

基于光谱分析的玉米氮素营养诊断

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Nitrogen Nutrition Diagnosis for Corn Based on Spectral Analysis

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摘要

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摘要 利用光谱技术实时、快速、无损监测作物氮素营养状况是现代农业的研究热点之一。试验根据玉米氮素营养的生理特点,在关键生育期有针对性地选择第6片完全展开叶和第12片完全展开叶(果穗叶)进行光谱监测。结果表明,被考察的19个光谱特征参量中,红边斜率(Dr)、绿峰最大反射率(Rg)、比值植被指数(RNIR/Red)和归一化差值植被指数(R(NIR-Red)/(NIR+Red))与叶片氮含量均存在较好的相关关系。考虑到诊断模型的简单实用性,选择RNIR/Red与叶片氮含量建立估测模型。根据RNIR/Red在玉米生育前期和后期与不同叶片氮含量的相关性,确立在玉米生育前期以第6片完全展开叶为诊断对象;在生育后期以第12片完全展开叶(果穗叶)为诊断对象。经过回归分析和验证,RNIR/Red与叶片氮含量建立的对数模型和指数模型分别在生育前期和生育后期具有较高的可靠性和稳定性,确立玉米生育前期以对数模型,生育后期以指数模型为氮素营养的光谱诊断模型。该结果为研发低成本便携式作物氮素营养光谱诊断仪提供依据。

关键词: 玉米 氮素营养 光谱特征参量 诊断模型

Abstract: The spectrum technology is one of modern agriculture research focuses, which can be used for real time, fast, nondestructively monitoring crops nitrogen nutrition condition. The spectral diagnosis models were constructed on the leaf blade level for corn nitrogen nutrition on the base of the whole pooled experimental data. In this study, according to the physiological characteristics of corn (*Zea mays* L.) nitrogen nutrition, the 6th and 12th (fruit leaf) full expanded leaf were acted as observed object using the spectrum technology at the key growth stages. The results show that among 19 spectral characteristic parameters, there are better correlations between leaf nitrogen content and the red edge slope (Dr), green summit maximum reflectance (Rg), ratio vegetation index (RNIR/Red) and normalized difference vegetation index (R(NIR-Red)/(NIR+Red)), respectively. In view of simpleness and practicality of the diagnosis models, ratio vegetation index (RNIR/Red) is chosen to act as spectral variable for leaf N content determination. The correlation relationship between RNIR/Red and different leaf N content is higher in the 6th leaf than that in the 12th leaf at the early growth stage, and higher in the 12th leaf than in the 6th leaf at the late growth stage. Therefore, the 6th full expanded leaf is acted as object for nutritional diagnosis at the early growth stage, and the 12th full expanded leaf is acted as object for nutritional diagnosis at the late growth stage. Passed through regression analysis and validation, logarithmic model and exponential model with variables RNIR/Red and leaf N content have high reliability and stability at the early growth stage and at the late growth stage, respectively. So those models with variables, RNIR/Red and leaf N content, are regarded as diagnosis models for corn nitrogen nutrition at different growth stages. These results are provided with practical significance for researching and exploiting low cost and portable crop nitrogen nutrition diagnosis instrument.

Keywords: Corn N nutrition Spectral characteristic parameters Diagnosis model

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