

RESEARCH ARTICLE

Assessing the Spatial Variability of Alfalfa Yield Using Satellite Imagery and Ground-Based Data

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Data Availability Statement: Data are available as follows: (A) Alfalfa yield datasets are uploaded as a Supporting Information file. (B) Landsat-8 satellite images used for this study are available from the Earth Explorer service (<http://earthexplorer.usgs.gov>) USGS/EROS, Sioux Falls, SD, USA.

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Abstract

Understanding the temporal and spatial variability in a crop yield is viewed as one of the key steps in the implementation of precision agriculture practices. Therefore, a study on a center pivot irrigated 23.5 ha field in Saudi Arabia was conducted to assess the variability in alfalfa yield using Landsat-8 imagery and a hay yield monitor data. In addition, the study was designed to also explore the potential of predicting the alfalfa yield using vegetation indices. A calibrated yield monitor mounted on a large rectangular hay baler was used to measure the actual alfalfa yield for four alfalfa harvests performed in the period from October 2013 to May 2014. A total of 18 Landsat-8 images, representing different crop growth stages, were used to derive different vegetation indices (VIs). Data from the yield monitor was used to generate yield maps, which illustrated a definite spatial variation in alfalfa yield across the experimental field for the four studied harvests as indicated by the high spatial correlation values (0.75 to 0.97) and the low P-values (4.7E-103 to 8.9E-27). The yield monitor-measured alfalfa actual yield was compared to the predicted yield from the VIs. Results of the study showed that there was a correlation between actual and predicted yield. The highest correlations were observed between actual yield and the predicted using NIR reflectance, SAVI and NDVI with maximum correlation coefficients of 0.69, 0.68 and 0.63, respectively.

1. Introduction

Alfalfa (*Medicago sativa*) is considered, worldwide, as being one of the most important forage crops. It is cultivated in more than 80 countries covering an area of 35 million hectares. Its growth structure is upright with crowns that contain 5–25 stems that grow up to 60 to 90 cm in height [1].