

# THE SOUTH INDIAN SUGARCANE & SUGAR TECHNOLOGISTS' ASSOCIATION



## TWO DAY SEMINAR

on

**“Sustainability of Sugar Industry  
by Improving Sugarcane Productivity and  
Sugar Recovery”**

on

**20<sup>th</sup> & 21<sup>st</sup> May, 2022**

at

**THE PARK HOTEL  
Chennai**



**The South Indian Sugarcane  
& Sugar Technologists'  
Association (SISSTA)**

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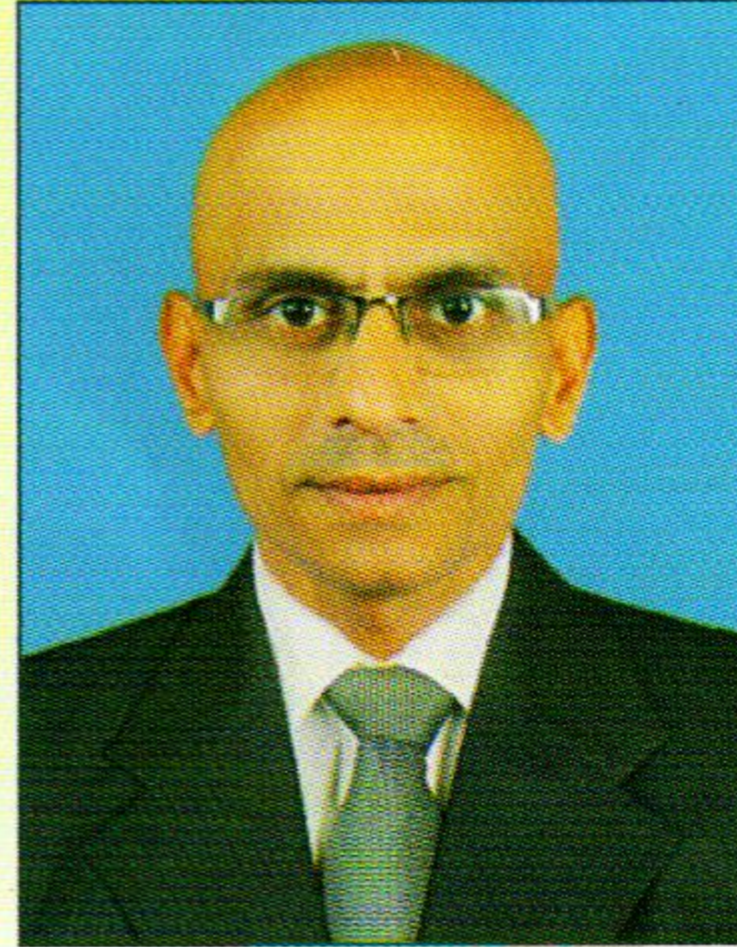
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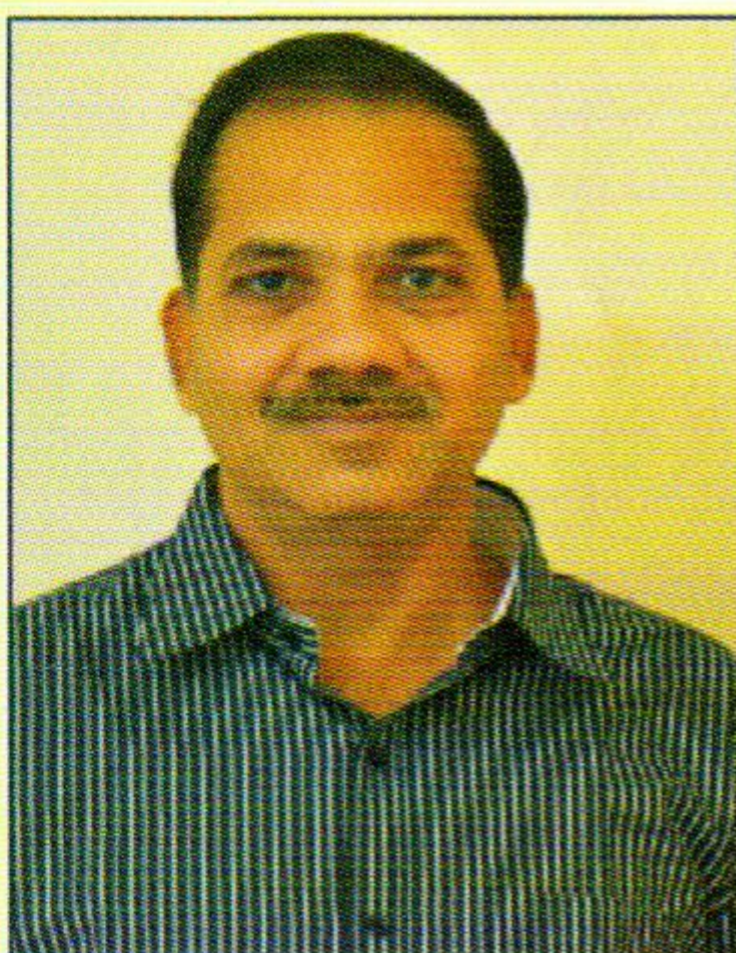
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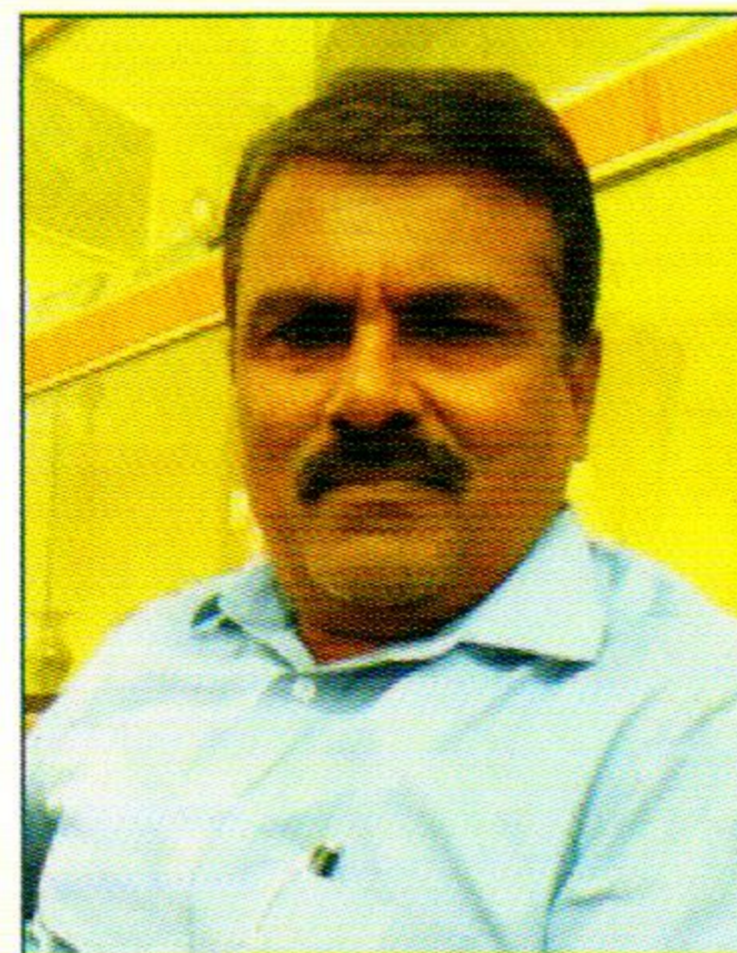
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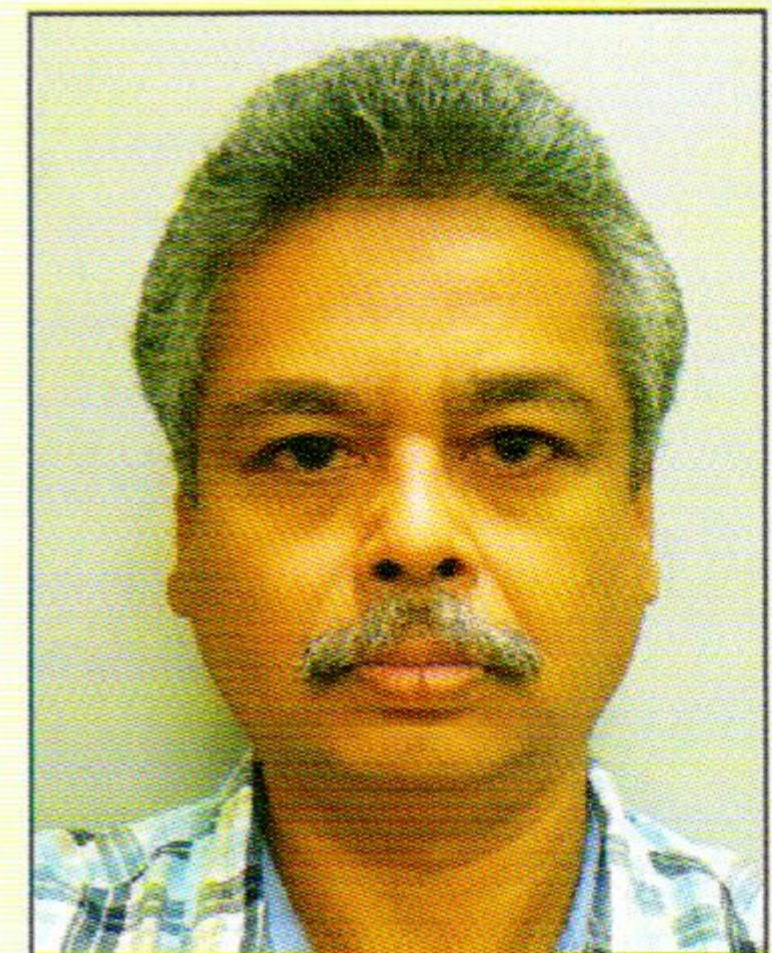
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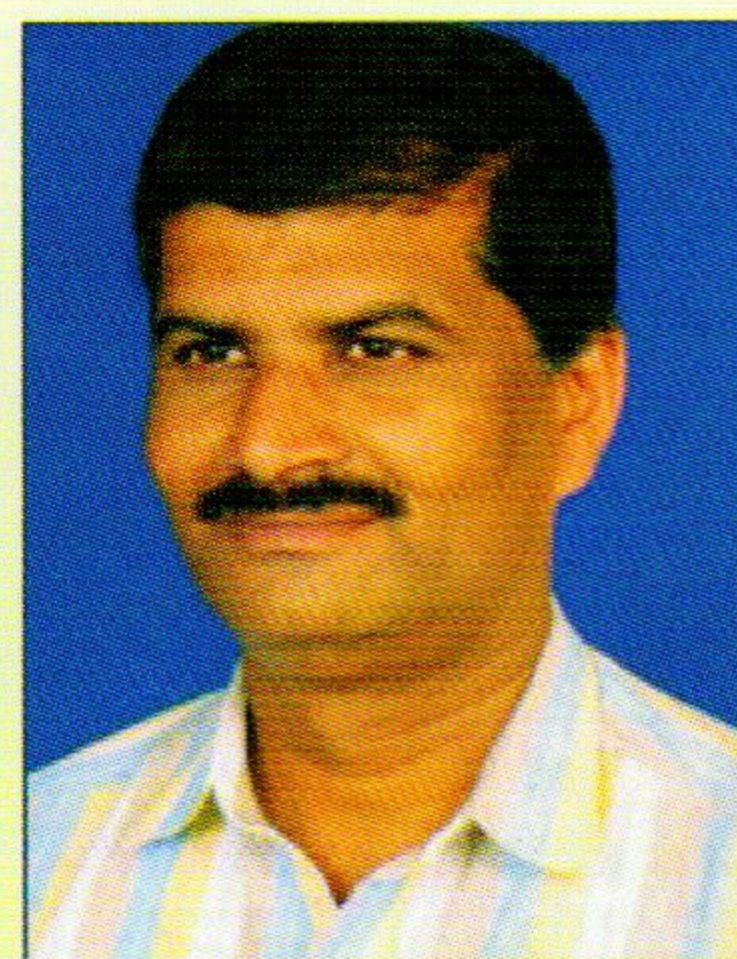
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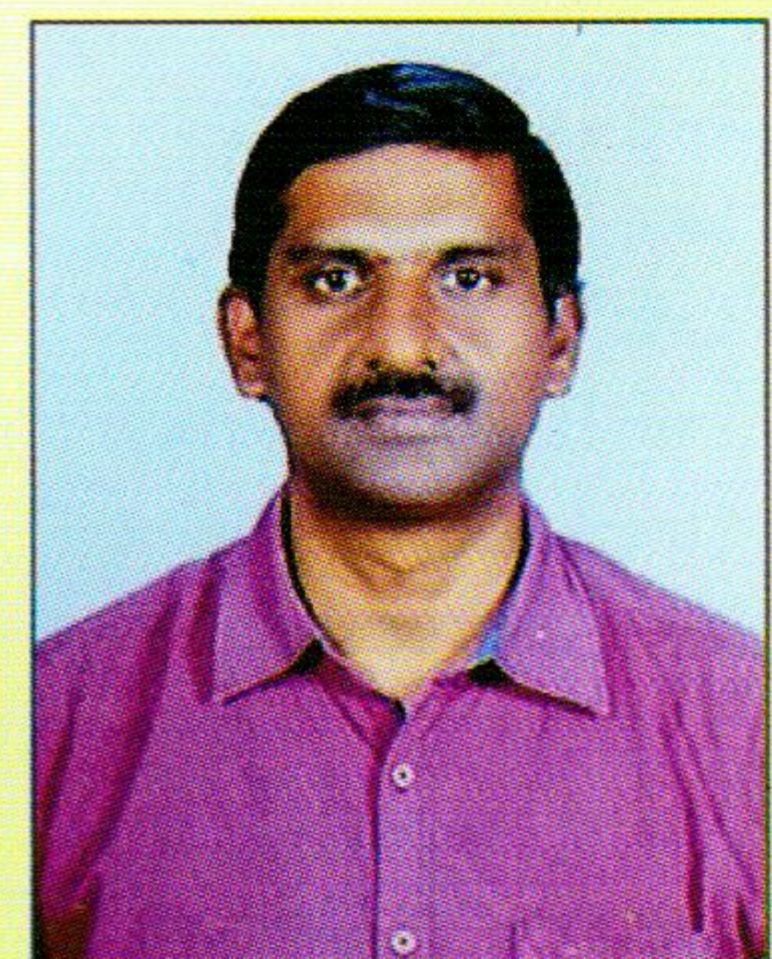
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## **WATER CONSERVATION IN SUGARCANE FARMING THROUGH IRRIGATION SCHEDULING USING SOIL MOISTURE INDICATOR**

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Water is a scarce resource in the 21<sup>st</sup> century which is a serious concern for agriculture and allied sectors. Improving water productivity is understood in terms maximum output from per unit volume of water. Soil moisture based irrigation scheduling is not in practice in our country, due to non-availability of suitable devices. Scheduling irrigations would lead to more crop and income per drop of water, which requires use of simple, low-priced and efficient soil moisture indicating devices. 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 sophisticated devices viz., neutron moisture probe, Ultrasonic Doppler systems etc., are very expensive and suitable only for research purposes, these are unsuitable for farmers use.

A research project, entitled Farmers' Participatory Action Research Programme (FPARP), funded by the Ministry of Jal Shakti, Govt of India has been initiated in 2008. In this project, experiments were laid in different locations and farmers were sensitized on various water conservation techniques including scheduling of irrigations using a popular device for measuring soil moisture status "Tensiometer". Farmers irrigated their sugarcane crops based on Tensiometer readings, which considerably reduced the number of irrigations, led to saving of water. However, there were problems in using the device such as need for multiple installations in the field, expensive, need for regular filling of water, frequent blocks in the ceramic cup, leakage and other maintenance problems.



To address these issues and to find a better device ICAR-SBI team scientist made efforts and developed a simple device named as 'Soil Moisture Indicator (SMI)' and used for scheduling irrigations. 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 (FPAR). This device was tested in PTD (Participatory Technology Development) approach by the farmers in comparison to the Tensiometer for saving precious irrigation water. The results indicated that farmers' preferred SMI totensiometer due to various advantages viz., inexpensive compared to Tensiometer, simple to use, no recurring expenses, relatively less maintenance, irrigation water saving of about 15% and 8% improvement in cane yield (which is about 30 lakh litres of irrigation water/hectare in the case of sugarcane crop). It has helped to bring additional area under cultivation with the same quantity of irrigation water available in the farm.

#### **Effect of using SMI on cane yield and water savings in farmers' field**

<b>Item</b>	<b>Conventional irrigation</b>	<b>Irrigation based on SMI</b>
Cane yield (t/acre/crop)	55.8	60.4
No. of irrigations / crop	42.0	36.0

#### **About the SMI**

This device works based on the principle that soil electrical resistance is inversely proportional to soil moisture content. Field capacity, available soil moisture and permanent wilting point (PWP) are the key parameters considered for soil moisture indication. The device has two metal sensor rods for measuring soil moisture. It works by inserting the metal rods in the soil and pressed the switch, after pressing the switch, the electronic circuit translates soil resistance into a colour glowing light emitting diode (LED). Totally ten LEDs are provided which comprises three each for blue, green, red and one orange for approximation. Three LEDs are provided for respective soil moisture approximation primarily to suit different types of soils. The indications are,



moisture status slightly above PWP is indicated by orange glow, in any case soil moisture must not go below this level. The glowing of red colour LED indicates immediate irrigation failing which drastically affect crop growth and yield potential of the crops. Soil moisture status sufficiently above PWP and less than field capacity is indicated by green glow. Blue glow indicate soil moisture is at field capacity, which indicates excess soil moisture. SMI will not provide the precise soil moisture status, as it is only an objective indication. There is a possibility of getting errors while using SMI in saline or clayey or sandy soils, which warrants a fine-tuning in the electronic assembly before out for use in the field. SMI is portable, requires no permanent installation in the field and can be used in the field to ascertain the soil moisture level as per the user's choice.

### **Farmers' acceptance**

Large scale demonstrations by SMI in the farmers' fields through FPARP indicated a saving of about 15% irrigation water and 8% improvement in cane yield. As the purchase-price of SMI is much lower, farmers can easily buy SMI (Rs. 1500/-+GST) compared to Tensiometer (next best available option) which needs an expense of about Rs. 20,000/ha. SMI reduces the number of irrigations thereby saving significant quantity of precious water resources per hectare, which is about an estimated 30 lakh litres of irrigation water/hectare in case of sugarcane crop. Due to this, farmers could bring additional area under cultivation with the same quantity of irrigation water and earn additional profits. Reduction in number of irrigations helps in reducing the cost of sugarcane cultivation by saving six man-labourers. Currently, with the one-man labour wage rate being about Rs. 400/day a saving of Rs. 2,400 could be ensured. Overall, the reduction in the estimated cost of cultivation is Rs. 5000/ha. This reduction could also save 220- 240 units of electricity in a year/ha. At the national level, if SMI is used, an estimated saving of about 60 - 65 crore units of electricity per year is estimated in case of sugarcane cultivation. In terms fringe benefit, as every irrigation would require at least one working day for monitoring and managing a one hectare farm, the farmer could effectively use about 6 working days to other farm work, when SMI is used.



## **Awareness for SMI**

The awareness on water saving through soil moisture indicating device is rare practice in the country. In order to scale-up and scale-out the technology, display and demonstrations of the device were carried out in the Agri Exhibitions, Farm fairs, Kisan Melas, National Science Day, Trainings, Seminar, Symposia, Conferences and other gatherings to reach farmers, rural and urban youth, sugar mills officials, line department personnel etc. These efforts were widely covered in print, radio and television media, besides social media. The technology was introduced to high level dignitaries viz., Union Ministers, Government Secretaries, etc., in 87<sup>th</sup> Annual General Meeting of ICAR meeting at New Delhi and Special meeting with The Secretary, Department of Agriculture, Cooperation & Farmers welfare (DAC&FW), New Delhi. Such efforts had resulted in large scale demonstrations by KVKs across the country. Since SMI is versatile in nature, it can be used for various crops, besides sugarcane, such as groundnut, brinjal, Ladies finger, coconut, banana, paddy, sesame, black gram, green gram, tomato, mustard and pomegranate, as demonstrated by Krishi Vigyan Kendras (KVKs) in the country. These details are available in KVK knowledge network [https://kvk.icar.gov.in/Passevent\\_farmer.aspx](https://kvk.icar.gov.in/Passevent_farmer.aspx).

## ***Commercialization, business opportunities***

An Indian patent application No. 2685/CHE/2010 dated 14-09-2010 and design registration IPO Nos. 231432, 231433, 231434 and 231435 were filed for the technology. ICAR-SBI- Institute Technology Management Unit (ITMU) has granted licence to twenty registered companies viz., (1) KSNM Marketing, Coimbatore, (2) Tech Source Solutions, Bengaluru, (3) Nagarjuna Agrochemicals Pvt. Ltd., Hyderabad, (4) Parashar Agrotech Bio Private Ltd., Varanasi (5) Gayathri Agri Inputs, Hyderabad, (6) Farm Tech India, Yavatmal, (7) G.T. Biosciences Pvt. Ltd., Nagpur, (8) SKR Agrotech, Nagpur, (9) Labtronics, Panchkula, (10) Harit Biocontrol Lab, Yavatmal (11) Solvent India Ltd, Lucknow, (12) Richardson Agriclinc, Indore and (13) OXITECH Corporation, Coimbatore, (14) Network Solution, Deoria, (15) Ranaji Biotech (India) Pvt. Ltd, Kanpur, (16)



Celebrating Farmers Edge International Pvt. Ltd (CFEI), Nashik, Maharashtra, (17) Microplex India, Wardha, (18) NEXT GEN Agro, Nagpur and (19) Varsha Agrotech, Bijapur and (20) National Instruments Corporation, Roorkee, Uttarakhand for commercial production in the country. The unit price of SMI is about Rs. 1500/- + GST depending on the manufacturers.

Till date, the licensees have produced and sold over 1.25 lakh units to sugarcane growers, farmers, State Agricultural Universities, ICAR KVKs and sugar mills throughout the country. Farmers' experiences reveal that scheduling irrigations using SMI could save considerable quantity of irrigation water per hectare per year in sugarcane crop without compromising on yield.

### ***Agri business incubator (ABI)***

This technology has created new business opportunity to the agripreneurs besides improvement in water productivity. Recently, one national level FPO, CFEI which has members all over the country including farmers, entrepreneurs and venture capitalists, has registered with ICAR-SBI-ABI, for commercial production and popularisation of ICAR-SBI technologies including SMI, among all categories of the farmers in the country. Apart from that, this device an ideal choice for start-ups, entrepreneurs due to low initial investments for licensing and commercial scale production at cottage industries.

### ***Awards and Recognitions***

Soil Moisture Indicator was included in the State of Indian Agriculture 2012-13 report published by the Ministry of Agriculture entitled, 'Soil Moisture Indicator: a Handy Device to save irrigation water'. It had also found a place in the Ministry of Agriculture's publication – New steps, progressive steps: A glimpse of PM's achievements during June 2014 to December 2016. A video-documentary on this project has been included in the ICAR's video catalogue and can be accessed at <http://www.youtube.com/watch?v=GL5kin1fZuI>. The Agriculture Skill Council of India (ASCI) and National Skill Development Corporation (NSDC) have included the skill viz., *how to schedule irrigation using devices such as Soil Moisture Indicator* in the National Occupational Standard of



a Sugarcane Cultivator. “Soil Moisture Indicator and its application in irrigation water management” was awarded the **First Prize** in the **National Water Awards - 2019** by the Ministry of Jal Shakti, Government of India under the Best Research/ Innovation/Adaptation of New Technology for Water Conservation category during the year 2020. During 2022, this technology has bagged the prestigious The energy and Resources Institute (TERI) –International Water Association (IWA)-United Nations Development Programme (UNDP) Water Sustainability Award 2021 – Excellence in water use efficiency in Agricultural Sector. This technology finds a place in Twitter and Facebook pages of Ministry of Agriculture and Farmers’ Welfare, Government of India and ICAR.

“Soil Moisture Indicator” was developed and tested in farmers’ fields for irrigation scheduling. This resulted in conservation of water resources, higher farm profit, electricity and labour saving, which is in agreement with Sustainable development Goals and National Development Priorities. Continual scaling-up and scaling-out efforts ensured the technology reach to stakeholders. Further details of the technology are available in <https://sugarcane.icar.gov.in/index.php/en/home/1157-soil-moisture-indicator>.

