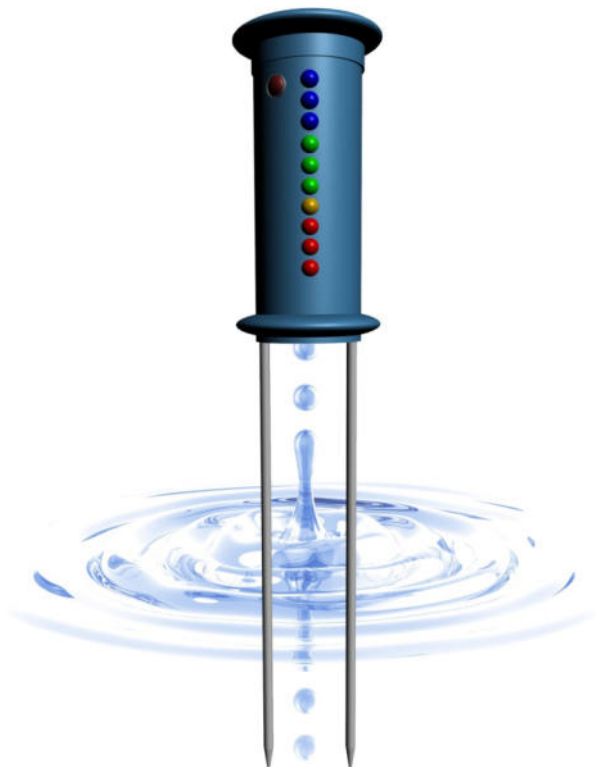


SOIL MOISTURE INDICATOR

USER MANUAL



**ICAR-Sugarcane Breeding Institute
Coimbatore 641007**

2016



USER MANUAL

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Prepared by: K. Hari, D. Puthira Prathap and K. Sivaraman

Published by: Dr Bakshi Ram, Director, ICAR-Sugarcane Breeding
Institute, Coimbatore 641007, Tamil Nadu, India

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Introduction

Depletion of water resources in agriculture has been a serious cause of concern. In most of the farmers' fields, particularly in sugarcane fields, efficient irrigation management practices such as irrigation scheduling, based on soil moisture status is rarely in practice. In an effort to save water and to facilitate irrigation scheduling, ICAR-SBI has developed this gadget a handy and user friendly electronic moisture indicating device, named "Soil Moisture Indicator".

This device was developed with the active participation of farmers and sugar factory personnel across three agro-climatic zones of Tamil Nadu through the Farmers' Participatory Action Research Project (FPARP) during 2008-10. This device was tested by the farmers' in their fields, comparing with the already known irrigation scheduling device 'tensiometer'. From farmers experience, it was found that tensiometer has many inherent problems like permanent installation of multiple units in different places of the field, blocking of ceramic cup, regular filling of water in the reservoir tube immediately after irrigation, vacuum leakage problems, chances for breaking the ceramic cup of the field installed tensiometer, expensive (each unit costing about Rs. 6500/-) . Soil moisture indicator was found better than tensiometer in assessing the moisture status of their fields and helped them to decide when to irrigate. Based on the farmers' experience, it was found that scheduling irrigations based on soil moisture status considerably reduced the number of irrigations required for cultivating crops, thereby saving precious water without affecting productivity.

Working principle of Soil Moisture Indicator

Field capacity and permanent wilting point are two levels of moisture that are used to calculate available water for plant. This soil moisture indicator has been designed to objectively indicate soil moisture status. The device works based on the principle that electrical conductivity of the soil is directly proportional to soil moisture or soil electrical resistance is indirectly proportional to soil moisture content (similar to gypsum block technique).

How to use?

SMI has two metal sensor rods. When these rods are properly inserted in soil and on pressing the switch, the electronic circuit translates conductivity or resistance and indicates soil moisture level through a colour glow of light emitting diode (LED).

Three LEDs are provided for approximation and to suit different soils. The device indication is as follows,

- ✓ Moisture status slightly above permanent wilting point is indicated by red or orange LED light glow. This status indicates immediate requirement for irrigation.
- ✓ Soil moisture status sufficiently above wilting point and less than field capacity (sufficient soil moisture) is indicated by Green glow. No need to go for immediate irrigation; can wait for few more days.
- ✓ Soil moisture at field capacity is indicated by Blue glow. Excess or more than sufficient soil moisture.

There is no need to install the unit permanently in the field. It is portable and whenever required it can be used in any place in the field to ascertain the soil moisture level.

Problems associated with SMI

Soil moisture indicator will not provide / measure exact soil moisture. This can only be used for objective indication of soil moisture and not for quantitative measurement.

This device measures soil electrical conductivity and translates to moisture indication. It is possible to get varied results / errors depending on different situations / conditions viz., heavy clayey or sandy soil, salinity, high EC in soil and irrigation water etc. These problems have been addressed to some extent by approximation of LED colour indication. However, certain situations may warrant fine tuning.

For example, under high EC soil/water situation, salts interfere with the measurement. Thus, this type of soil needs fine-tuning.

Further, high clay soils hold more water than alluvial soil. Highly clay soils hold more moisture (about 5 to 10 percent higher than alluvial) both at wilting point and field capacity. Similarly, highly sandy soils hold lesser moisture than alluvial soil. They hold less moisture (about 5 to 10 percent lower than alluvial) both at wilting point and field capacity. Under these situations too, the soil moisture needs fine-tuning.

In all these problem situations, it is always possible to fine tune the electronic assembly appropriately before using the soil moisture indicator.

Calibration Procedure for Soil Moisture Indicator

(Soil moisture indicator is pre-calibrated and does not require calibration in general, calibration require expert assistance. However, if warranted it can be calibrated as below)

1. Select the soil to be calibrated.
2. Selected soil to have 'known moisture' (determine by oven drying method).
3. Based on the soil and crop-type know the wilting point and field capacity. This can be determined only by expensive 'Pressure plate apparatus' in a laboratory; however with approximate soil water holding property of different soils can be used,

Approximate water content (%) of different soils and LED indication

Sl. No.	Moisture parameter level	Soil type			LED Light indication
		Sandy	Loamy	Clayey	
1	Field capacity	12 - 15	22 - 30	30 - 40	BLUE
2	Available soil moisture	9 - 12	12 - 20	20 -30	GREEN
3	Wilting point	5 - 8	8 - 10	12 -15	RED

4. For the selected and weighed soil add known amount of water to obtain known soil moisture level (2 - 3 % above the wilting point) to approximately 10% moisture level (require about 80 ml water to air - dry soil) and mix the soil/water thoroughly and allow the soil to stabilize for about 1 hour. (In general, air-dried soil has approximately 3 - 5% w/w moisture.
5. Take the indicator and insert the rods into the soil to about 20 cm deep. The ten LEDs are numbered from red to blue. In the

- electronic circuit, turn the potentiometer (POT) to have glow of the third red LED or fourth orange LED to indicate soil moisture level 2 - 3% above the wilting point of the soil.
6. Similarly add water to correspond to the mid-value between field capacity and wilting point (approximately 20%) and mix the soil/water.
 7. Take the indicator and insert the rods into the soil. Turn the POT to have the glow of Green LED.
 8. Similarly add the water (equal to the saturation of the soil) and mix the soil/water.
 9. Take the indicator and insert the rods into the soil. Turn the POT to have the Blue LED to indicate the saturation point of the soil.
 10. Follow the above procedure to complete the calibration of the soil moisture indicator.

Suitability for different crops: For using in sugarcane fields, the sensor rods of SMI have to be inserted up to 15-20 cm depth, near the clumps. SMI can be used for other crops as well, by increasing or decreasing the insertion depths, accordingly.

Battery: Needs two AA batteries. If the LED glow is dim it is time to replace the batteries. Open the cap and install the batteries with correct polarity.

Caution: Soil moisture indicator has two sharp metal rods. Needs to be handled carefully to avoid personal injury. Keep out of reach from children. Store in the safe socket.



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