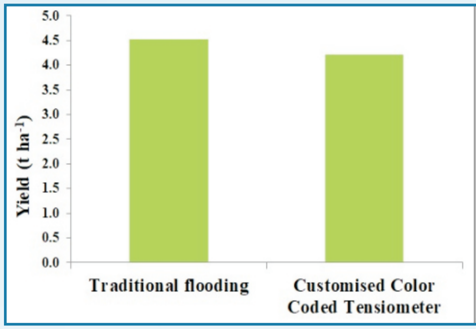
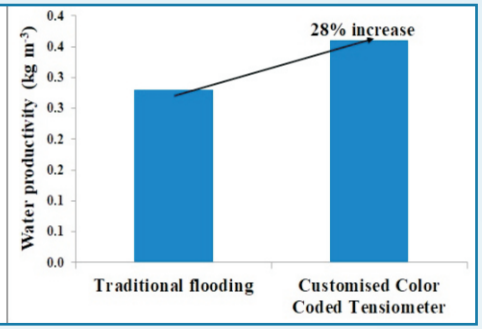
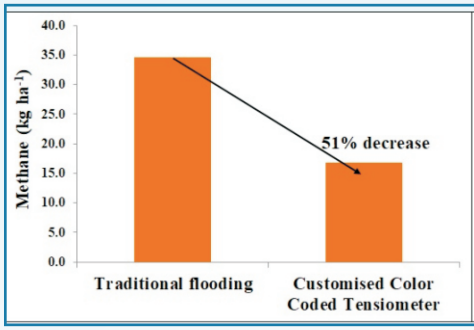
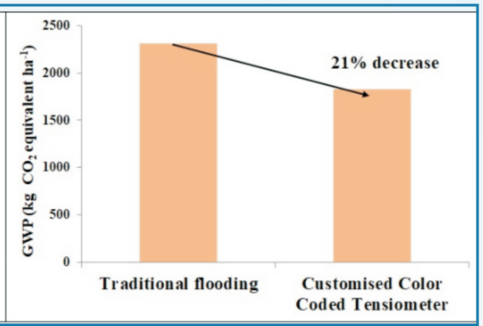
Upscaling

Customized color coded tensiometer can be upscaled by imparting training and demonstration by taking leverage of State and Central Govt. schemes like Pradhan Mantri Krishi Sinchai Yojana, National Food Security Mission, Odisha Integrated Irrigation Project for Climate Resilient Agriculture etc. Policy support and systematic extension will help popularization of this technology among the farmers.









Customized Color Coded Tensiometer for Scheduling Irrigation in Rice

NRRI Technology Bulletin - 154

Editing and layout : GAK Kumar & Sandhyarani Dalal

Photography: Prakash Kar & Bhagaban Behera

Laser typeset at the National Rice Research Institute, Indian Council of Agricultural Research, Cuttack (Odisha) 753 006, India and printed at Printech offset, BBSR. Published by The Director, for the National Rice Research Institute, Cuttack (Odisha) 753 006.

Customized Color Coded Tensiometer for Scheduling Irrigation in Rice

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Rice crop is known to have high water requirement. In traditional rice cultivation, farmers generally keep the field continuously flooded from transplanting to physiological maturity of rice crop. However, it is well established that continuous flooding is not necessary for rice to achieve high yields. After seedling establishment phase, even in the absence of standing water in field, rice plant can extract soil water from the below surface soil around root zone. Over the past few decades, water scarcity has emerged as one of the biggest challenges for sustaining rice production. Development of novel water saving technologies is an important step to help rice farmers cope with water scarcity. It is well proved that soil water potential as measured by tensiometer can be used as an irrigation index for scheduling irrigation in rice.

The tensiometer consists of a rigid and sealed body tube and a porous ceramic cup filled with water. The body tube is transparent so that water within the tube can easily be seen. The tensiometer tube along with the ceramic cup is inserted in the soil preferably at the plant root zone depth to provide a direct measurement of soil water potential- the force by which the soil particles hold the water. The wetter the soil, the lower the soil water potential. The ceramic cup is porous so that water can move through it to equilibrate with the soil water. As the soil dries out, water is sucked out of the tensiometer through the porous ceramic tip. This creates a partial vacuum in the sealed tensiometer tube which is measured by the electronic gauge. When the soil is watered the converse happens.

The core idea behind the use of tensiometer is the identification of threshold soil water potential for optimizing irrigation scheduling. Such irrigation scheduling can maximizing water productivity by reducing irrigation water input, because farmer generally over irrigates the crop irrespective of its requirement.

A simplified and farmer friendly version of tensiometer tube for real time soil water potential based irrigation management has been developed by ICAR National Rice Research Institute, Cuttack. In this tensiometer, the usual measuring gauge has been replaced by the stripes of light blue, deep blue, orange and brown color. While the water level in tensiometer tube at light blue stripe signifies no need for irrigation, there is need to irrigate when the water level enters the deep blue stripe. The entry into the orange and brown stripe may adversely affect the crop yield and hence should be avoided.

Installation and Use

STEP-1

Before installation, fill the tensiometer tube with air free water and cap it. Place the unit into a container of clean water deep enough to cover the ceramic cup and leave overnight. The porous ceramic cup of the tensiometer must be kept dipped overnight to ensure that they get fully water saturated and do not leak.

STEP-2

The instrument is now ready to be installed, but the ceramic cup must be protected from drying out. Cover the ceramic cup with wet paper towels or a plastic bag, while transporting to the site.

STEP-3

- For field installation, make a hole in the soil, using a soil auger up to the desired depth (15 cm). Remove the auger and drop a handful of loose friable soil into the hole.
- Insert the tensiometer into the hole after removing the paper towel. Push the instrument by giving a firm twisting downward motion applied to the connecting tube and place the cup at the desired soil depth. This procedure will ensure the necessary intimate contact between the porous cup and the soil in the vicinity. However, care must be taken that the cup is not broken in this process.
- Backfill the hole with soil slurry so that the tensiometer is firmly held in the soil.

STEP-4

- Check the tensiometer tube for accumulated air. If air bubble is present beneath the service cap, the cap should be removed and the tube should be refilled with de-aerated water.
- Allow the tensiometer to equilibrate for about 24 hours before recording readings.

Precautions

- At regular interval the tensiometer tube should be inspected for accumulated air and if air has accumulated beneath the service cap, the cap should be removed and the tube should be refilled with water.
- In some of the soils viz. cat clay (Shrink-swell clay) which may shrink away from the porous cup during drying, resulting in loss of contact with the soil, very coarse sands which creates capillary barrier at the interface between micro and macropores, saline-sodic soils as their salts might block the pores of the ceramic cup, the response of tensiometer is slow and readings are not reliable.

Interpretation of the color stripes of Customized color coded tensiometer

Color Stripe	Interpretation
Light Blue	No need of Irrigation
Deep Blue	Irrigation should be applied
Orange	Immediate need of irrigation
Brown	Adverse effect on grain yield and hence should be avoided

Testing and Validation

Customized color coded tensiometer was tested and evaluated both at research station and farmer's field. Experimental data revealed that irrigation scheduling based on customized color coded tensiometer resulted in similar grain yield with significantly higher water productivity (28%) and it also mitigates methane emission by 51% and global warming potential by 21%. Its cost-benefit ratio varies from 0.4 to 0.5.