

# The response of potato crop to the spatiotemporal variability of soil compaction under centre pivot irrigation system

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## Abstract

Precision agriculture techniques were employed to study the impact of the spatiotemporal variations of soil compaction on the performance of potato crop during its various growth stages. The study has been conducted on a 30 ha centre pivot irrigated potato field, located in Wadi Al-Dawasir area in Saudi Arabia. In situ soil compaction measurements were collected, in conjunction with Sentinel-2A satellite data, and correlated spatiotemporally against potato crop growth and yield parameters. The univariate and bivariate Moran's function (Moran's I), the linear regression and the analysis of variance (ANOVA) techniques were used to analyse the data and examine the interrelationships. The spatial correlations between the measured variables revealed high clustering, producing Moran's I of 0.87, 0.79 and 0.57 for soil compaction, yield and normalized difference vegetation index (NDVI), respectively. Compaction-yield relationship revealed a relatively high significant negative spatial correlation (Moran's I = 0.68). While, the spatial correlation between the average values of compaction and NDVI has negatively produced a Moran's I value of 0.45 (at 0.001 significance level), when 999 permutations were tested for all relationships. A significant positive correlation was observed between high compaction and high proportion of small size tubers, with  $R^2$  and  $P > F$  values of 0.65 and .0001, respectively. In contrast, a significant negative correlation has been obtained between high compaction and high proportion of large size tubers, with  $R^2$  and  $P > F$  values of 0.57 and .0001, respectively. Understanding the causes of disparity in the productivity of agricultural fields will help decision-makers and farmers to take proactive actions towards better agricultural practices.

## KEYWORDS

potato crop, precision agriculture, remote sensing, soil compaction

## 1 | INTRODUCTION

Due to the growing interest in the global importance of potatoes, emphasis has been placed on the continued expansion of the potential for increased production in the coming

decades (Walker, Thiele, Suarez, & Crissman, 2011). Given the scale of future food needs given the increasing rate of urbanization and large numbers of consumers, the opportunity to manufacture and trade potato products in Saudi Arabia is an issue of additional importance. According to