

ESTIMATION OF SOIL DTPA-EXTRACTABLE ZINC USING ARTIFICIAL NEURAL NETWORKS

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INTRODUCTION

The utilisation and management of natural soil resources require regional and local planning supported by information on the physicochemical characteristics of different soil types (M.Alvarez and et.al, 2006). The distribution of metals among soil components is important for assessing the soils potential to supply sufficient micronutrients for the growth of plant and to retain toxic quantities of heavy metals. The degree of metal association with different geochemical phases strongly depends upon the physico-chemical conditions of the soils, basically pH, %CaCO₃, cation-exchange capacity (CEC), nutrient status (competitive species in soil solution), organic matter content (OM) and texture (Kabata-Pendias,2001). The development of models simulating soil processes has increased rapidly in recent years. These models have been developed to improve the understanding of important soil processes and also to act as tools for evaluating agricultural and environmental problems. Consequently, simulation models are now regularly used in research and management (Minancy,2002). This study was conducted to develop predictive models to estimate the DTPA-extractable zinc concentration.

MATERIALS AND METHODS

soil samples were collected from 150 randomly selected cereal fields in the three provinces: Isfahan, Fars and Qom (from 50° 21' to 53° 4' E longitude and 28 °51 'to 35 ° 6' N latitude). Soil samples were taken from 0-20cm. The soils were analyzed for physico-chemical properties including pH, EC, %CaCO₃, soil texture, organic matter, available phosphorus, total nitrogen, and concentration of total and available zinc. These soil variables were used as model inputs. Then, multiple linear regression and neural network model (fitting net back-propagation network) were employed to develop a model for prediction of DTPA-extractable zinc concentration. Regression and neural networks analyses were done by means of the spss18 and Matlab8 software, respectively. The performances of the developed models were evaluated using various standard statistical performance evaluation criteria. The statistical measures were included the root mean square error (RMSE), model efficiency factor (MEF), mean absolute error (MAE), and correlation coefficient (R) between the measured and predicted DTPA-extractable zinc concentration values.

RESULTS AND DISCUSSION

The root mean square error (RMSE), mean absolute error (MAE), model efficiency factor (MEF) and correlation coefficient (R) between the measured and the estimated values using the ANN model were 0.025, 0.001, 0.88 and 0.94, respectively. Comparisons were made based on EF and correlation coefficient (R) between the measured and predicted values. In MLR analysis, the EF was -1.38 and a lower correlation coefficient of 0.38 was obtained in comparison with the ANN model. The performance comparison showed that ANN model have greater potential in predicting DTPA-extractable zinc concentration from soil characteristics, whereas linear regression methods did not perform well.

Key words: DTPA-extractable zinc concentration, Artificial neural networks, Regression

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