



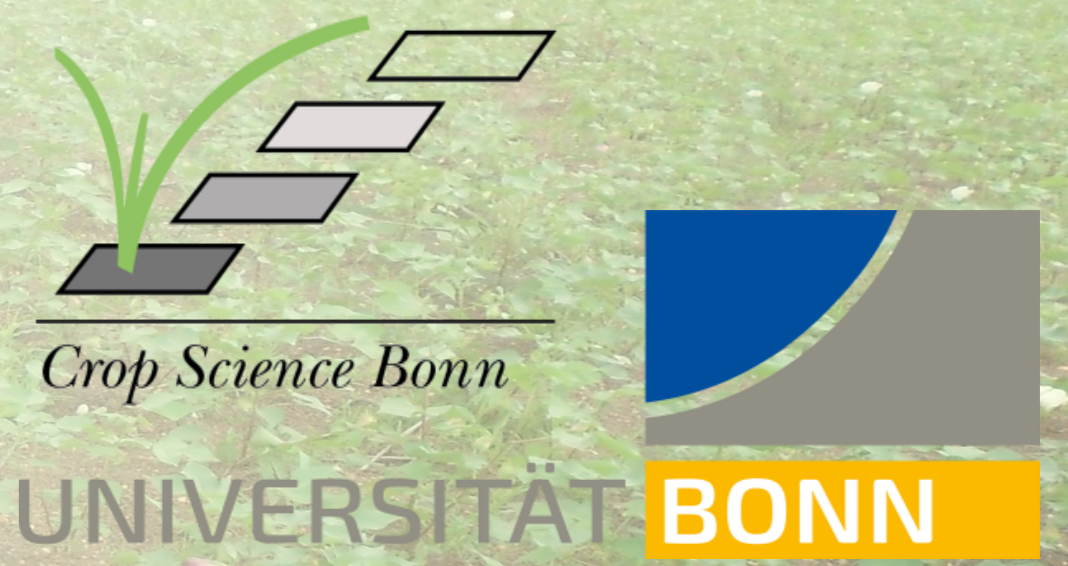
# Impact of Alternative Management Practice on Fertilizer Recovery by Cotton in Different Soil Types of West-Africa

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## Problem Statement

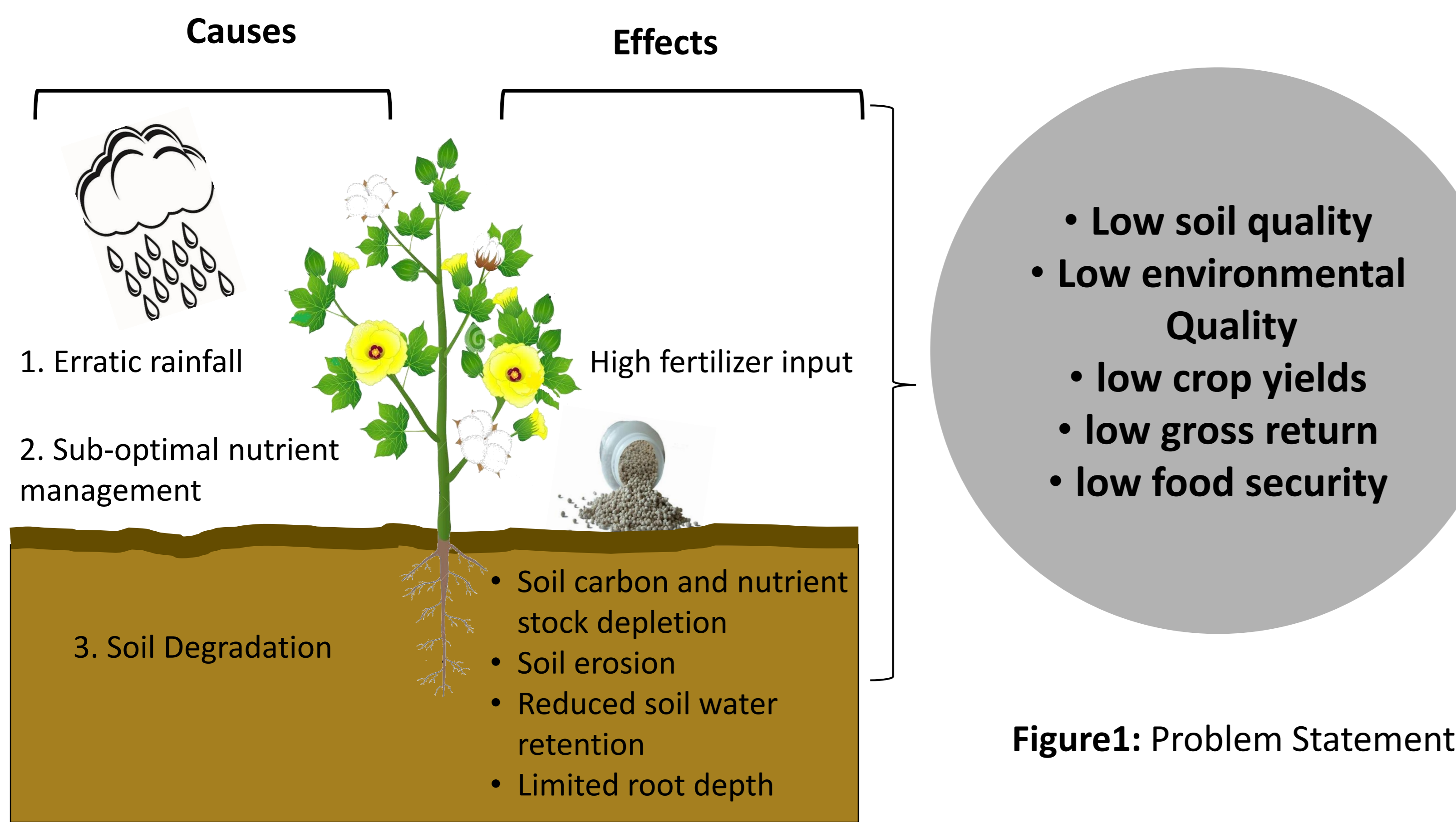


Figure1: Problem Statement

Alternative management options consisting of a combination of tillage, crop residue incorporation and nitrogen management might be a potential technical solution to restore soil nutrient stocks and efficient use of applied fertilizer

## Research Aim

What is the relative contribution of alternate management practices to the efficient use of applied fertilizer

1. To assess the interactive effects of tillage and different nitrogen doses on **Apparent Nutrient Recovery Efficiency (ANR)** and **Agronomic Efficiency (AE)** under four different soil types.
2. To collect field data to improve and calibrate soil-crop models and conduct simulations of long-term nitrogen use efficiency and fertilizer management decisions in tropical soils.

## Study Area

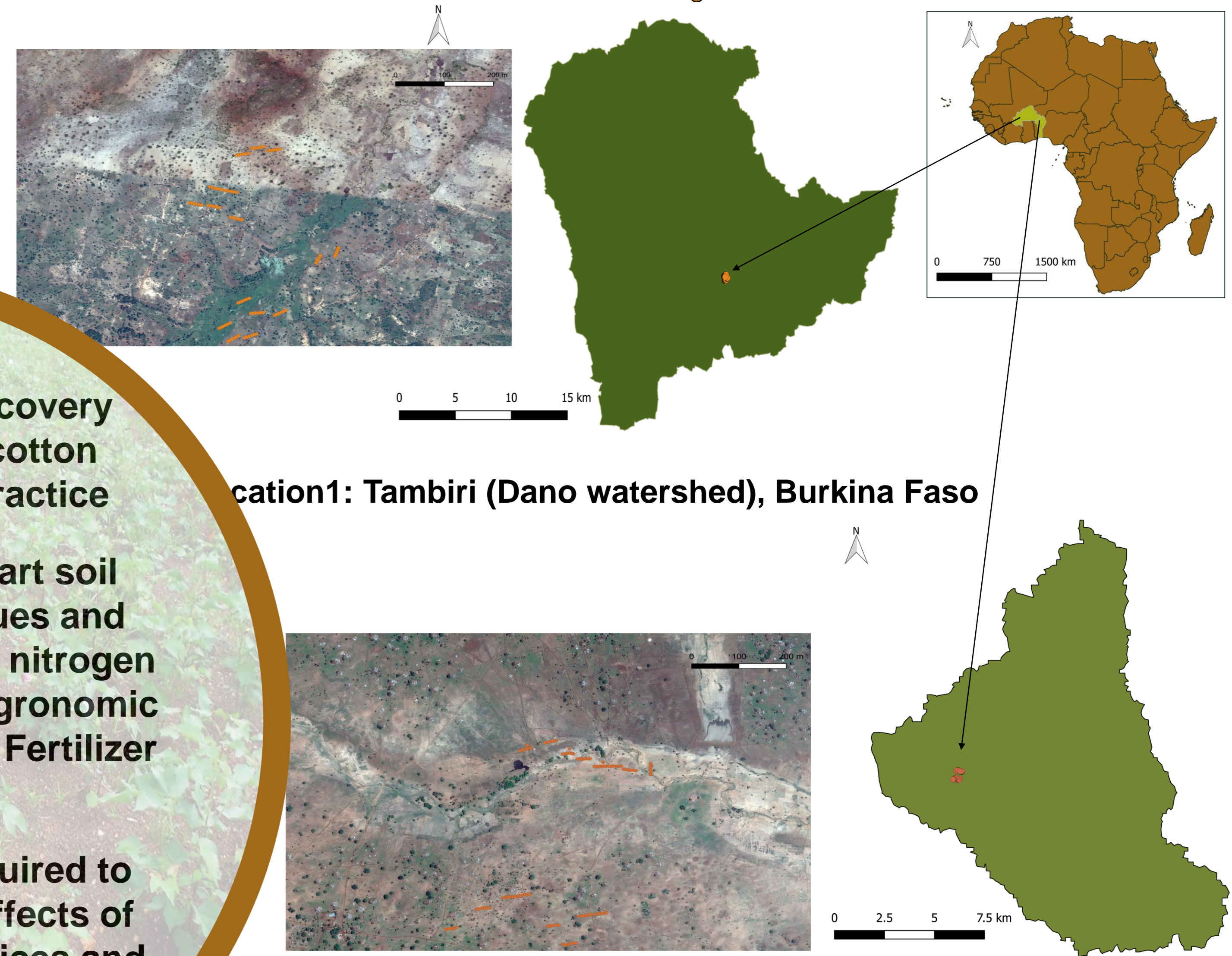


Figure2: Study Locations

## Results

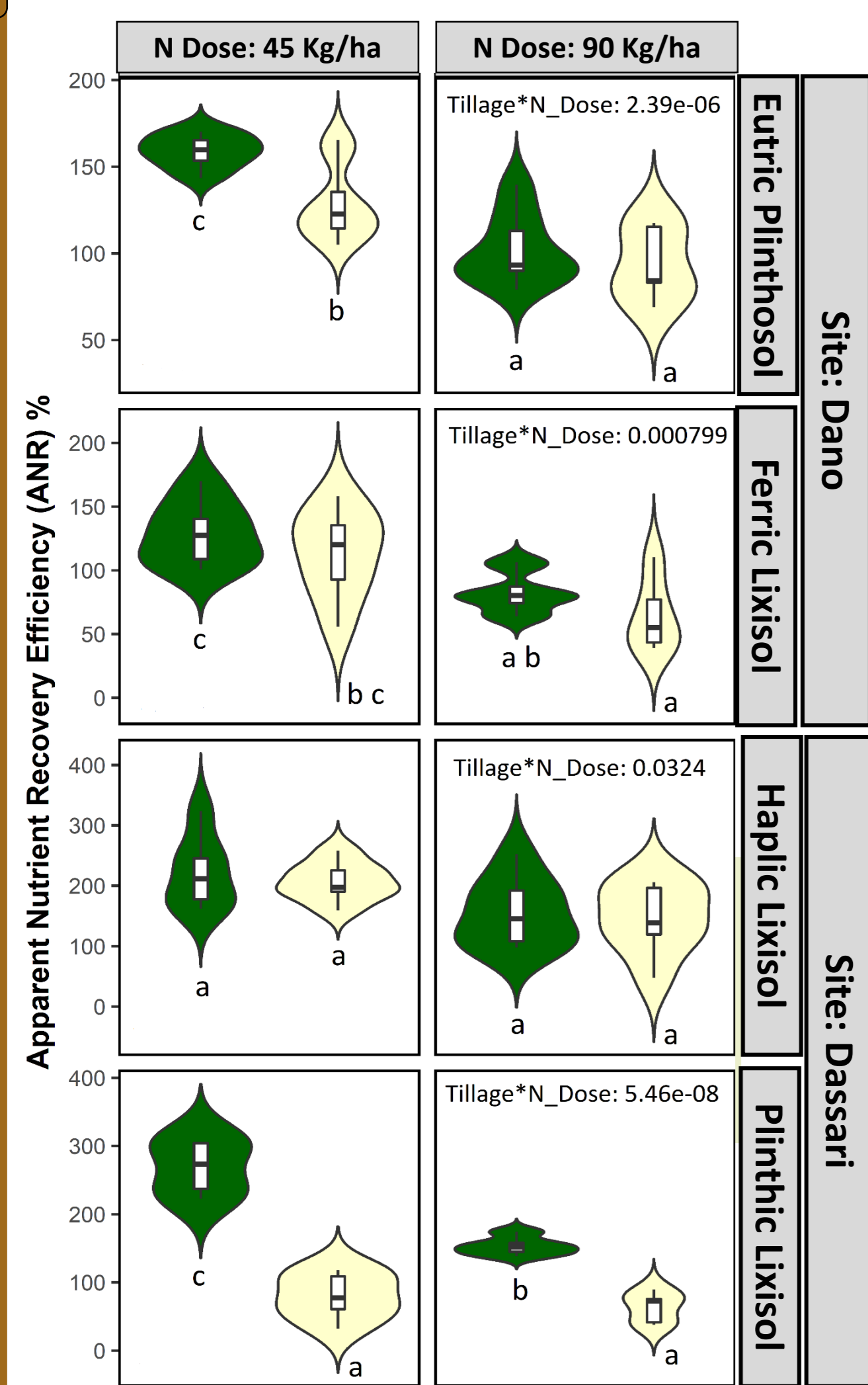


Figure 4: Response of Apparent Nutrient Recovery Efficiency (ANR) in total above ground biomass to the interaction of tillage and nitrogen doses for all four soil types.

ANR was significantly affected by tillage and nitrogen dose interaction. contour ridge tillage along with recommended nitrogen fertilizer dose (45 Kg/ha) has significantly improved cotton ANR .

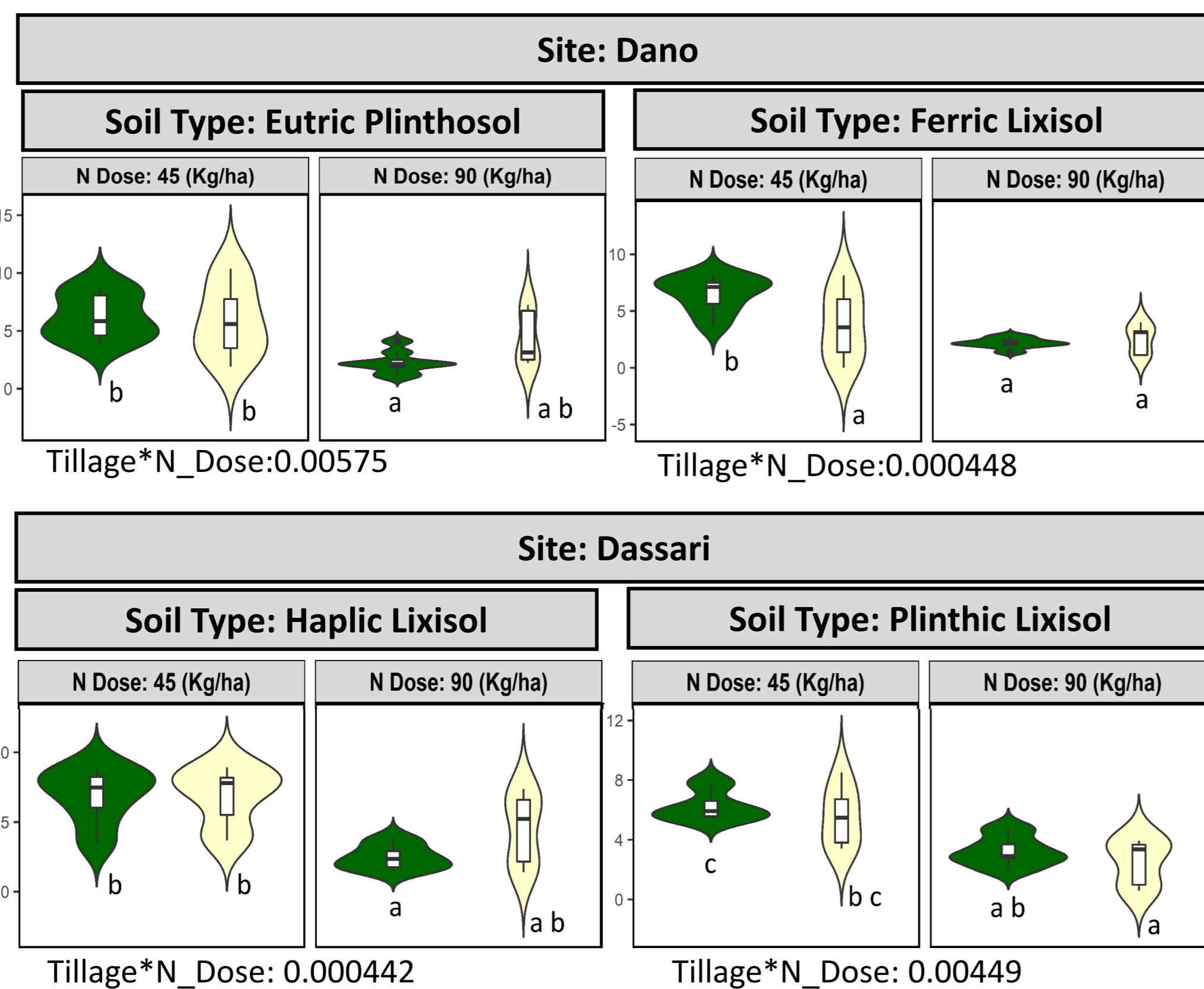


Figure 5: Response of Agronomic Efficiency to the interaction of tillage and nitrogen doses for all four soil types.

AE was significantly affected by tillage and nitrogen dose interaction. No significant difference was found between contour ridge and reduced tillage except for Ferric Lixisol. Under both tillage systems, the rate of 45 Kg/ha N fertilizer gave higher AE than that at 90 Kg/ha for all soil types.

✓ Apparent nitrogen recovery efficiency (ANR) of cotton depends on tillage practice

✓ A combination of smart soil management techniques and judicious application of nitrogen fertilizer can improve Agronomic Efficiency of mineral N Fertilizer in cotton

✓ A further research required to assess the coupling effects of soil management practices and 4R nutrient stewardship on fertilizer use efficiency

## Experimental Setup

### Strip-Split Plot design

**Main Plot:** Tillage (Contour Ridge & Reduced Tillage)

**Sub-plots:**

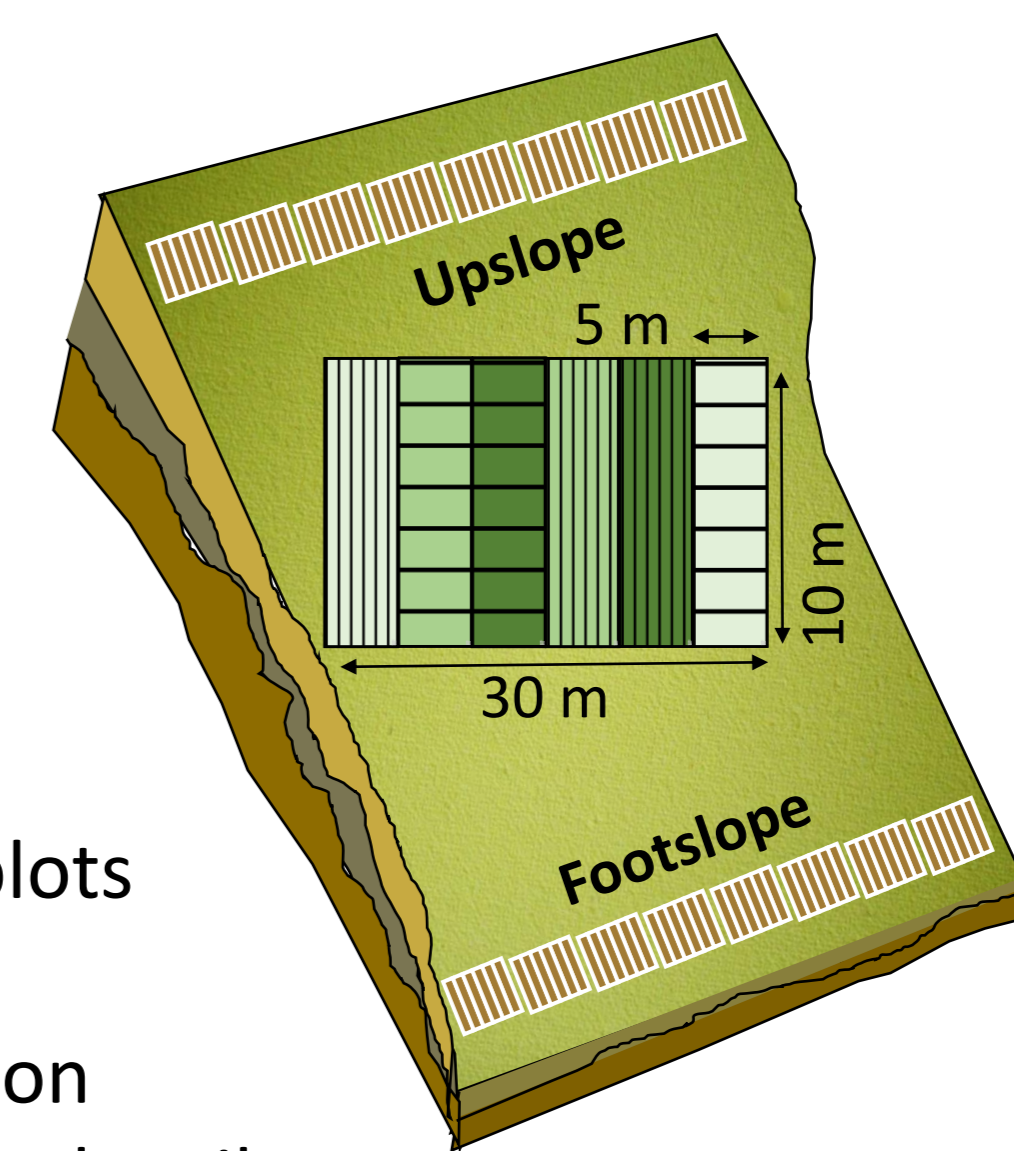
- Crop Residue with crop residue without crop residue
- Nitrogen Management  
0 Kg/ha  
45 Kg/ha  
90 Kg/ha

Randomized within the main plots

**Crops:** Maize and cotton rotation

A total of 48 sub plots under each soil type

Figure3: Field Trail Layout



## Sampling & Analysis



- Sampled during the physiological maturity stage
- Processed and analysed for nitrogen content in the laboratory
- Calculated Apparent Nutrient Recovery Efficiency (ANR) and Agronomic Efficiency using the following formulas:

$$ANR \% = \frac{(\text{Total N uptake, F} - \text{Total N Uptake, C}) \text{ Kg/ha}}{\text{Amount of Fertilizer Applied Kg/ha}} \times 100$$

$$AE = \frac{(\text{Yield, F} - \text{Yield, C}) \text{ Kg/Kg}}{\text{Amount of Fertilizer Applied}}$$

Where, F= plots with fertilizer, C= plots without fertilizer

## References

- Baligar, V. C., and N. K. Fageria. "Nutrient Use Efficiency in Plants: An Overview." *Nutrient Use Efficiency: from Basics to Advances*, 2015, pp. 1–14., doi:10.1007/978-81-322-2169-2\_1.
- Du, Xiangbei, et al. "Nitrogen Use Efficiency of Cotton (*Gossypium Hirsutum* L.) As Influenced by Wheat–cotton Cropping Systems." *European journal of agronomy* 75(2016): 8-79. doi: 10.1016/j.eja.2016.01.001
- Zhang, Dongmei, et al. "Lint Yield and Nitrogen Use Efficiency of Field-Grown Cotton Vary with Soil Salinity and Nitrogen Application Rate." *Field Crops Research*, vol. 138, 2012, pp. 63–70., doi:10.1016/j.fcr.2012.09.013.

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