

基于数据包络分析和人工神经网络的变量施肥决策方法研究

Decision making method for variable-rate fertilization based on data envelopment analysis and artificial neural network

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中文摘要:

采用数据包络分析(DEA)方法评价玉米施肥单元的投入产出技术效率,把非DEA有效的单元进行投影,使之DEA有效,所获得的投影数据供神经网络训练使用。建立3层BP神经网络模型,以土壤养分和产量为输入,以施肥量为输出,并结合输入输出的价格因素扩展模型,实现利润最大化决策。该模型既为充分使用所有试验数据引入了可行方法,又弥补了传统施肥决策方法中非线性关系描述的不足。应用表明,该模型可以揭示施肥单元的需肥特性和提供最佳施肥方案,目标产量不超过9750 kg/hm²时,预测结果较合理。

英文摘要:

Data Envelopment Analysis(DEA) method was used to evaluate technical efficiency of input and output of the corn fertilizing unit, and to turn the inefficient unit into effective unit through projections. Then all the data were well prepared for the Artificial Neural Network(ANN) by this way. In Matlab program, BP ANN model with three layers was developed with soil nutrients and yield as inputs, and with fertilizer application rate of nitrogen, phosphorus and potassium as outputs. Automated regularization function tainbr was chosen to train the network, and the decision making model of variable-rate fertilization could be obtained by this way. The model can also consider the price factors as input and output to enlarge its function to make decision to achieve the maximum profits. In other words, the model can not only introduce an effective method to utilize all the experimental data, but also can solve the non-linear problems that cannot be solved by traditional decision method. The application shows that the model can describe the fertilizer demand property and provide optimum scheme of fertilization for every fertilizing unit. When aim yield is not higher than 9750 kg/hm², the estimation result is quite reasonable.

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