

## **USE OF CHEMICAL AND PHYSICAL ATTRIBUTES OF SOIL IN MANAGEMENT UNITS DEFINITION**

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### **ABSTRACT**

Several equipments and methodologies have been developed to make available precision agriculture, especially the high cost of its implantation and sampling. An interesting possibility is to define management zones, whose aim is dividing the producing areas in smaller management zones that could be treated differently. So, they could be used as a source of recommendation and analysis.. Thus, this trial used physical and chemical properties of soil and its yield, aiming at generating management zones to identify whether they can be used as recommendation and analysis. Management zones were generated by the Fuzzy C-Means algorithm and their evaluation was obtained by calculating the reduction of variance and performing means tests. The division of the area into two management zones was considered appropriate for the present distinct averages of most soil properties and yield. The division of the area into two management zones was considered appropriate for the present distinct averages of most soil properties and yield. The used methodology allowed the generation of management zones that can serve as source of

recommendation and soil analysis; despite this, the relative efficiency has shown a reduced variance for all attributes in divisions in the three sub-regions, the ANOVA did not show significant differences among the management zones.

**Keywords:** Precision agriculture, spatial variability, fuzzy clustering, management zones, autocorrelation, cross-correlation.

## INTRODUCTION

The ongoing development of precision agriculture technology (PA) has put forward the emergence of machines equipped with sensors and equipment aiming at reducing costs and improving performance of production processes as well as allowing more detailed analysis of both soil and plants.

Thus, new forms of research on how to apply this technology study on lower sampling costs associated with sample size and the definition of management zones (TAYLOR et al., 2007; ROUDIER et al, 2008; RIBEIRO et al., 2011; SUSZEK et al., 2012) have emerged to make a practical and economic PA. This study aimed at defining management zones using physical and chemical data of soil and soybean yield data in order to define sub-regions which can be taken as a source of recommendation and optimized sampling. Thus, the Fuzzy C-means clustering technique implemented in software SDMZ (Software for Definition of Management Zones) was used.

## MATERIAL AND METHODS

The study was carried out in a 19.8 ha commercial farming area, in Serranópolis do Iguaçu/PR. Fifty eight sampling points

were defined (2.93 points ha<sup>-1</sup>) using an irregular grid. The collected data were soybean yield, soil chemical parameters (C, pH, H + Al, Ca, Mg, K, Cu, Zn, Fe, Mn) and textural (silt, sand, clay) properties, in addition to water content and soil penetration resistance at 0 to 0.3 m layers.

Matrices of spatial correlation were generated to select the layers that will serve as input data for the Fuzzy C-Means algorithm using Software for Definition of Management Zones.

The Relative Efficiency and Variance Analysis parameters were used in order to carry out the evaluations.

## **RESULTS AND DISCUSSION**

For year-to-year unstable attributes, Mg layer was selected to generate management zones for all performed divisions. Despite this fact, when comparing yield data using analysis of variance, only the divisions in 2 and 3 sub-regions were considered different in average.

For stable attributes, sand layer was selected and did not show good results for the studied divisions as  $RE < 1$ , while ANOVA showed that the data sets had equal averages for almost all cases.

## **CONCLUSION**

The studied methodology allowed the generation of management zones that can serve as source of recommendation and soil analysis;

The program “Software for Definition of Management Zones- SDMZ” enabled a quick and easy creation of

management zones, despite the complexity of the applied methodology;

Despite the relative efficiency that showed reduced variance for all attributes in divisions in the three sub-regions, ANOVA presented no consistent results.

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