Geographic Information System to Support Irrigation Management Strategies

Cassiane J M Victoria Bariani*[1], Nelson M Victoria Bariani[2], Petry M T[1], Carlesso R*[1], Kersten D S[1], Awe G O[3]

[1]Agriculture Engineering Department, Federal University of Santa Maria, Av. Roraima, Nº1000, Cidade Universitária - Bairro Camobi 97105-900, Santa Maria - RS. Brazil.
[2]Federal University of Pampa - BairroPromorar 97650-000, Itaqui - RS. Brazil.
[3]Department of Crop, Soil and Environmental Sciences, Faculty of Agricultural Sciences, Ekiti State University, PMB 5363, Ado Ekiti, Nigeria.
E-mail cassiane.victoria@gmail.com

Abstract

Meteorological variables, phenology, plant health and crop management, soil physical and chemical properties, water and energy balances as well as variables related to economics, logistics and monitoring processes, among others, create complexity in the management of irrigation, which make it difficult to be administered conceptual or empirical models. Also, physico-mathematical modelsdescribing isolated phenomena cannot cover the overall complexity of the problem. This can be seen, in practice, by the gradual growth of factors which threaten the sustainability of irrigation enterprise. Currently, the advent of geotechnology application in agriculture and its integration with weather information in Geographic Information System (GIS) environments has make possible a more detailed support for irrigation management and planning. The objective of this study therefore was to organize and develop a geo-relational database with information from 30 pivots located in Cruz Alta, RS, Brazil, to further establish the usefulness of GIS in irrigation management. Data base preparation took place in two stages: (i) acquisition, georeferencing, image vectorization, snipping and calculation of vegetation indices relating to 107 images from Landsat5/TM satellite; and (2) creation of geo-related tables for each pivot containing information obtained from fieldsand weather stations in the region. Besides statistical analysis of NDVI values of pixels (picture elements) from each pivot, informationon crop type, planting date, phenological stages, soil type, evapotranspiration and weather data were also included in the database. Image processing, calculations and statistical analyzes, as well as mapping were done using SPRING software. Thus, a geographical database capable of integrating field information with those obtained by remote sensing was created and mapping of the distribution of key crop variables enabled better visualization of the dynamics of processes in progress, thus enabling comprehensive technical background for decision making with respect to planning and management of production systems in irrigated agriculture.

Keywords: Central Pivot, SPRING, Landsat, Cruz Alta