



Rice Production improvement under poor nutrient conditions in Sub-Saharan Africa

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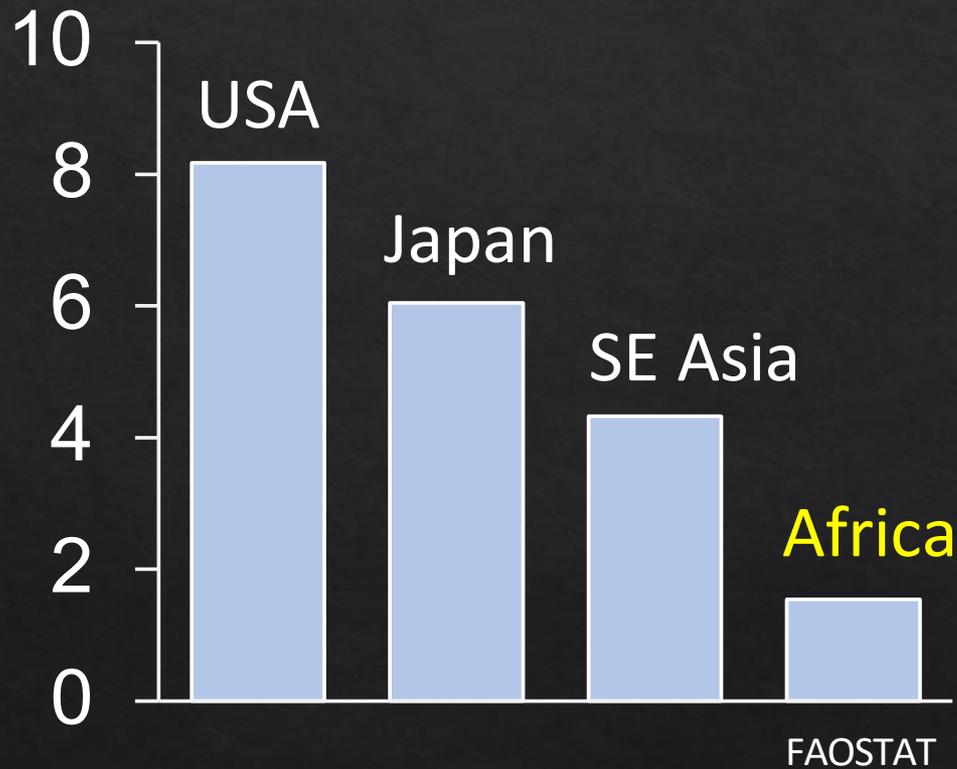
Project leader

Japan Int'l Research Center for Agricultural Sciences

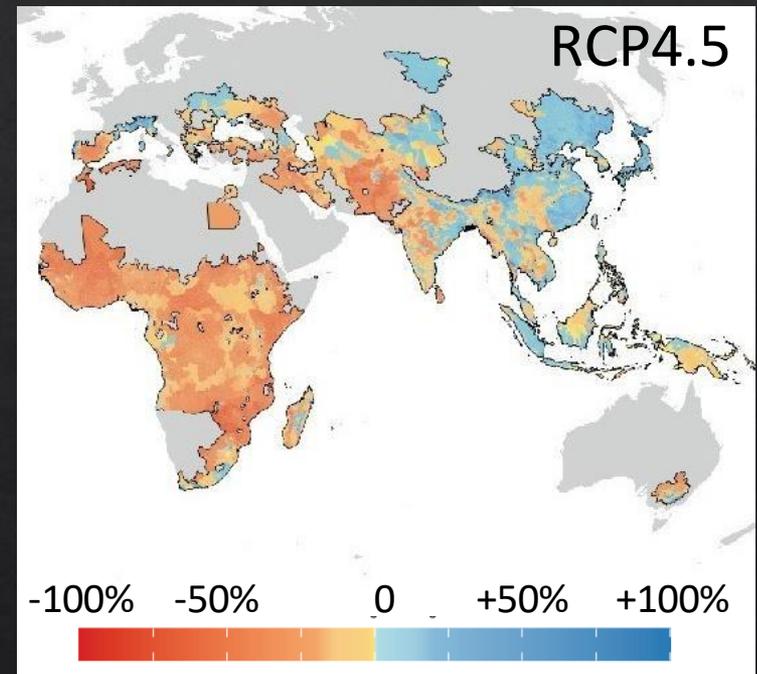


Low crop productivity is a key challenge for the food security in Africa

Cereal Yield (t/ha)



Projected climate impacts on rice yield in 2089-2098

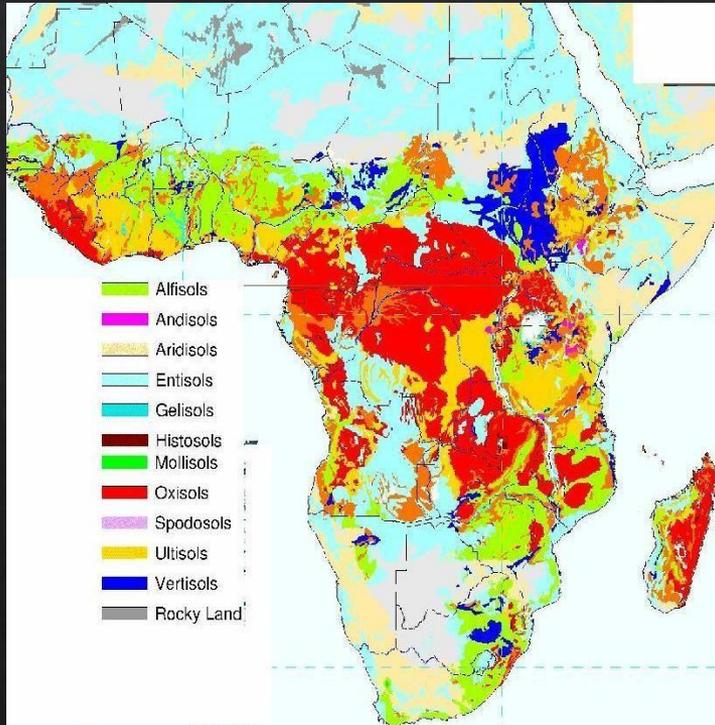


Hultgren et al., 2025, Nature

Studies consistently predict Africa will face the hardest climate change impact on crop yields

1. Highly weathered soils = poor nutrient supply

Highly weathered soils
(e.g., Oxisols, Entisols)

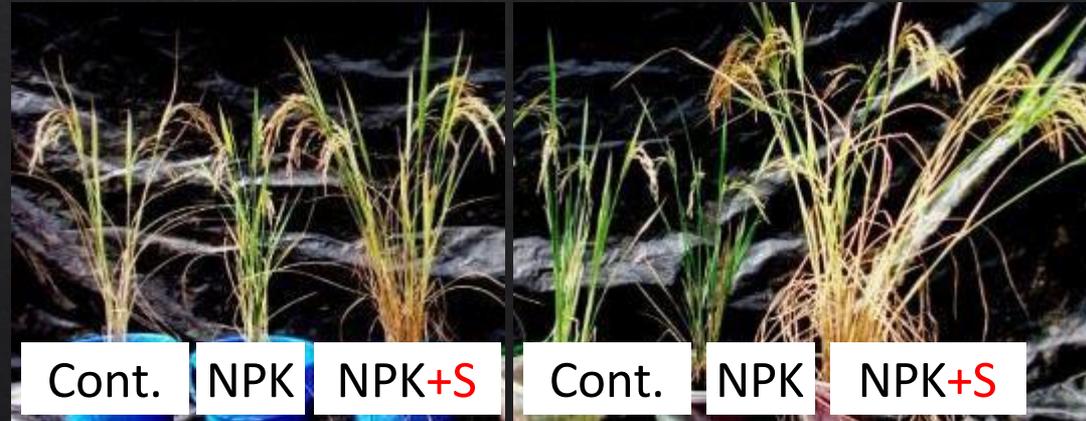


USDA Global Soil Regions

Phosphorus (P) deficient soils in Madagascar

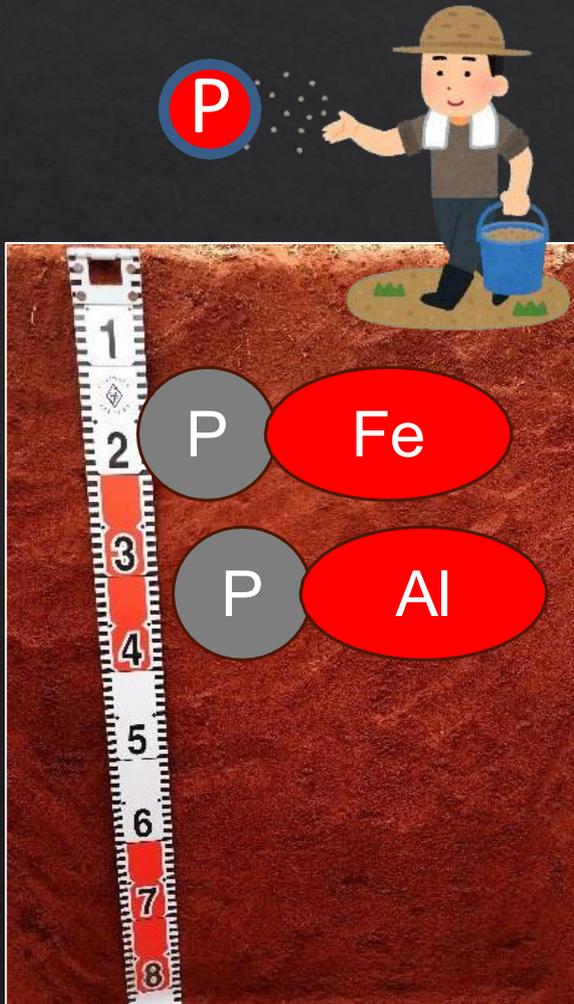


Sulfur (S) deficient soils in West Africa



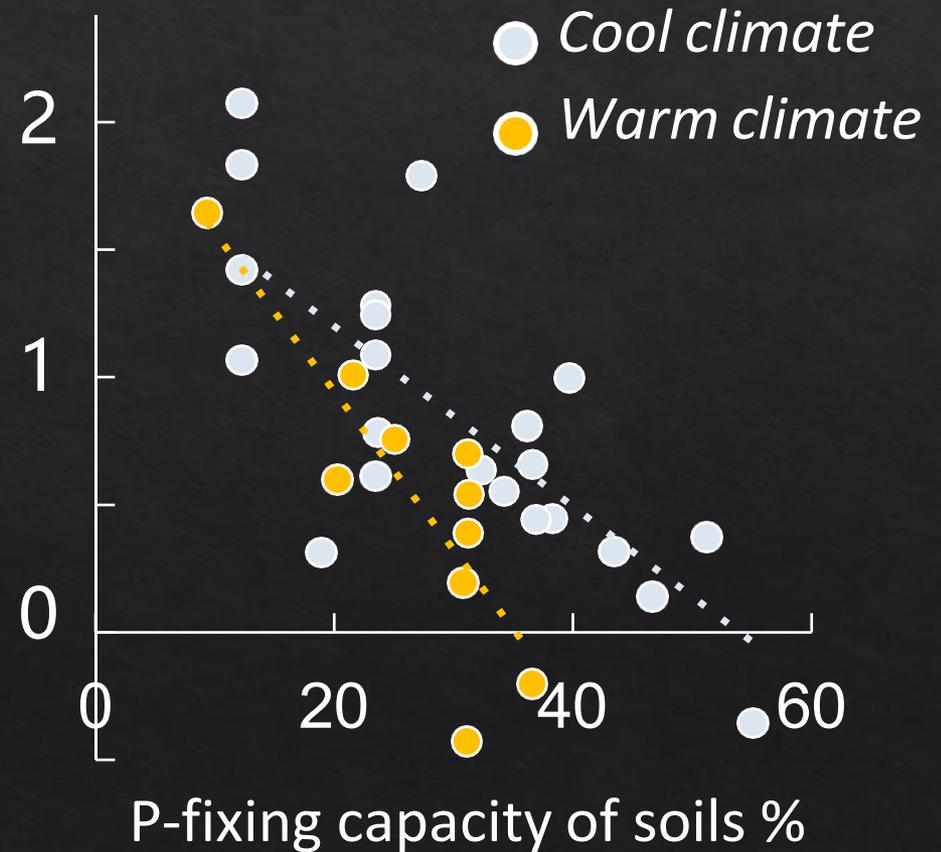
65% rice fields in SSA
are Si def.

1'. Dominance of highly P-fixing soils



On-farm trials in Madagascar

Yield gain by P application (t/ha)
(NP-N plot)

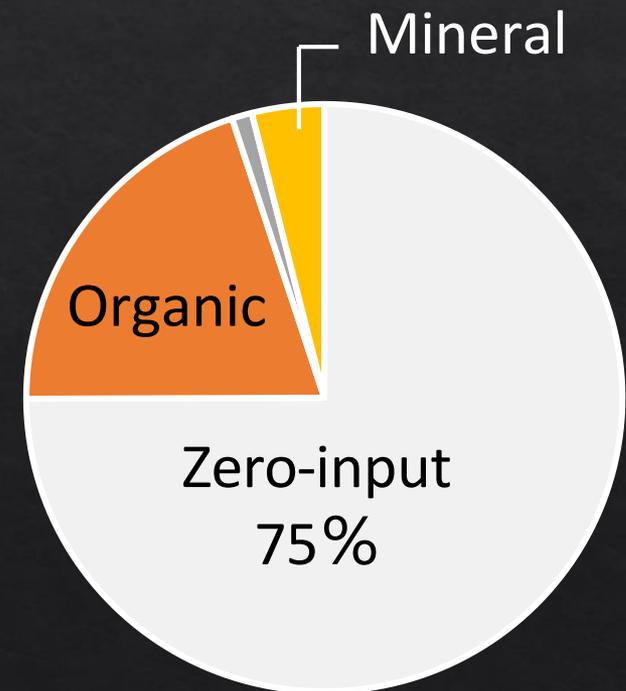


2. Limited fertilizer input

poor access to market physically and economically



Farmers' fertilizer use in Madagascar (n=1736)



Solution-oriented and inclusive research approach in Madagascar

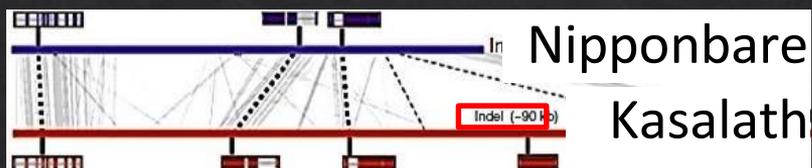
1. Development of new lowland rice variety using P-deficiency-tolerance gene, Pup1
2. Development of P-dipping technique that increases rice yields with little fertilizer use in poor-nutrient and highly P-fixing soils



SATREPS

Development of new lowland rice variety using P-deficiency-tolerance gene, *Pup1*

Pup1 gene identified from local cv. *Kasalath* (Nature, 2012)



IR64 + *Pup1*

IR64



✈ 2015-2019: Repeated selection & generation adv. in Madagascar



2020-2021: Prod. & taste tests

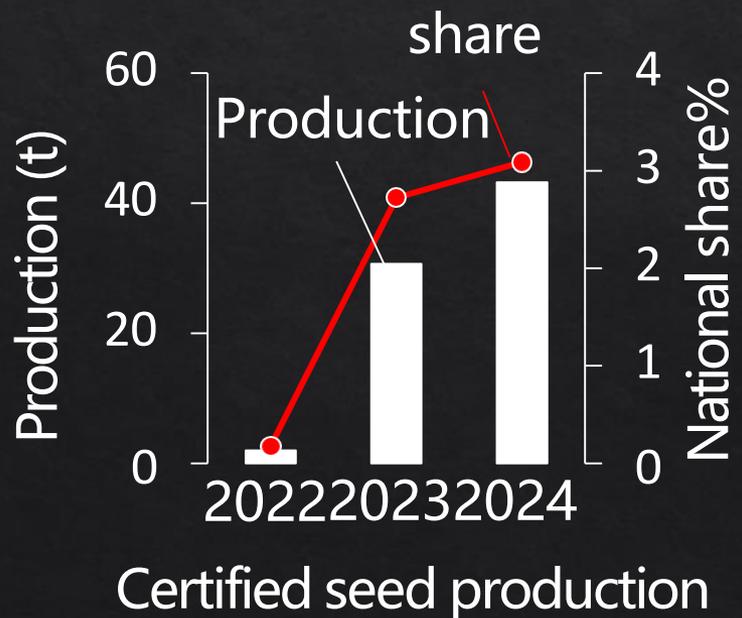


Superior yield and equivalent taste qlt. to the parent or leading variety

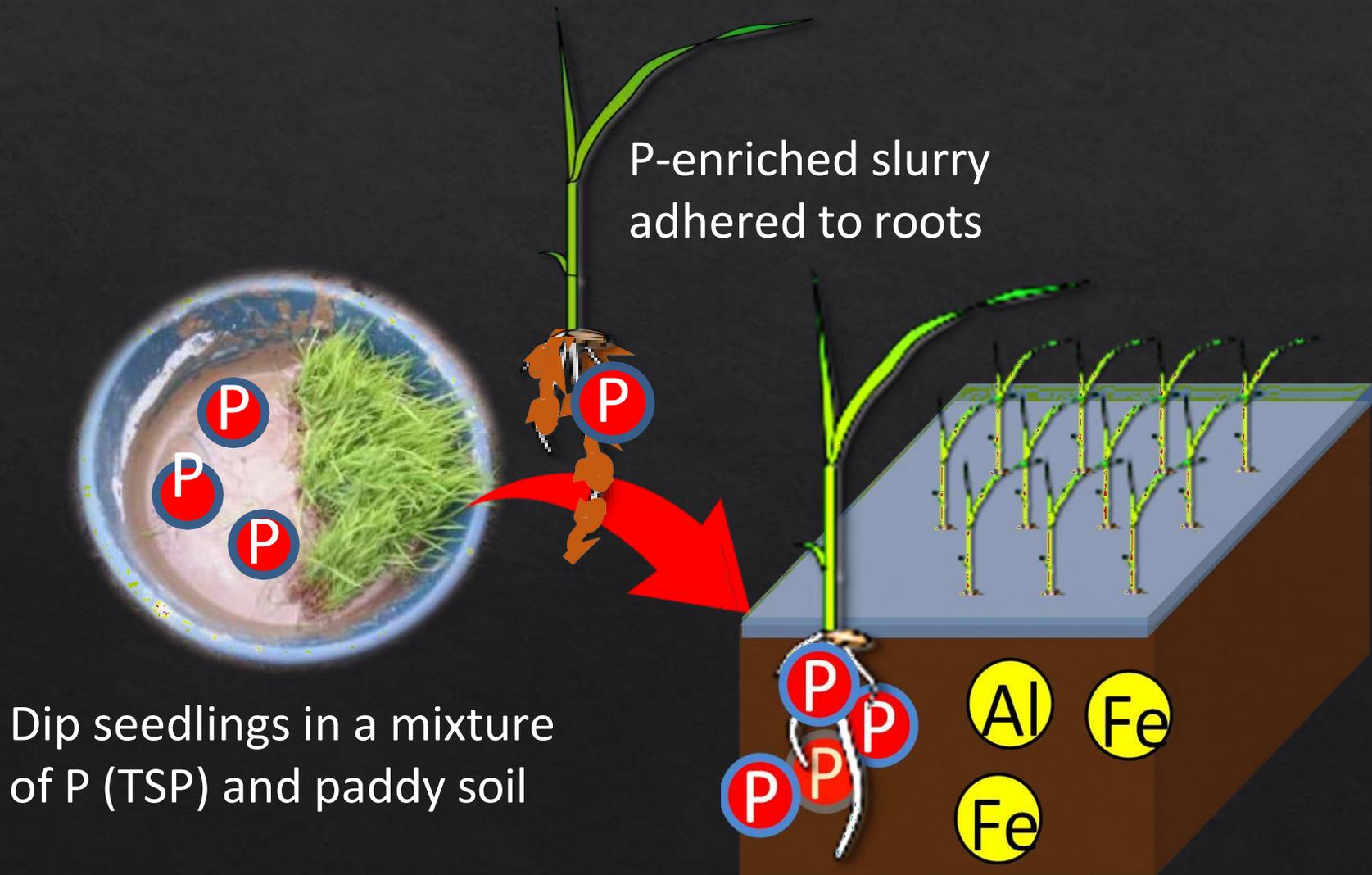


2021. Released as a new variety, **FyVary32**

Dissemination of FyVary varieties in Madagascar



Localized P-application via P-dipping for transplanting rice production



P-dipping is effective under high P-fixing soils

P-fixing capacity=23%

P-dipping

P incorp

Zero P

Same amount of P



P-fixing capacity=7%

P-dipping

P incorp

Zero P

Same amount of P



Soluble P hotspot



0.04

0.06

0.08

0.10

Soluble P concentration in soil (mg/kg)

Repeated on-farm trials in Madagascar

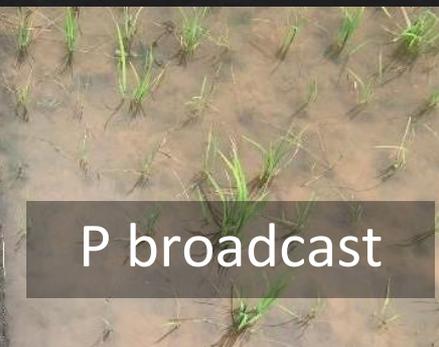


P-dipping increases rice yields with minimal fertilize use and resilience to climate-induced stresses

Shortened growth duration averting late season cold/drought stresses



Vigorous initial growth averting flooding stress



P-dipping may reduce CH₄ emission via rhizosphere envir. change

Social implementation: invested by local farmers and fertilizer companies

↓ Disseminated to >3,000 farmers

1.1 t/ha yield up (on average)



Even smallholder farmers can adopt

Invested by private entities



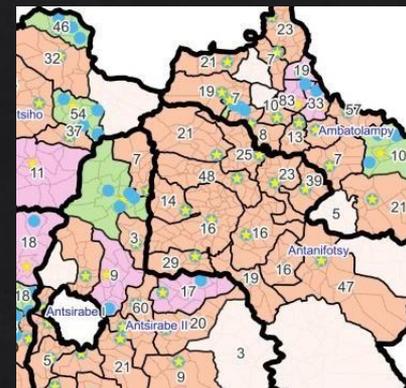
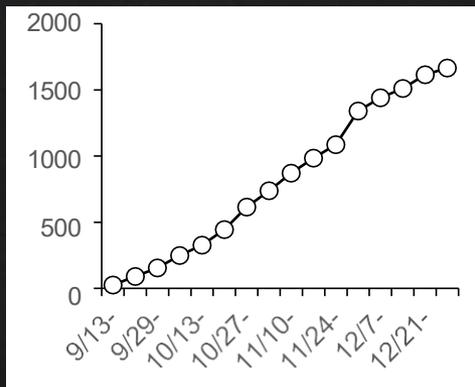
Dissemination monitoring by App.



Yield estimate by HOJO based on >3K crop cut data



P-dip fertilizer sales record



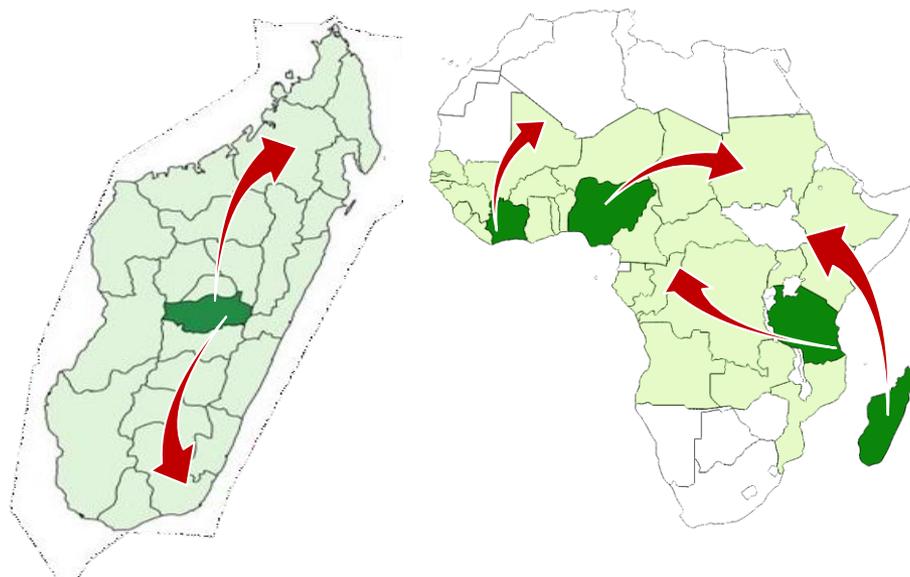
For further scale up and out

2025-2030: JICA Project to disseminate P-dipping and FyVary varieties in Madagascar.

2026-2028: WB-PHRD Project also target the dissemination of these research outputs (Hojo App, and Zn-fortified upland rice).

2026. IRM (Private company) ordered additional 500 tons of TSP.

*Demonstration during the field tour on Day3. Should you get interested, please let us know.





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