Effects of El Niño Southern Oscillation (ENSO) on the Agroclimatic Zoning for Tomato in Mozambique

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Introduction

Challenges for tomato production in Mozambique:

- **Seasonal climate variability** is a main factor affecting **agricultural production**
- **Tomato** is a **high value** crop with **high risk** associated with weather conditions
- **Lack** of **extension services** and reliable **weather data**
- During **summer**, weather is **not favorable**
- **El Niño** is associated with **drier and warmer** weather, and the **opposite** is valid for **La Niña**
- **Competition** with imported tomatoes from South Africa
- Horticultural crops are **irrigated** or **hand watered**
- **Agroclimatic zoning as tool to minimize risks in production:**
  - Define **areas** with **lower climatic risk**
  - Contribute to **public polices**

Objectives

- Create **agroclimatic zoning for tomato production in Mozambique according to ENSO phases**
- Utilize a simple tool to **communicate the information** to farmers and extension agents
- **Reduce production risks** associated with **climate variation** throughout the year

Material and Methods

- **Gridded temperature** data from **CFSR** (Climate Forecast System Reanalysis) – 0.25º x 0.25º resolution – Global database, daily data since 1983
- **Gridded rainfall** data from **FEWS** (Famine Early Warning System) (1) – 0.10º x 0.10º resolution – database for African continent, daily data since 1983
- Days classified as **suitable, marginal or unsuitable** (Table 1) according to **temperature and rainfall** requirements
- Each growing cycle was classified as Neutral, El Niño or La Niña using the Oceanic Niño Index (ONI)
- **Frequency** of each category by day of the year (Table 2)
- **Growing cycles of 75, 90, and 105 days** were evaluated considering **24 planting dates**
- Processing using R programming language

Table 1. Criteria to classify days as suitable, marginal or unsuitable for tomato production according to temperature and rainfall

Suitable	Marginal	Unsuitable
18 ≤ Tmax ≤ 25 ºC	5 ≤ Tmax < 18 & 25 < Tmax ≤ 36 ºC	Else
10 ≤ Tmin ≤ 20 ºC	5 ≤ Tmin < 10 &20 < Tmin ≤ 24 ºC	Else
Rain ≤ 25 mm	25 < Rain ≤ 50 mm	Else

Table 2. Frequency of years classified in each category to classify regions as suitable, marginal or unsuitable for tomato production

Suitable	Marginal	Unsuitable
80% years suitable	80% years marginal and/or suitable	Else

Results

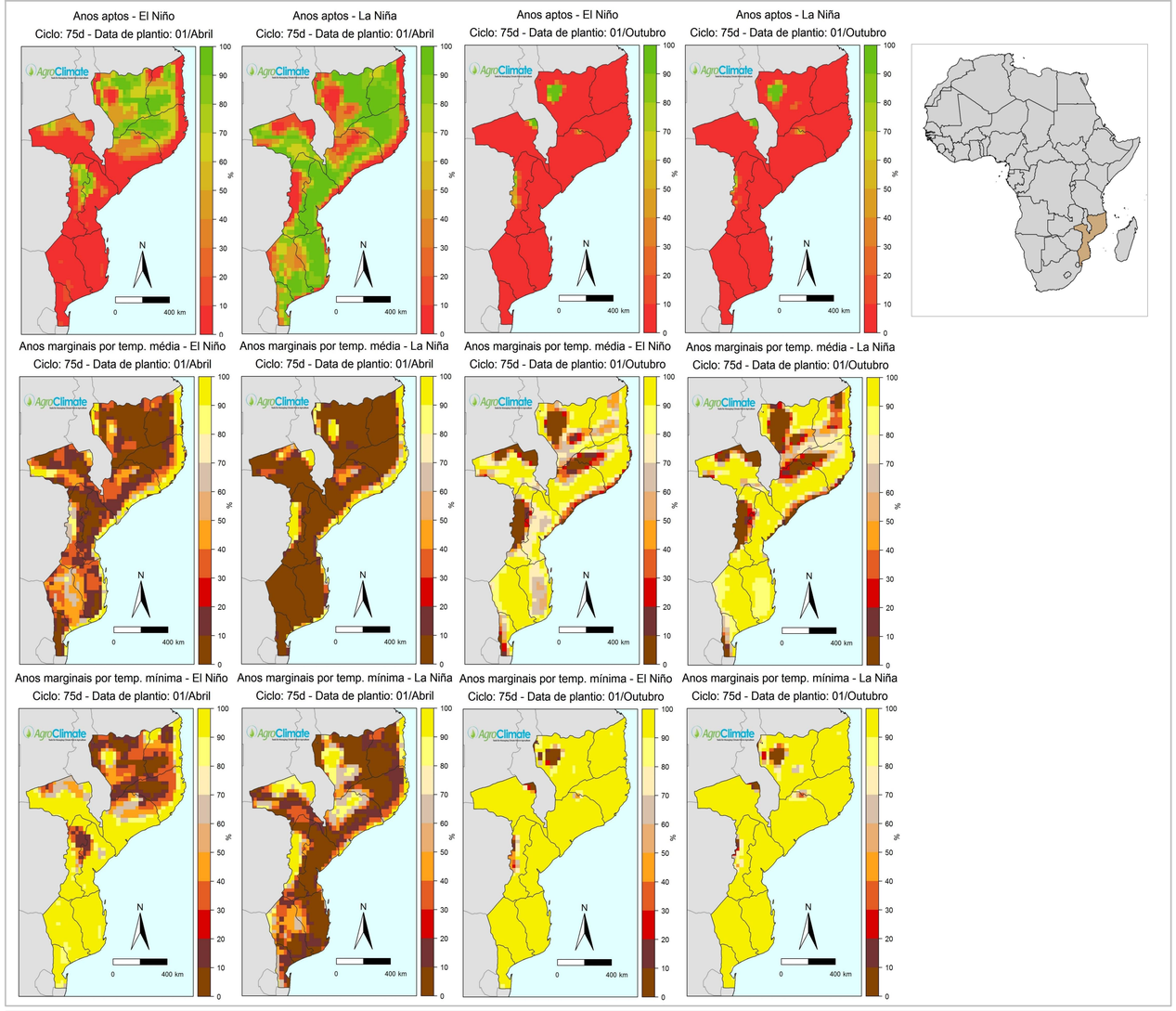

Figure 1. Example of Agroclimatic zoning for tomato production in Mozambique considering two planting dates: April/01 (cold period) and October/01 (warm period).

Discussion and Conclusions

- During warm period, only locations at **high elevations** have **ideal** conditions due to cooler temperatures
- During winter, **minimum temperatures** limit the conditions at high elevations
- **Better** conditions during **fall and winter at low elevations**
- **ENSO** has **high** influence during **fall** and low during warmer period
- **ENSO** information can be used to **adjust management**
- Tomato **planting dates** have to be carefully **selected** for each region

References

(1) Saha, S., Moorthi, S., Pan, H.-L., Wu, X., Wang, J., Nadiga, S., Tripp, P., Kistler, R., Woollen, J., Behringer, D., et al. (2010). The NCEP Climate Forecast System Reanalysis. Bull. Am. Meteorol. Soc. *91*, 1015–1057.