

基于夫琅和费暗线原理的太阳诱导叶绿素荧光仪 Development of a Solar-induced Chlorophyll Fluorescence Monitor Based on Fraunhofer Line Principle

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关键词: 太阳诱导叶绿素荧光 仪器 夫琅和费暗线原理 光谱

摘要: 叶绿素荧光技术是探知植物生理状态及其与环境关系的理想方法。太阳诱导叶绿素荧光可以利用夫琅和费暗线原理进行提取。阐述了夫琅和费暗线探测自然光条件下光合作用荧光的基本原理和方法, 以及波长760nm叶绿素荧光探测仪的光学系统、仪器硬件组成及其各部分功能、仪器的软件设计。通过与ASD地物光谱仪器的对比试验表明, 研制的太阳诱导叶绿素荧光测量的数据与地物光谱仪测量的数据相关系数都大于0.9。基于夫琅和费暗线原理的太阳诱导叶绿素荧光探测仪器提供了一种低成本、实时测量作物冠层太阳诱导叶绿素荧光的方法和仪器。A portable solar-induced chlorophyll fluorescence monitor based on this principle was developed and tested. The instrument uses sunlight as its light source. There are two sets of photoelectrical detectors with the center wavelength at 760nm and 771nm respectively and the bandwidth of each detector is 1nm. Both sets of detectors are composed of an upper detector which are used for detecting incidence sunlight and a bottom detector which are used for detecting reflected light from the canopy of crop. The detector is the core of the monitor to measure the spectrums at special bands. The microprocessor calculates solar-induced fluorescence value based on the A/D values obtained from detectors. And the value can be displayed on the LCD, stored in the flash memory and uploaded to PC through the PC's serial interface. The prototype was tested in the crop field at different view directions and the results demonstrated that the instrument could measure the solar-induced chlorophyll value accurately with the correlation coefficients higher than 0.9 compared with the values obtained from analytical spectral devices FieldSpec Pro NIR spectrometer.

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