




Characterization of the spatial variability of surface topography and moisture content and its influence on potato crop yield

Khalid A. Al-Gaadi^{a,b}, Abdalhaleem A. Hassaballa^a, ElKamil Tola^a, Ahmad G. Kayad^b, Rangaswamy Madugundu ^a, Fahad Assiri^c and Bander Alblewi^c

^aPrecision Agriculture Research Chair, King Saud University, Riyadh, Saudi Arabia; ^bDepartment of Agricultural Engineering, College of Food and Agriculture Sciences, King Saud University, Riyadh, Saudi Arabia; ^cWater and Energy Conservation Department, Saudi Agricultural Development Company (INMA), Wadi Eddawasir, Saudi Arabia

ABSTRACT

Addressing the cause of the spatial variability of crop (*Solanum tuberosum* L.) yield is of a great importance to farmers who plan to apply precision agriculture techniques. Therefore, a study on two centre pivot irrigated potato fields in Saudi Arabia was conducted to detect and assess the spatial dependencies among three variables (surface topography, moisture content, and potato yield) and to examine the influence of surface topography and moisture on the potato yield. In addition to surface elevation data in the form of digital elevation model, cloud-free satellite images of Landsat-8 with a spatial resolution of 30 m were acquired throughout the study period. Samples of potato yield were collected 2 days prior to the harvest time and upscaled into yield maps using the interpolation technique in ArcGIS software program. Soil field capacity (F_C) and permanent wilting point (PWP) were determined for the study area and utilized to generate moisture content maps using thermal inertia method. The study employed the bivariate Moran's Index (Moran's I) and the Bivariate Local Indicator of Spatial Autocorrelation in order to measure the strength of the spatial autocorrelation and to quantify the spatial dependency between each two of the acquired variables. The interpretation of the mapped topography, cumulative moisture, and yield revealed a substantial agreement along the spatial distribution of the high moisture and yield values with the adverse value of the surface elevation. Results of the spatial autocorrelation indicated that the spatial patterns of moisture-yield over the two study fields were strongly associated with high-high clustering level covering an area of 42% of field 68-S and 39% of field 44-S, while topography-yield patterns over field 68-S and 44-S covered only 25% and 22% of the areas, respectively, with a confidence level of 0.01 for all patterns at both fields.

ARTICLE HISTORY

Received 27 November 2017
Accepted 22 May 2018