Caracterización de la variabilidad espacial de propiedades del suelo a partir de la conductividad eléctrica aparente

RESUMEN

La caracterización de la variabilidad espacial de las propiedades del suelo y la complejidad de factores que inciden en el rendimiento de los cultivos, constituyen los principales desafíos para la adopción de tecnologías para el manejo sitio específico. Los avances en técnicas de sensoramiento directo del suelo han sido ampliamente documentados como métodos rápidos, eficientes y precisos para la delimitación de zonas de manejo a escala de lote. Entre ellos, la Conductividad Eléctrica aparente del suelo (CEa) ha sido estudiada debido a que su determinación geofísica está influenciada por una combinación de propiedades físico químicas del suelo que incluyen contenido y mineralogía de arcillas, contenido de agua, materia orgánica, capacidad de intercambio catiónico y temperatura del suelo. El objetivo fue determinar la existencia de la variabilidad espacial de propiedades del suelo a partir de su relación con la CEa, utilizando a ésta como variable predictora para la delimitación de zonas de manejo homogéneo. Tres lotes agrícolas ubicados en el Partido de Tres Arroyos fueron utilizados. A cada lote se le realizaron mediciones de CEa, altura y profundidad efectiva (PE). La CEa fue determinada a partir del sensor Veris 3100 a dos profundidades: 0-30 cm (CEa30) y 0-90 cm (CEa90). A partir del análisis geoestadístico se diferenciaron dos zonas de CEa para cada lote, dentro de las cuales se procedió al muestreo de suelo a dos profundidades 0-30 y 30-90 cm. Las propiedades analizadas fueron materia orgánica, capacidad de intercambio catiónico, pH, conductividad eléctrica del extracto y textura. Las propiedades de suelo y su asociación con zonas de CEa fueron analizadas utilizando ANOVA con un diseño de factores anidados. La relación entre CEa con altura y PE se evaluó mediante regresión espacial. Los resultados indican que las relaciones entre las propiedades del suelo y las zonas de CEa no fueron consistentes. El contenido de arcilla presentó diferencia significativa entre zonas de CEa30 en todos los lotes y no se hallaron diferencias significativas entre zonas de CEa90. No se presentó relación significativa entre la altura y la CEa30 en ninguno de los lotes. Se presentó relación significativa entre la PE y la CEa30. A partir de este estudio se concluye que los valores altos de CEa30 estuvieron relacionados a zonas someras debido a su mayor contenido de arcilla. Para la CEa90, es posible que la variabilidad en profundidad del horizonte petrocálcico haya interferido en la medición de la CEa.

Characterizing the spatial variability of soil properties using apparent electrical conductivity

ABSTRACT

The characterization of the spatial variability of soil properties and the complexity of factors that affects crop yield are the major challenges for the adoption of technologies for site-specific management. Advances in direct soil sensing techniques have been widely documented as rapid, efficient and accurate methods for management zone at field scale. Among them, the apparent electrical conductivity of soil (ECa) has been studied because its determination is influenced by a combination of soil physical and chemical properties including clay mineral content, water content, organic matter, cation exchange capacity and soil temperature. The objective was to determine the existence of the spatial variability of soil properties from its relationship with ECa, using it as a predictor for the delimitation of homogeneous management zones. Three agricultural fields located in Tres Arroyos Department were used. ECa measurements, elevation and effective depth (ED) were evaluated at field scale. ECa was measured using Veris 3100 sensor at two depths: 0-30 (ECa30) and 0-90 cm (ECa90). A geostatistical analysis was performed to differ two ECa zones for each field, within which we proceeded to soil sampling at two depths 0-30 and 30-90 cm. The properties analyzed were organic matter, cation exchange capacity, pH, electric conductivity of the extract and texture. The soil properties and its association with ECa zones were analyzed using ANOVA with nested factors design. The relationship among elevation and ED with ECa was assessed using spatial regression model. The results indicate that the relationship among soil properties and ECa zones were not consistent. Clay content was significantly different among ECa30 zones in all fields and no significant differences among ECa90 areas were found. No significant relationship among elevation and ECa30 in any fields. Significant relationship among the ED and ECa30 was found in all fields. From this study we conclude that ECa30 high values will be related to shallow zones because of its higher clay content. For ECa90, it is possible that the variability in depth petrocalcic horizon could be interfered in ECa measurement.

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