变量穴施水穴播机的变量施水数学模型 Mathematic Models of Water Application for a Variable Rate Irrigating Hill-seeder

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关键词： 穴施水穴播机 变量施水 数学模型 人工神经网络

摘 要： 根据变量穴施水穴播机使用要求，建立了最小施水量数学模型和电磁阀控制时间数学模型。在自行开发的变量穴施水穴播机上进行静态试验，通过改变水箱水量、施水时间，获得不同的施水量。分别采用回归分析和人工神经网络预测2种方法，研究了水箱水量、施水时间及施水量之间的关系，建立了电磁阀控制时间的数学模型。回归试验表明，在水箱水量处于满箱、半箱和1/8箱容积3种状态时，所对应的电磁阀控制时间线性回归模型的调整判定系数R2依次为0.992、0.991和0.998，具有较高的拟合度。对回归方程进行的F检验结果表明，F计算值远大于查表值，回归方程极显著。采用2-5-1型拓扑结构的人工神经网络对施水时间进行预测，结果表明，拟合的最大偏差为3.95ms，平均偏差仅为1.46ms，网络结构具有较高的预测精度。 Variable rate irrigating hill-seeder can automatically adjust the amount of the irrigating water according to the variation in soil moisture content in the field to alleviate drought and save water. Mathematical models for minimizing water application and determining the control time of the electromagnetic valve are developed. Static experiment is conducted with the developed variable rate irrigating hill seeder. Changing water amount in tank and irrigating time, the water amount ejected from the electromagnetic valve varies. The mathematical models for the control time of the electromagnetic valve are established based on the relations among water amount in tank, irrigating time and water amount supplied using linear regression and artificial neural networks. Regression results show that the adjusted coefficients of determination for the linear regression models are 0.992, 0.991 and 0.998 when the tank is 100% full, 1/2 full and 1/8 full, respectively. A 2-5-1 artificial neural network is used to predict irrigating time. The network provides high prediction accuracy with a maximum deviation of 3.95ms and an average deviation of 1.46ms.

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