

## Introduction

- Climatic variability is a major constraint to agricultural development and threat to food security for smallholder farmers, particularly in arid and semi-arid lands (ASALs)
- Agricultural production is also affected by variability in soil properties which influence growth and crop yields
- Guided by the science of agroforestry, trees have the potential to increase farm productivity and foster resilience to adverse effects of climate variability
- Matching tree species to site, however, requires understanding of growth patterns and their compatibility within specific environments and management systems
- This study assessed growth of four indigenous species (*Vachellia seyal*, *Vachellia xanthophloea*, *Cordia africana* and *Faidherbia albida*), and the exotic *Grevillea robusta* in monospecific and mixed-species treatments and effect of 3-year old trees on maize yields



## Material and methods

### Site description and experimental design

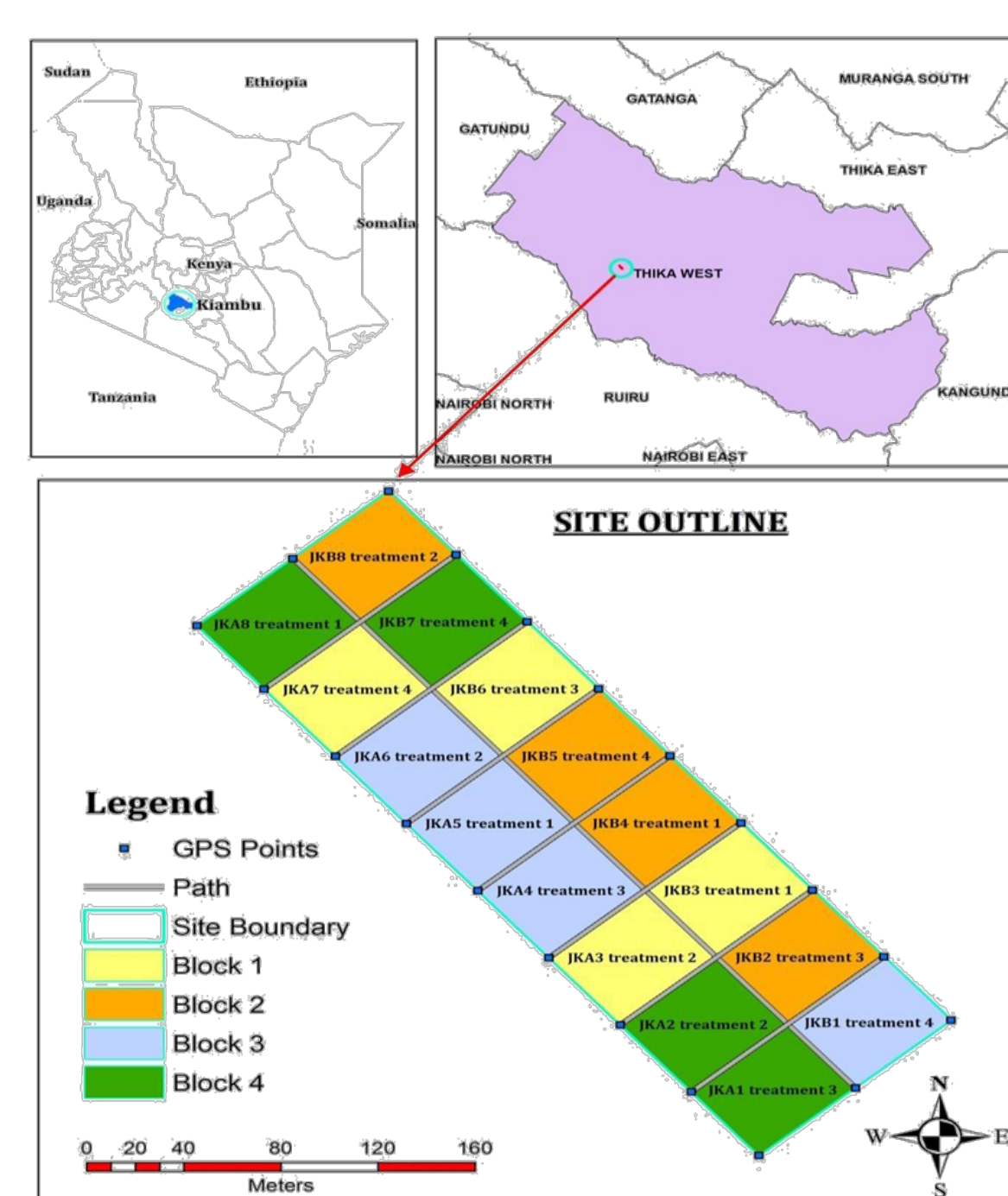
- The site is located at latitude 1o 05' S, longitude 37o 00' E and altitude 1528 m above sea level. It is classified as agro-ecological zone IV and covers 3.2 hectares
- Area receives bimodal rainfall pattern with peaks in April and November
- Soil analysis and characterization showed that soils were predominantly Vertisol for the low-lying and Cambisol in the slightly raised plots
- Trial laid out in a randomized complete block design with the following four treatments replicated four times;

*F. albida* plus maize

Control (sole maize)

*C. africana* plus maize

Mixed stand of *V. seyal*, *V. xanthophloea*, *C. africana*, *F. albida* and *G. robusta* plus maize



Map of the study site and the experimental layout

### Light interception (PAR) and grain yield measurements

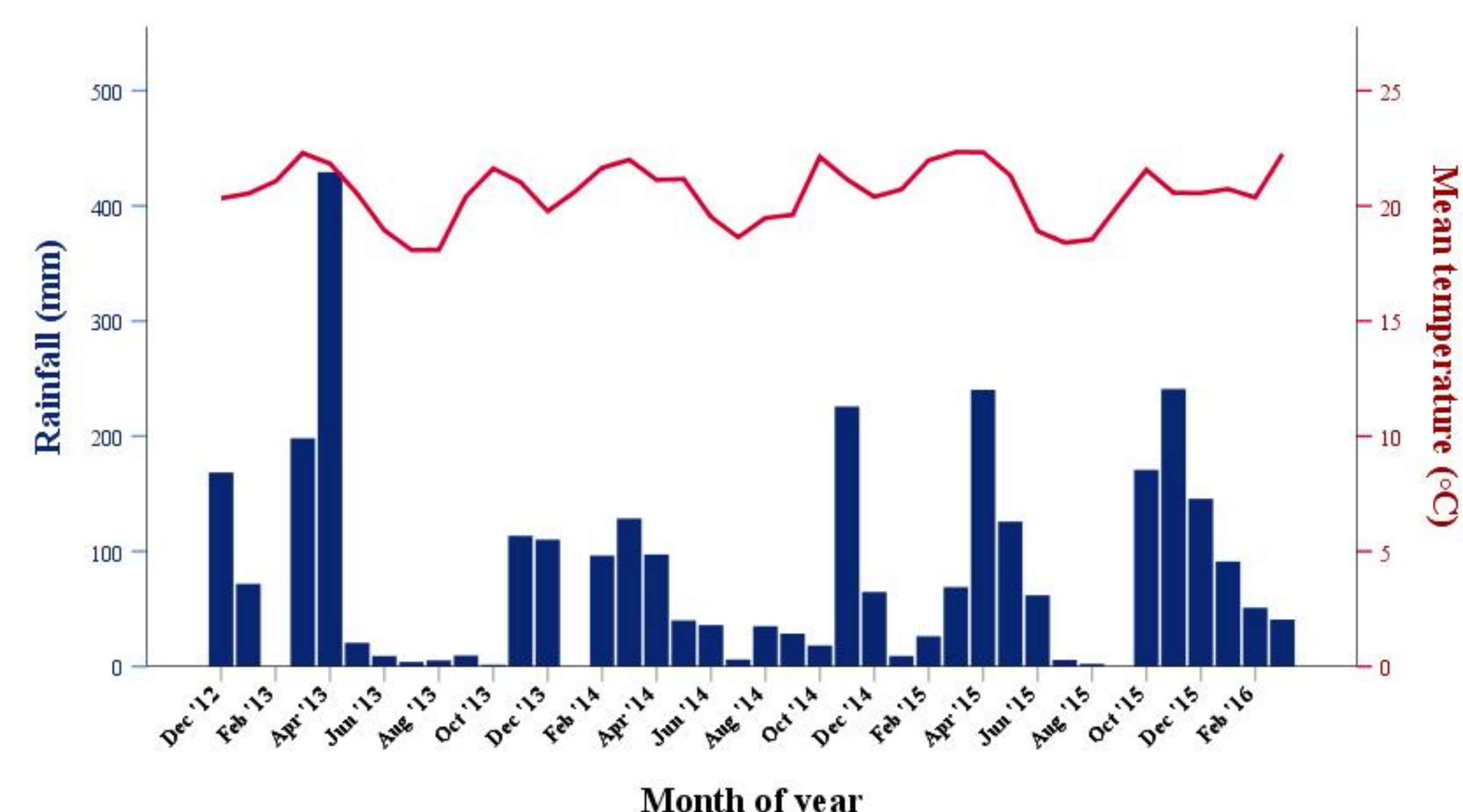
- Photosynthetically active radiation (PAR) incident upon understory maize for 3-year old trees was measured using AccuPAR LP-80 Ceptometer between 1200 and 1400 hours
- F. albida* canopy was not fully developed to exert influence on intercropped maize
- Grain yield measured adjacent (1 m) and away (3 m) from tree rows to determine tree influence



## Results

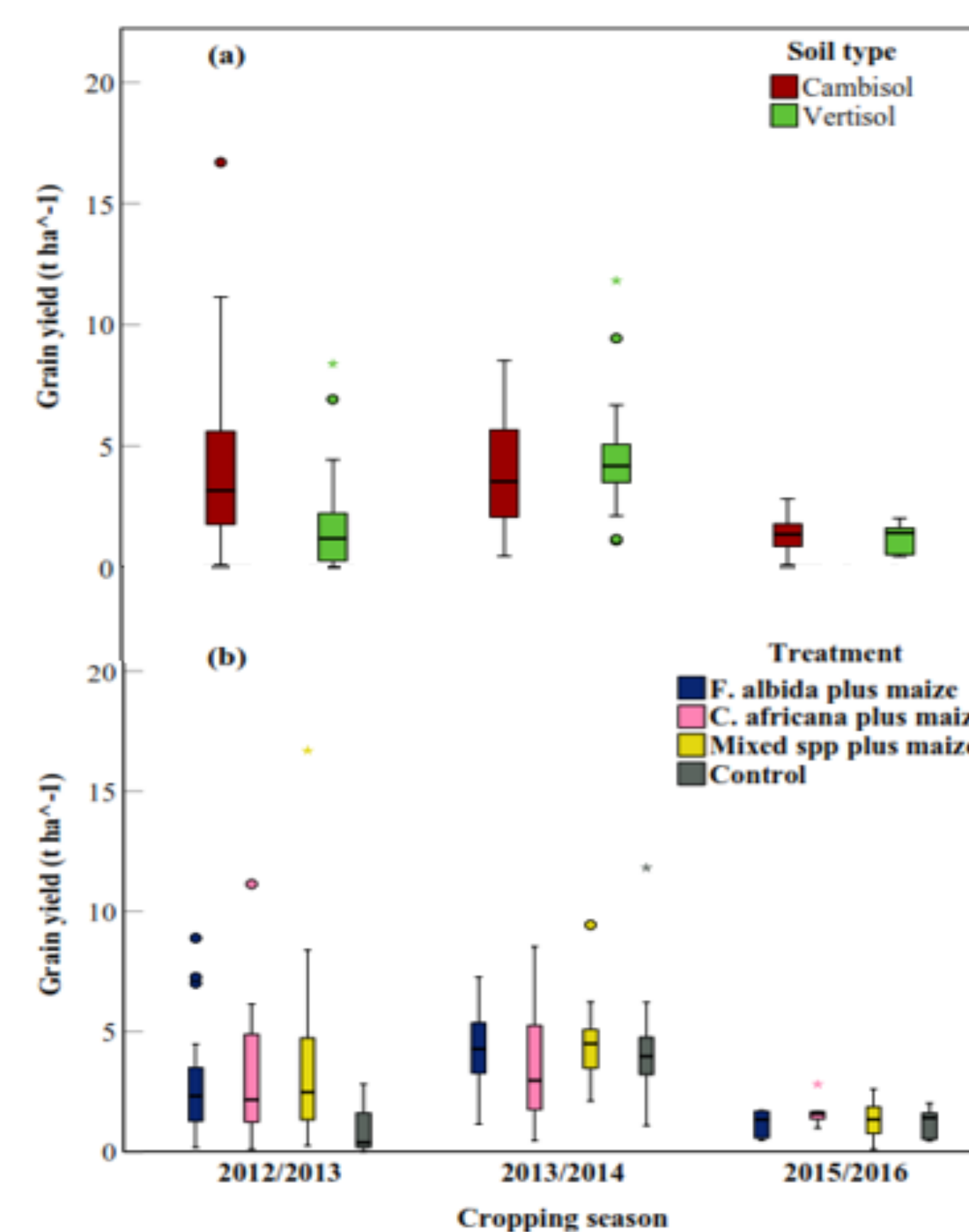
### Rainfall variability and maize yield

- Rainfall showed great inter- and intra- seasonal variability with distribution rather than amount observed to be critical for maize production
- Crop failure experienced during the 2014/15 cropping season as 57% of rainfall was received in a few days of the first month (November) and the remainder being unevenly distributed
- Rainfall contributed to 36% of variance in maize productivity becoming, by far, the highest individual contributor of variance



### Agroforestry treatments and grain yield

- Photosynthetically active radiation (PAR) incident upon understory maize was 18 and 24% in *C. africana* and mixed-species agroforestry treatments
- F. albida* canopy was not extensive enough to exert influence on intercropped maize
- Role of trees apparent in 2015/16 cropping season treatments recording 153 and 144% relative to sole maize respectively despite reduced rainfall



Tree leafing phenology (leaf fall) allowed for successful establishment of intercropped maize particularly in *C. africana* treatment

This minimized competition for growth resources from the impact of developing tree canopies

Trees provided shade during critical stages of crop growth (grain filling), thus reducing radiation load and subsequent water demand by crops

## Conclusion

- The study supports efforts aimed at forecasting rainfall patterns to ensure proper planning of farming operations, while promoting tree species diversity in farming systems
- Rainfall is a primary contributor of variability in maize yields, but other factors such as soil property variability, tree and crop management, agronomic practices and seed quality cumulatively contribute to yield differences
- Adopting modelling approaches is key to advancing understanding on how tree-crop interactions evolve as trees mature

## Acknowledgements

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