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研究论文

用机器视觉技术获取棉花叶片叶绿素浓度

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摘要 运用机器视觉技术获取棉花叶片颜色特征，建立棉花叶片叶绿素测定模型。研究表明，（1）RGB颜色系统的B/R、色度坐标b、b/r值及HIS彩色系统中的饱和度S值均与棉叶叶绿素含量显著或极显著相关，可用于测定叶片叶绿素浓度；（2）棉花叶片正、背面RGB、HIS颜色系统的颜色特征值与叶绿素浓度的相关性高度一致，且叶片背面的颜色特征值与叶绿素浓度之间的相关性更高；（3）基于机器视觉技术建立和筛选出了6组棉叶叶绿素含量预测模型，预测误差在7.8%~13.65%之间。为棉花生长的快速监测提供了依据。

关键词 机器视觉 RGB HIS 棉花叶片 叶绿素浓度

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Acquired Chlorophyll Concentration of Cotton Leaves with Technology of Machine Vision

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Abstract The technology of machine vision monitoring crop morphological and physiological status has been tremendous potential by applied with its advantage of simple, convenient, quick, nondestructive and no-site measurement. The color characteristics of leaf as better indexes have been used to diagnose the nutrition status of wheat and rice in field condition. A field study was conducted at the Experiment Station of Institute of Crop Sciences, CAAS in 2004, with cotton. The study aimed at predicting chlorophyll concentration under field conditions using the machine vision technology, establishing the foundation to make the portable field diagnosed instruments of measuring chlorophyll. The images of leaf were taken by digital camera at the boll forming and the beginning of boll opening stage, respectively. The color characteristics of leaf images were extracted with the image processing software. The data showed that the significant positive correlations were found between the B, B/R, b, b/r and chlorophyll concentration (Table 1 and Fig.1) in the RGB system and between the saturation(S) and chlorophyll concentration (Fig.2) in the HIS color system, which were highly consistent (Table 4) for both sides of leaf. The correlated degree with chlorophyll was higher when the color parameters were transformed. The B, B/R, B, b/r and S of cotton leaf could be used as an easy and fast tool to predict chlorophyll content. Furthermore, 12 sets statistic correlation model with color characteristics were developed (Table 2, 3), and six of them were chosen according to the determination coefficients. The predicted accuracy of six sets model were tested, the related error was from 7.8 to 13.65% (Table 5). The predicated accuracy is higher than that of SPAD in the whole leaf level. These influenced factors on predicted accuracy such as camera condition, cotton variety, water and nutrition were discussed. How the applications of the method are extended from single leaf to canopy level needs to be studied farther.

Key words Machine vision RGB HIS Cotton Chlorophyll

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