Spatial pattern of soil and soybean crop: an assessment using digital mapping techniques

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The aim of this study was to analyze the relationships among spatial patterns of soil properties and soybean crop. The study was carried out in three provinces of Argentina: (i) Buenos Aires (BA), (ii) Entre Rios (ER) and (iii) Cordoba (COR). In each province, 2 agricultural fields were selected. Ancillary information related to soil forming factors in each field was gathered, for example apparent electrical conductivity (ECa), NDVI and yield maps. We used principal component spatial analysis (MULTISPATI-PCA) to delimit zones for soil type by field. To zonal validation, 4 sampling sites were located in which we collected soil samples, grain yield and soybean crop quality. Random Forest (RF) was used to determine the importance of soil properties over soybean crop properties. For comparing soil properties in each zone between fields, a mix lineal model and ANOVA were adjusted. Our results suggest that MULTISPATI-PCA was efficient to delimit zones for soil type. Relationships between soil properties and crop yield were examined and understood. However, it did not occur with crop quality patterns. Topography did not prove to be an accurate indicator of spatial pattern relations of soil properties and crop, whereas ECa, yield maps and NDVI proved to be effective indicators. Grains m-2 and NDVI were affected homogeneously and were showed spatial correspondence according to soil limitations. Percentage of protein did not show spatial correspondence with delimited zones in saline soils, particularly in ER. In such fields, Om and pH were important for percentage of protein. It was evidenced that a direct relation exists between complex relationship of soil and crop properties and soil degradation.