Dynamic zoning of agricultural plots based on satellite information

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Supported by remote sensors information, farmers can identify key factors that impact crop yield and plan non-uniform agricultural management to make more efficient use of the natural and economic resources. In recent years, the availability of satellite products has grown, and it is possible to find multispectral images as well as synthetic aperture radar (SAR) images at a spatial scale that allows their use in the context of precision agriculture (PA). Based on this information, it is possible to derive dynamic indicators of crop status; however, the use of SAR-related information is not widely studied in PA. The objective of this study is to compare the efficiency of zoning agricultural plots using optical images, SAR images, or a combination of both at different crop stages. Images from five corn fields were analysed. For each field, images in six dates related to the crop cycle (V6, V10, V14, R1, R4) were obtained. All fields were zoned at each date, delimiting two to five homogeneous zones, using information from bands and indices derived from optical and radar images, and combining both sources. The zonings were performed using the KM-sPC method, that applies spatial principal components (sPC) on the satellite data and fuzzy k-means to cluster field sites using the sPC as input. In addition, a consensus cluster among zoning at different crop stages was performed for each agricultural field using the majority method. Differences between field zones, for each type of satellite data, were assessed by the pseudo-F index. It was observed that optical images performed better than radar images for zoning corn fields. In a few fields, SAR images provided extra information to improve zoning compared to optical images.

Keywords: remote sensing, precision agriculture, spatial principal components, fuzzy k-means