Datasheet

HandHeld FieldSpec Spectrometer	ATP9100

Features

- High sensitivity, the quantum efficiency of the detector can reach up to 60%, and the near-infrared sensitivity is 40% higher than that of traditional PDA detectors
- Fast measurement speed, one sampling time is less than 10 milliseconds
- Optical fiber probe measurement, light weight, flexible use
- Built-in anti-secondary diffraction coating and filter, high accuracy
- Dynamic dark current correction to reduce the influence of thermal noise
- Display the inclination angle of the probe, and the laser indicates the detection position, which is convenient for adjustment
- The host is dustproof and waterproof, not easy to damage
- Handheld, dedicated carrying case, easy to carry
- HD touch screen control, or PC software control
- HD camera display spectrum shooting area
- Direct calculation of vegetation index

Application

- Agriculture, forestry and animal husbandry, geological research, prospecting
- Remote sensing measurement, satellite remote sensing data calibration
- Forest research, oceanographic research
- Environmental damage assessment

Description

ATP9100 handheld hyperspectral ground object spectrometer (field spectroradiometer) is a member of Optosky's high-performance ground object spectrometer family, with a wavelength range of 300~1100 nm, suitable for remote sensing measurement, crop monitoring , forest research to oceanographic research and other fields of application.

In addition to the functions of conventional handheld ground object spectrometers, ATP9100F can also directly and intuitively display the monitored spectrum area in real time, making the experiment more accurate.

ATP9100 ground object spectrometer has the characteristics of high cost performance, fast and accurate measurement, simple operation, and easy to carry. It is equipped with a powerful software package. In addition to reflectance measurement, it can also be used for radiometric, photometric and colorimetric measurements.

Model	Description
ATP9100	Standard Handheld FieldSpec
ATP9100F	Intuitive spectral image region display

Fig1. ATP9100 Handheld FieldSpec

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Fig 2 FieldSpec measurement case in the field

1. Performance

Model	ATP9100&ATP9100F
Detector	
Type	Linear CMOS sensor
Detector	2048
Optical Parameters	
Spectral Range	300~1100 nm
Wavelength Accuracy	± 0.5 nm
Spectral Resolution	2.7nm@756nm
FOV	narrow FOV lens，1º/8º/15º/25ºoptional
Indicate laser wavelength	650 nm
Indicate laser power	5 mW
SNR	＞800:1
Spectral Sampling Interval	0.4nm

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Hardware spectral average	Max. up to 100,000 times
Electrical parameters	
Operation system	Android
Camera	13 MP front camera
LCD Screen	5″HD 720*1080 capacitive screen
Integration Time	1 – 10 s/ auto optimization integration time
Data Export Port	TYPE-C
Angle data	MC3430 gyroscope optical measure angle: 0°-180°
Location data	GPS positioning
Sensors	Humidity accuracy ±2% RH, Temperature accuracy ±0.3°C, Altitude sensor accuracy ±1.5 meters
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 °C
Working Humidity	< 90%RH
Physical Parameters	
IP level	IP65
Dimension	151×157×85 mm
Weight	1.1kg (complete machine)

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2. FieldSpec Pictures

2.1 Reflectance Detection

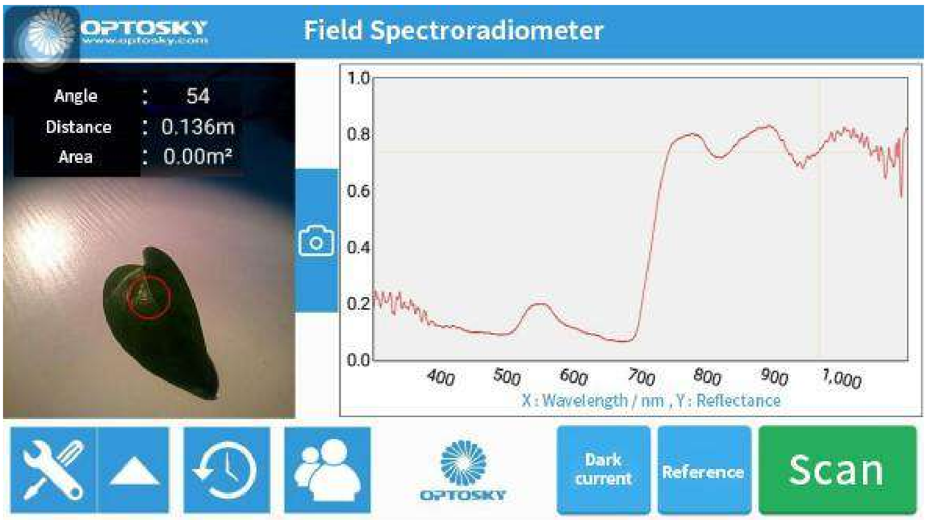

Fig 3 ATP9100F Interface, the left image circled in red triangle, the right reflectance spectrum

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Fig 4 FieldSpec measurement case “Red Tide” on the ship on May 11-16, 2020

Fig 5 ATP9100 FieldSpec measurement case in the field

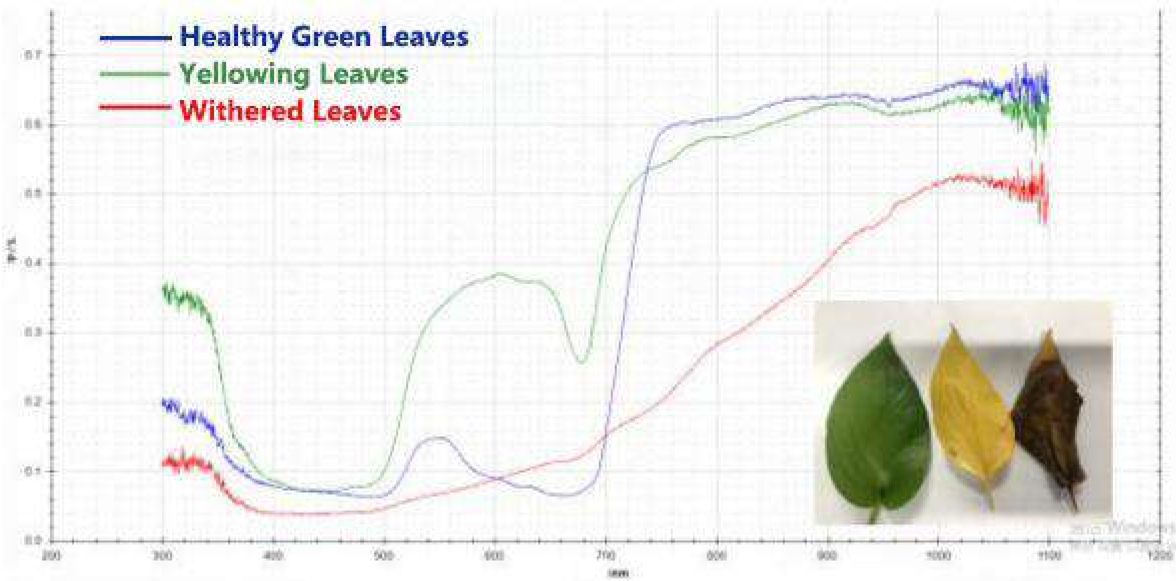

Fig 6 ATP9100 FieldSpec measure Healthy, yellowing and withered leaves

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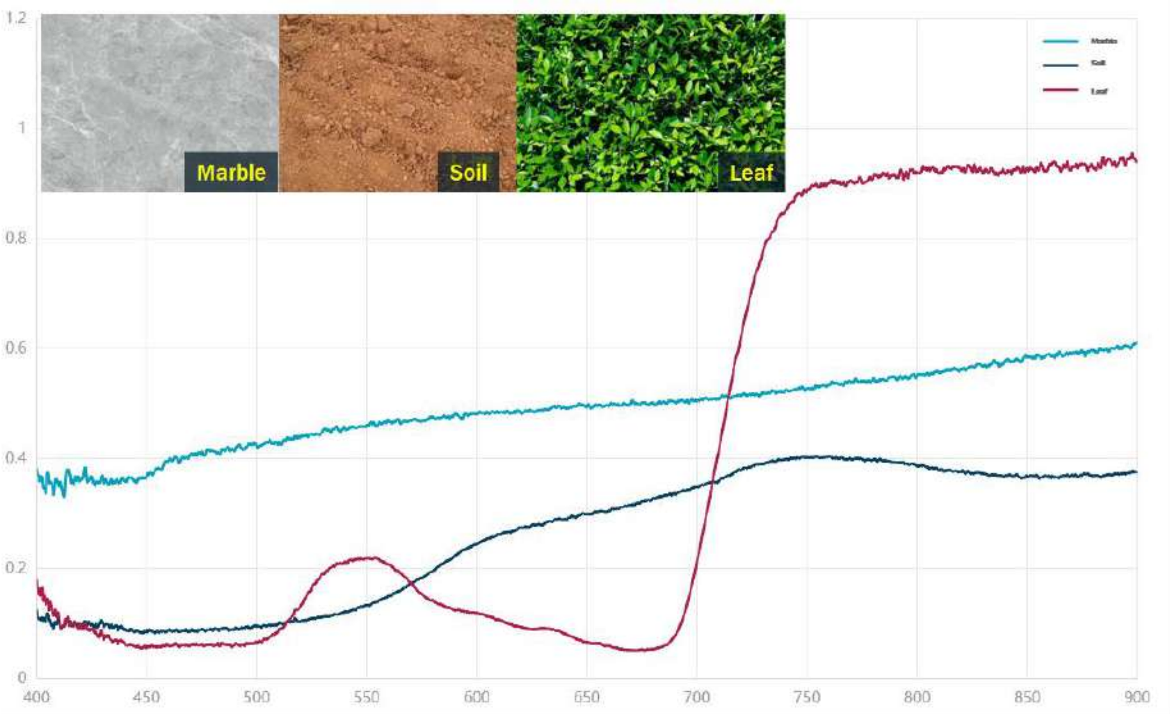

Fig 7 ATP9100 measure marble, soil, and leaves spectra

2.2 Vegetation Index Detection

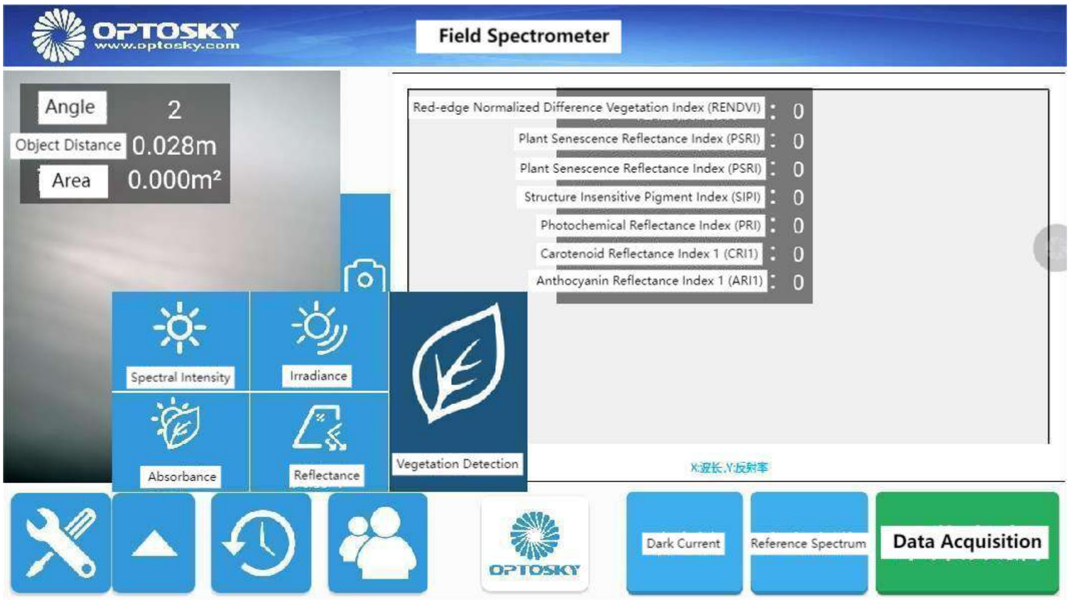

Figure 8 ATP9100 Vegetation Index Function Key Interface

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Figure 9 Field Measurement of ATP9100

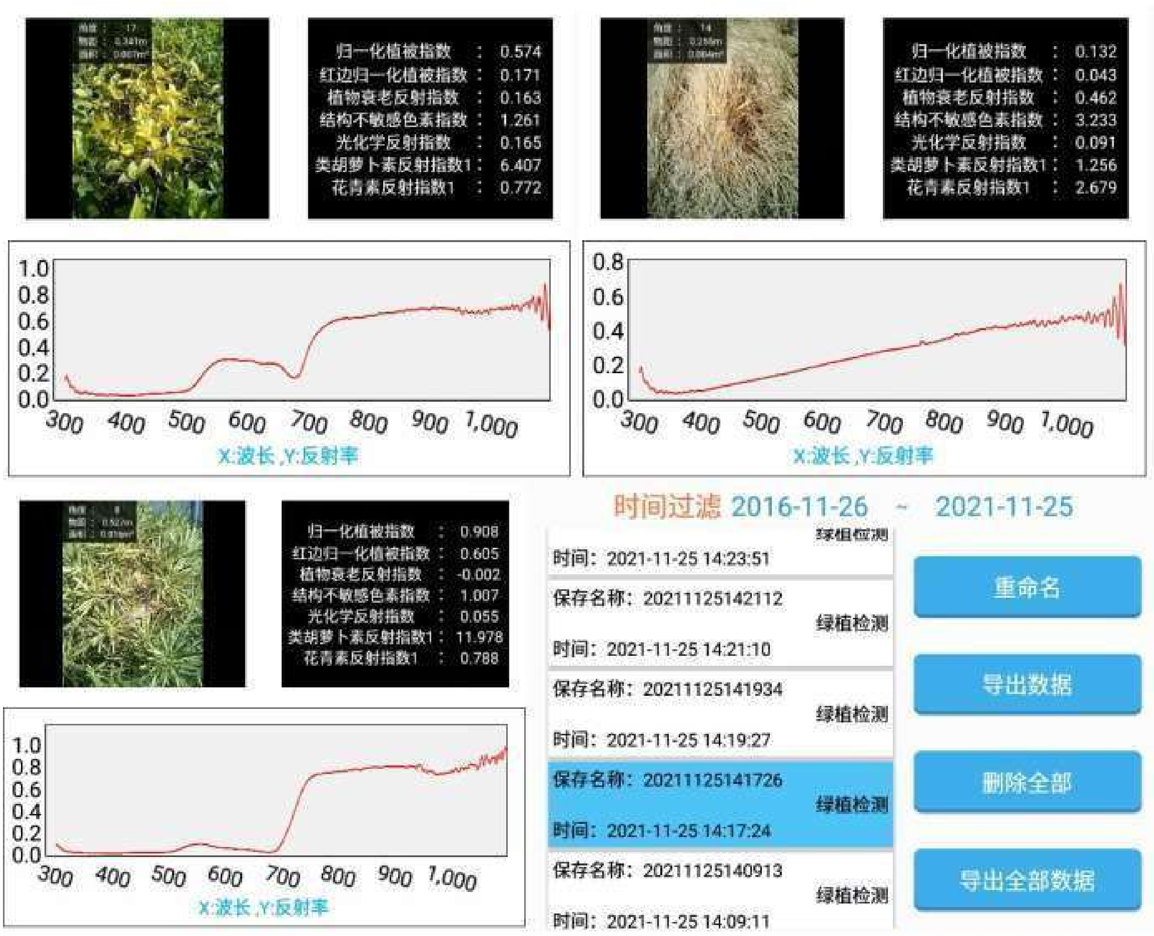

Figure 10 Vegetation Index Detection Results of ATP9100

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3. Accessories

No.	Standard Accessories	Specifications	Quantity
1	Charger	5V/3A	1
2	Diffuse Reflectance Standard Whiteboard	10*10cm，95%	1
3	Field of View (FOV) Lens	25°	1
4	Cosine Angle Lens	/	1

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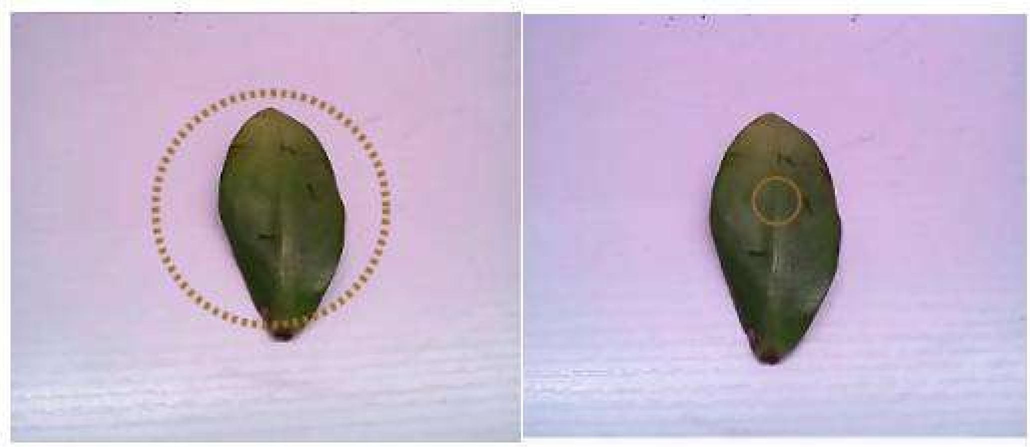

Figure 11 Comparison of Measurement Ranges Between 25° FOV Lens and 5° FOV Lens

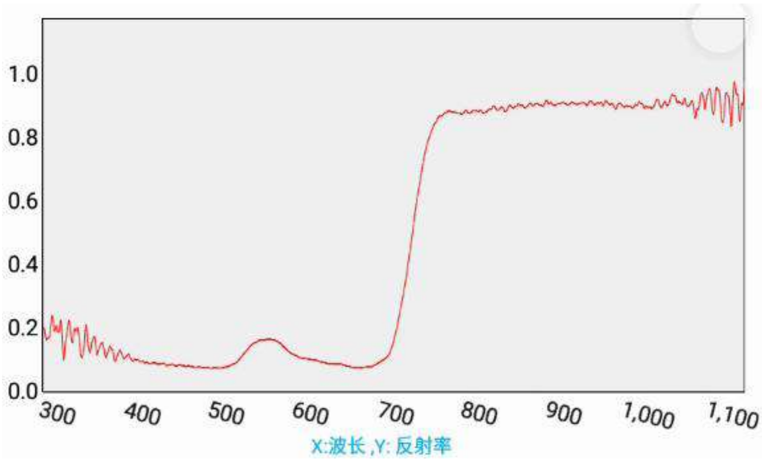

Figure 12 Measured Leaf Reflectance Using Reflectance Test Handle

4. Application cases of geodetic spectrometer

1.1. Application of geodetic spectrometer (hyperspectral) in ocean and water quality

Red tides, also known as red blooms, are ecological anomalies caused by the sudden proliferation or aggregation of certain phytoplankton, protozoa, or bacteria in seawater under specific environmental conditions over a short period. In recent years, toxic red tides have occurred frequently and on an increasingly larger scale, severely impacting coastal fisheries, aquaculture, and marine ecosystems. Red tide toxins also pose a threat to human life safety.

Marine brown algae, middle ribbed diatoms, and Danish columnar diatoms are three types of phytoplankton that cause red tides. Red chironomidae is the only reported protozoan capable of forming red tides; it is colorless and feeds on phytoplankton. The three major factors determining the optical properties of seawater are phytoplankton pigments (mainly chlorophyll, carotenoids, and other accessory pigments), inorganic suspended particles, and colored dissolved organic matter. These collectively influence the radiative information of the ocean above water (such as remote sensing

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reflectance spectra). Considering the spectral properties of these three water color elements, from a spectral morphology perspective, different types of red tide spectra exhibit distinct bimodal distributions in the 400-900 nm wavelength range. Notably, the second reflection peak located at 687-728 nm is a characteristic reflection peak that distinguishes red tide water spectra from normal seawater spectra. This feature has been successfully utilized in algorithms for detecting red tides based on aerial hyperspectral remote sensing.

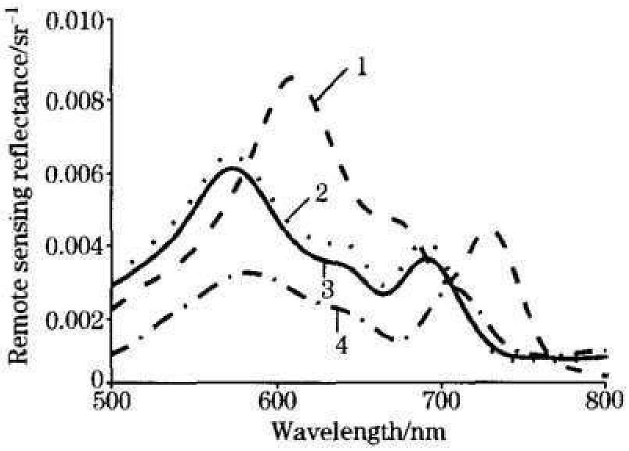

Figure 13 Hyperspectral spectra of different types of red tides. 1: red mid-rib algae; 2: mid-rib algae; 3: Danish column algae; 4: Marine brown algae

1) The relatively high concentration of inorganic suspended matter is the main reason for the first reflection peak of 570~585nm. Due to its strong scattering effect on light, the reflection peak of chlorophyll at 550nm is obscured and cannot be clearly expressed in the spectral curve. The appearance of high concentration of inorganic suspended matter is directly related to the nearshore area of the experimental sea.
2) The absorption of phycocyanin (Phycocyanin), an accessory pigment, at 615~ 630nm forms a shoulder peak of reflection spectrum near 640nm.
3) The absorption peak near 670nm originates from the strong absorption of chlorophyll.
4) The second reflection peak of red tide water spectrum is not related to the existence and content of yellow substances and suspended sediment, but attributed to the fluorescence characteristics of chlorophyll in this band.
5) In previous Marine optical studies, it is generally believed that the fluorescence peak of chlorophyll is 685nm. However, recent experimental observations and spectral simulation studies show that with the increase of chlorophyll a concentration, the intensity of the fluorescence peak increases, and the emission wavelength of the fluorescence also redshifts.
6) The small reflection peak near 800nm in the spectral curve is due to the minimal absorption of pure water at this band.

ATP9100 Handheld ground object spectrometer (field spectral radiometer) is the latest product of Optosky (Aospectra), with a wavelength range of 300~1100nm, suitable for remote sensing measurement, crop monitoring, forest research and oceanographic research.

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ATP9100 The ground object spectrometer boasts high cost-effectiveness, rapid and accurate measurement, simple operation, and easy portability. It comes with a powerful software package that can be used not only for reflectance measurements but also for radiometric, photometric, and chromatic measurements. In April 2020, it successfully monitored the red tide in the Sandu Bay waters off Ningde aboard the Jia Geng of Xiamen University. By analyzing the distribution maps at different times, it determined the direction of the red tide's movement and successfully issued a red tide warning.

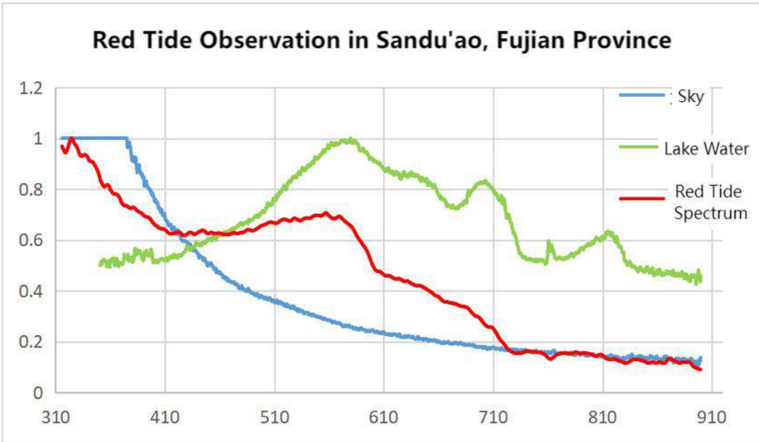

Figure 14 In April 2020, the Aosutiancheng ATP9100 ground-based spectrometer monitored the red tide in Sandu Bay, Ningde, Fujian province

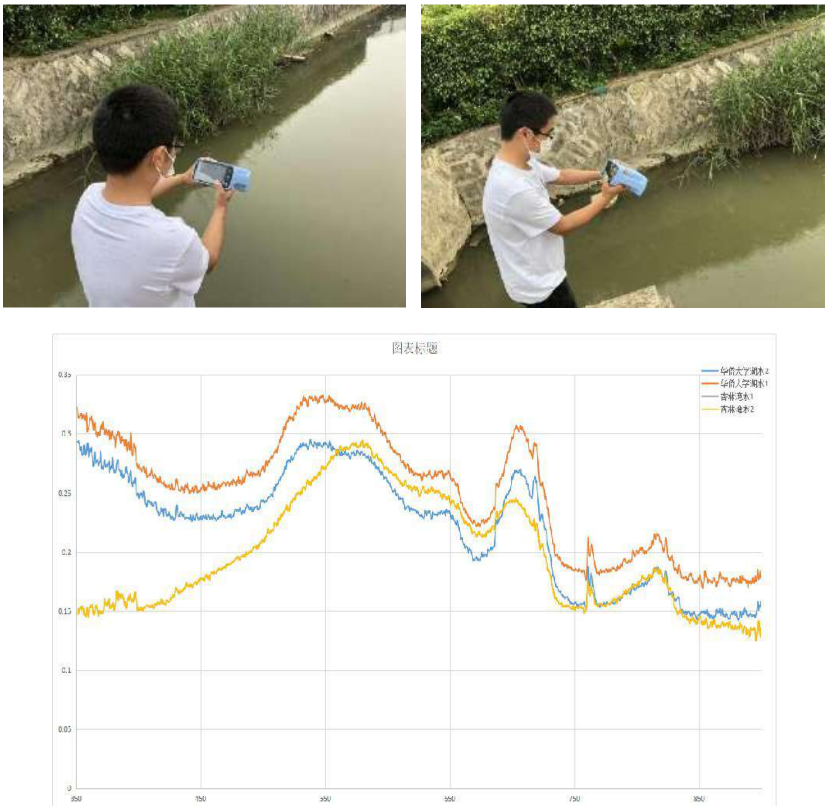

Figure 15. Application of ground-based spectrometer in analyzing lake water color

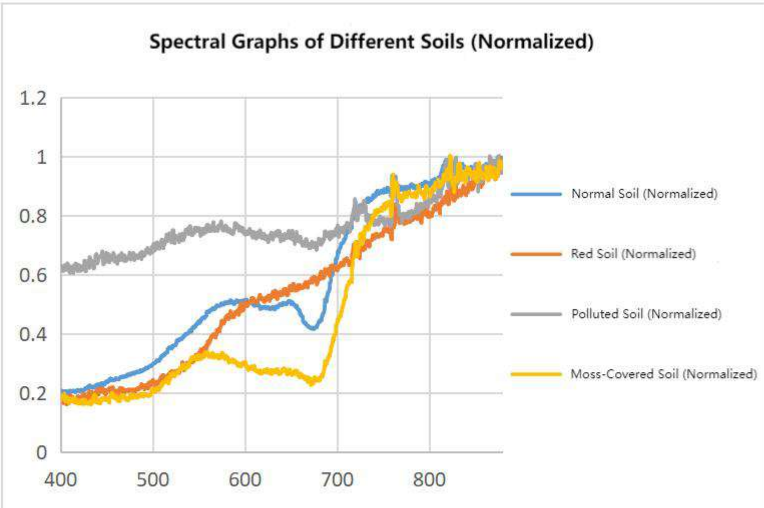

Figure 16. Application of geodetic spectrometer in monitoring Marine soil pollution

ATP9100 It is a completely self-developed product of Aosu Tiancheng, with high measurement accuracy, strong portability and low cost, which can perfectly replace imports, reduce costs and improve the market share and competitiveness of enterprises in our city in high-end Marine detection equipment.

4.2 Application of geodetic spectrometer (hyperspectral) in agriculture

Nitrogen is one of the primary limiting factors for increasing crop yields and economic benefits in arid regions. The nitrogen nutrition index (Nitrogen nutrition index, NNI) can effectively assess the nitrogen nutrient availability at different growth stages of crops. Using hyperspectral remote sensing technology to quickly and accurately diagnose the nitrogen nutrition status of drip-irrigated cotton fields, and subsequently optimize nitrogen supply at various growth stages, is a key measure to improve nitrogen fertilizer efficiency and soil environment. With the maturation of hyperspectral technology, applying this technology and algorithms to invert physiological and biochemical parameters such as leaf nitrogen content, chlorophyll concentration, leaf area, and biomass in crop leaves is currently the main method for studying nitrogen nutrition status in cotton. However, these parameters can vary due to differences in growth stage, canopy density, plant morphology, climate, and light conditions. Additionally, the parameters mentioned above only provide a relatively rough understanding of the nutrient status of cotton; they cannot qualitatively determine the degree of nutrient deficiency or

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excess. Vegetation indices are highly sensitive to nitrogen and less affected by other factors, so changes in vegetation indices can be used to infer changes in nitrogen levels. The nitrogen nutrition index is more closely related to nitrogen content, so monitoring changes in the nitrogen nutrition index can accurately assess the nitrogen nutrient status of plants.

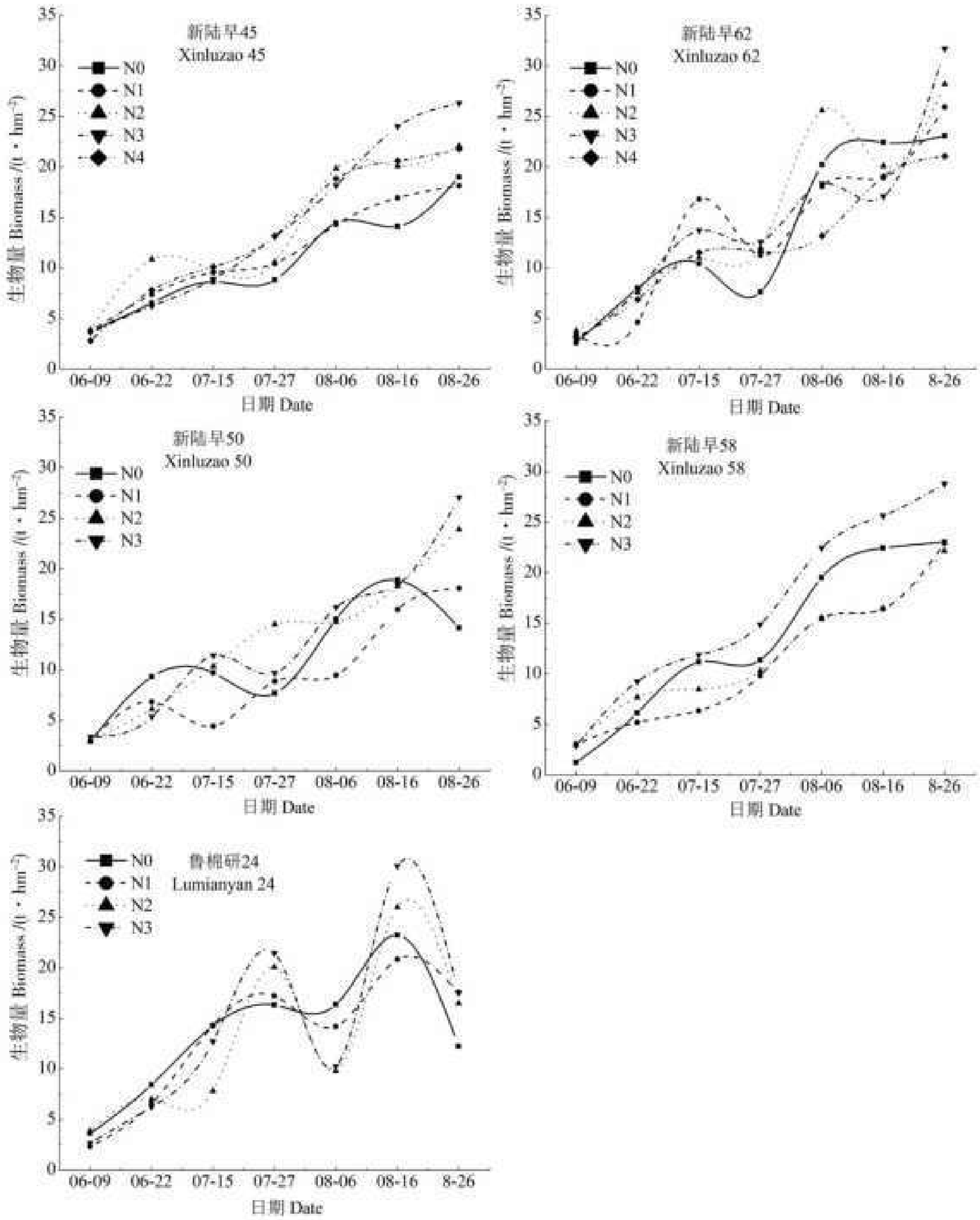

Figure 17 Biomass dynamics of different cotton varieties throughout the whole growth period

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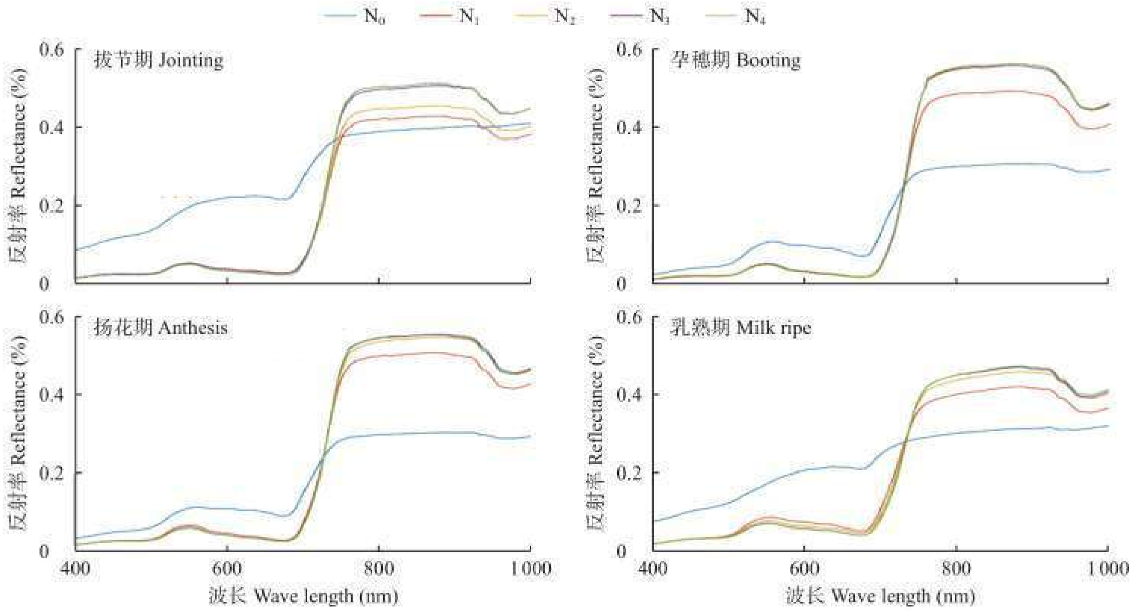

Figure 18. Spectral reflectance of winter wheat canopy under different nitrogen fertilizer gradients

To fully leverage the advantages of reflectance spectral data in monitoring physiological and biochemical parameters and the advantages of canopy SIF data in monitoring the photosynthetic physiological state of vegetation, we integrate reflectance spectral data with canopy SIF data to invert the incidence of stripe rust in wheat. Through comparative analysis of experimental data, it is found that the precision of the stripe rust monitoring model constructed using both reflectance spectral data and canopy SIF data is higher than that of the model built solely on reflectance spectral data.

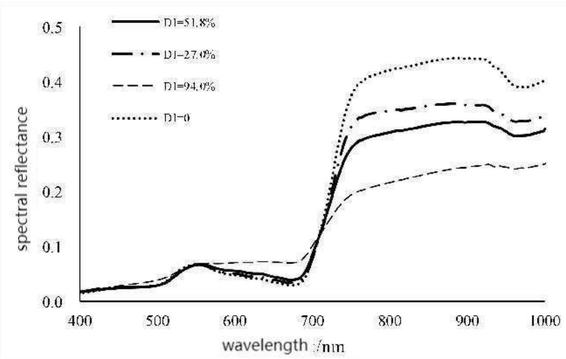

Figure 19 Original canopy spectral curves of different wheat stripe rust severity.

Comprehensive use of reflectance spectral data and canopy SIF data can improve the monitoring accuracy of wheat stripe rust severity. The SIF detector produced by Optosky is on the right

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