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Spatial variability of soil available phosphorous and potassium at three different soils located in Pannonian Croatia

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Information on spatial distribution of soil nutrients in agroecosystems is critical for improving productivity and reducing environmental pressures in intensive farmed soils. In this context, spatial prediction of soil properties should be accurate. In this study we analyse 704 data of soil available phosphorus (AP) and potassium (AK); the data derive from soil samples collected across three arable fields in Baranja region (Croatia) in correspondence of different soil types: Cambisols (169 samples), Chernozems (131 samples) and Gleysoils (404 samples). The samples are collected in a regular sampling grid (distance 225 x 225 m). Several geostatistical techniques (Inverse Distance to a Weight (IDW) with the power of 1, 2 and 3; Radial Basis Functions (RBF) - Inverse Multiquadratic (IMT), Multiquadratic (MTQ), Completely Regularized Spline (CRS), Spline with Tension (SPT) and Thin Plate Spline (TPS); and Local Polynomial (LP) with the power of 1 and 2; two geostatistical techniques -Ordinary Kriging – OK and Simple Kriging - SK) were tested in order to evaluate the most accurate spatial variability maps using criteria of lowest RMSE during cross validation technique. Soil parameters varied considerably throughout the studied fields and their coefficient of variations ranged from 31.4% to 37.7% and from 19.3% to 27.1% for soil AP and AK, respectively. The experimental variograms indicate a moderate spatial dependence for AP and strong spatial dependence for all three locations. The best spatial predictor for AP at Chernozem field was Simple kriging (RMSE=61.711), and for AK inverse multiquadratic (RMSE=44.689). The least accurate technique was Thin plate spline (AP) and Inverse distance to a weight with a power of 1 (AK). Radial basis function models (Spline with Tension for AP at Gleysoil and Cambisol and Completely Regularized Spline for AK at Gleysol) were the best predictors, while Thin Plate Spline models were the least accurate in all three cases. The best interpolator for AK at Cambisol was the local polynomial with the power of 2 (RMSE=33.943), while the least accurate was Thin Plate Spline (RMSE=39.572).