

# Selecting risk management strategies for smallholder farmers in Northern Ghana

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## Introduction

- Conditions for smallholder production in Northern Ghana:
  - Variability in seasonal and interannual rainfall,
  - Acute vulnerability to food price spikes,
  - Self-consumption of most crops (mainly maize).
- Problem statement: Investing in sustainable management options is costly, resulting in soil nutrient mining.
- Objectives of this study:
  - Comparing different fertilizer strategies for maize on yield distributions and cost structures,
  - Reflecting on farmers' risk management strategies.

## Background

- Main threats perceived by farmers:
  - prolonged droughts,
  - prolonged floods,
  - financial restrictions (e.g., buying inputs).
- Risk management options by farmers (examples):
  - Adjust planting date,
  - Drought-resistant crops,
  - Off-farm income,
  - Diversification (focus on livestock),
  - Reduce the intensity of production,
  - Weather index insurance (WII).
- Adelesi et al. (2024) showed the advantage of WII for most smallholder farmers based on bio-economic farm modelling.  
**How is the profitability at single crop level for different fertilizer rates for maize?**



**Figure 1:** Field experiments carried out by SARI on different nutrient management options (Photo: H. Amankwah)

## Methods and data

- Based on results from SIMPLACE crop modelling focusing on different fertilizer rates for maize,
- Management data from a farm survey (CASCAID) in three districts in Northern Ghana,
- Additional expert knowledge for correcting outliers and missing data,
- Comparison of yield distributions, cost structures and efficiencies.

## Results

### Crop yields:

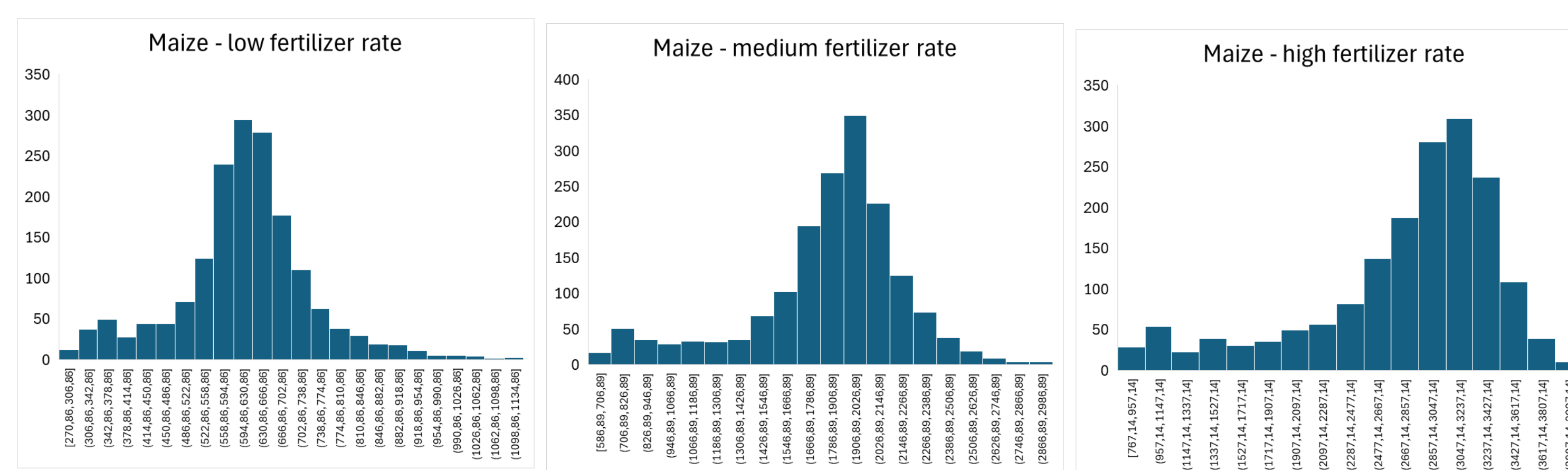
Different fertilizer application rates result in different yield levels and cost structures.

**Table 1:** Maize yields simulated for different fertilizer rates by SIMPLACE. The management data was derived from farmer survey (data source: CASCAID project)

		Maize-low	Maize-medium	Maize-high
Average yield (modelled)	kg/ha	616	1826	2769
std dev	kg/ha	126	408	682
Median	kg/ha	623	1907	2961
Labour requirements	man day/ha	55	155	206
Input cost	cedis/ha	424	1552	3002
Labour input/output	man day/kg	0.09	0.08	0.07
input cost/output	cedis/kg	0.69	0.85	1.08

### Crop yield variability:

Simulation of different fertilizer application rates resulted in substantial variation in yield levels and distribution patterns (Fig. 2).



**Figure 2:** Yield histograms for different fertilizer rates

## Discussion

- Costs: relative input costs per kg of output increase with fertilizer applications,
- Labour input slightly decreases with higher fertilizer rates,
- Yield distributions tend to make production riskier when applying more fertilizers,
- Financially constrained farmers are likely to choose low-intensity options to avoid losses,
- Results explain unsustainable fertilizer use levels for smallholder farmers.

## Further steps

Development of a decision support tool considering:

- risk sources (yield risk caused by weather),
- Risk mitigation strategies (insurance, farm practices).

### References:

Adelesi, O. O., Kim, Y. U., Schuler, J., Zander, P., Njoroge, M. M., Waithaka, L., ... & Webber, H. (2024). The potential for index-based crop insurance to stabilize smallholder farmers' gross margins in Northern Ghana. *Agricultural Systems*, 221, 104130.