

Effects of soil and foliar applied micronutrients on productivity and profitability of rice in Tanzania

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Introduction

Rice production in sub-Saharan Africa is largely nutrient-limited, hence application of micronutrients along with NPK is often needed to boost and sustain yields. Foliar and soil application of micronutrients could be efficient, however, few studies have simultaneously compared the efficiency and effectiveness of foliar vs soil-applied fertilizers, and the results have been inconclusive.

Objectives

- To understand the efficiency of soil and foliar applied micronutrients on yield
- To analyze the cost effectiveness of soil and foliar applied micronutrient

Experimental set-up

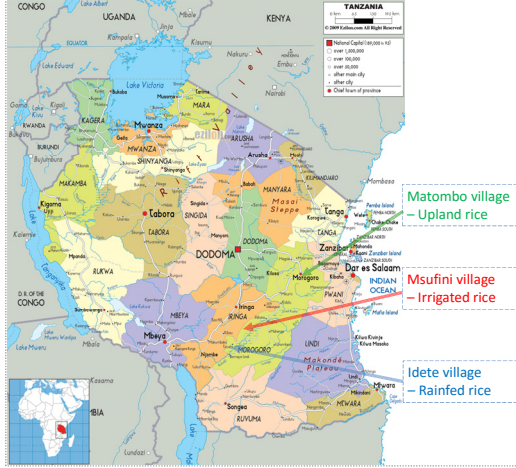
- 30 researcher managed on-farm trials in 2015
- Three rice growing conditions: Irrigated lowland (n=10; var: sar05); Rainfed lowland (n=10; var: sar05) & Upland (n=10; var: NERICA1)
- Three reference treatments; five foliar nutrient products & one soil application of micronutrients per trial
- Treatments under two blocks (NPK vs No NPK)
- Treatments randomized within each block

Treatment details

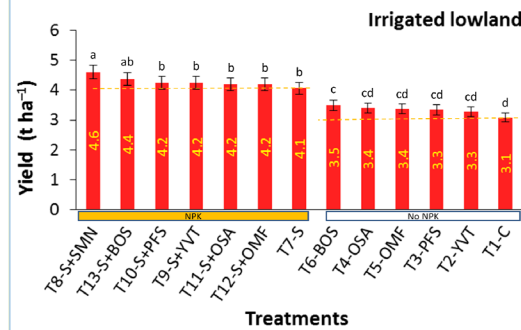
Tt. No.	Treatment details	Treatment description	Selected Foliar nutrient for the treatment
T1	Control	No application of either soil or foliar nutrient	Ref. treatment - 1
T2	F1-YVT	Only foliar nutrient	F1=Yara vita Tracel Bz (YVT)
T3	F2-PFS	Only foliar nutrient	F2= Poly-feed starter & finisher (PFS)
T4	F3-OSA	Only foliar nutrient	F3= OSA Rice (OSA)
T5	F4-OMF	Only foliar nutrient	F4= Omex foliar feed (OMF)
T6	F5-BOS	Only foliar nutrient	F5= Booster (BOS)
T7	S	N:P:K @ 80:17:33 kg/ha	Ref. treatment - 2
T8	S+SMN	N:P:K @ 80:17:33 kg/ha + micronutrients (B, Zn, S & Mg @ 2, 3, 7.5 & 10 kg/ha, respectively)	Ref. treatment - 3
T9	S+F1-YVT	N:P:K @ 80:17:33 kg/ha + F1	F1=Yara vita Tracel Bz (YVT)
T10	S+F2-PFS	N:P:K @ 80:17:33 kg/ha + F2	F2= Poly-feed starter & finisher (PFS)
T11	S+F3-OSA	N:P:K @ 80:17:33 kg/ha + F3	F3= OSA Rice (OSA)
T12	S+F4-OMF	N:P:K @ 80:17:33 kg/ha + F4	F4= Omex foliar feed (OMF)
T13	S+F5-BOS	N:P:K @ 80:17:33 kg/ha + F5	F5= Booster (BOS)



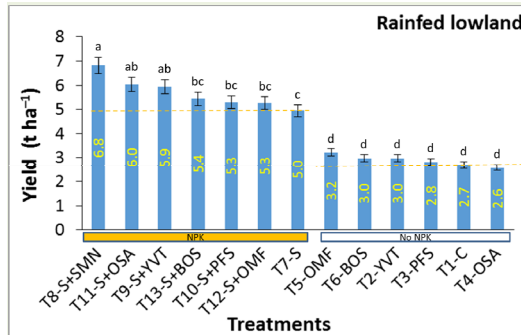
Experimental sites



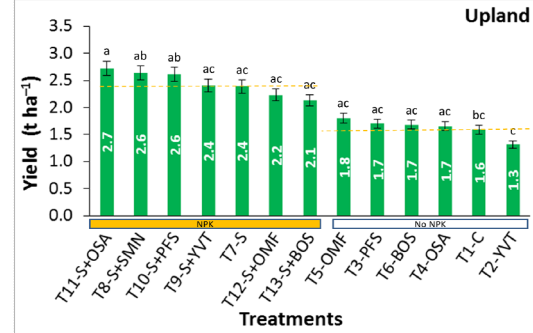
Results – Yield



- No NPK vs NPK = 3.1 vs 4.1 t ha⁻¹ (significant)
- SMN increased yield significantly; while no significant yield increase for foliar under NPK
- BOS increased yield under No NPK, while no significant yield increase for other foliar in No NPK
- 4.6 t with SMN over control (4.1 t ha⁻¹); 0.5 t ha⁻¹ yield increase

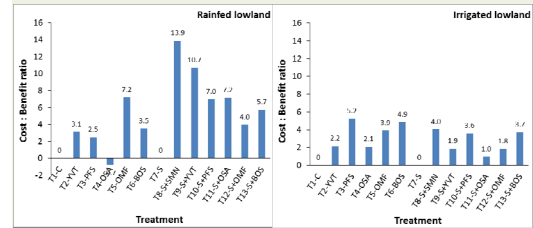


- No NPK vs NPK = 2.7 vs 5.0 t ha⁻¹ (significant)
- SMN, OSA & YVT increased yield significantly with NPK
- 6.8 t with SMN over control (5 t ha⁻¹); 1.8 t ha⁻¹ yield increase
- No significant yield increase for foliar with No NPK



- No NPK vs NPK = 2.4 vs 1.6 t ha⁻¹ (not significant)
- No significant yield increase for SMN or foliar
- 2.6 t with SMN over control (2.4 t ha⁻¹); 0.2 t ha⁻¹ yield increase
- Terminal drought observed in upland conditions

Results – C:B ratio



- Soil applied micronutrients (SMN) have a C:B ratio of 14, 4 and 2 for rainfed, irrigated and upland conditions, respectively
- All foliar products and SMN are cost effective in rainfed and irrigated conditions but not in upland conditions
- OSA contains only Si and its performance is highly variable
- Tiller and panicle density, plant height and 1000-grain weight are in correspondence with the yield in all rice growing conditions

Conclusions

- Efficiency and cost benefit of micronutrients are highly variable across the three rice growing conditions.
- Application of micronutrients increased the rice yield significantly in rainfed and irrigated lowlands. But its effectiveness was not clear in upland.
- Yield and economic benefits were higher for soil applied micronutrients than foliar, but application rates were (roughly 10-15 times) higher.
- In rainfed and irrigated lowland conditions of Tanzania, soil and foliar application of micronutrients can be recommended; However further studies are needed for confirmation.

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