Soil Management Options for Improving Nitrogen Use Efficiency of Rice in the Kilombero Flood Plains

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Introduction

- Rice is an important staple food crop in East Africa and its production needs to be increased to meet the increasing demand.
- East African wetlands provide opportunities to meet the demand if managed efficiently.
- Different soil management options to improve NUE of rice under rain-fed conditions are ongoing in the Kilombero flood plain of Tanzania

Methodology

Three on-farm rice cv. SARO 5 experiments have been completed since 2014 under three hydrological zones (Fringe, Middle, and Center)

Study topic	Treatment	Agronomic details
Recovery Study	Natural vegetation recovery	initial ploughing, regrowth of semi-natural vegetation
Yield Gaps (YG)	Farmer´s Practice	no bunding, 1 time weeding, 0 N
	YG – bunding, weeding	0 N
	YG – Urea-N	60 kg N ha-1
	Max. attainable yield	120 kg N ha-1, 60 kg P ha-1, 60 kg K ha-1, irrigated
Alternative Options	Green manure	2 month pre-cropped *L. purpureus* (approx. 60 kg N ha-1)
	Animal manure	cow manure (app. 60 kg N ha-1)
	Animal manure+ legume	cow manure (app. 60 kg N ha-1) + *Stylosanthes guianensis*
Intensive Systems	Double crop – NPK fertiliser	rice 60 kg N ha-1, dry season maize 60 kg N ha-1
	Double crop – manure	rice + cow manure (60 kg N ha-1), dry season with cow pea

Nursery bed establishment

Green manure lablab

Fertilizer application before puddling

Puddling and leveling of plots

Transplanting of rice

Monitoring rice plants in center zone

Prelimnary results

- **Overall, higher NUE were achieved in the 'Fringe' than ‘Middle’ and 'Center' experimental sites(Fig 1-2).**
- **Fringe zone has a higher PFP and ANRE compared to the Middle zone (Fig.3-4).**
- **APE was higher in the order of 60 kg N (urea) > Lablab > 120 kg N (urea) > Cm. while 60 Kg N (urea) produced the highest PE, too (Fig.5).**
- **Increase in nitrogen uptake resulted to increase in grain yield (Fig.6).**
- **Grain yield was significantly higher for treatments receiving mineral N compared with all other treatments (Fig. 7).**

Objectives

- To determine the effect of different treatment's on the NUE
- To evaluate the effect different fertilizer sources on rice yield parameters
- To determine the contribution of nitrogen sources on nutrient availability
- To quantify the effect of mineral fertilizers, green and animal manure on grain yield and nutrient flows

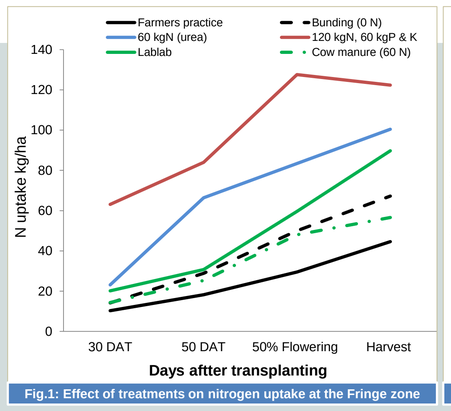


Fig.1: Effect of treatments on nitrogen uptake at the Fringe zone

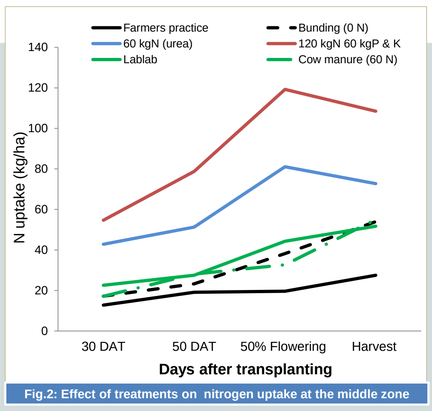


Fig.2: Effect of treatments on nitrogen uptake at the middle zone

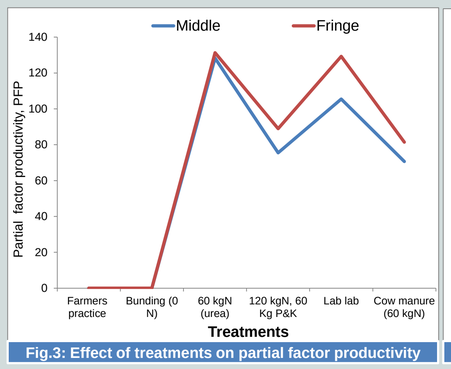


Fig.3: Effect of treatments on partial factor productivity

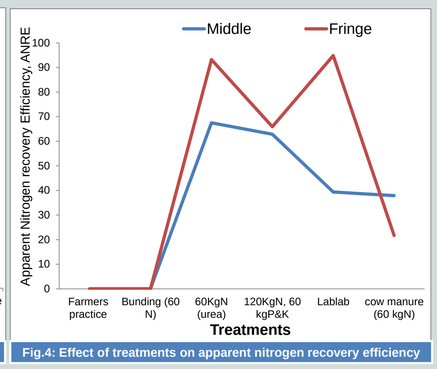


Fig.4: Effect of treatments on apparent nitrogen recovery efficiency

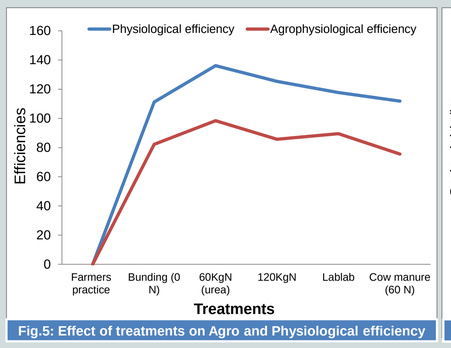


Fig.5: Effect of treatments on Agro and Physiological efficiency

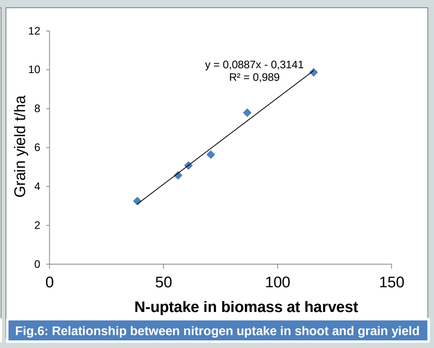
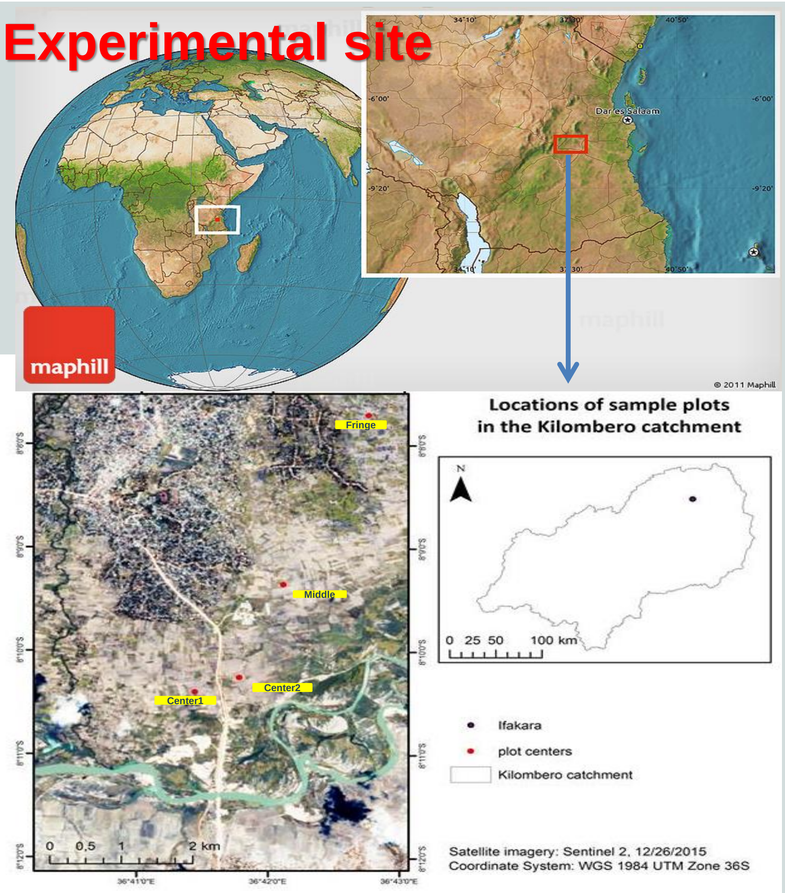


Fig.6: Relationship between nitrogen uptake in shoot and grain yield

Experimental site



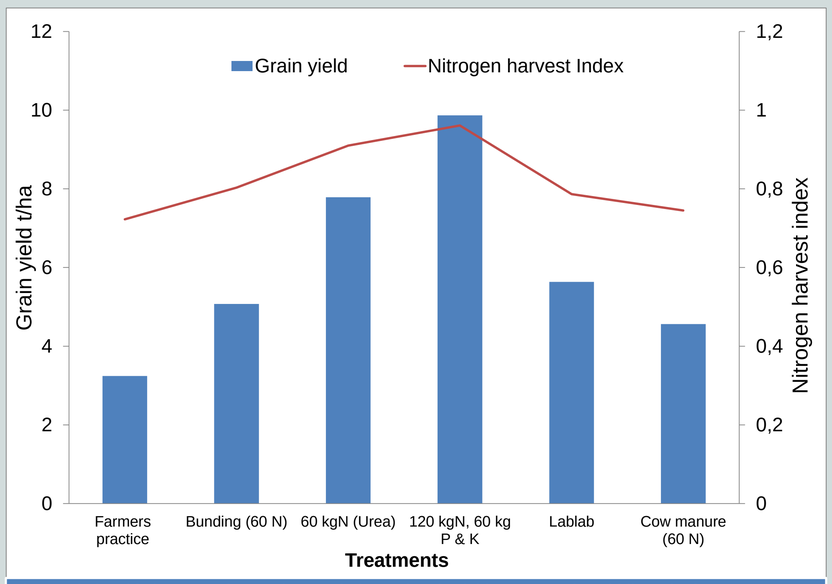


Fig.7: Relationship between nitrogen harvest index and grain yield as a mean for Middle and Fringe zones

Conclusion

Different responses to average NUE in the hydrological zones of the flood plain are high for the best management practices compared to farmers practice

Alternative N options to improve NUE

- Post-crop legume green manure (Cowpea) grown after the rice crop might improve soil nitrogen fertility

- Use of legume fodder crop *stylsanthes guianensis* might also improve soil nitrogen

- Combining bunded rice 60 kg N (Urea) and post-rice maize, 60 kg N (Urea).

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