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. 4000/-.). 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.

**About soil moisture indicator**

About soil water, the field capacity and the 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. This 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). SMI has two metal sensor rods, when 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 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 indicate 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 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.
Problems associated with SMI

- Measuring soil moisture is tricky and difficult, as it is very complex. The standard method is gravimetric oven drying method, which is practically not possible under field situations / farmers fields. Other highly sophisticated devices viz., neutron moisture probe, Ultrasonic Doppler systems etc., but these are very expensive and suitable only for research purposes; these are unsuitable for farmers use.

- Soil moisture indicator will not give / 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 soil and irrigation water EC etc. In all these problem situations, it is always possible to fine tune the electronic assembly appropriately before using/implanting the soil moisture indicator.

Advantages of using Soil Moisture Indicator

Based on the farmers’ experiences, it was found that scheduling irrigations based on soil moisture status require 36 irrigations per sugarcane crop (12 months) compared to conventional farmers practice which require about 42 irrigations. This reduction in the number of irrigations did not affect the cane yield while saving precious irrigation water. But, one irrigation was quantified about 5 lakh litres per hectare, totalling about 30 lakh water is saved per hectare. The feedback from the cane growers of this device has been encouraging. This user-friendly device can be included in the government schemes for sensitizing the farmers about efficient use of irrigation water and scheduling irrigations based on soil moisture status.

Cane yield and water savings in sugarcane under farmers’ holdings in three districts of Tamil Nadu

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Item</th>
<th>Conventional Irrigation</th>
<th>Irrigation based on SMI</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cane yield (t/acre/crop)</td>
<td>55.8</td>
<td>60.4</td>
</tr>
<tr>
<td>2</td>
<td>Water usage</td>
<td>24600 m³</td>
<td>21000 m³</td>
</tr>
</tbody>
</table>

Awareness created on the use of Soil moisture Indicator

1) Large scale demonstrations and sensitization camps on irrigation water conservation and irrigation scheduling using different gadgets were conducted in the farmers’ fields.

2)(a) Recognising the importance of the technology, ICAR has invited to display and demonstrate the technology at 87th Annual General Meeting of ICAR meeting at New Delhi on 04-02-2016
2)(b) The technology was demonstrated by Director, ICAR-SBI in a special meeting arranged by The Secretary, Department of Agriculture, Cooperation & Farmers welfare (DAC&FW), New Delhi on 28th June 2016 and
2(c) Director, ICAR-SBI gave a presentation on Soil Moisture Indicator was given in the Conference on Innovations in Agricultural Mechanization organized by Department of Agriculture Cooperation and farmers' welfare at Vigyan Bhawan, New Delhi on 8.7.2016. A good response was witnessed after the presentation.

(3) Large scale demonstrations are being done by KVKs across the country from 2017 to till date. Recently demonstrations are through Jal Shakthi Abhiyan were carried out by KVKs across the country. This can be found in the Krishi Vigyan Kendra knowledge network https://kvk.icar.gov.in/Passevent_farmer.aspx. These demonstrations were done for different crops such as sugarcane, groundnut, brinjal, bhendi, coconut, banana, paddy, sesame, black gram, green gram, tomato, mustard etc.

(4) Display and demonstration of the technology in the in Agri Exhibitions, Kisan Melas, Nation Science Day, Seminar, Symposia, Conference and Other Gatherings was extensively carried out.

(5) Publications -Popular articles, Pamphlets and Other publications were published to popularise the water saving technologies including SMI based irrigation scheduling.

**Commercialization of soil moisture indicator:**

ICAR-SBI has licensed this technology across the country to eight firms viz., (1) KSNM Marketing, Coimbatore (2) Tech Source Solutions, Bengaluru, (3) Nagarjuna Agrochemicals Pvt. Ltd., Hyderabad, (4) Parashar Agrotech Bio Pvt Ltd., Ghausabad,Varanasi, (5) Gayathri Agri Inputs, Hyderabad, (6) Farm Tech India, Yavatmal, Maharashtra, (7) G.T. Biosciences Pvt. Ltd., Nagpur, and (8) SKR Agrotech, Nagpur. Details of the licensees are provided below. The above licensees widely represent major agriculture states in the country.

**For licence requirement the interested parties/firms/companies can contact**, The Director, ICAR-Sugarcane Breeding Institute, Coimbatore 641007, Tamil Nadu, India. Phone: 0422 2472621. Website: www.sugarcane.res.in Email: director.sbi@icar.gov.in, itmu.sbi@icar.gov.in.

**For retail or wholesale requirement of soil moisture indicator the licensees who are manufacturing at present, is provided below, may be contacted directly. Approximate price per unit is Rs. 1500/-+GST.**
Details of eight firms obtained licence from ICAR-SBI for commercial production

Shri Madeswaran V  
KSJNM Marketing,  
SF No. 29/1B, Ona Palayam,  
Vadavalli to Thondamuthur Road,  
Coimbatore Tamil Nadu 641 109, India,  
http://www.ksnm.co.in/,  
+91 93632 61175, +91 93603 88900  
Email: info@ksnm.in

Shri Vinay Krishna  
Proprietor  
Tech Source Solutions,  
#163, Rajeshwari Complex, 2nd Floor, Above Karnataka Bank,  
R V Road, Near Minerva Circle, Bengaluru 560004,  
Mobile: +91 9035067427, Email: info@techsourcesolutions.in.

Shri Mugunth  
Director,  
Nagarjuna Agrochemicals Pvt. Ltd.,  
G-01, D.No. 6-3-1218/6/2, Street No.6, Spring Heaven, Umanagar, Begumpet, Hyderabad-500016, Andhra Pradesh, India,  
Phone: (p) 9848045670, (0) 07660000650, Email: minilab2015@yahoo.com,  

Shri P.Shekhar Pandey,  
Director, Parashar Agrotech  
H.O. : S-15/2-14-4-5, Mohankung Apartment,  
Ghausabad, Varanasi-221002 (U.P.)  
Mobile : 9918470920, 8173844260  
E-Mail : Parasher76@gmail.com

Shri A. Muralidhar  
Proprietor, Gayathri Agri Inputs  
Regd.Office : Plot No.10, Block No.25, IInd Floor, APIIC Industrial Area, Autonagar, Hayathnagar Mandal, R.R. Dist. Hyderabad-500070  
Works: Plot No.35, Sy.No.448/2, APIIC Industrial Area, Gopalaipally Village, Chityal Mandal, Nalgonda Dist. Telangana, India  
E-Mail: gayatriagri14@gmail.com Ph. :-+91 99595 22537, +91 91777 55523

Shri Kaushal Paliwal  
M/s Farm Tech India,  
6, Sawarkar Market  
Dutta Chowk Yavatmal-445001  
Phone : +91 232244282, Mobile: 9689064640  
Email: farmtech@ yahoo.com

Dr Suraj Patil  
M/s G.T. Biosciences Pvt. Ltd.,
The following four firms are actively manufacturing the soil moisture indicator and distributing throughout the country.

Shri Vinay Krishna  
Proprietor  
Tech Source Solutions,  
#163, Rajeshwari Complex, 2nd Floor, Above Karnataka Bank,  
R V Road, Near Minerva Circle, Bengaluru 560004,  
Mobile: +91 9035067427, Email: info@techsourcesolutions.in.

Shri P. Shekhar Pandey,  
Director, Parashar Agrotech  
H.O.: S-15/2-14-4-5, Mohankung Apartment,  
Ghausabad, Varanasi-221002 (U.P.)  
Mobile: 9918470920, 8173844260, E-Mail: Parasher76@gmail.com

Shri Mugunth  
Director,  
Nagarjuna Agrochemicals Pvt. Ltd.,  
G-01, D.No. 6-3-1218/6/2, Street No.6, Spring Heaven, Umanagar, Begumpet,  
Hyderabad-500016, Andhra Pradesh, India,  
Phone: (p) 9848045670, (0) 07660000650, Email: minilab2015@yahoo.com,  

Shri Radheshyam Mundhda,  
SKR Agrotech,  
Shri Devi Ratan Complex, 132, Subhash Rd,  
Agyaram Devi Square,  
Ganeshpeth Colony, Nagpur,  
Maharashtra-440018, Phone: (p):7709373832
Till date totally eight firms were provided with license by ICAR-SBI for manufacturing the Soil Moisture Indicator. Some of the technology licensing photos is provided below,

Tech Source solutions, Bengaluru signed an MoU for Soil Moisture Indicator technology on

Farm tech, Yawatmal, Maharashtra signed a MoU for Soil Moisture Indicator technology on 28-11-2018
Parashar Agrotech Bio. Pvt Ltd., Varanasi signed a MoU for Soil Moisture Indicator technology on 26-02-2018

Gayathri Agri Inputs, Hyderabad signed a MoU for Soil Moisture Indicator technology on 26-02-2018
GT Bioscience Pvt Ltd, Nagpur signed a MoU for Soil Moisture Indicator technology on 04-01-2019

SKR Agrotech, Nagpur signed a MoU for Soil Moisture Indicator technology on 22-11-2019

ICAR-Sugarcane Breeding Institute
Coimbatore 641007, Tamil Nadu India