Influence of El Niño Southern Oscillation (ENSO) on tomato late blight incidence in Mozambique

Eduardo Gelcer[1,2], Daniel Perondi[1,3], Daniel Dantas Barreto[1], Clyde W. Fraisse[1] and Natalia Peres[4]

[1]Department of Agricultural and Biological Engineering, University of Florida, Gainesville, FL, USA [2]CAPES Foundation, Ministry of Education of Brazil, Brasilia – DF 70040-020, Brazil
[3]Institute of Exact Sciences and Geosciences, University of Passo Fundo, Passo Fundo, Brazil [4]Gulf Coast Research and Education Center, University of Florida, Wimauma, FL, USA
Contact information: Eduardo Gelcer - egelcer@ufl.edu and Clyde W. Fraisse – cfraisse@ufl.edu

Introduction

- **Seasonal climate variability** is a main factor affecting **agricultural production**
- **Tomato** is a **high value** crop with **high risk** associated with weather conditions and **disease occurrence**
- **Lack** of **extension services** and **reliable weather data** to assist farmer to define **fungicide application schedule**
- **Decision support systems**, have been used in other locations for **timing fungicide applications**
- The main **tomato** crop season is from **March to October**
- El Niño Southern Oscillation (**ENSO**) has strong **impact** in the region
- **El Niño** is associated with **drier and warmer** weather, and the **opposite** is valid for **La Niña**

Objectives

- To determine the risk of **late blight** (caused by *Phytophthora infestans*) incidence, by location, in tomatoes in Mozambique
- To determine how **ENSO** affects **disease** pressure in the region
- To create an web AgroClimate tool to optimize fungicide application and improve crop disease management.

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) – 0.10º x 0.10º resolution – database for African continent, daily data since 1983
- First late blight control: **10 consecutive days** with conditions **favorable** to late blight
- A day was considered **favorable** when (MacHardy, 1979; Becker, 2005):
  - 1-day Minimum Temperature ≥ 7.2ºC &
  - 5-day Average Temperature ≤ 25.5ºC &
  - 10-day total rainfall ≥ 30 mm
- Years were classified as **Neutral, El Niño or La Niña** using the Oceanic Niño Index (ONI)
- **Bootstrapping** with ten replicates was performed based on the samples for each ENSO phase
- Kruskal-Wallis test was used to define if **ENSO** influence is **significant** at 5% significance level
- The data analysis was done using R Programing Language.

Results & Discussion

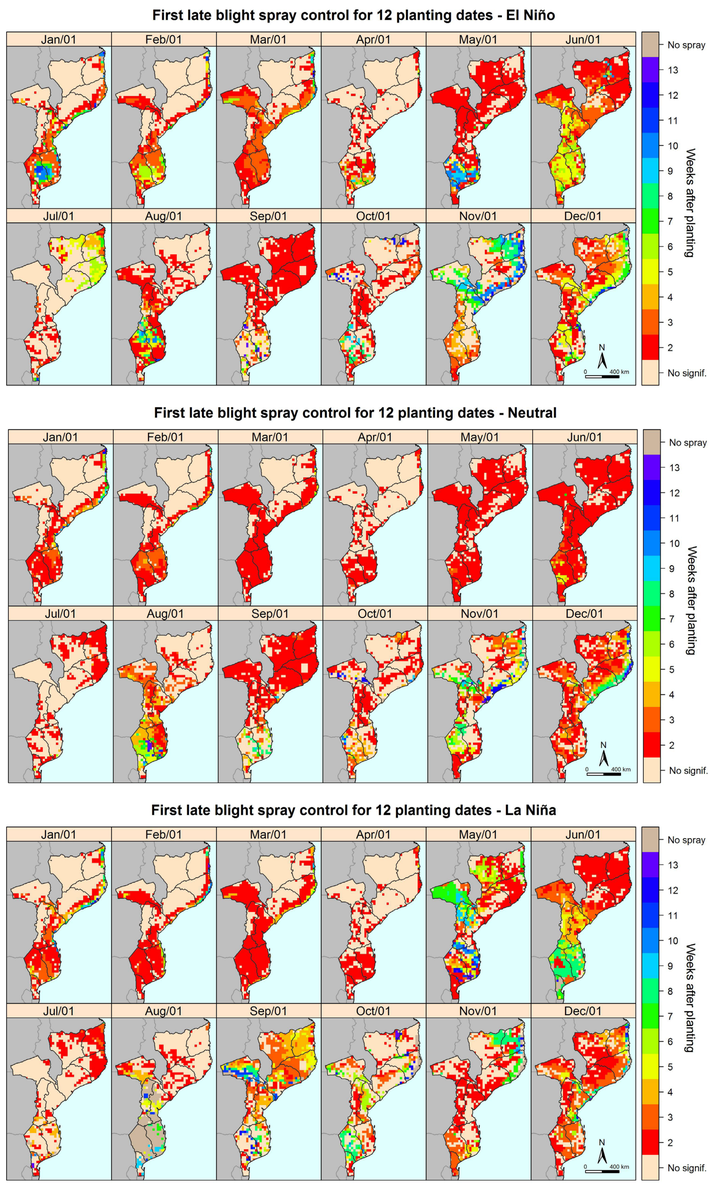


Fig 1. Week of the first application to control late blight for a tomato crop planted on 12 planting dates for El Niño, La Niña and Neutral. No significant indicate no significant influence of ENSO, therefore the lowest values of all years (2 week) should be used.

- For most conditions, the first late blight control should occur 10 days (second week) after planting.
- **ENSO** influence is **significant** for most planting dates and regions
- The use of **ENSO** information result in a spraying **delay** of **1 to 7 weeks** depending on the region and planting date
- **Neutral** condition is associated with **earlier spraying** due to higher climate variability
- Crops planted in **August** during **La Niña** may not need late blight control for the south region.

Results & Discussion

AgroClimate Web Tool

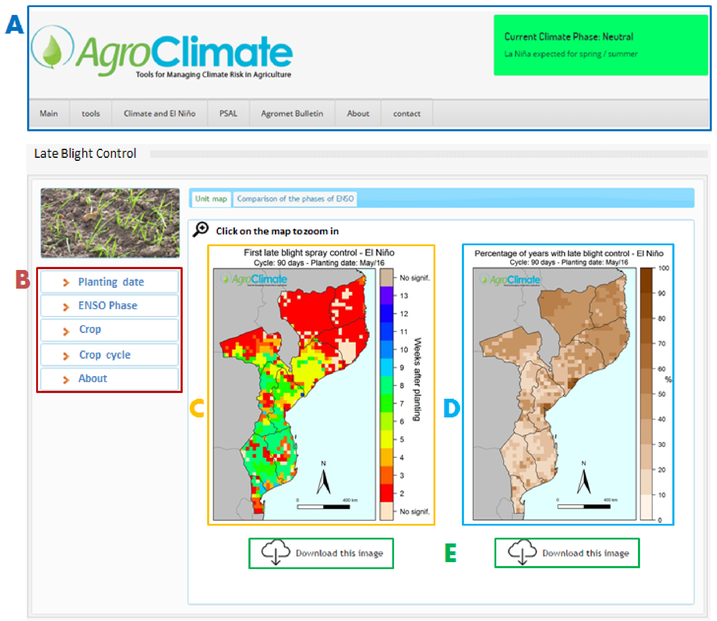


Figure 2. Screenshot of the Late Blight Tool in AgroClimate Mozambique (http://mz.agroclimate.org). It shows when the first spray to control late blight should occur for a tomato crop planted on May 16 and the percentage of years with need of control. **A** indicates AgroClimate main menu, **B** is the menu with management options, **C** is the map with the week at which the first late blight control should occur, **D** is the map with percentage of years with late blight control, and **E** is the option to download the image.

- The tool allows the users to select planting date, ENSO phase, and crop cycle length
- It displays when the earliest **first late blight control** has occurred based on historical conditions for different planting dates and ENSO phases
- **Subsequent** applications should occur on **calendar basis**.

Conclusions

- **Late blight tool** can assist farmers to define when the **first application** should occur
- **ENSO significantly influences** late blight spraying schedule
- **ENSO-based** late blight schedule can be used as **guideline** to **improve** disease management, especially when combined with ENSO forecast.

References

Becker, W.F. 2005. Validação de dois sistemas de previsão para o controle da requeima do tomateiro na região de Caçador, SC. *Agropecuária Catarinense* 18: 63-68.

Machardy, W.E. 1979. A simplified noncomputerized program for forecasting potato late blight. *Plant Disease Reporter* 63: 21-25.