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长期定位施肥条件下作物光谱特征及养分吸收量预测

Canopy spectral characteristics of crops and prediction on main nutrients uptake in long-term fertilization experiment

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中文摘要:

为了明确不同施肥条件下典型生育期冬小麦和夏玉米冠层光谱特征差异，该研究以长期定位施肥试验为研究对象，在确定典型生育期作物冠层光谱反射率与收获期作物地上部分主要养分吸收量相关性的基础上，建立收获期作物主要养分吸收量预测模型。结果表明，可见光波段相似生育期夏玉米冠层光谱反射率与冬小麦相近，但在近红外区域平均高于冬小麦8.42%。生育中期2种作物秸秆、籽粒及地上部分氮（N）、磷（P）、钾（K）吸收量与冠层光谱反射率在可见光波段普遍呈极显著负相关关系，在近红外波段呈极显著正相关关系。全生育期夏玉米冠层光谱反射率与作物吸氮量的相关系数在可见光波段基本持平，但在近红外波段平均高于冬小麦0.4152。全生育期夏玉米冠层反射率与地上部分吸磷量的相关系数在可见光波段和近红外区域较冬小麦平均分别低0.3621和0.2072。全生育期夏玉米冠层光谱反射率与地上部分吸钾量相关系数在可见光波段平均低于冬小麦0.1270，在近红外波段高于冬小麦0.0341。除夏玉米吸磷量外，基于冬小麦和夏玉米典型生育期冠层光谱反射率建立的模型均可准确预测收获期作物主要养分吸收量，且对冬小麦养分吸收量的预测精度略高于夏玉米，该结论可以为黄淮海地区冬小麦和夏玉米的长势监测和肥料管理提供科学依据。

英文摘要:

Abstract: Nitrogen (N), phosphorus (P) and potassium (K) are the necessary nutrients for the plant growth. To save the cost and minimize ecological impact of fertilizer application, it is important to use variable rate of fertilizer management to address differences in plant nutrients requirements. The objective of this study was to develop a model to predict winter wheat and maize N, P, and K uptake based on canopy spectral reflectance from a long-term fertilizer experiment in Huang-Huai-Hai area. The relationship between total N, P, and K uptake at harvesting stage and canopy spectral reflectance of winter wheat and summer maize at four typical growth stages were established so that plant nutrient uptake can be predicted based on the spectral reflectance. The results showed that the reflectance value of summer maize were similar to the value of winter wheat in visible light at the corresponding stages, but its average was 8.42% higher than winter wheat in near- infrared region. There were significant negative correlations between main nutrients uptake of crops and canopy spectral reflectance, in contrast, there were significant positive correlations between those at near-infrared region. The average correlation coefficients between the reflectance of summer maize and N uptake were similar to winter wheat at visible light at whole stage, but it was 0.4125 higher than winter wheat in near-infrared region. The average correlation coefficients between the reflectance of summer maize and P uptake were 0.3621 and 0.2072 lower than winter wheat at visible light and near-infrared region, respectively. The average correlation coefficients between the reflectance of summer maize and K uptake were 0.1270 lower than winter wheat at visible light, and it was 0.0341 higher than wheat winter in near-infrared region. Then, the stepwise regression was used to generate equations for the estimation of major nutrients requirement of winter wheat and summer maize from the canopy reflectance. The results showed that except for P uptake of summer maize, other major nutrients uptake of two crops could be predict at four different growth stages. The results can provide a tool for nutrient management of winter wheat and summer maize in Huang-Huai-Hai region of China.

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