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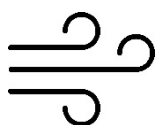
USER MANUAL



CB1020

SPAD METER

CHLOROPHYLL



TO MEASURE  TO KNOW



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I. Introduction

Chlorophyll plays a crucial role in the photosynthesis of plants. Its content is an important indicator of plant nutrition stress, photosynthetic capacity, and growth conditions. Chlorophyll content measurement can be used to monitor the growth and development conditions of plants, thereby making scientific guidance of cultivation, fertilization and management, ensuring the good growth vigor, and enhancing crop quality and yield. As a result, it is of great significance for precision agriculture and forestry.



The chlorophyll meter is able to measure the relative content of chlorophyll in plant leaves (unit SPAD) or “greenness”, thereby learning plants’ actual demands on nitryl and helping the user identify the shortage of nitryl in soil or whether nitrogenous fertilizer has been applied excessively. This meter can be used to enhance the utilization ratio of nitrogenous fertilizer and protect the environment.



II. Operating Principle

Traditionally, chlorophyll content is measured using chemical methods, which not only time and energy-consuming and harmful to plants. With the development of spectrum technology, it has been a research focus to make quick noninvasive diagnosis using spectrum technology in precision agriculture. Spectrum technology is one that describes the information contained in spectrum data by means of the relationship between spectrum response and wavelength of the target.

Spectrum characteristics of plants present the changes of light absorption, transmission and reflection of plants caused by their physiological features. Therefore, the physiological information of plants can be extracted by means of spectrum monitoring. The principle of spectrum-based crop physiological information detection is that changes of plant leaf color, thickness and morphology are subject to the influence of the changes of plant physiological information, thereby leading to varied spectrum absorption, reflection, and transmission features. For example, the spectrum monitoring of plant nitrogen nutrition is made by detecting different reflecting, absorption, and transmission spectra caused by different absorption and reflection of light of certain wavelengths due to the

vibration response of chemical bonds of molecules of various proteins, amino acids, chloroplasts, and other nitrogen forms at a certain radiation level (different frequencies or wavelengths). When it is specific to chlorophyll, the spectrum absorption of chlorophyll is that the absorption peaks lie in the blue and red spectral regions while the absorption valleys lie in green spectral region. There is barely absorption near the red spectral region. When light reaches the leaf, some will be absorbed by chlorophyll, some will be reflected, with a small part penetrating the leaf. The relative chlorophyll content within the leaf can be worked out by measuring the light intensity penetrating the leaf, making A/D conversion, and processing data using the micro-processing unit.



III. Measurement Principle and Steps

1. Measurement Principle

The two LED light sources emit two types of lights—red light (peak wavelength: 650nm) and infrared light (940nm), both of which penetrate the leaf and reach the receiver. Next, light signals are converted into analog signals that are amplified by the amplifier and are then converted into digital signals by analog/digital converter. Digital signals are processed by the micro-processing unit to calculate SPAD, which is then displayed on the LCD.

2. Calibration and Calculation of Measured Value

- (1) The indenter does not clamp the sample during calibration. The two LED lights are on in turn. The light received is converted into electrical signals. And the ratio of light intensity is used for calculation.
- (2) When the sample is clamped by the indenter, the two LED lights are on again. Light that penetrates the leaf reaches the receiver, by which it is converted into electrical signals. And the ratio of transmitted light intensity is used for calculation.
- (3) Values obtained in steps 1 and 2 are used to calculate SPAD, which signifies the relative chlorophyll content of leaf sample currently clamped.



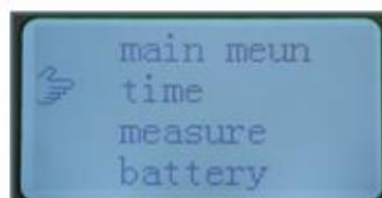
IV. Major Technical Indicators

1. Measurement range 0.0–99.9SPAD
2. Measurement area 2mm*2mm
3. Measurement precision
within ± 1.0 SPAD unit (SPAD is between 0–50)
4. Repeatability within ± 0.3 SPAD unit (SPAD is between 0–50)
5. Measurement interval <3s
6. Data storage SD card
7. Data storage capacity 2GB
8. Power 4.2V rechargeable lithium battery
9. Battery capacity 2000mah

V. Operating Instructions

1. Startup

Press the ON/OFF button at the side of the meter, the main menu will be displayed (Figure 1).

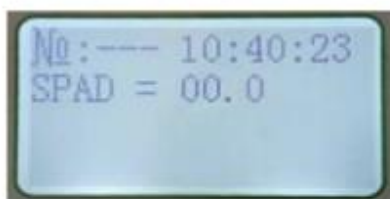


(Figure 1)

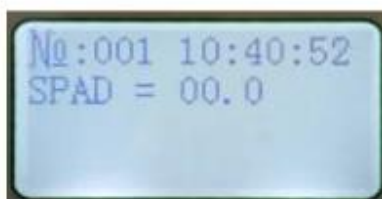


2. Calibration

When calibration is made by pressing the measuring head (do not place any object at the measuring position), it will be automatically switched to data measurement interface (press the measuring head until “SPAD=---” turns to “SPAD=00.0”, which suggests calibration completion). “No:001” that appears at the top left of the LCD suggests that the SD card has been detected by the meter and data storage can be made, whereas “No:---” means there isn’t any SD card detected. In this case, please check whether the SD card has been properly inserted. (Figure 2, Figure 3)



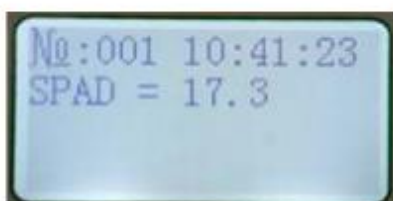
(Figure 2)



(Figure 3)

3. Measurement

Do not use this device until calibration is completed. Place the leaf to be tested on the measuring position, press the indenter for 3-5 seconds. Then the chlorophyll content of the leaf under test is automatically displayed. Press “confirm” to save the test result into the SD card. Then, sample number (No.) will increase by “1”. If it is unnecessary to save the test result, press the measuring head to conduct next measurement. (Figure 4)

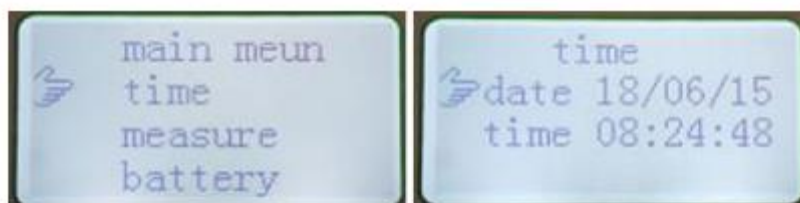


(Figure 4)



4. Time Settings

When the meter is powered on, the cursor will automatically point to time settings. Press “ENT” to skip to time settings interface where date and time can be set up by pressing “▲/▼” and “ENT”. Press “ESC” to return to the main menu when time/date settings are completed (Figure 5, Figure 6).

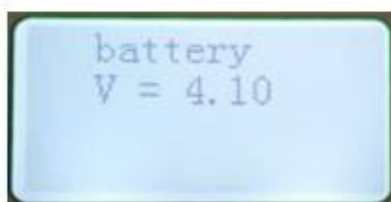


(Figure 5)

(Figure 6)

5. Battery Status Measurement

Move the cursor to battery status on the main menu interface, press “ENT” to skip to battery status monitoring interface where battery voltage can be observed to check whether battery voltage is normal. If the voltage is lower than 3.8V, please have the meter recharged in time. Press “ESC” to exit the battery status interface after checking battery voltage. (Figure 7).



(Figure 7)



VI. Precautions

1. Press the measuring head to skip to data measurement interface when the meter is powered on.
2. Make sure there isn't any obstruction under the measuring head during calibration, otherwise the calibration may not be conducted normally.
3. Press the measuring head to make recalibration after exiting from the time settings or battery status interfaces by pressing "ESC", otherwise it cannot be skipped to the data measurement interface.
4. Every time the measuring head is pressed, SPAD will turn to "---". In this case, continue to press the measuring head until a chlorophyll reading is displayed. Then, press "ENT" to save the result. This operation will last 3-5s.
5. Do not insert or remove the SD card when the device is on. In the event that there isn't an SD card in the device, there will be "No:---" at the top left of the LCD.
6. When not in use for a long time, please have the device recharged once every 60 days.



VII. Troubleshooting

1. In the event that the calibration cannot be completed normally for several successive times, please clean the measurement position and check if there is any object covering the photoelectric sensor. If not, please have the device recharged for around one hour to check if it is caused by low battery. Please contact us if this phenomenon continues.

2. With calibration completed, please check battery level if the measurement result differs from each other. With a normal battery level, please power off the device and reboot it five minutes later to conduct calibration again before using it for measurement. In the case of a system crash, please press the reset button (reset button is a hidden button lying between the four buttons on the main panel) to power the device off, then reboot it. The device will return to normal function.

Packing List of the Chlorophyll Meter

No.	Name	QTY	Unit
1	Principal machine	1	Set
2	SD card	1	pcs
3	Card reader	1	pcs
4	Charger	1	pcs
5	User manual	1	Copy
6	Qualification certificate	1	Copy
7	Packing list	1	Copy



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