ABSTRAK

IDENTIFIKASI KADAR NITROGEN PADA LAHAN MARGINAL MENGGUNAKAN METODE JARINGAN SARAF TIRUAN (*BACKPROPAGATION*)

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Produktivitas pertanian di Indonesia sangat bergantung pada ketersediaan unsur hara tanah, khususnya nitrogen (N) yang berperan penting dalam pertumbuhan vegetatif tanaman. Namun, proses pengukuran kadar nitrogen total (N-total) tanah umumnya masih dilakukan di laboratorium, sehingga membutuhkan waktu, biaya, dan tenaga yang besar. Oleh karena itu, penelitian ini bertujuan untuk mengembangkan model Jaringan Saraf Tiruan (JST) yang mampu memprediksi kadar N-total tanah marginal berdasarkan parameter karakteristik tanah yaitu pH, kadar air, dan resistansi.Penelitian dilakukan menggunakan 96 data sampel tanah yang berasal dari lima jenis lahan berbeda: tanah pasca perkebunan sawit, tanah pesisir pantai, tanah ultisol, tanah podsolik merah kuning, dan tanah tailing pasca tambang timah. Model JST dikembangkan menggunakan algoritma *backpropagation* dengan fungsi pelatihan trainbr (*Bayesian Regularization*) dan variasi arsitektur dua lapisan tersembunyi *(hidden layer)* berjumlah neuron 5–5, 8–8, dan 12–12. Kombinasi fungsi aktivasi yang diuji meliputi logsig–logsig, logsig–tansig, tansig–logsig, dan tansig–tansig.

Hasil pengujian menunjukkan bahwa konfigurasi terbaik diperoleh pada kombinasi fungsi aktivasi tansig–tansig dengan jumlah neuron 8–8 menghasilkan performa paling optimal. Model ini kemudian diimplementasikan dalam Graphical User Interface (GUI) menggunakan perangkat lunak MATLAB, Hasil validasi sistem menunjukkan nilai R^2 sebesar 0,9324 dan RMSE sebesar 0,0476, yang menandakan bahwa sekitar 93,24% variasi kadar nitrogen aktual dapat dijelaskan oleh model JST ini.

Kata kunci: *Backpropagation*, GUI, Jaringan Saraf Tiruan, MATLAB, Nitrogen, Tanah Marginal.

ABSTRACT

IDENTIFICATION OF SOIL NITROGEN CONTENT IN MARGINAL LAND USING AN ARTIFICIAL NEURAL NETWORK (BACKPROPAGATION)

By

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Agricultural productivity in Indonesia highly depends on the availability of soil nutrients, particularly nitrogen (N), which plays a crucial role in vegetative plant growth. However, the measurement of total soil nitrogen (N-total) is generally conducted through laboratory analysis, requiring considerable time, cost, and labor. Therefore, this study aims to develop an Artificial Neural Network (ANN) model capable of predicting N-total content in marginal soils based on soil characteristics parameters, namely pH, moisture content, and resistivity. Total of 96 soil samples were collected from five different land types: post-oil palm plantation soil, coastal soil, ultisol, red-yellow podzolic soil, and post-tin mining tailing soil. The ANN model was developed using the Backpropagation algorithm with the trainbr (Bayesian Regularization) training function and various architectures consisting of two hidden layers with 5–5, 8–8, and 12–12 neurons. The activation function combinations tested included logsig–logsig, logsig–tansig, tansig–logsig, and tansig–tansig.

The experimental results showed that the best configuration was obtained using the tansig–tansig activation function with 8–8 neurons, providing the most optimal performance. The model was then implemented in a Graphical User Interface (GUI) using MATLAB software. System validation results showed an R^2 value of 0.9324 and an RMSE of 0.0476, indicating that approximately 93.24% of the actual nitrogen content variation could be explained by the ANN model.

Key words: Artificial Neural Network, Backpropagation, GUI Nitrogen, MATLAB, Marginal Soil.