Water Limited Yields & Optimum Maize Sowing Time & Variety Recommendation Summary for Kenya

Background

Maize is part of a the diet for millions of people in Kenya. The crop is cultivated on about 1.5 million hectares of arable land. The average production is less than 2 t/ha, against a yield potential of even more than 10t/ha. The yield gap is attributed, to poor fertility management and climate risks (KALRO, 2024). This research therefore sought to enhance development of fertilizer recommendations and improve climate resilience. This was undertaken through simulation of potential water limited yields under different season types and varieties at scale for Kenya.

Methodology

Kenya, has extreme agro-ecologies, with high maize potential in the Western Kenya, as opposed to the rest of the country. The CGIAR-Excellence in Agronomy (EiA) Initiative, sought to determine the water limited yields, optimum sowing dates and variety for Maize in Kenya, through use of the AgWise Water Limited Yield crop modelling platform. The AgWise modelling framework, comprises of a variety of crop models, such as APSIM, DSSAT, WOFOST and Oryzae. This activity utilized the spatialized DSSAT 4.8 crop model, which was coupled with weather and soil from CHIRPS and AgERA5 and soil from ISRIC. Simulations based on 22-year historical data from, 2000, for 3 generic (short, medium and long), varieties over 9 weekly sowing dates. The simulation outputs were aggregated across different sowing dates, varieties and ENSO phases. This therefore enabled determination of the optimum sowing dates across different varieties and season types. The date with the highest median yield was referred to as the optimum sowing date, Specifically, season types were determined through classification of the season across the 3 ENSO phases. Determination of ENSO phases was undertaken through use of the Oceanic Niño Index (ONI), where an ONI value of greater and less than 0.5 ^{O}C, signifies an *El Nino* and *La Nina* respectively. ONI value between -0.5 and 0.5, signifies it is a *neutral.*

Results

The analytics framework aggregated all the Maize yield data across different sowing dates, varieties and ENSO phases for Kenya. Specifically, early sowing around 2 March, led to high yields across all ENSO phases, compared to the rest of the sowing window. The impact of ENSO is significant as even earlier in the season, as yields are low despite sowing early under the *La Nina* and *Neutral*, ENSO phases (Figure 1).

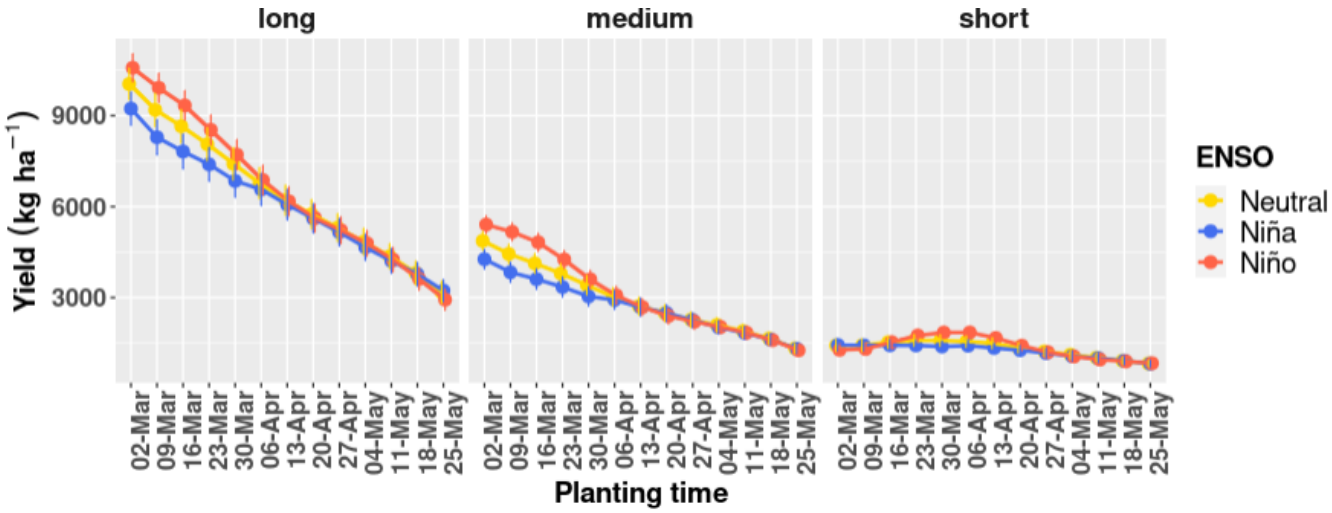

Figure 1: Maize yield response to varying sowing dates across different varieties and ENSO phases in Kenya.

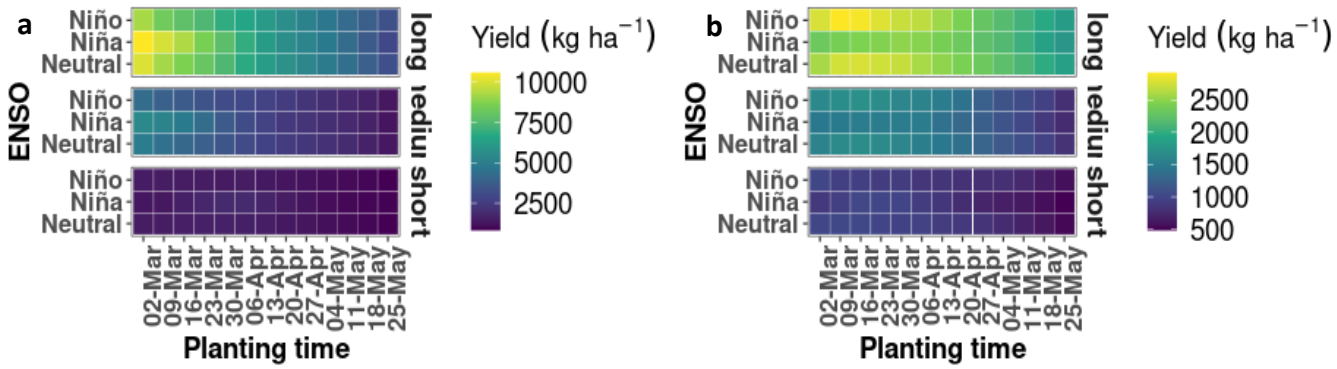

Figure 2: Maize grain yield (a)-summaries, (b)- stability, across different sowing dates, varieties and ENSO phases for Kenya.

There is greater yield stability on cultivation of short and medium season varieties, despite the very low yields, compared to long seasoned varieties. There was high yield variability under the *El Nino* and *Neutral* conditions, compared to the *La Nina* conditions (Figure 2).

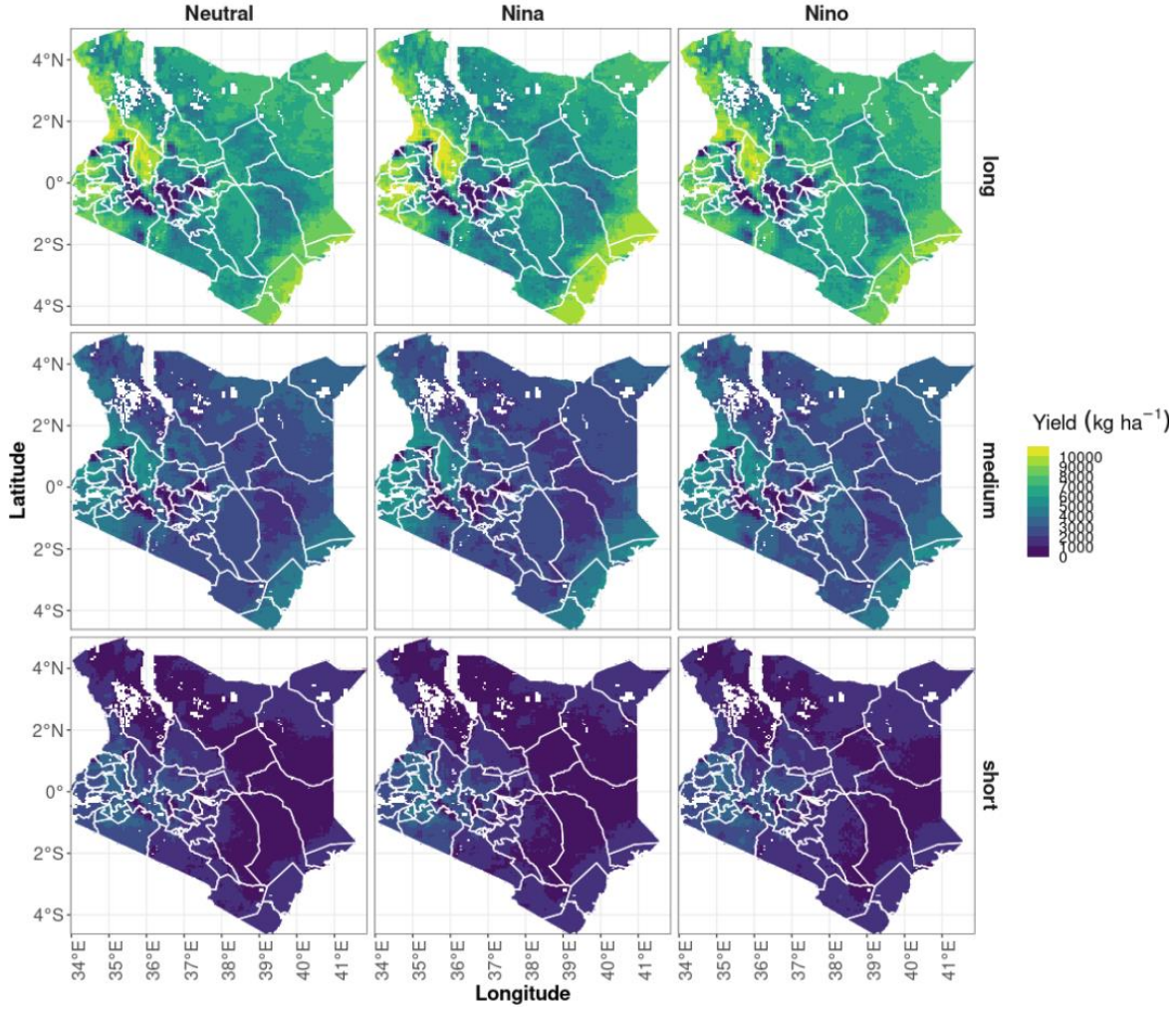

Figure 4: Mean yield distribution across different varieties and ENSO phases for Maize in Kenya.

El Nino caused slightly higher yields along the north western regions of Kenya, compared to *La Nina* and *Neutral* conditions. Pattern was also more notable for the short-seasoned varieties where *La Nina* and *Neutral* conditions, had very low yields as compared to under *Nino* (Figure 4).

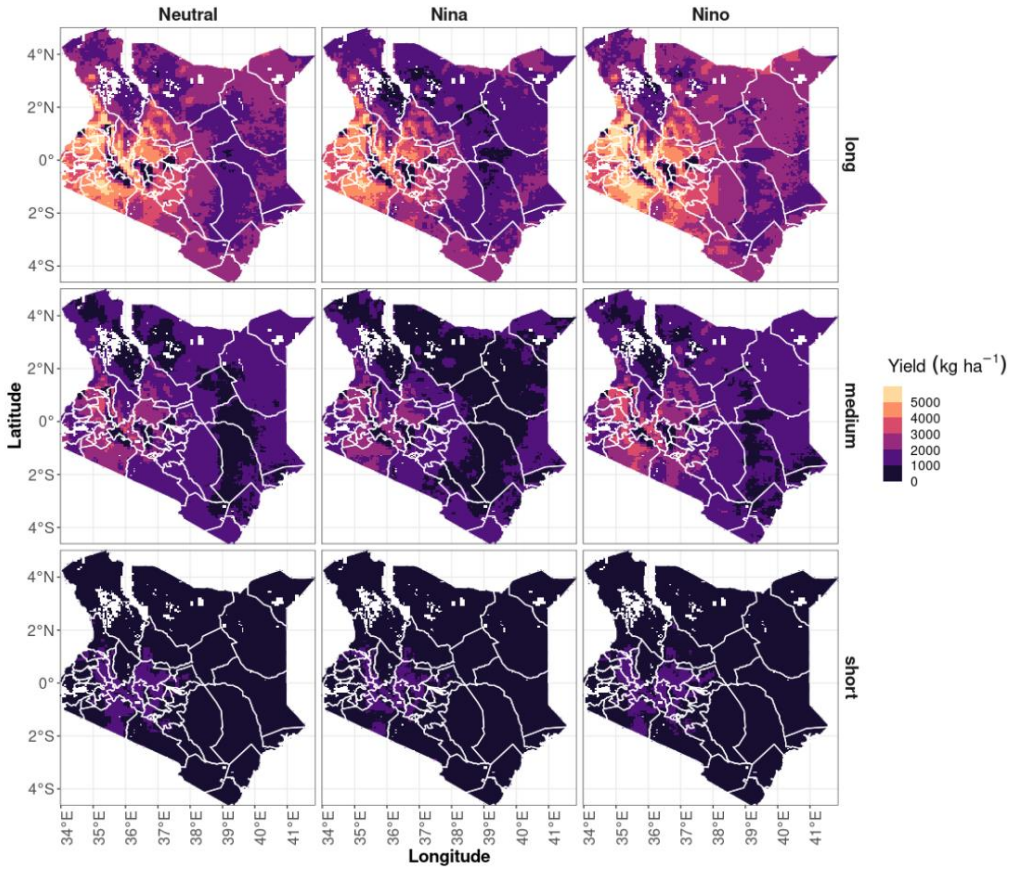

Figure 5: Maize grain yield standard deviation across different varieties and ENSO phases for Kenya.

There is higher standard deviation, translating to lower yield stability, in the western parts of Kenya as opposed to the North and South. Nino had slightly higher variability compared to other phases across the different varieties (Figure 5).

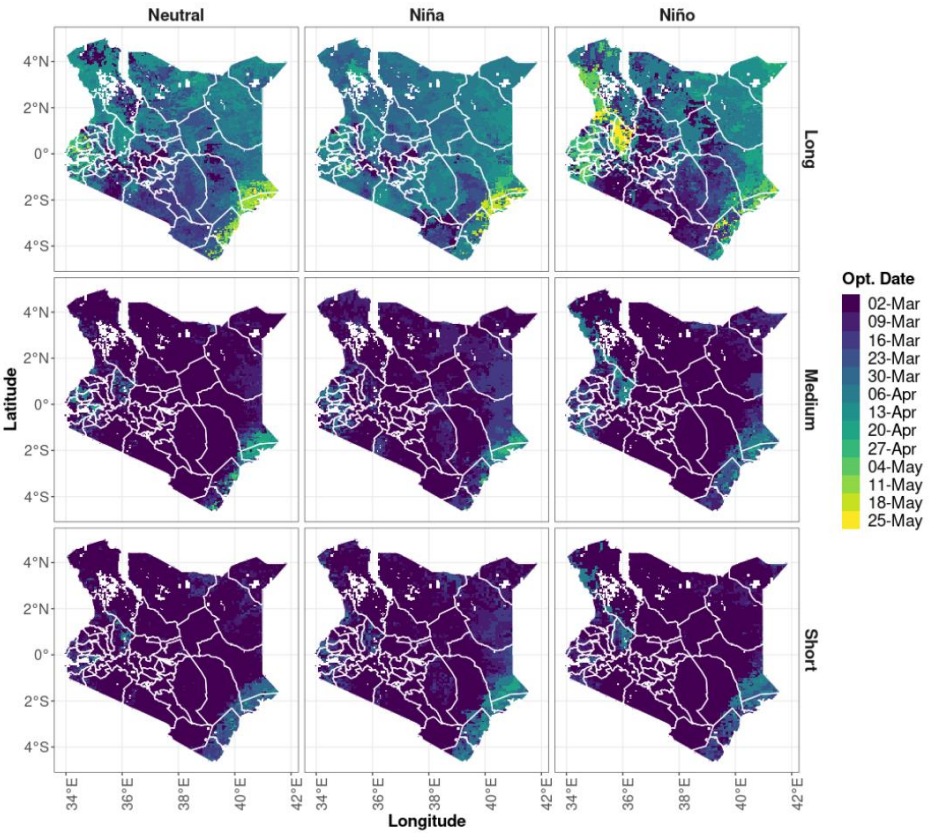

Figure 6: Optimum sowing dates across different varieties and ENSO phases for Maize in Kenya.

The earliest sowing dates (early March), are realized in mostly short and medium varieties, across all ENSO phases. Long seasoned varieties need proper timing across the different varieties and ESNO phases. Long seasoned varieties have slightly delayed optimum dates of Early April. Nino actually had the earliest sowing dates, especially in Short and Medium and less so in the long-seasoned variety (Figure 6).

Conclusion

Timing of sowing is critical across different ENSO phases and varieties in Kenya. The optimum sowing dates also vary by region and ENSO phase. There is less yield variability of dates under the different varieties.

Reference

KALRO, 2024. Maize production in Kenya. https://www.kalro.org/maize/

NB: The outputs should only be used to provide a general recommendation, due to the potential uncertainty from the use of gridded geo-spatial data sets. The recommendations therefore need to be used in consultation with local experts.