Mathematical and Computer Modelling 54 (2011) 1100–1106

Contents lists available at ScienceDirect

Mathematical and Computer Modelling

journal homepage: www.elsevier.com/locate/mcm

The design of an optimal decision-making algorithm for fertilization

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ARTICLE INFO

Article history:
Received 16 September 2010
Accepted 4 November 2010

Keywords:
Fertilization algorithm
Optimal decision-making
Multiple linear regression
Least squares regression
Kriging interpolation

ABSTRACT

Aiming to solve the problem of crop yield forecasting and accurate fertilization, this paper presents a method based on optimized design ideas about fertilization decision-making. The algorithm is based on a variety of fertilizer function fittings, and weighting optimal solutions to obtain the fertilizing amount. The algorithm in this paper which uses the interpolation algorithm improves the rationality and reliability of fertilization by solving the problem of which need large-scale test, and large computation so as to become difficult to implement. This algorithm is composed of three sub-programs. One or some of its sub-programs can be used flexibly. The goals to access better economic efficiency with less inputs can be achieved.

1. Introduction

In recent years, with GIS and computer technology being widely used in the study of fertilization, many fertilization expert systems have been developed. Some fertilization systems have as many as 52 fertilization standards, and some fertilizer software can provide consulting services on 11 nutrients of 140 crops [1]. However, because these systems have some shortcomings and limitations, it is difficult for them to become popular. The knowledge of fertilization can be extracted and organized by an artificial neural network algorithm system [2]. Large samples of training data will improve the universality of this algorithm but degrade the fitness of the artificial neural network [3]. Fertilization decision-making systems can predict fertilizer amounts [4] by the support vector machine (SVM) algorithm system; the bottleneck of Fuzzy Modeling is the acquisition of fuzzy rules.

At present, three fertilization models are widely used, and have good results, and they have their own advantages and disadvantages [5]. (a) The Soil Fertilizer nutrient balance model is based on soil nutrient and yield goals in decision making. However, crop yield, soil nutrients and other factors, make the model show highly nonlinear relationship and reduce the accuracy of algorithm [6]. (b) The Dissimilar Subtraction method of soil fertility is designed to carry out fertilization methods according to an equal relationship between the fertilizer production rate and difference of target yield and the blank yield. The advantages of the dissimilar subtraction method is that it does not need soil tests, so we can avoid the trouble of the quarterly measurements of soil nutrients, also it is easier to calculate. But the blank field yield is the decision factor of the combined result of various yield factors, and we cannot get the exact value of fertilization according to the production forecast, so the test results can be biased easily. (c) The Soil Fertilizer Effect Function method including "3414" fertilizer experiments is widely used at home and abroad, and is a statistical model about fertilization and crop yield, which is able to calculate a crop's optimal yields in theory and the corresponding fertilization amounts. The soil fertilizer effect function method has a variety of mathematical function models, applicable to different crops, but sometimes it is prone to saddle surface, and has big deviation when predicting fertilization [7].

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0895-7177/$ – see front matter
doi:10.1016/j.mcm.2010.11.041