Hand Held Spectroradiometer

bonsai ADVANCED TECHNOLOGIES

HH-S / F

Features

- High sensitivity, detector quantum efficiency reach up to 60%, NIR sensitivity is 40% higher than traditional, PDA detector
- Fast speed, each sampling time< 10 ms
- Light weight and flexible optic fiber probe
- Built in the second order sorting fiAlm or filter, high accuracy
- Dynamic dark current correction, reduce noise
- Display probe inclined angles, laser indicator indicates probe direction, easy to adjust
- Water proof can avoid damage
- Exclusive handheld case easy to carry
- Touch screen control and Android software

Application

- Geography, Mining exploration
- Remote Sensing Measure
- Agriculture Monitor
- Forestry & oceanographyResearch

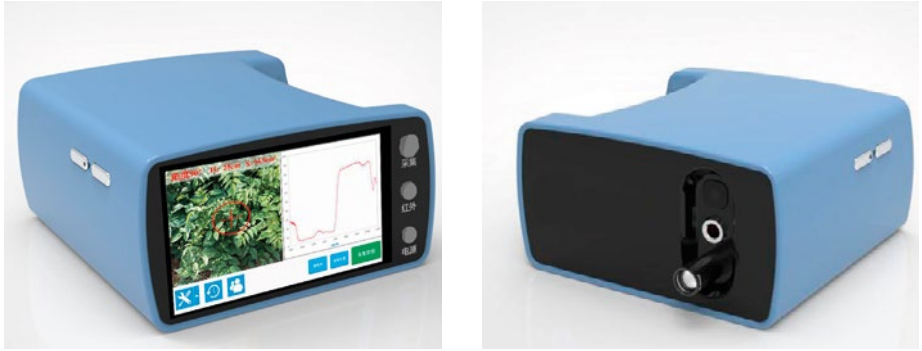
Description

HH- S is a new handheld hyperspectral field spectroradiometer that employs spectral range between 300-1100nm, and it's applied to fields of remote sensing measurement, crop monitoring, research of forest and oceanography etc.

HH- S is field spectroradiometer employs high performance, fast and accurate measurement, easy to operate and held etc. It's configured powerful software package, and applied to measurement of reflectance,radiometry,photometry and colorimetry.

Model	Description
HH-S	Universal FieldSpec
HH-S F	Adding functions of capture distance & area

1 Handheld FieldSpec HH-S



2HandheldFieldSpec HH-S F (capturedistance&area)

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Fig1. FieldSpec&Hyperspectralinfieldco-working

HH-S / F

1. Performance

Detector	
Type	Linear CMOS sensor
Detector	2048 CCD
Optical Parameters	
Spectral Range	300-1100 nm
Wavelength Accuracy	3 0.5 nm
Spectral Resolution	1.4 nm@756nm
FOV	Tiny FOV lens 1º/8º/15º/25ºoptional
Indicate laser wavelength	650 nm
Indicate laser power	5 mW
SNR	>800
Spectral Sampling Interva	0.4nm
Hardware spectral averag	Highest up to 100,000 times
Electrical parameters	
Operation system	Android 6.0
Camera	13-mega front camera
LCD Screen	5"HD 720*1080 capacitive screen
Integration Time	1 – 10 s/ auto integration time
Data Export Port	TYPE-C3.0 /USB 2.0, bluebooth
Angle data	MC3430 gyroscope optical measure angle: 0°-180°
Power supply	Built-in Li battery 5200maH
Charging	USB 5V Charger
Battery life span	>4H
Working Current	<800mA
Storage Temp.	-20°C～ +65°C
Operating Temp.	-10 ～ 45 oC
Working Humidity	< 90%RH
Physical Parameters	
IP level	IP65
Dimension	151×157×85mm
Weight	1.1Kg

2. FieldSpec Pictures

Fig 2 HHSF User Interface (Screenshot),
the left image area circled in red triangle, the right reflectance spectrum

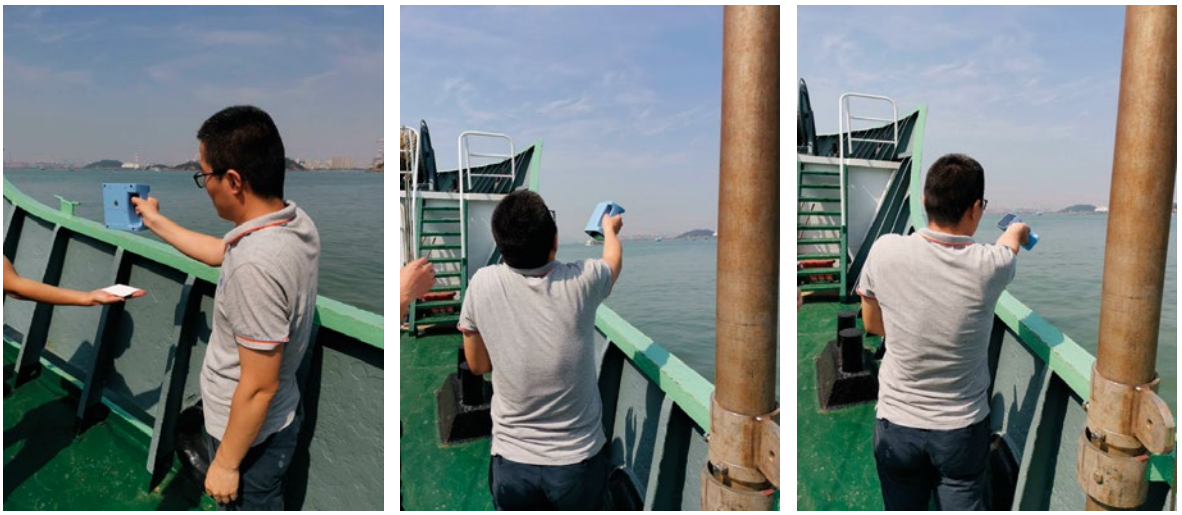

Fig 3 FieldSpec measure “Red Tide” on the ship on May 11-16, 2020

Fig 4 HH-S FieldSpec measure in field

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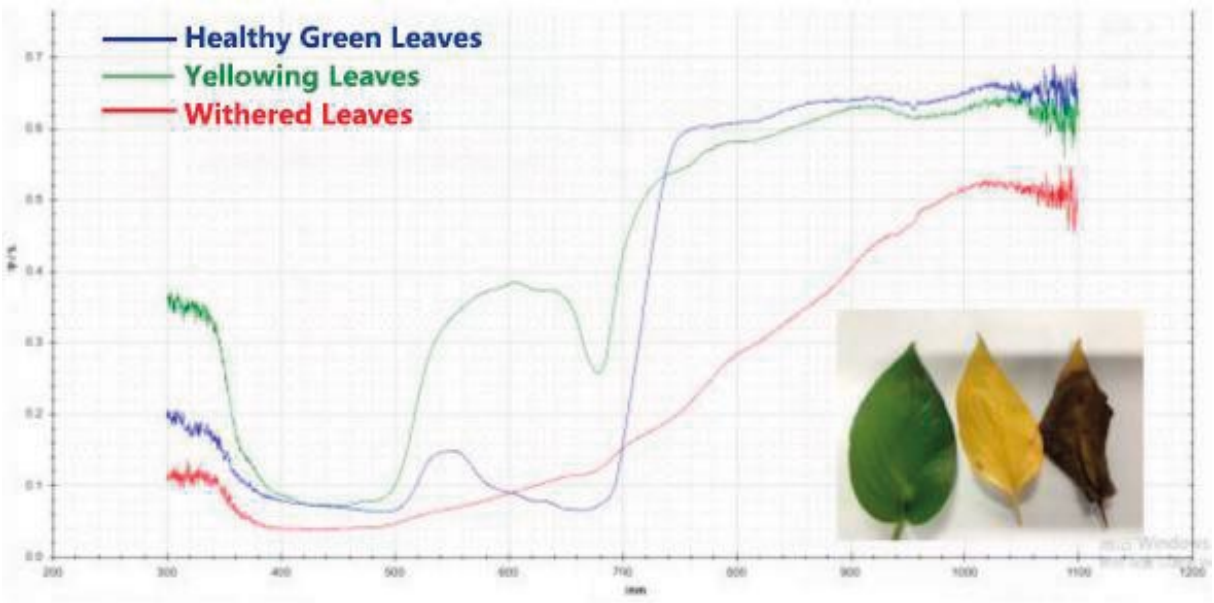

Fig 5 FieldSpec Hand Held measure Healthy, yellowing and withered leaves

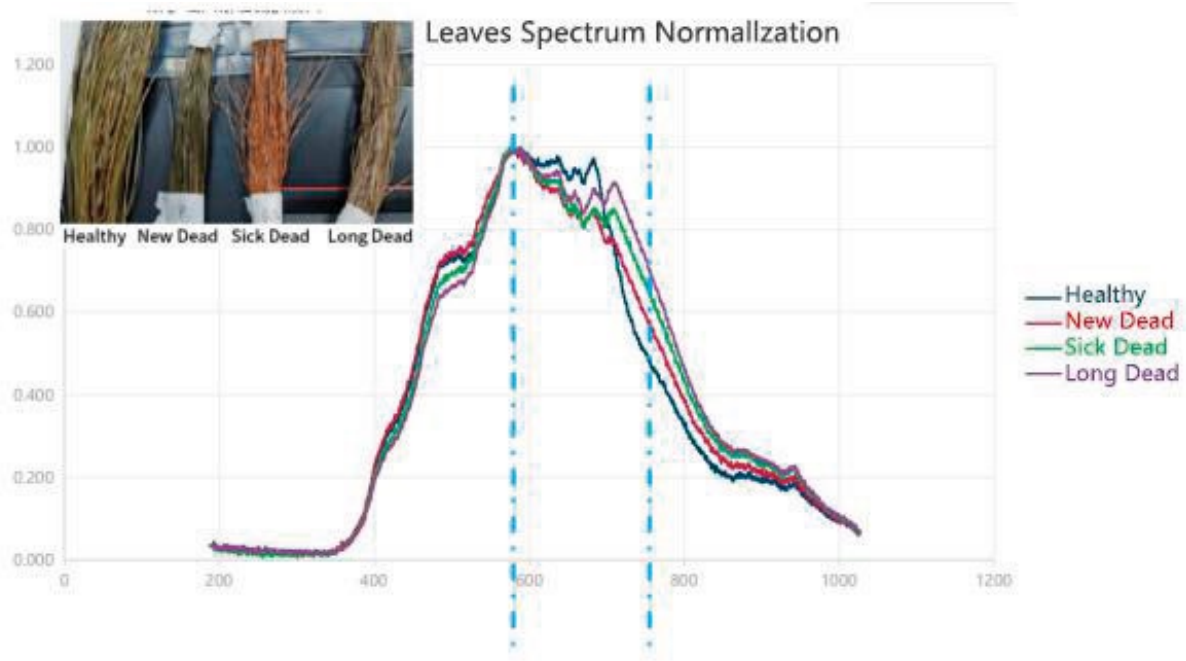

Fig 6 FieldSpec HH measures Healthy, dead, sick dead, dead long time branches

HH-S / F

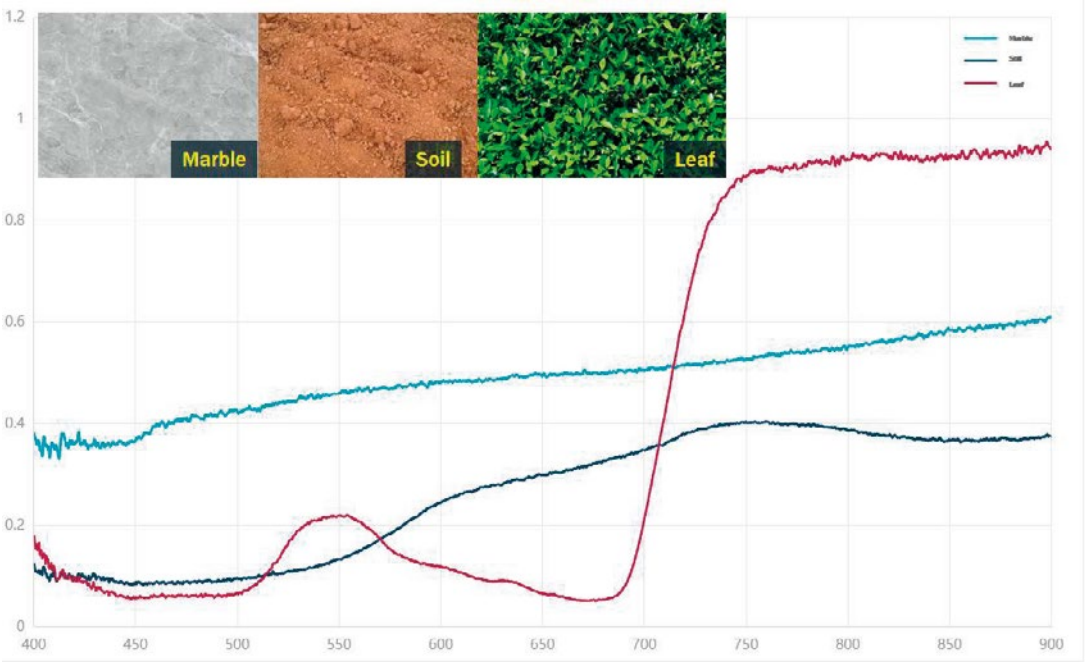

Fig 7 HH-S measure marble, soil, and leaves spectra

3. Attachment

Standard Attachment	
1	USB Data wire
2	Field fiber patch cable
3	Exclusive PC software
4	Charging adaptor 5V/3A
5	Cosine lens
6	FOV 25º
7	Standard Board
8	Carry case
9	White board box
Optional Attachment	
1	FOV，1º/5º/8º/10º/15°（Optional）
2	Reflectance Probe+leave clip Reflectance measure attachment
3	Indoor Light Source
4	Halogen lamp attachment case/ATG1021 INT:12V
5	Measure holder+integration sphere measure transmittance
6	Cuvette holder for water quality absorption measure
7	Intelligent measure distance & area system (Only for HH-S F)
8	Standard white board 99% Reflectance 10cm*10cm (Customized)
9	White Board 60% Reflectance 10cm*10cm (Customized)

4. Application

4.1. FieldSpec applied to Oceanic and Water Quality

Red tide is an ecological abnormal phenomenon caused by the sudden proliferation or accumulation of certain phytoplankton, protozoa or bacteria in the seawater in a short period of time under certain environmental conditions. In recent years, toxic red tides have occurred frequently and have been expanding in scale, seriously affecting coastal fisheries, aquaculture and marine ecological environment. Red tide toxins also threaten the safety of human life.

Marine Phaeosporium, Skeletonema costatum, and Leptophyllum denmark are three types of phytoplankton that cause red tides. Red worms are currently the only reported protozoa that can form red tides. They are colorless and feed on phytoplankton. ; Phytoplankton pigments (mainly chlorophyll, carotene and other ancillary pigments), inorganic suspended particulate matter, and colored dissolved organic matter are the three major factors that determine the optical properties of seawater, which together affect the ocean's out-of-water radiation information (such as remote sensing reflectance spectroscopy)), considering the spectral properties of these three aquatic elements. From the perspective of spectral morphology, in the ange of 400~900 nm, different types of red tide spectra show obvious bimodal distributions, especially the second reflection at 687~728nm. The peak is the characteristic reflection peak that distinguishes the red tide water spectrum from the normal sea water spectrum. This has been successfully used in the red tide detection algorithm based on aerial hyperspectral remote sensing.

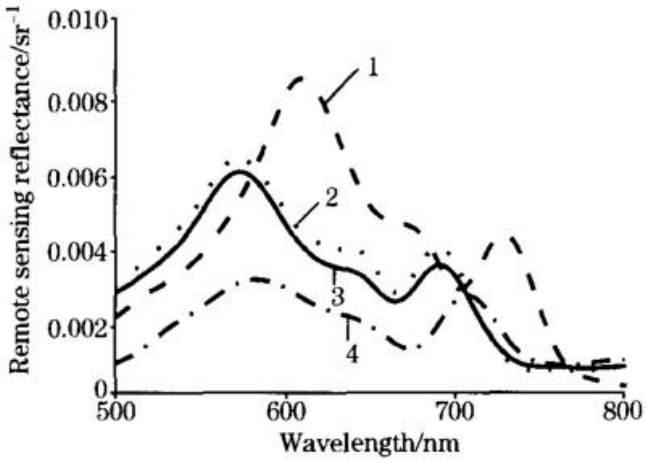

Fig 8 Spectra of different types of red tide 1: Red worms; 2: Skeletonema costatum; 3: Leptocylindrica denmark; 4: Marine Phaeosporium

1) The relatively high concentration of inorganic suspended matter is the main reason for the first reflection peak at

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1) The relatively high concentration of inorganic suspended matter is the main reason for the first reflection peak at 570~585 nm. Due to its strong light scattering effect, the reflection peak of chlorophyll at 550 nm is obliterated, making it invisible from the spectral curve. The ground shows that the appearance of higher concentration of inorganic suspended matter is directly related to the nearshore of the experimental sea area.

2) Phycocyanin (Phycocyanin), an accessory pigment, absorbs at 615~630nm to form a shoulder peak of the reflection spectrum near the wavelength of 640 nm.

3) The absorption peak near 670 nm originates from the strong absorption of chlorophyll.

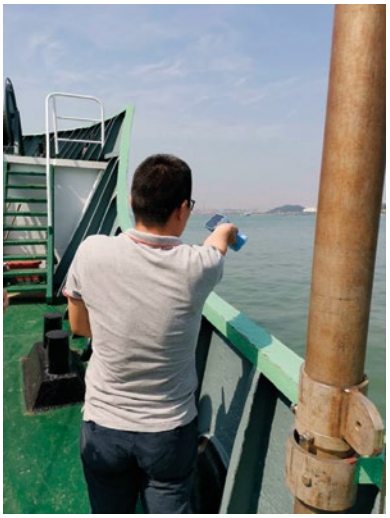
4) The second reflection peak of the red tide water spectrum has nothing to do with the presence and content of yellow substances and suspended sediments, and is attributed to the fluorescence characteristics of chlorophyll in this band.

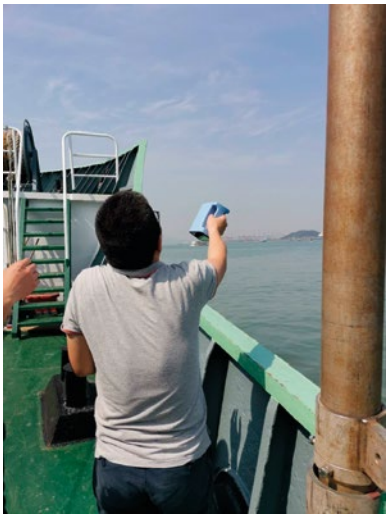
5) In the previous ocean optics research, it is generally believed that the fluorescence peak of chlorophyll is at 685nm. In recent years, experimental observations and spectral simulation studies have shown that as the concentration of chlorophyll a increases, the fluorescence peak intensity increases at the same time that the fluorescence peak The emission wavelength will also be red-shifted.

6) The small reflection peak of the spectral curve near 800 run is caused because pure water has a minimum value of absorption in this waveband.

HH-S handheld hyperspectral surface object spectrometer (field spectroradiometer) is the latest product of BONSAI ADVANCED, with a wavelength range of 300~1100 nm, suitable for remote sensing measurement, crop monitoring, forest research to oceanographic research, etc. Application in various fields.

HH-S ground feature spectrometer has the characteristics of high cost performance, fast and accurate measurement, simple operation and convenient carrying. It is equipped with a powerful software package. In addition to reflectivity measurement, it can also be used for radiometry, photometry and colorimetry. In April 2020, along with Xiamen University Jiageng in Sanduao waters of Ningde, the red tide was successfully monitored, and the direction of the red tide was judged based on the distribution maps monitored at different times, and the red tide warning was successfully carried out.





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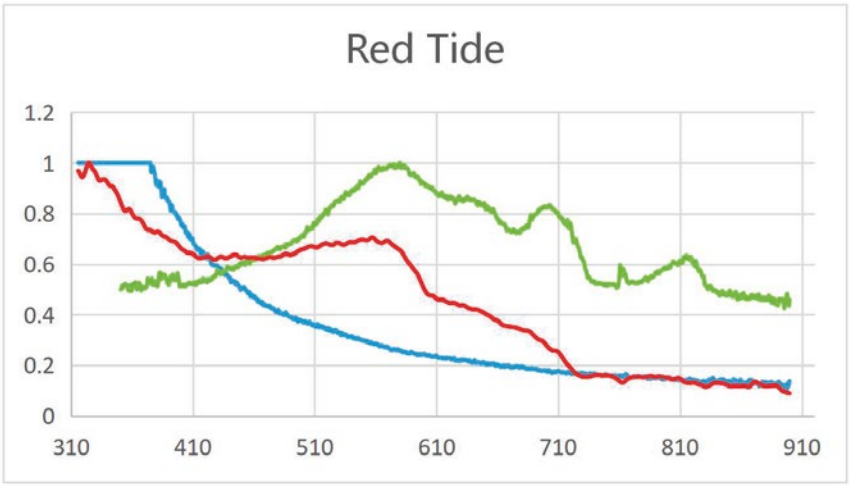


Fig 9 HH measure spectra of sky, lake and red tide

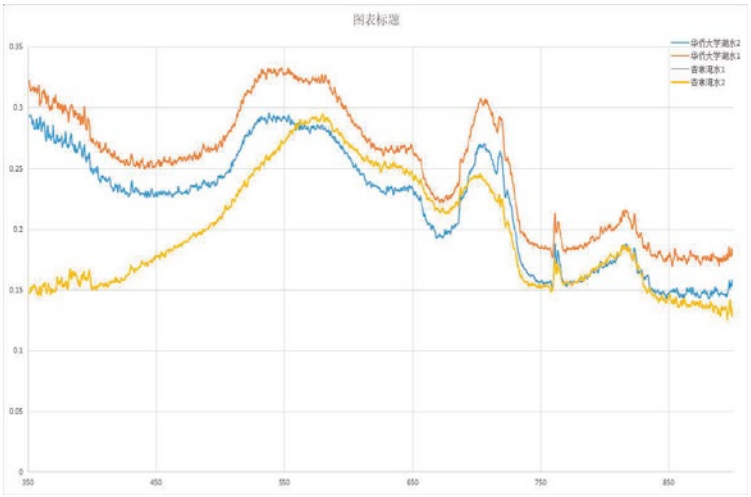
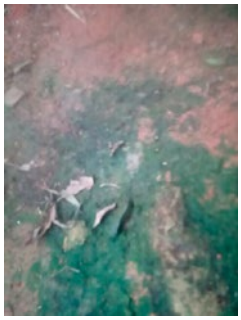


Fig 10 HH measure lake water color



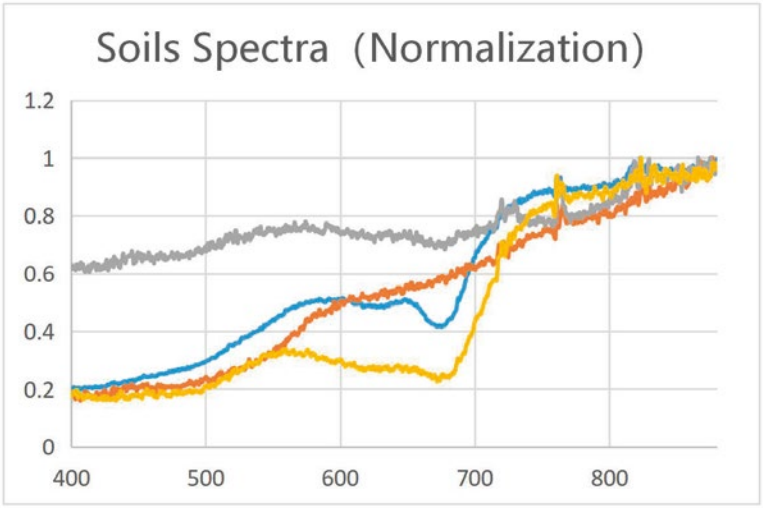


Fig 11 HH measure soils, blue is normal soil, red is red soil, grey is polluted soil, yellow is moss soil

4.2.FieldSpecappliedtoagriculture

Nitrogen is one of the main limiting factors for crop yield and economic benefits in arid regions. Nitrogen nutrition index (NNI) can effectively judge the abundance and deficiency of nitrogen nutrition in each growth period of crops. Using hyperspectral remote sensing technology to quickly and accurately diagnose the nitrogen nutrition status of drip-irrigated cotton fields, and then optimize the nitrogen supply in each growth period of the crop is a key measure to improve the nitrogen fertilizer use efficiency of the crop and improve the soil environment. With the maturity of hyperspectral technology, the application of hyperspectral technology and algorithms to retrieve crop leaf nitrogen content, chlorophyll concentration, leaf area, biomass and other physiological and biochemical parameters is currently the main method to study the nitrogen nutrition status of cotton.

However, these parameters will vary due to differences in growth period, canopy density, plant morphology, climate and light. In addition, the above-mentioned parameters can only give a relatively rough understanding of the nutrient status of cotton, and cannot give a qualitative judgment on the degree of its nutrient deficiency and overnutrition. The vegetation index is highly sensitive to nitrogen and is less disturbed by other factors. Therefore, the change of the vegetation index can be used to predict the change of nitrogen, and the nitrogen nutrition index is more closely combined with the nitrogen content, so the nitrogen nutrition index is monitored The changes can accurately monitor the nitrogen nutrition status ofthe plants.

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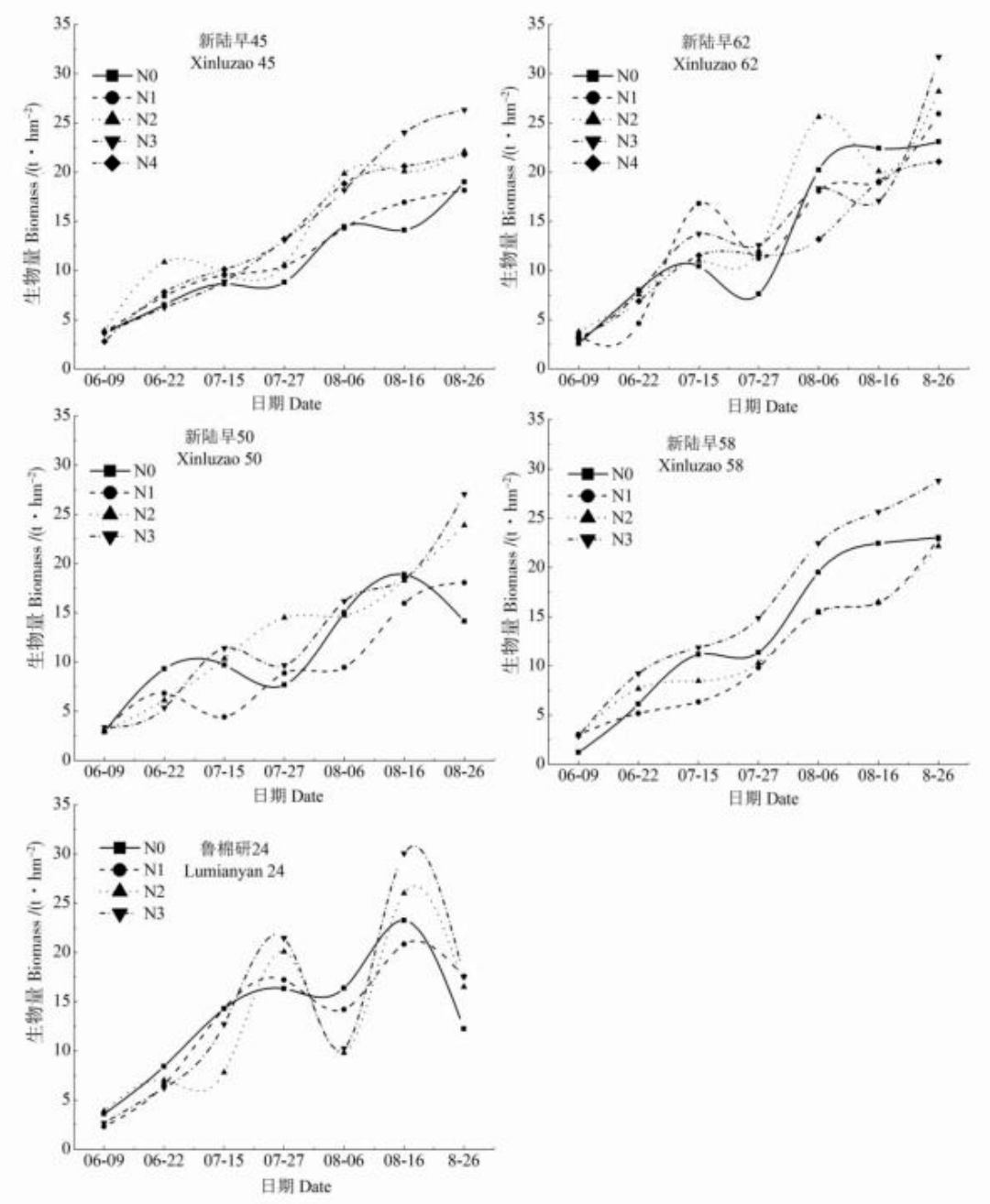

Fig 12 Cotton growth period biomass spectra

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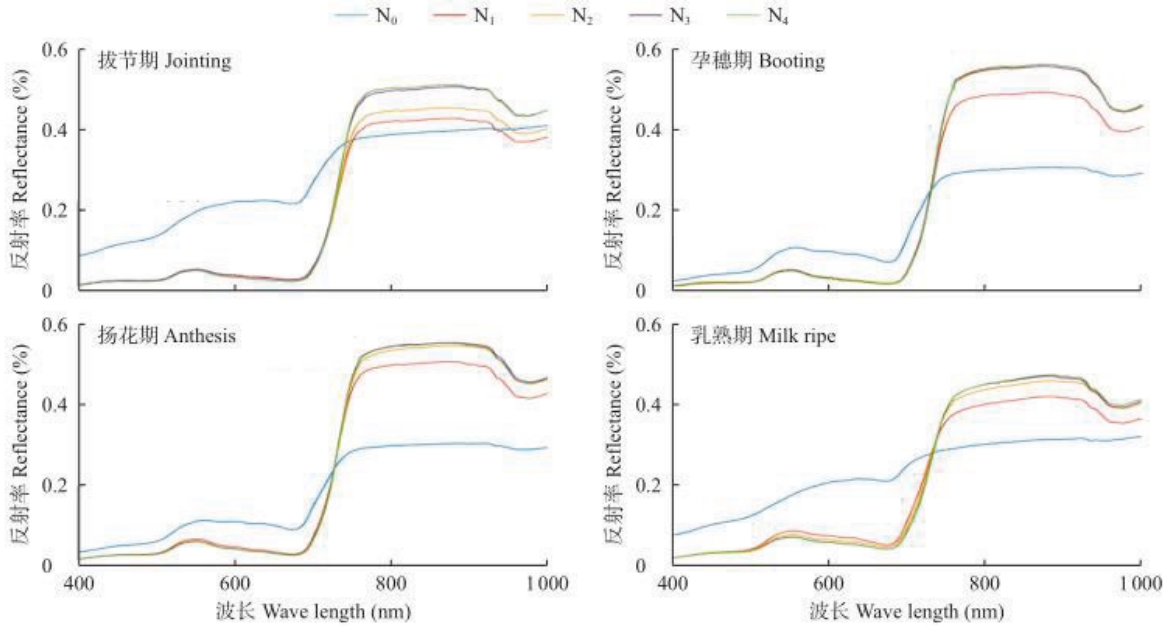

Fig 13 Winter wheat canopy reflectance spectra

Make full use of the advantages of reflectance spectrum data in monitoring physiological and biochemical parameters and the advantages of canopy SIF data in monitoring the photosynthetic physiological state of vegetation, and integrate the reflectance spectrum data with canopy SIF data to invert the incidence of wheat stripe rust. Through the comparative analysis of the experimental data, it is concluded that the accuracy of the monitoring model for wheat stripe rust constructed by synergistic reflectance spectral data and canopy SIF data is higher than that of the monitoring model constructed by reflectance spectral data.

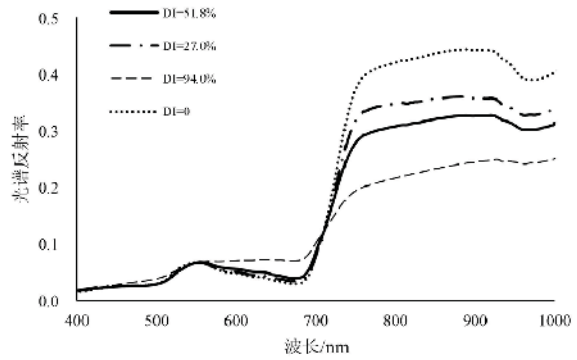

Fig 14 The original curve of the canopy spectrum of different wheat stalk disease severity, combined with the reflectance spectrum data and the canopy SIF data, can improve the monitoring accuracy of the wheat stalk disease severity.

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