Farmers' Field School on Climate Smart Water Management Practices in Rice

RESILIENCE

Water is elixir of life. Life cannot exist on earth without water. It's very much important to conserve the water and use it judiciously. Agricultural crops consume a significant proportion of fresh water available for use. In India, out of the total water available for agriculture, 52% is used for rice farming, most of it is lost through deep percolation resulting in a very poor water productivity. Several farm management techniques are available if adopted properly can enhance water use efficiency in rice and save a lot of water for other competing requirements. Of these techniques, diversification of rabi rice to low water requiring crops, alternate wetting and drying (AWD), System of Rice intensification (SRI), Tensiometric and Chameleon sensor based irrigation scheduling, micro irrigation (Drip system) etc are some of the promising options available for its wider adoption. The dissemination of these climate smart technologies to farmers' field can be done by demonstration and training through farmers Field School (FFS).

Efficient water management is one of the important steps in rice production process, which influence the productivity and cost of cultivation. Availability of limited water during *rabi* season gives an opportunity to farmers to utilize the available water efficiently without wasting much water. Farmer Field School (FFS) on "Climate Smart Water Management Practices in Rice" was organized at villages Badakusunpur and Sundarda of Tangi and Niali block respectively during *rabi* season of the year 2021 under the "RESILIENCE PROJECT". In FFS, 32 farmers from five villages namely Badakusunpur, Abhaypur, Juanga, Sundarda and Haripur participated in experiential learning activities related to climate smart water management practices. These activities involve field demonstration experiments, regular field observations, and group analysis. The knowledge gained from these activities enabled the participants to make their own situation-specific decisions about water management practices.

Objectives of FFS

1. To train the farmers on use of micro irrigation (Drip and sprinkler), Alternate wetting and drying (AWD), Tensiometric and Chameleon sensor based irrigation scheduling for reducing the wastage of water and enhancing the water use efficiency.
2. Enhancing farmers' awareness towards beneficial effect of climate smart water management practices and its economic and environmental impact.

Farmers Field School (FFS) on "Climate Smart Water Management Practices in Rice"

Course Director: Dr A K Nayak, Principal Scientist and Head CPD, ICAR-NRRI, Cuttack
Course Coordinator: Dr Rahul Tripathi, Senior Scientist, CPD, ICAR-NRRI, Cuttack
Venue: Badakusunpur, Tangi, Cuttack and Sundarda, Niali, Cuttack
Period: 20.01.2021 to 28.02.2021

Sl. No	Date	Time	Topic	Resource person
1.	20.01.21	10.30 am 11.30 am	Importance of different water management strategies in rice	Dr AK Nayak
2.	20.01.21	11.30 to 01.30 pm	Different water management strategies for non rice crops in *rabi* season	Dr AK Nayak

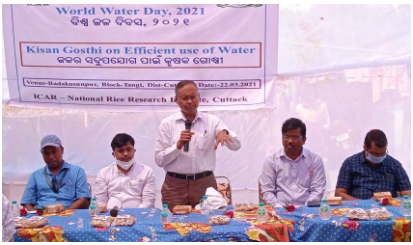
3.	27.01.21	09.00 to 10.00 am	Alternate wetting and drying system for irrigation management as an alternative to flooded irrigation in rice	Dr Rahul Tripathi
4.	27.01.21	10.00-11.00 am	Installation and use of piezometers (pani pipe) for irrigation management in rice	Pranab Ku Nandy/ Dr Rahul Tripathi
5.	27.01.21	11.00 am 12.00 pm	Sensor based alternate wetting and drying	Dr Anjani Kumar
6.	05.02.21	10.30 – 11.30 am	Effect of age of seedlings on rice yield	Dr B.S. Satpathy
7.	05.02.21	11.30 am - 12.30pm	Effect of planting distance on rice growth and yield	Dr M Shahid
8.	05.02.21	12.30 - 01.30pm	System of rice Intensification for enhancing the water use efficiency and profitability	Dr BB Panda
9.	16.02.21	10.00 - 11.00am	Drip irrigation in maize and sunflower	Pranab Ku Nandy/ Mr A.K. Mishra
10.	16.02.21	11.00 am 12.00pm	Scope of micro irrigation system for enhancing water productivity in cereals, oilseeds and vegetables	Dr Rahul Tripathi/ Pranab Ku Nandy/Dr PK nayak
11.	16.02.21	12.00 – 01.00 pm	Advantages of drip system of irrigation over the flooded irrigation system and economics of installation , farmers profitability and government support	Pranab Ku Nandy/ Dr DR Sarangi/ Simran Mohapatra
12.	18.02.21	10.00 - 11.00am	Principles of Tensiometric and Chameleon sensor based irrigation scheduling in rice and other crops	Dr Anjani Kumar
13.	18.02.21	11.00 - 12.00 pm	Concept of soil moisture tension and its application for determining the time of irrigation	Dr S Mohanty
14.	18.02.21	12.00 – 01.00 pm	Installation & use of chameleon sensor for irrigation scheduling in vegetables	Pranab Ku Nandy/ Simran Mohapatra
15.	27.01.21	10.00 - 11.00am	Effect of water management and plant water stress on incidence of rice-pest and disease	Dr SD Mohapatra
16.	28.02.21	11.00 – 12.00 am	Concept of Parshall flume for measurement of flow of water in open channels	Dr Rahul Tripathi/ Pranab Ku Nandy
17.	28.02.21	12.00 – 01.00pm	Installation of Parshall flume for water flow measurement in rice field	Pranab Ku Nandy

The approach of FFS was followed to provide opportunity to farmers to learn and acquire the modern skills on irrigation methods and various climate smart water management practices through non formal education in a natural setting by directly involving them in installation of different equipments in the experimental field during the *rabi* season 2021 through demonstrations. Thirty two farmers (male & female) were selected to enroll and participate in the programme. These farmers were encouraged to attend the theory classes along with their kids, visit the demonstration in the fields, take observations and learn by doing independently. The classes of FFS were organized in the field. In the first session, the existing knowledge level of farmers was assessed through questionnaire and prevailing farmers' practice. Both theory & practical classes were conducted to train them about various climate smart water management technologies to implement in their experimental field.

Theory classes

Total eight theory classes were conducted to teach the farmers about water sources, efficient use of water and different water management strategies in rice like alternate wetting and drying (AWD) for irrigation management in rice**,** sensor based alternate wetting and drying**,** System of Rice Intensification (SRI) for enhancing the water use efficiency and profitability, effect of age of seedling and planting distance on growth and yield of rice, principle of colour coded tensiometer for irrigation management in rice and different water management strategies for non rice crops in *rabi* season like micro irrigation system for enhancing water productivity in cereals, oilseeds and vegetables and Chameleon sensor based irrigation scheduling in crops like maize, sunflower and vegetables. They were also briefed about concept of Parshall flume for measurement of flow of water in open channels.

Briefing the farmers about the climate smart water management strategies for agricultural crops



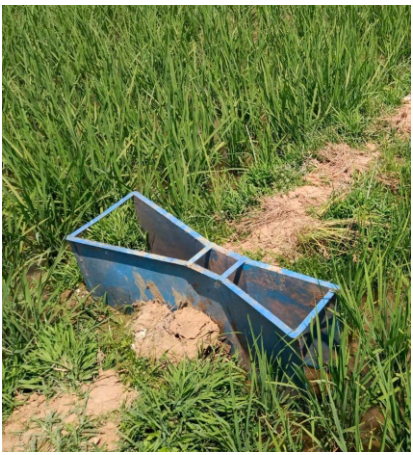
World water day 2021 celebration with Kisan Gosthi on efficient use of water at Badakushunpur

Practical classes

In nine practical classes farmers were given hands on and practical demonstration in their field for using improved water management practices like water measurement by Parshall flume, drip irrigation, Chameleon sensor based irrigation, Tensiometer based irrigation, Alternate wetting and drying (AWD), System of Rice Intensification (SRI).

Measurement of flow of water in open channels using Parshall flume

Parshall flumes are devices for the measurement of flow of water in open channels. The flume consists a converging section with a level floor and walls converges towards the throat section, a throat section with a downward sloping floor and parallel walls, and a diverging section with an upward sloping floor and diverging walls towards the outlet. The size of flume is determined by the width its throat.



Installation and measurement of irrigation water using Parshall flume

Guidelines should be followed for Installation of Parshall flume

- Set the flume in such a way that it is centred in the flow stream & the upstream floor of the flume should be set high.
- Set the outlet of the flume at or above the inverted outlet channel. The flat floor of the converging section must be set upstream. The flume must not float out of its intended final position during installation.
- Measure the depth of water flowing over the converging section of the Parshall flume by a measuring scale.

Alternate wetting and drying for irrigation management in rice

Alternate wetting and drying (AWD) is a water management technique, practiced to cultivate irrigated lowland rice with much less water than the usual system of maintaining continuous standing water in the crop field. In AWD, irrigation water is applied a few days after the disappearance of the ponded water. Hence, the field gets alternately flooded and non-flooded.

The field water tube

The main purpose of the tube is to monitor the water depth.

- Cut the plastic pipe or the bamboo to a 30 cm length with a diameter of 10 to 15 cm.
- Drill the bottom 20 cm of the tube with holes on all sides; these holes should be about 0.5 cm each and 2 cm away from one another.

Guidelines to be followed to install and take field observation using field water tube

- Place the pipe in a readily accessible part of the field, close to the bund (not less than 1 m away) for easy monitoring.

Alternating wetting & drying irrigation in rabi season

- Before burying the pipe, tie a coconut rope around the perforated portion of the pipe for easy movement of water into the pipe in such a way that the bottom 20 cm of perforated portion remains below the soil surface and the non-perforated 10 cm above the surface.
- Irrigate the field to re-flood to a depth of 5 cm above the soil surface as and when the water level drops 15 cm below the soil surface.
- Keep the field flooded during the flowering stage of the rice and after flowering, repeat the above procedure.
- To suppress the growth of weeds in the rice field, follow AWD method 1–2 weeks after the transplantation. In the case of many weeds in the field, start AWD after three weeks of transplantation.

System of Rice Intensification

System of Rice Intensification (SRI) is a set of climate smart Agroecological methodologies for increasing the productivity of rice by improving the management of plants, soil, water and nutrients.

Main components and principles of SRI

- Only 2-5 kg seeds are required to transplant in one acre of land.Transplant young seedlings of 8-12 days with 2-3 leaf stages in the main field with a wider spacing of 25x25 cm row to row and plant to plant with the help of a marker.
- Place a single seedling at the marked intersecting point & transplant straight and horizontally shallow depth of 1-2 cm. Use organic fertilizer like FYM and green manure.
- Use conoweeder for weed management in SRI between rows after 12 to 14 days of planting. Rotary weeder or Mandwa weeder is also used for control of weeds in SRI.

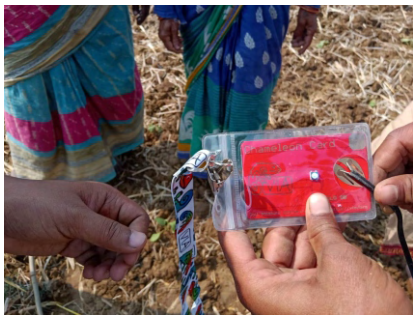
Younger seedlings, wider spacing and cono weeding in SRI method of cultivation

Chameleon Soil Moisture Sensor

Chameleon Soil Moisture Sensor is an instrument which measures water level and moisture content of soil and helps in irrigating the crop at right time. The Chameleon Card is used with Chameleon Soil Water Sensors and reads soil moisture.

Guidelines to be followed to install & take reading using Chameleon Soil Moisture Sensor

- Soak the sensor node in water for a few minutes before installation & make a hole for the sensor using the tools available; for example, an auger, trowel or large drill bit.
- Install the sensor node individually in the active part of the root zone depth of 20 cm or at several depths at 10, 20 and 40 cm to measure the upper and lower part of the root zone**.**
- To ensure good contact between the sensor and soil, use a metal rod or wooden dowel to compact the soil down the hole and around the sensor.
- Place the two bare wires into the slots in the gold leaf & hold down the button to take the reading then a LED will display blue, green or red.
- Blue colour indicates wet soil, green colour – moist soil, brown-dry soil, fluorescent yellow colour- sensor wire is not connected and red colour indicates Battery needs replacement.



Chameleon sensor based irrigation scheduling

Colour coded Tensiometer based irrigation

Soil water potential as measured by tensiometer can be used as an irrigation index for scheduling irrigation in rice. For real time

measurement of soil water potential, tensiometer tubes and measuring gauge are required. Since, the cost of measuring gauge is high, the farmers cannot afford it. A simplified and farmer friendly version of tensiometer tube for soil water potential based real time irrigation management has been developed by ICAR - NRRI, Cuttack. In this tensiometer, the usual gauge has been replaced by the stripes of light blue, deep blue, orange and brown color.

Guidelines to be followed for installation and use of Colour coded Tensiometer

- Before installation, keep the porous cup of the tensiometer dipped into air free water for 2-3 days to ensure that they get fully water saturated and do not leak.
- For field installation, make a hole in the soil, using a soil auger up to the desired depth (15 cm) & drop a handful of loose friable soil into the hole.
- Fill the tensiometer with de-aerated water and cap it & push the tensiometer into the hole by giving a firm twisting downward motion applied to the connecting PVC tube and place the cup at the desired soil depth.
- Fill the space around tensiometer in the hole with soil slurry so that the tensiometer is firmly held in the soil & fill the tensiometer with de-aerated water and cap it. Allow the tensiometer to equilibrate for about 24 hours before making readings.
- Light blue colour indicates no need for irrigation, deep blue colour indicates irrigation should be applied, orange colour indicates immediate need of irrigation and brown colour indicates adverse effect on grain yield and hence should be avoided.

Tensiometer based irrigation in rabi season

Drip irrigation

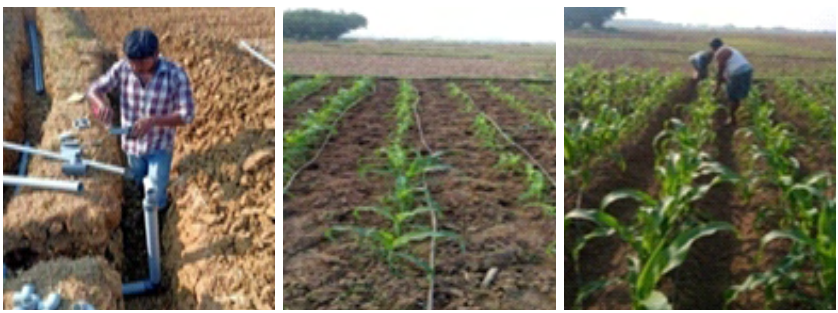
Drip irrigation is called trickle irrigation and involves dripping water onto the soil at very low rates (2-20 litres/hour) from a system of small diameter plastic pipes fitted with outlets called emitters or drippers. A typical drip irrigation system consists of the following components: pump unit, control head, main and sub main lines, laterals, emitters or drippers.

With drip irrigation, water applications are more frequent (usually every 1-3 days) than with other methods and this provides a very favorable high moisture level in the soil in which plants can flourish, fertilizer and nutrient loss is minimized due to a localized application, field leveling is not necessary, weed growth is less, labour cost is less than other irrigation methods, soil erosion is minimised, water distribution is uniformly controlled by the output of each nozzle.

To install drip system in your field you can get benefit from Govt. Schemes like PMKSY, under this scheme, 90% subsidy for small and marginal farmers & 80% subsidy for other farmers is provided.

Guidelines to be followed to install drip system

- Attach a screen filter in between the pump and the main line so that the organic particles and sand particles present in water are filtered.
- Install the main and sub main lines 1.5-2 feet depth below the ground level so that these are not damaged by the tillage implements.



Installation of drip irrigation system at Badakusunpur

- Attach the lateral with sub main and lay the lateral above the field.
- Choose the spacing of lateral to lateral and dripper to dripper distance according to the crops grown in the field like for rice 20x15; sweet corn 60x25; potato 60x15-20; brinjal 60x45; tomato 60x30; okra 50x30; chilli 50x30 cm.

Evaluation and Farmer's feedback

The impact of FFS on farmers' knowledge in relation to water management was evaluated by conducting tests through questionnaire both at the beginning and end of the school. The questionnare consists of 16 simple questions viz

1- What are the three simple techniques to save water? Write the names.

2- What is the minimum depth of water level you should maintain in the field for the AWD ?

3- What should be the length and diameter of the water pipe to be used in AWD?

4- At what level of water depth you have to irrigate the field in the method of AWD?

5- What is the procedure for preparation of seed bed for SRI?

6- How many days of seedling should be used for planting in the method of SRI?

7- What should be the spacing to be maintained during planting in SRI?

8- What is the number of seedling to be transplanted in SRI?

9- What is the advantage of drip irrigation?

10- What are the main components of drip system?

11- What is the procedure to install colour coded tensiometer?

12- What does the colour deep blue indicate in colour coded tensiometer?

13- What do the orange and brown colour indicate in colour coded tensiometer?

14- What is the procedure to use chameleon sensor?

15- What do the colours blue, green & red suggest in chameleon card?

16- How do you install the parshall flume?

The tests conducted at the begining showed none of the farmers could score more than 30%. However, at the end of the FFS, 9 farmers scored more than 85% mark, 12 farmers scored more than 75% and 11farmers scored more than 65% mark. Out of the 32 farmers more than 90% attended all practical and theory classes and actively participated in the interaction and showed keen interest to learn water management methods.

Conclusion

The FFS on climate smart water management practices improved the knowledge and skill of farmers from five villages namely, Badakusunpur, Abhaypur, Juanga, Sundarda and Haripur about the different climate smart water management techniques and installation of different instruments in their field. Through their participation in theory and practical classes, taking observation, interpretation and group interaction they could enhance their knowledge about the procedure of implementation of different techniques. The FFS could improve awareness of farmers about the environmental and economic importance of water management, thereby empowering them to contribute towards sustainable crop production.

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Farmers' Field School Brochure

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