Introduction

Uncertainty caused by the alteration of climate patterns brings adverse consequences on crop productivity. It means that agricultural producers have to make decisions regarding the management of crops that affect economic, social and environmental aspects, among others (Rodriguez et al., 2017). In general, the consequences of these decisions are not known with certainty in the short time, but long time after and the results may be better or worse than what was expected. (Breuer et al., 2010).

One strategy to support the choice of a “good decision” is the implementation of Decision Support Systems (DSS), which are tools that are based on a selection process that considers a set of criteria to achieve one or more objectives (Herbert, 1960; Beynon et al., 2002). In this sense, the MAPA Expert System (ES-MAPA) was proposed as a tool to facilitate the management of agroclimatic risk from a Climate Smart Agriculture (CSA) perspective in three different spatial scales: departmental, municipal and local. ES-MAPA is part of the MAPA project (MAPA Agroclimatic Adaptation and Prevention Models), executed in 54 farming systems and the same number of municipalities. At a departmental level, it characterizes agroclimatic threats; at a municipal level, it identifies zones of agroclimatic aptitude under events of climatic variability, delimiting “productive niches of low agroclimatic risk” for conditions of excesses and water deficits in the soil. At a local scale, the EAWS-Prototype calculates a probable humidity condition in the area through the use of a seasonal, one, two and three-month seasonal climate prediction, and then it recommends a technological offer based on the alert (Rodriguez et al., 2017). At a local scale, the ES-MAPA hosts the EAWS-Prototype, which calculates a probable humidity condition in the area through the use of a seasonal, one, two and three-month seasonal climate prediction, and then it recommends a technological offer based on the alert (Rodriguez et al., 2017).

At the national level, three EAWS-Prototypes are implemented in the municipalities of: Repelón (Atlántico), Paipa (Boyacá) and Yacuquin (Nariño), for the crops of Tomato (Solanum lycopersicum), Cauliflower (Brassica oleracea) and Potato (Solanum tuberosum) respectively. The system can be consult in http://www.corpoica.org.co:8086/NetCorpoicaMVC/SEMapa/Actualizaciones/Presentacion?ZonaId=8

Methodology

Study area

The EAWS-Prototype for the crop potato is implemented in the municipality of Yacuquin, department of Nariño, in southwestern of Colombia. The crop production cluster is located at average altitudes of 2,500 meters above sea level with average temperatures between 6 and 14 °C. The EAWS-Prototype has five meteorological stations associated with temperature and precipitation records (Table 1).

System approach

It is calculated from the water requirement of the crop (climate module), based on the ALERT of excess or deficit of the probable conditions of humidity. An irrigation calendar is presented (technological supply module), to conclude with the linking of the effects and the technological options depending on the probable humidity conditions (technological offer module).

Climate Module: Seasonal climate prediction

The seasonal climate prediction of precipitation and temperature is performed using Model Output Statistics MOS applications. It calculates the Standardized Precipitation Index SPI, which defines probable humidity conditions.

Agroclimatic Module: consumptive use for potato

It is based on FAO documents No. 33 “Effects of water on crop yields” and FAO No. 56 “Crop evapotranspiration: Guidelines for the determination of water requirements of crops”.

Technological OFFert Module: technological options

According to the probable conditions of water availability for cultivation, technological options are suggested to be implemented in the potato crop.

Results

An exercise was carried out for the month of May 2018, finding that for a crop sown on March 1, the consumptive use is 30 mm/month, being less than the probable precipitation, so it is not necessary to apply irrigation.

Conclusions

The approach of the system allows to obtain a series of technological offers according to the probable humidity condition, specifically for the production clusters of potato then municipality of Yacuquin.

References


Table 1. Main characteristics of the meteorological stations used for the EAWS-Prototype

<table>
<thead>
<tr>
<th>Code</th>
<th>Station Name</th>
<th>Location (GC)</th>
<th>Elevation (m)</th>
<th>Municipality</th>
<th>Station type according DSSM</th>
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</table>

Fig. 1. Area of influence and location of meteorological stations associated with the EAWS-Prototype for potato crops (Solanum tuberosum) in the municipality of Yacuquin (Nariño, Colombia)

Fig. 2. System approach for the EAWS-Prototype for potato crops in the municipality of Yacuquin.

Fig. 3. Procedure for calculating the probable humidity condition

Fig. 4. Procedure for calculating the consumptive use for potato

Fig. 5. Technological OFFert Module for the EAWS-Prototype for potato crops in the municipality of Yacuquin.

Fig. 6. Probable humidity conditions and irrigation calendar for potato crops in the municipality of Yacuquin

Fig. 7. Technological options for normal conditions for potato crops in the municipality of Yacuquin

Early Agroclimatic Warning System Prototype (EAWS-Prototype), for potato crops (Solanum Tuberosum) in the municipality of Yacuquin (Nariño, Colombia)

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