Advances in the development of localised P-dipping technique as a simultaneous solution to phosphorus overuse and sustainable lowland rice production in sub-Saharan Africa (SSA)

Aung Zaw Oo[1] , Yasuhiro Tsujimoto[1] , Njato mickaël Rakotoarisoa[2] , Razafintsalama Harimenja[3]
[1]JIRCAS, Japan, [2]FOFIFA, Madagascar, [3]LRI, Madagascar

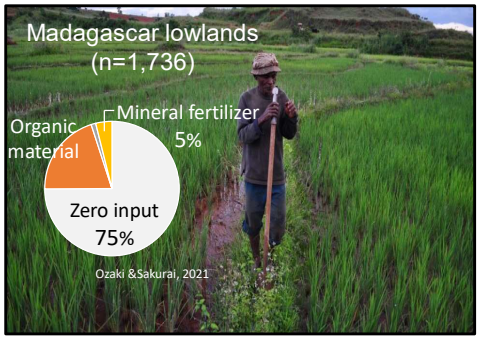
Introduction

Rice yield in SSA remains low due to:

1) nutrient deficiencies
2) high P-fixing capacity of weathered soils
3) farmers' economy limits for fertilizer use

Efficient nutrient management with minimal fertilizer input is key to increasing rice yield

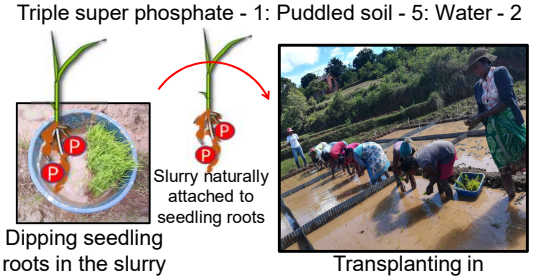
Fertilizer management in Madagascar



Methods

P-dipping technique in Madagascar

P-enriched slurry ratio:
Triple super phosphate - 1: Puddled soil - 5: Water - 2



Results

Exp. 1 P-dipping effect on P fixing soils

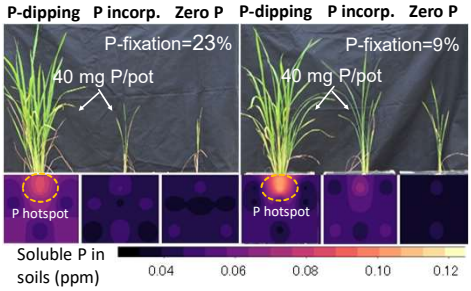


Fig. 1 Interaction effect of P-dipping and soil P fixation

- P-dipping is effective even in highly P-fixing soils that are un-response to conventional P application **(Fig. 1).**
- The synergy of P-dipping and shallow root genotype significantly improved shoot biomass and P uptake **(Fig. 2).**

Exp. 2 Root architecture vs P-dipping

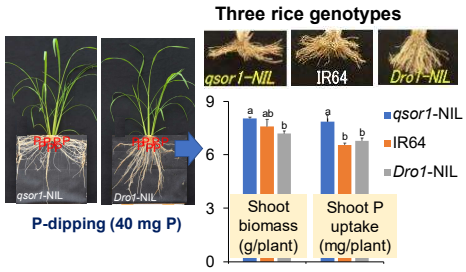


Fig. 2 P-dipping and root system on early rice growth

Exp. 3 On-farm trials in Madagascar

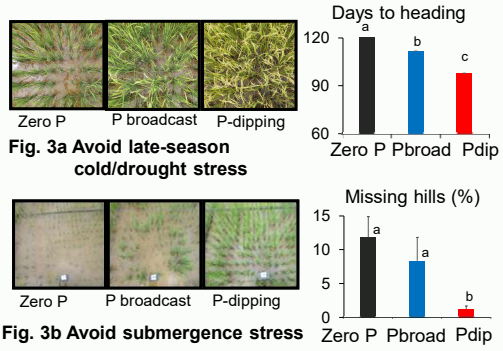


Fig. 3a Avoid late-season cold/drought stress

Fig. 3b Avoid submergence stress

Exp. 3 On-farm trials in Madagascar

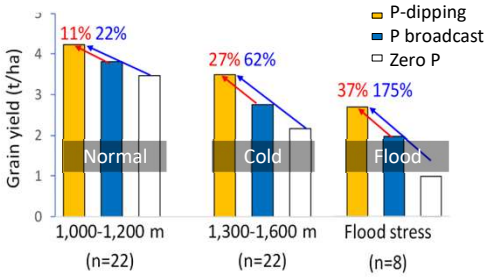


Fig. 4 P-dipping effect on grain yield

- Shortened growth duration to avoid late-season stresses and accelerated early growth to avoid submergence stress **(Fig. 3).**
- Yield increased under P-deficient fields, and the effect was more significant under cold climates and in flood environments **(Fig. 4).**

Exp. 4 Pilot scale trials with 312 farmers

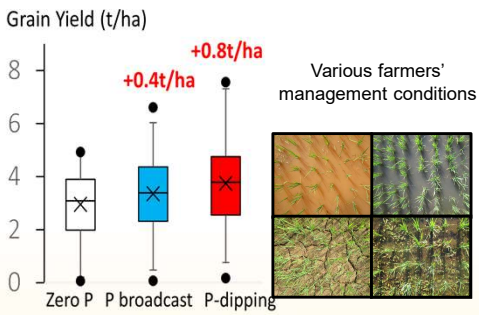


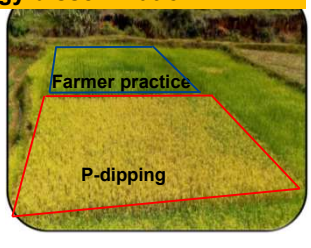
Fig. 5 P-dipping effect under farmers' practices

- Yield increased under a wide range of farmers` management practices **(Fig. 5)**

Technology dissemination

Technical Manual

Small fertilizer sac (3 kg) for P-dipping



>3,000 farmers in 5 regions practiced P-dipping

Easy to buy, carry, do, and effective>more to practice

Conclusion on P-dipping

- An entry point for sustainable rice production in SSA.
- An adaptation strategy to climate change: pronounced effect in cold and flood stress environments.
- Development of a technical manual and a small fertilizer bag facilitate the dissemination.
- Farmers can easily apply the technique, and the willingness to continue using P-dipping is high.
- Expansion of dissemination to other regions through this conference.

Acknowledgment:
This research is funded by Science and Technology Research Partnership for Sustainable Development (SATREPS), Japan Science and Technology Agency (JST)/and Japan International Cooperation Agency (JICA) [grant number JPMJSA1608].