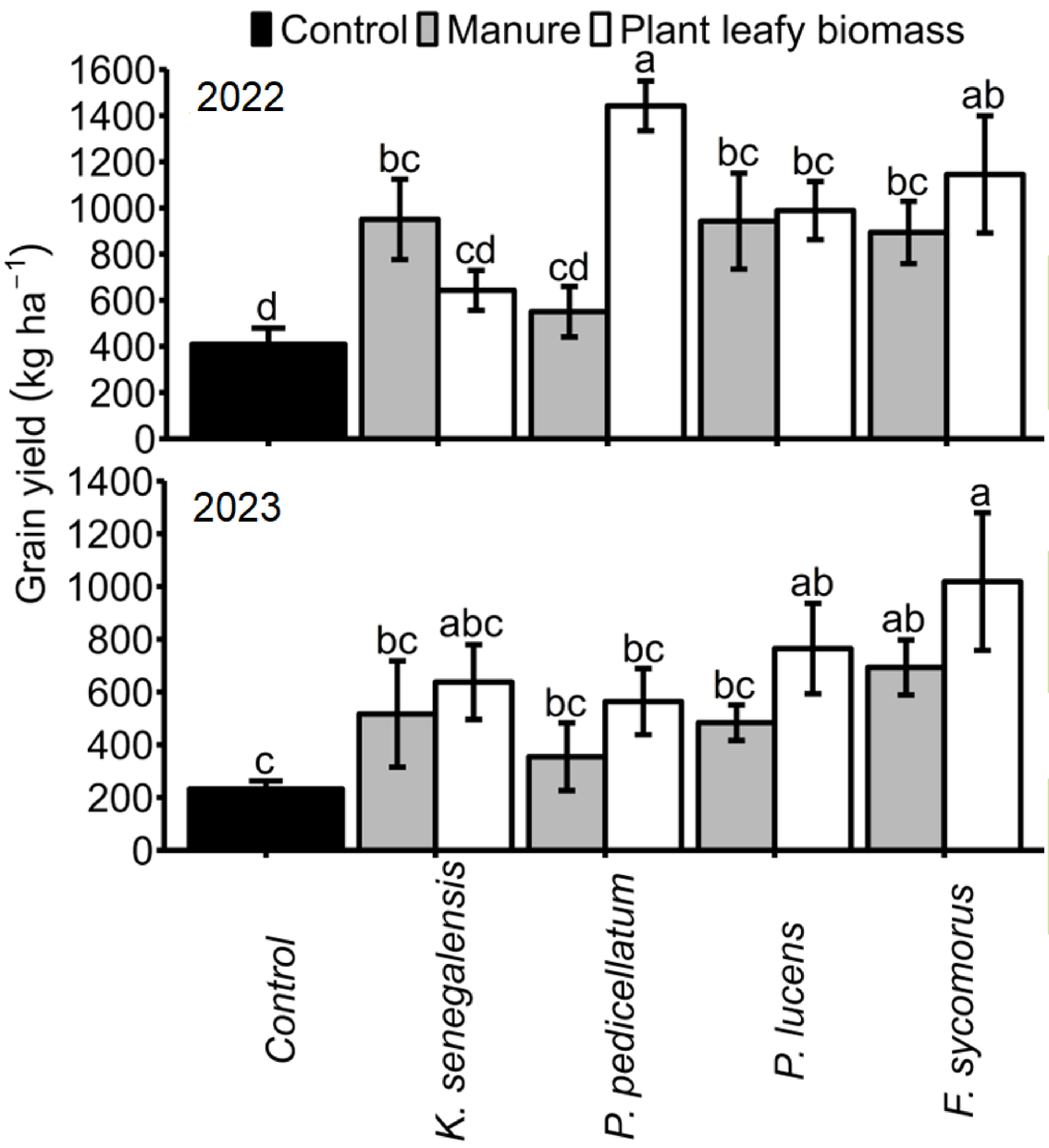


Figure 2. Effects of plant leafy biomass and their manure derivatives on grain yield of sorghum in 2022 and 2023 in Koulikoro, Mali. Treatments with different lower-case letters above the standard error of the mean are significantly different (p < 0.05).

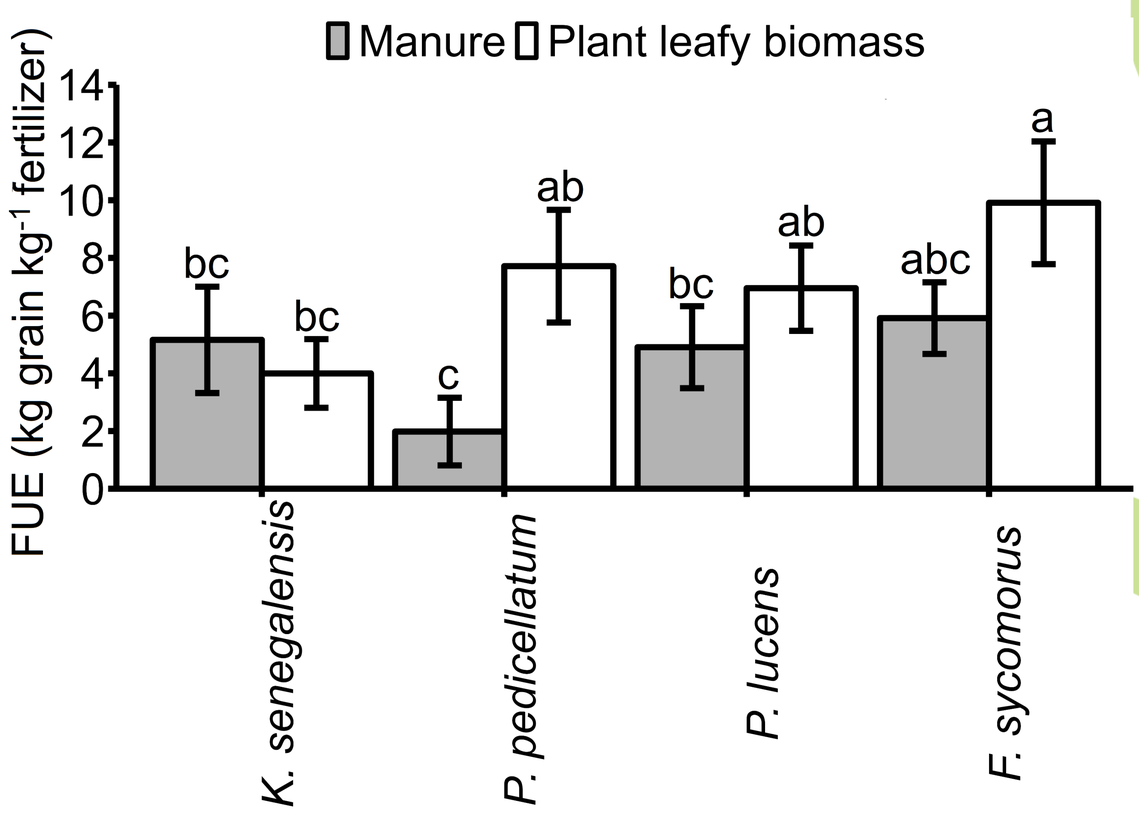


Figure 3. Average fertilizer use efficiency (FUE) of sorghum after two cropping years (2022 and 2023) in Koulikoro, Mali. Treatments with different lower-case letters above the standard error of the mean are significantly different (p < 0.05).

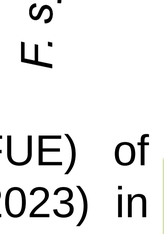
Conclusions

The field application of plant leafy biomass or their manure derivatives had similar effects on sorghum grain yield across species. Only for *P. pedicellatum*, fertilizer use was higher when leaves were applied as biomass than as manure. These results have important implications for nutrient management recommendations in the study zone and beyond.

Acknowledgements

DAAD Deutscher Akademischer Austauschdienst German Academic Exchange Service

Sustain Sahel



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