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应用土壤质地预测干旱区葡萄园土壤饱和导水率空间分布

Predicting spatial distribution of soil saturated hydraulic conductivity by soil texture on vineyard in arid reg

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中文关键词: 土壤 水分 统计方法 土壤饱和导水率 空间变异 葡萄园 空间相关

英文关键词:soils moisture statistics methods soil saturated hydraulic conductivity spatial variability vineyard spatial correlation

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中文摘要:

田间表层土壤饱和导水率的空间变异性是影响灌溉水分入渗和土壤水分再分布的主要因素之一，研究土壤饱和导水率的空间变化规律，有助于定量估计土壤水分的
分布和设计农田的精准灌溉管理制度。为了探究应用其他土壤性质如质地、容重、有机质预测土壤饱和导水率空间分布的可行性，试验在7.6 hm2的葡萄园内，采用均
格25 m×25 m与随机取样相结合的方式，测定了表层（0～10 cm）土壤饱和导水率、粘粒、粉粒、砂粒、容重和有机质含量，借助经典统计学和地统计学，分析了表层
饱和导水率的空间分布规律、与土壤属性的空间相关性，并对普通克里格法、回归法和回归克里格法预测土壤饱和导水率空间分布的结果进行了对比。结果表明：1）
饱和导水率具有较强的变异性，平均值为1.64 cm/d，变异系数为1.17；2）表层土壤饱和导水率60%的空间变化是由随机性或小于取样尺度的空间变异造成；3）土壤饱
水率与粘粒、粉粒、砂粒和有机质含量具有一定空间相关性，而与土壤容重几乎没有空间相关性；4）在中值区以土壤属性辅助的回归克里格法对土壤饱和导水率的预
度较好，在低值和高值区其与普通克里格法表现类似。研究结果将为更好地描述土壤饱和导水率空间变异结构及更准确地预测其空间分布提供参考。

英文摘要:

Abstract: The surface soil saturated hydraulic conductivity on farmland is one of the most important factors affecting water infiltration and distribution in soils and is also an important parameter in most soil water flow models. Previous studies have shown that saturated hydraulic conductivity is a highly spatial varied parameter under field conditions. Therefore, understanding and quantifying spatial variability at field scale is valuable to better simulate soil water movement dynamics through incorporating spatially-distributed saturated hydraulic conductivity into soil water flow models. This could help to evaluate impacts from different management practices and to develop precision irrigation manager practices. The objectives of this study were to characterize spatial variability of the surface soil saturated hydraulic conductivity and explore its potential association with soil properties. The experiment was conducted on a 7.6 hm2 vineyard in an arid region of northwest China. Soil saturated hydraulic conductivity and other properties (clay, silt, sand, s bulk density and organic matter) were measured for 0 - 10 cm soil of the geo-referenced points, which were located on a regular grid of 25 m × 25 m. At each sampling point, the sc saturated hydraulic conductivity was determined by the variable water level method. Spatial structure of spatial saturated hydraulic conductivity was described by a fitted variogr model based on a computed sample variogram, and possible spatial relationship between saturated hydraulic conductivity and other soil properties were evaluated through cross correlograms. The regression kriging, based on step-wise linear regression of the saturated hydraulic conductivity with other soil properties, was used to predict spatial saturated hydraulic conductivity. I Its performance was compared to ordinary kriging and simple linear regression methods based on ME and RMSE computed from observed and predicted saturated hydraulic conductivity values. For this study, 70% of the measured data of the 135 sampled points were randomly selected to calibrate the models while the remaining 3(were used as a validation dataset, and the same calibration and validation datasets were used for the different methods. Main results from the study were: 1) according to descript statistics analysis, the soil saturated hydraulic conductivity showed strong spatial variability with mean of 1.64 cm/d and CV of 117% and the CV value was over 10 times larger th that of other soil properties; 2) the sample variogram was best fitted by an exponential variogram model, and the results showed that the correlation range was about 165 m which comparable with results from other studies in fields with the similar size. The results also showed that about 60% of surface soil saturated hydraulic conductivity variability could attributed to random variability from measurement error or sampling variability at distance shorter than our sampling distance; 3) the correlation analysis showed that soil saturate hydraulic conductivity was significantly correlated with silt, sand, clay and organic matter content and the correlation length was about 120 m while uncorrelated with soil bulk de 4) among the four prediction methods, regression-kriging performed the best in the medium zone where saturated hydraulic conductivity was between the first and third quartiles values, and performed similarly with ordinary kriging at both lower and higher zones.