Geophysical Research Abstracts
Vol. 18, EGU2016-702, 2016
EGU General Assembly 2016

Application of spatial methods to identify areas with lime requirement in eastern Croatia

Igor Bogunović (1), Ivica Kisic (1), Milan Mesic (1), Zeljka Zgorelec (1), Aleksandra Percin (1), and Paulo Pereira (2)

(1) University of Zagreb, Faculty of Agriculture, Department of General Agronomy, Zagreb, Croatia (igor.bogunovic@gmail.com), (2) Environmental Management Center, Mykolas Romeris University, Vilnius, Lithuania (pereiraub@gmail.com)

With more than 50% of acid soils in all agricultural land in Croatia, soil acidity is recognized as a big problem. Low soil pH leads to a series of negative phenomena in plant production and therefore as a compulsory measure for reclamation of acid soils is liming, recommended on the base of soil analysis. The need for liming is often erroneously determined only on the basis of the soil pH, because the determination of cation exchange capacity, the hydrolytic acidity and base saturation is a major cost to producers. Therefore, in Croatia, as well as some other countries, the amount of liming material needed to ameliorate acid soils is calculated by considering their hydrolytic acidity. For this research, several interpolation methods were tested to identify the best spatial predictor of hidrolitic acidity. The purpose of this study was to: test several interpolation methods to identify the best spatial predictor of hidrolitic acidity; and to determine the possibility of using multivariate geostatistics in order to reduce the number of needed samples for determination the hydrolytic acidity, all with an aim that the accuracy of the spatial distribution of liming requirement is not significantly reduced. Soil pH (in KCl) and hydrolytic acidity (Y1) is determined in the 1004 samples (from 0-30 cm) randomized collected in agricultural fields near Orahovica in eastern Croatia. This study tested 14 univariate interpolation models (part of ArcGIS software package) in order to provide most accurate spatial map of hydrolytic acidity on a base of: all samples (Y1 100%), and the datasets with 15% (Y1 85%), 30% (Y1 70%) and 50% fewer samples (Y1 50%). Parallel to univariate interpolation methods, the precision of the spatial distribution of the Y1 was tested by the co-kriging method with exchangeable acidity (pH in KCl) as a covariate. The soils at studied area had an average pH (KCl) 4,81, while the average Y1 10,52 cmol+ kg-1. These data suggest that liming is necessary agrotechnical measure for soil conditioning. The results show that ordinary kriging was most accurate univariate interpolation method with smallest error (RMSE) in all four data sets, while the least precise showed Radial Basis Functions (Thin Plate Spline and Inverse Multiquadratic). Furthermore, it is noticeable a trend of increasing errors (RMSE) with a reduced number of samples tested on the most accurate univariate interpolation model: 3,096 (Y1 100%), 3,258 (Y1 85%), 3,317 (Y1 70%), 3,546 (Y1 50%). The best-fit semivariograms show a strong spatial dependence in Y1 100% (Nugget/Sill 20.19) and Y1 85% (Nugget/Sill 23.83), while a further reduction of the number of samples resulted with moderate spatial dependence (Y1 70% -35,85% and Y1 50% - 32,01). Co-kriging method resulted in a reduction in RMSE compared with univariate interpolation methods for each data set with: 2,054, 1,731 and 1,734 for Y1 85%, Y1 70%, Y1 50%, respectively. The results show the possibility for reducing sampling costs by using co-kriging method which is useful from the practical viewpoint. Reduced number of samples by half for determination of hydrolytic acidity in the interaction with the soil pH provides a higher precision for variable liming compared to the univariate interpolation methods of the entire set of data. These data provide new opportunities to reduce costs in the practical plant production in Croatia.