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Geostatistical modeling of uncertainty of the spatial distribution of available phosphorus in soil in a sugarcane field

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Phosphorus is one of the limiting nutrients for sugarcane development in Brazilian soils. The spatial variability of this nutrient is great, defined by the properties that control its adsorption and desorption reactions. Spatial estimates to characterize this variability are based on geostatistical interpolation. Thus, the assessment of the uncertainty of estimates associated with the spatial distribution of available P (Plabile) is decisive to optimize the use of phosphate fertilizers. The purpose of this study was to evaluate the performance of sequential Gaussian simulation (sGs) and ordinary kriging (OK) in the modeling of uncertainty in available P estimates. A sampling grid with 626 points was established in a 200-ha experimental sugarcane field in Tabapuã, São Paulo State, Brazil. The soil was sampled in the crossover points of a regular grid with intervals of 50 m. From the observations, 63 points, approximately 10% of sampled points were randomly selected before the geostatistical modeling of the composition of a data set used in the validation process modeling, while the remaining 563 points were used for the predictions variable in a place not sampled. The sGs generated 200 realizations. From the realizations generated, different measures of estimation and uncertainty were obtained. The standard deviation, calculated point to point, all simulated maps provided the map of deviation, used to assess local uncertainty. The visual analysis of maps of the E-type and KO showed that the spatial patterns produced by both methods were similar, however, it was possible to observe the characteristic smoothing effect of the KO especially in regions with extreme values. The Standardized variograms of selected realizations sGs showed both range and model similar to the variogram of the Observed date of Plabile. The variogram KO showed a distinct structure of the observed data, underestimating the variability over short distances, presenting parabolic behavior near the origin, characteristic of Gaussian model , which is characteristic of variables with smooth distribution in space. The statistics Egama of the selected realizations sGs, used to evaluate the accuracy in the reproduction of the variogram of the sample data by sGs and KO showed numerically that the realizations generated by sGs preserved the patterns of variability of the sample data, presented low values, ranging from 0.01 and 0.04, these being on average 240 times smaller than the value of 6.07 for an Egama obtained from KO. The goodness statistic (G) was used to assess the closeness of the estimated and theoretical fractions, indicated good agreement (0.81) between the values of simulated and observed fractions. The sGs realizations preserved the spatial variability of Plabile without the smoothing effect of the OK map. The accuracy in the reproduction of the variogram of the sample data obtained by the sGs realizations was on average 240 times higher than that obtained by OK. The uncertainty map, obtained by OK, showed less variation in the study area than that obtained by sGs. Thus, the evaluation of uncertainties by sGs was more informative and can be used to define and delimit specific management areas more precisely.