

Nutrient Management Strategies for Rice Production in the Kilombero Flood Plain in Tanzania

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Introduction

Tanzania is an important rice producer with about 16% of the total rice area of East Africa. Some 75% of the rice is grown by smallholder farmers under rainfed conditions in floodplain wetlands. Grain yields and returns to investments are modest and soil fertility tends to decline. In the frame of the interdisciplinary research project we investigate integrated nutrient management options for lowland rice in comparison with farmer methods.



Experimental site (center) after rice transplanting, due to excessive flooding the trial had to be abandoned in April 2015

Objectives

- Determine yield limiting factors in rice
- Quantify the effect of mineral fertilizers, green and animal manure on grain yield and nutrient flows
- Compare hydrological zones (fringe, middle, center) and land use intensification (double vs. single cropping) with respect to rice productivity
- Develop a basket of technologies for sustainable rice production in wetlands
- Assess economic and ecological impacts

Materials and Methods

- Establishment of a one-factorial field trial with rice cv. Saro 5 (RCB, 4 reps) at Ifakara, Morogoro Region, TZ, in three hydrological zones of Kilombero floodplain (fringe, middle, center) in March 2015
- Assessments: Crop phenology, crop growth and nutrient uptake, grain yield and yield structure, ANOVA

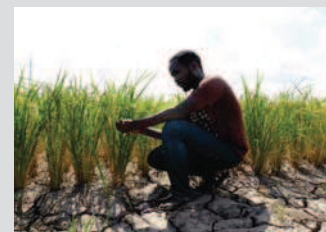
Study topic	Treatment	Agronomic details
Recovery Study	Natural Vegetation Recovery	initial ploughing, regrowth of semi-natural vegetation
Yield Gaps (YG)	Farmer's Practice	no bunding, 1 time weeding, 0 N
	YG – bunding, weeding	0 N
	YG – Urea-N	60 kg N ha ⁻¹
Alternative Options	Max. attainable yield	120 kg N ha ⁻¹ , 60 kg P ha ⁻¹ , 60 kg K ha ⁻¹ , irrigated
	Green manure	2 month pre-cropped <i>L. purpureus</i> (approx. 60 kg N ha ⁻¹)
	Animal manure	cow manure (app. 60 kg N ha ⁻¹)
Intensive Systems	Animal manure+ legume	cow manure (app. 60 kg N ha ⁻¹) + <i>Stylosanthes guianensis</i>
	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

Findings

- In 45 d lablab produced ~3 t ha⁻¹ of DM
- Bunding compared with no bunding (farmer's approach) resulted in higher grain yield (3.1 vs. 4.9 t ha⁻¹, mean of two zones) and biomass (Fig. 1 - 4)
- Highest grain yields (unmilled) were recorded after intensive fertilizer application (up to 10.1t ha⁻¹)
- Organic N sources from green and animal manure application had no yield increasing effect, however cumulative effects of repeated manuring are expected
- There is a considerable yield gap for rice in the Kilombero flood plain



View on the experimental field in the fringe zone



Unbounded experimental plot (farmer's practice)

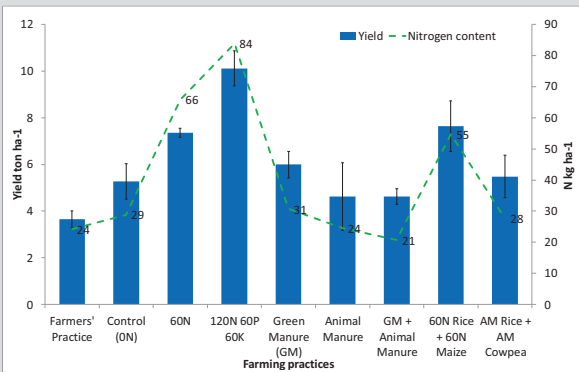


Fig. 1: Effect of treatments on grain yield and N uptake at 50 DAT, fringe zone

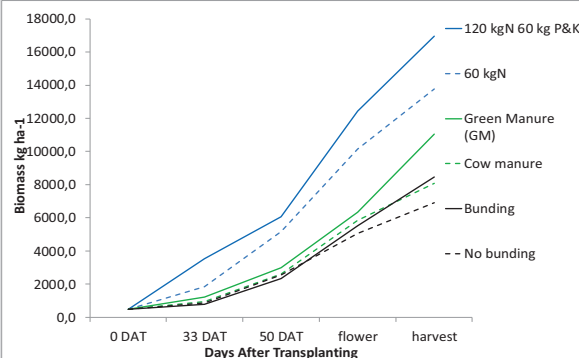


Fig. 2: Effect of treatments on biomass development, fringe zone



Lablab plot prior to incorporation



Rice transplanting in unbounded and bounded plots



SARO 5 nursery bed

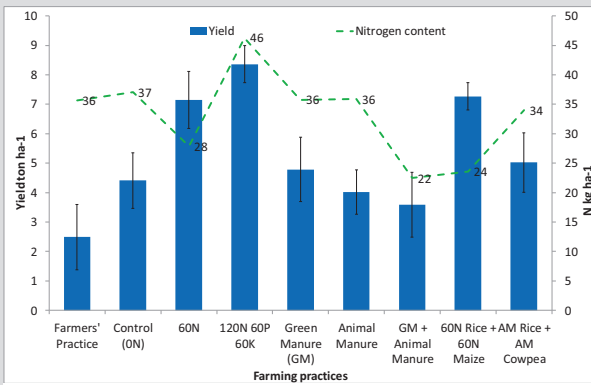


Fig. 3: Effect of treatments on grain yield and N uptake at 50 DAT, mid zone

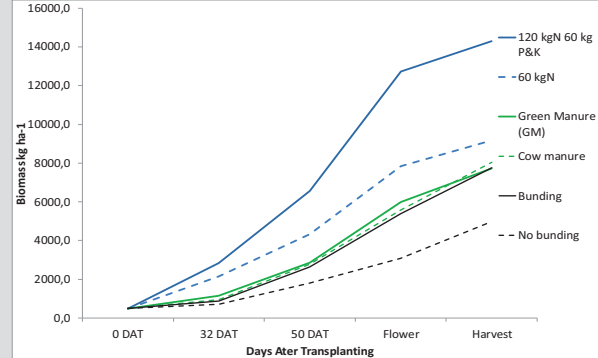


Fig. 4: Effect of treatments on biomass development, mid zone