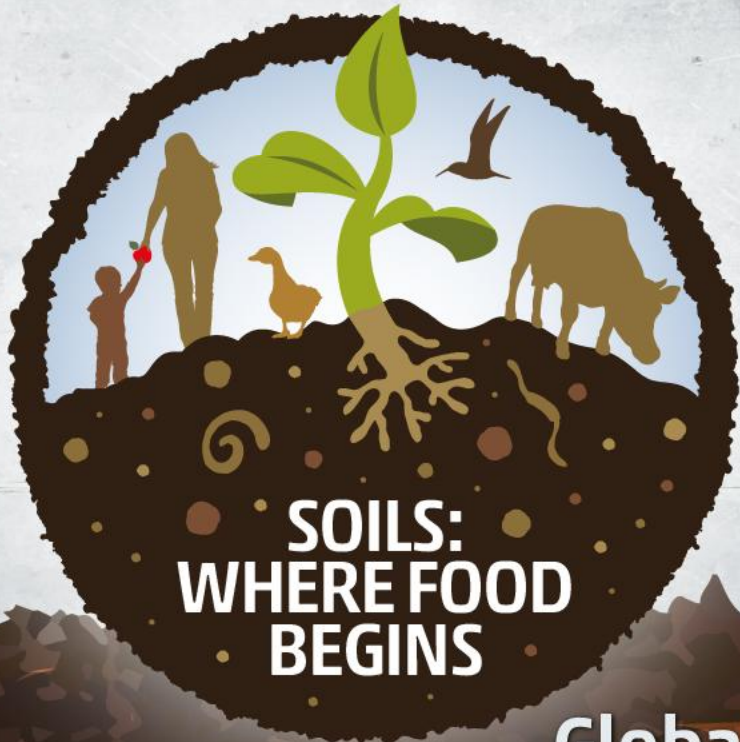




Inorganic fertilizer use in rice fields and its  
association with yield gap in different growing  
environments in sub-Saharan Africa  
*Jean-Martial Johnson*



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- Inorganic fertilizer use on arable land is generally low in sub-Saharan Africa (SSA).
- However, a comprehensive synthesis of current fertilizer use and the related yield in different rice-growing environments is lacking.



- Objective: To quantify spatial variation in fertilizer use and assess its relationship with yield and yield gap.



# Research questions

1. Where fertilizer use is higher/lower?
2. Are there any relationships between inorganic fertilizer use and yield, and yield gap?

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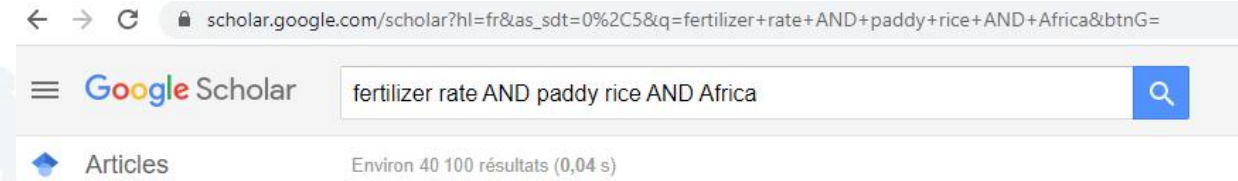
- Data compilation from farm surveys or farmers' field trials in which fertilizer management practices were conducted according to farmers' practices.

- Study variables: Country, location name, year, season, production system, N, P, and K application rate, and grain yield.

- Potential yield in IL systems or the water-limited potential yield in rainfed systems.

- Calculation & Statistical analysis [Descriptive analysis, Kruskal-Wallis test, correlation analysis, multinomial logit (MNL) regression].

- This paper mainly focuses on N.



Global Yield Gap Atlas



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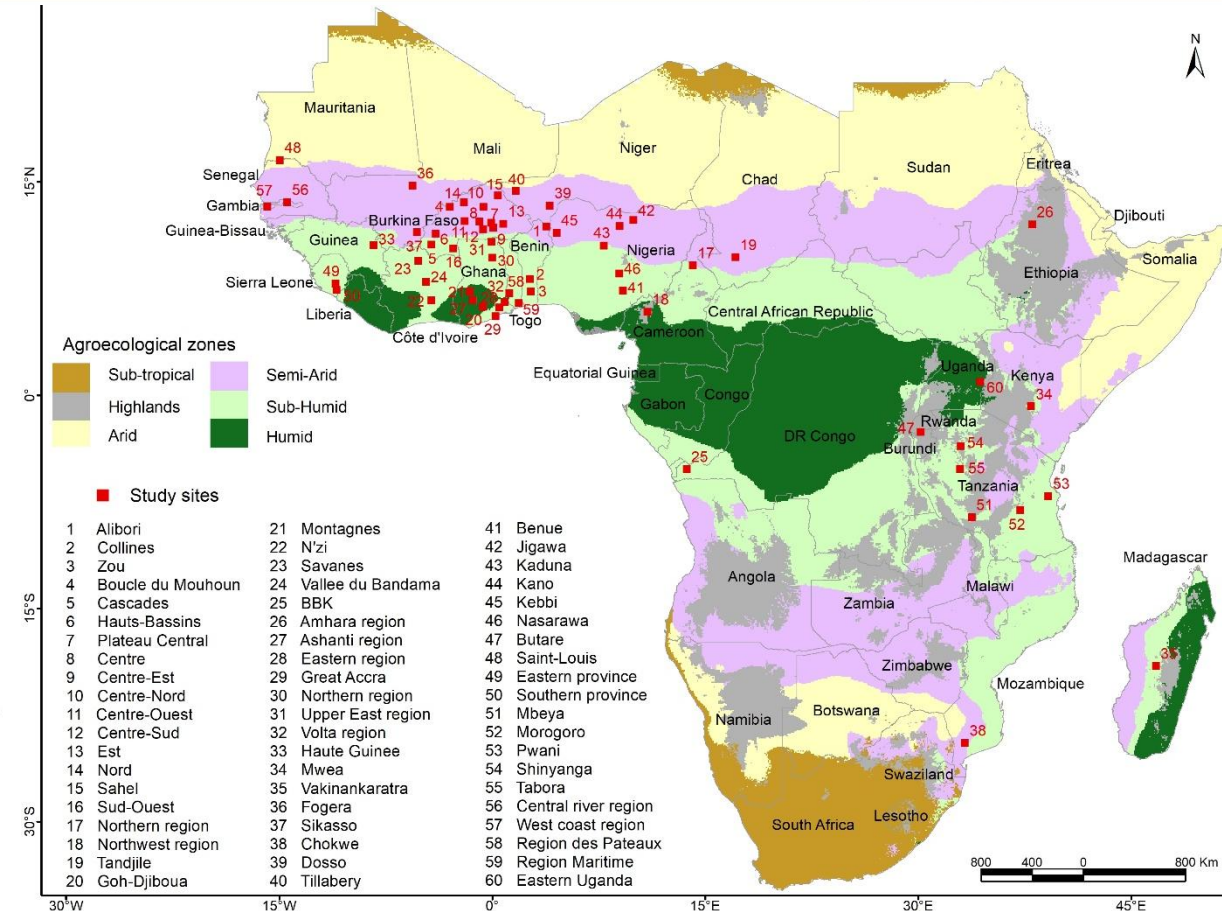
# Inorganic fertilizer use in rice fields and its association with yield gap in different growing environments in sub-Saharan Africa

Introduction

Methods

Results & Discussion

Conclusion & Significance



228 data points from studies conducted between 1995 and 2020

5 AEZs: Humid, sub-humid, semi-Arid, Arid & Highlands

24 SSA countries

3 different growing environments systems: irrigated lowland (IL), rainfed lowland (RL) & rainfed upland (RU)

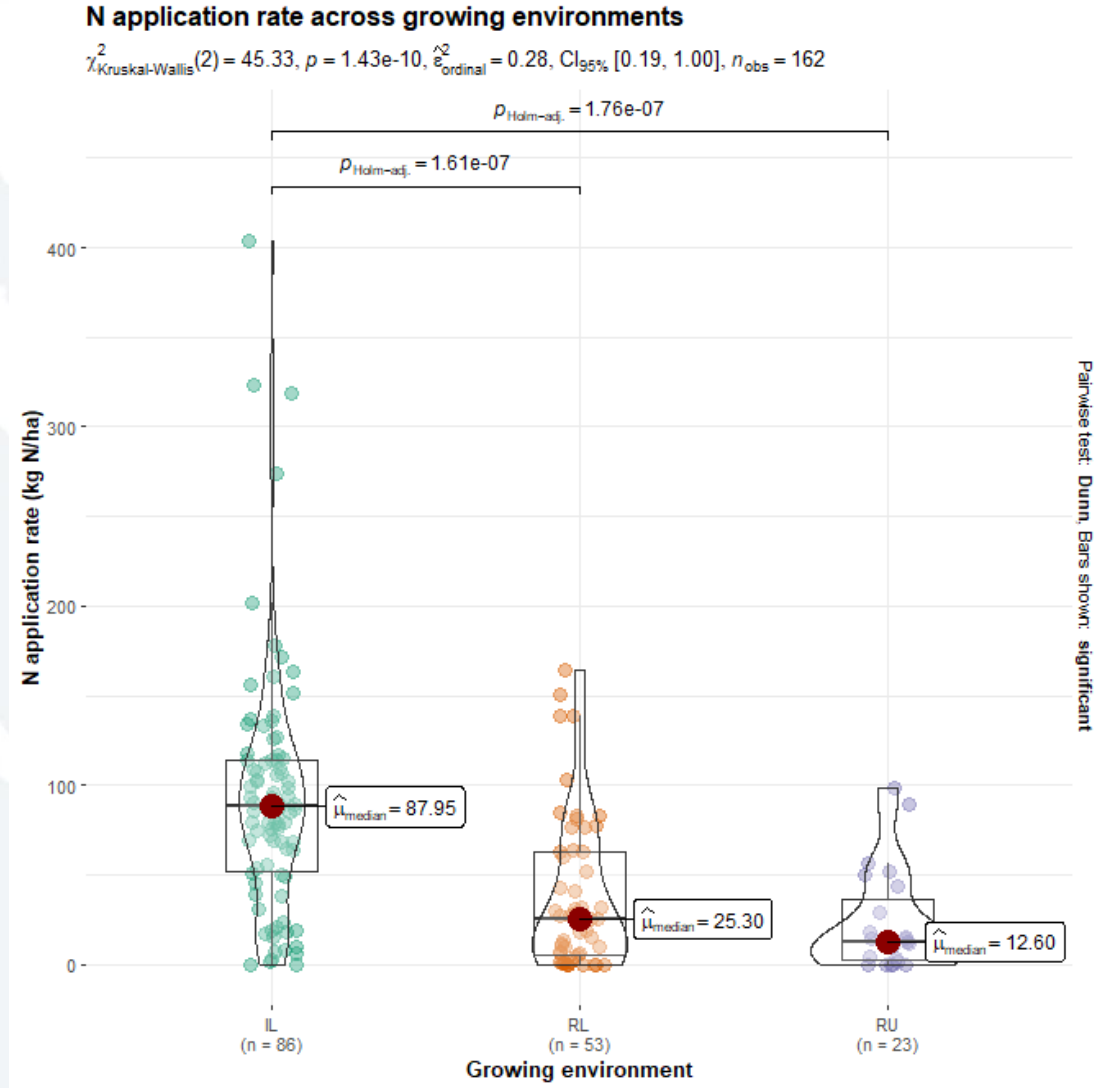
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# Research questions

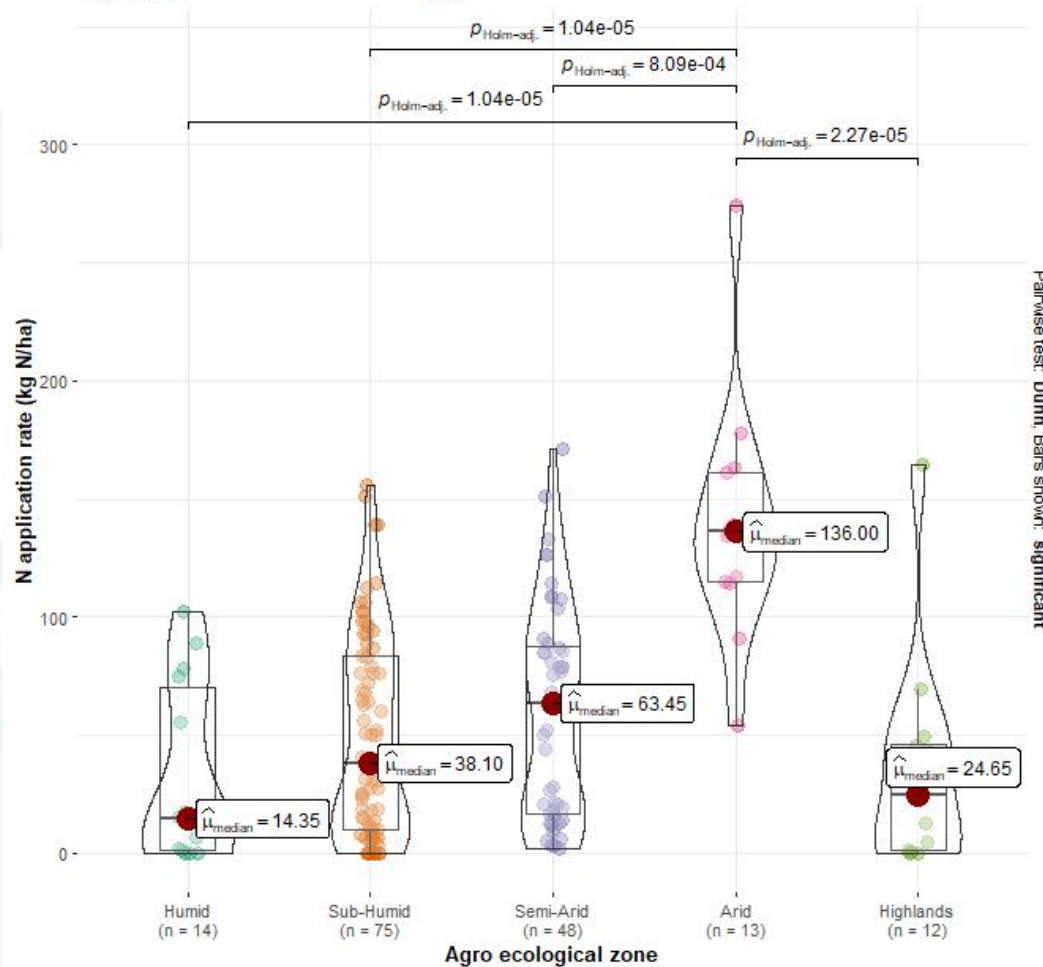
1. Where fertilizer use is higher/lower?
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- On average across 3 rice growing environments, N, P, and K rates are 54, 10, and 9 kg /ha, respectively, with their large variation (CV ~ 110 - 140%).
- N rate was higher in IL than in RL and RU.
- Same case for P and K rates (data not shown).



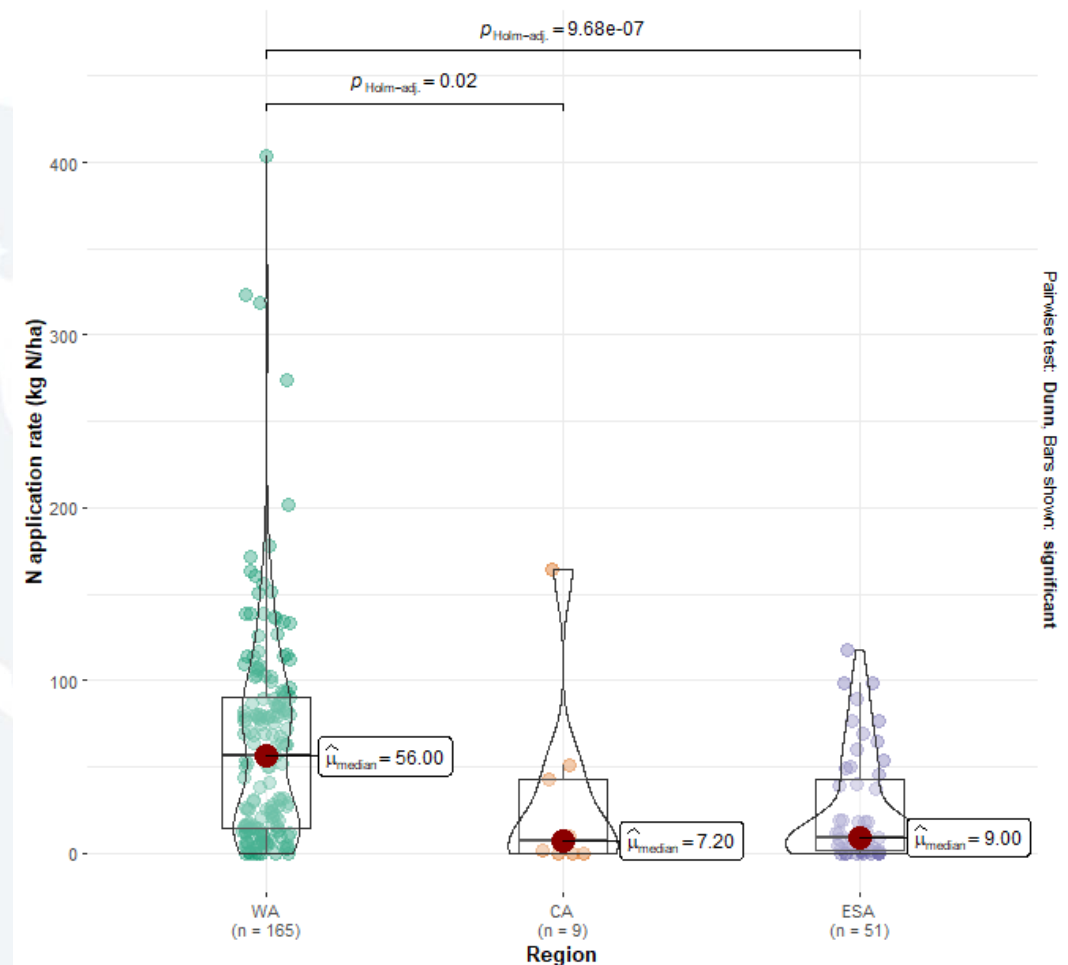
**N application rate across Agro ecological zones**

$\chi^2_{Kruskal-Wallis}(4) = 32.88, p = 1.27e-06, \hat{\epsilon}^2_{ordinal} = 0.20, CI_{95\%} [0.16, 1.00], n_{obs} = 162$



**N application rate across Regions**

$\chi^2_{Kruskal-Wallis}(2) = 30.12, p = 2.88e-07, \hat{\epsilon}^2_{ordinal} = 0.13, CI_{95\%} [0.08, 1.00], n_{obs} = 225$



- N rate was higher in Arid than in humid zone.
- Same case for P rate (data not shown).

- N rate was higher in WA than in CA and ESA.



# Research questions

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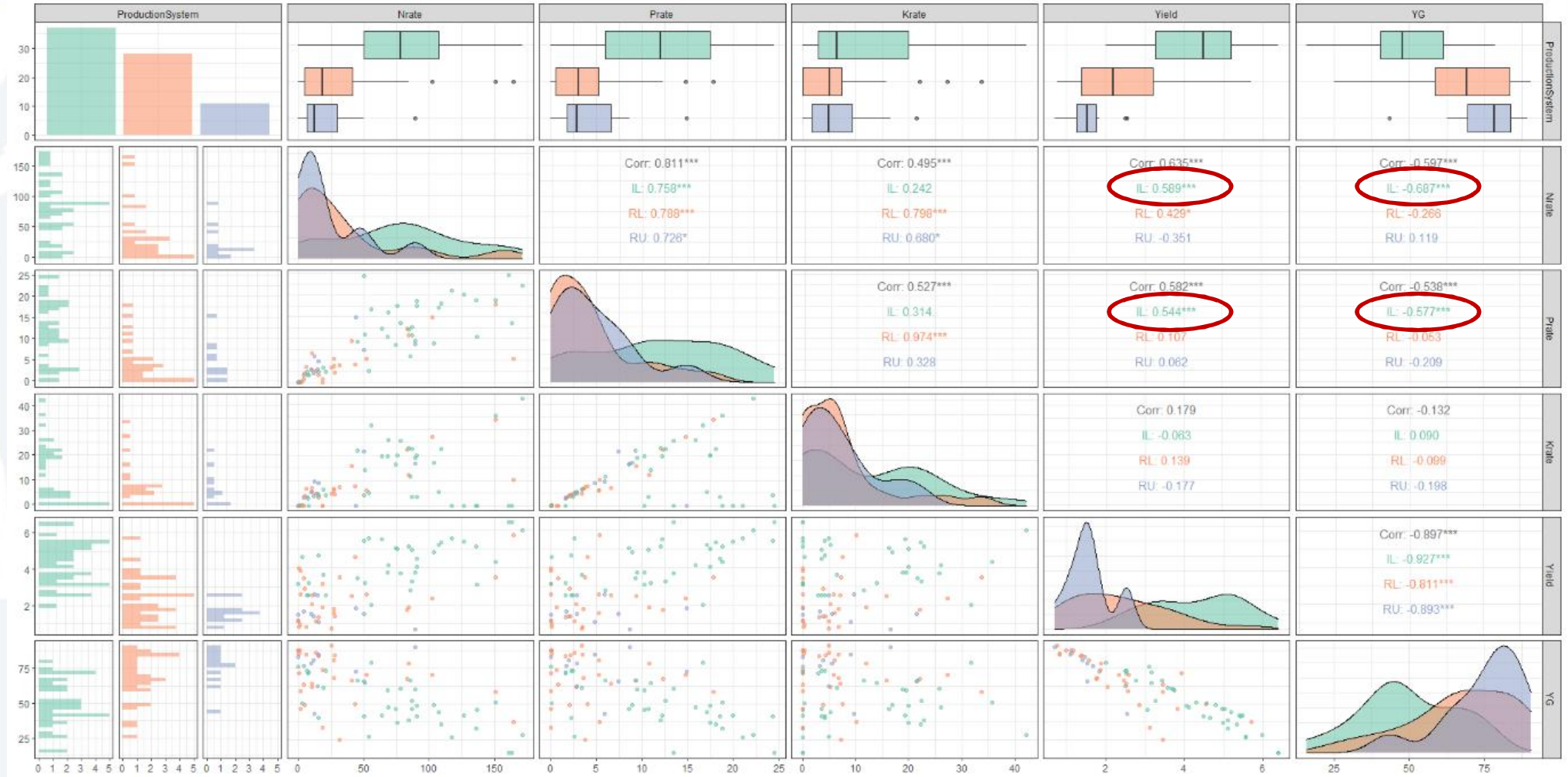
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- Higher N and P fertilizer application rates were associated with higher yield and lower yield gap in IL
- No clear relationship between N, P, and K fertilizer application rates and yield as well as yield gap in RU

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- ❑ Insufficient supply of fertilizer and a high risk of soil nutrient mining.
- ❑ Variation in fertilizer use was related to rice growing environment, AEZ, and region. The use was lower in rainfed systems, Humid/sub-Humid zones, and ESA.
- ❑ Rice yield and yield gap was significantly correlated with N and P rates.
- ❑ Reasons for low fertilizer use need to be identified for developing a strategy for enhancing its use and rice yield.



**Mobile APP**  
**RiceAdvice**  
Advice on field-specific rice management practices: recommendations on fertiliser management, general good agricultural practices and provision of a specific cropping calendar





Thank you !

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