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Up-scaling of water saving technologies in rice cultivation under corporate social responsibility scheme

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Abstract

Field demonstrations were carried out in 25 locations each separately in Villupuram district of Tamilnadu for upscaling water saving technology in rice cultivation like System of Rice Intensification (SRI) and Alternate Wetting and Drying Irrigation(AWDI). The bio-metric observation data was recorded in the earmarked area in the demonstration field plot and the computed average mean data was used for analysis. In the demonstrations, the total water requirement, quantity of water required to produce one kilogram of rice and number of irrigations were significantly less in SRI compared to conventional planting system. There was water saving of 350 mm recording 29.16 percentage. Similarly, AWDI demonstrations revealed that, AWDI saved 270-350 mm more water per hectare than the normal irrigation system. Increase in the grain yields obtained with water saving made the farmers confident on these water saving technologies.

Keywords: Rice crop,water saving technology, up-scaling

Introduction

Rice is the principal food crop grown in 29 districts of Tamilnadu state. Being the major consumer of water, the water use efficiency of growing rice crop is low compared to other field crops. The total area on an average under rice cultivation in Tamilnadu is 17 to18 lakh hectares. Though the modifications in rice cultivation system are available for mitigating the intermittent drought, the popularisation of these technologies is the need of the hour for conserving the precious irrigation water and to sustain the rice productivity. The promising technologies on water saving in rice like System of Rice Intensification (SRI) and Alternate Wetting and Drying Irrigation(AWDI) were advocated to the farmers on corporate social responsibility basis to upscale and popularise the techniques among poor land holding farmers and thereby improve the livelihood of the farmers in rice growing locations of Villupuram district of Tamilnadu.

Methodology

Up scaling of promising Technologies (SRI&AWDI)

1. The System of Rice Intensification (SRI)

The System of Rice Intensification, known as SRI in rice cultivation, can reduce water requirements, increase land productivity, and promote less reliance on artificial fertilizers, pesticides, herbicides, and other agrochemicals, all while buffering against the effects of climate change and reducing greenhouse gases. The methodology is based on principles that interact with each other like: early, quick and healthy plant establishment, reduced plant density, improved soil conditions through enrichment with organic matter and reduced and controlled water application. Recommended management practices for SRI under irrigated conditions are transplanting single seedlings (one plant per hill) that are 2 - 3 leaf-stage usually 14-15 days' old minimizing the transplanting shock and widely spaced in a square grid pattern of 25x25 cm accommodating 16 plants per metre square.

Soil: The soil is enriched with organic matter to improve soil structure, nutrient and water holding capacity, and favour soil microbial development.

Water: Only a minimum amount of water is applied during the vegetative growth period. 1-2 cm layer depth of water is introduced into rice plot followed by allowing the rice field to dry until cracks become visible, at that point of time, a thin layer of water is introduced by alternate wetting and drying until flowering stage. At flowering, a saturated layer of water is maintained till the grain filling period and water drained in the rice field 2-3 weeks before harvest.

Nutrients: As soils are improved through organic matter additions, many nutrients become available to the plant from the organic matter. Additionally, the soil is also able to hold more nutrients in the rooting zone and release them when the plants need them.

Weeds: While avoiding flooded conditions in the rice fields, weeds are to be kept under control at an early stage. A rotary hoe - a simple, inexpensive, mechanical push weeder is most often used starting at 10 days after transplanting, repeated ideally every 7-10 days until the canopy coverage of the crop. The weeder has multiple functions like incorporating the weeds into the soil, after decomposing the nutrients are recycled. The procedure also provides a light superficial tilth and aerates the soil. It stimulates root growth by root pruning and makes nutrients available to the plant system. The process also distributes water across the plot, contributing to continuous levelling of the plot and eliminating dry water patches in the field that could create anaerobic conditions for the rice plants. The use of the weeder contributes to homogeneous field conditions, creating a uniform crop stand and leading to increased yields.

2. Alternate Wetting and Drying Irrigation (AWDI)

Alternate Wetting and Drying Irrigation (AWDI) is a water-saving technology that farmers can apply to reduce their irrigation water use in rice fields without decreasing yield. In AWD, irrigation water is applied, a few days after the disappearance of the ponded water. Hence, the field is alternately flooded and non-flooded. The number of days of non-flooded soil between irrigations can vary from one to more than ten days depending on a number of factors such as soil type, weather and crop growth stage. A practical way to implement AWD safely is by using a 'field water tube' ('pani pipe') to monitor the water depth on the field. After irrigation, the water depth will gradually decrease. When the water level in the water pipe has dropped to about 15 cm below the surface of the soil, irrigation should be applied to re-flood the field to a depth of about 2.5 cm. One week before and a week after flowering, the field should be kept to a depth of 2.5 cm as needed. After flowering period, the water level can be allowed to drop again to 15 cm below the soil surface before re-irrigation. AWD can be started a few weeks (1-2 weeks) after transplanting. When more weeds are present, AWD should be postponed for 2-3 weeks to assist suppression of the weeds by the ponded water

The field **water tube (*Pani pipe*)**: The field water tube is made up of 30 cm long plastic pipe and should have a diameter of 10-15 cm so that the water table is easily visible, and also it is easy to remove soil inside. Perforate the tube with many holes on all sides, so that water can flow readily in and out of the tube. Hammer the tube into the soil, so that 15 cm protrudes above the soil surface. Take care not to penetrate through the bottom of the plough pan**.** Remove the soil from inside the tube so that the bottom of the tube is visible.

Results and Discussion

Field demonstrations were carried out in 25 locations each separately in Villupuram district for upscaling water saving technology in rice cultivation like SRI and AWDI. In the field demonstrations conducted, plant biometric observations were recorded and water saving components computed.

In SRI demonstrations, the conventional planting system recorded water requirement from 1200 - 1390 mm compared to 850 mm -1050 mm of water requirement in SRI. Quantity of water required to produce one kilogram of rice was 2200 - 2950 litres in conventional planting compared to 1440-1880 litres in SRI system. The number of irrigations recorded were 24-30 in conventional planting and 15-24 irrigations **(Table 1)** in SRI. There was water saving of 350 mm per hectare.

In AWDI demonstrations, the normal irrigation system recorded water requirement from 1200 - 1350 mm compared to 750 mm - 1050 mm of water requirement in AWDI. Quantity of water required to produce one kilogram of rice was 2300 - 2900 litres in normal irrigation system compared to 1300-1900 litres in AWDI. The number of irrigations recorded were 24-30 in normal irrigation system and 15-24 irrigations in AWDI **(Table 2).** There was water saving of 270 to 350 mm per hectare.

Outcome of the project

- ❖ During the conduct of the CSR programme, the farmers realized the ill effect of flooding and the positive factors of alternate wetting and drying.
- ❖ The water saving through adoption of the technologies helped the farmers to expand additional area under rice cultivation.
- ❖ Through introduction of these technologies, inadequacy of labour and non-availability of labours for field could be managed easily.
- ❖ Increase in the grain yields obtained made the farmers confident on the water saving technologies.
- ❖ The rice growing system in the demonstrated areas could be modified completely resulting in considerable quantity of water saving.
- ❖ The concept of flooding would be completely eliminated from the minds of rice farmers.

Table.1. Water productivity in conventional rice planting and system of rice intensification

Sl. No	Name of the Farmer	No. of Irrigation		WR (m^3)		Water Productivity (kg/m^3)		Litre of water /kg of grain		Rice Variety
		Conv	SRI	Conv	SRI	Conv	SRI	Conv.	SRI	
1.	Th.G.Nagarajan KilVayalamur	26	19	13000	9750	0.40	0.65	2471	1537	ADT 37
2.	Th.S.Durai,Kedar Kedar	24	17	12000	8500	0.41	0.67	2439	1483	TKM 13
3.	Th.P.Prabhagar Kalladikupam	25	19	12500	9750	0.40	0.63	2485	1585	ADT 37
4.	Th.N.Ganavel, Kedar	27	20	13500	10250	0.34	0.53	2903	1880	ADT 45
5.	Th.R.Duraikkannu Veeramur	26	19	13000	9750	0.41	0.64	2411	1560	ADT 39
6.	Th.M.Antonysamy Kilvayalamur	27	20	13500	10250	0.38	0.59	2626	1694	BPT5204
7.	Tmt.E.Dhanam Vairapuram	26	18	13000	9000	0.42	0.75	2342	1333	ADT 37
8.	Th.V.Purushotaman KilVayalamur	23	19	12500	9750	0.45	0.67	2200	1488	ADT 37
9.	Th.V.Abaranji KilVayalamur	26	19	13000	9750	0.42	0.64	2385	1547	ADT 37
10	Th.V.Mayappan KilVayalamur	27	21	13500	10500	0.41	0.62	2495	1622	ADT 37
11.	Th.V.Kumar Vairapuram	24	17	12000	8500	0.42	0.70	2366	1428	ADT 37

Sl. No	Name of the Farmer	No. of Irrigation		WR (m^3)		Water Productivity (kg/m^3)		Litre of water /kg of grain		Rice Variety
		Conv	SRI	Conv	SRI	Conv	SRI	Conv.	SRI	
12.	Th.V.Murugesan Vairapuram	23	15	12500	9750	0.37	0.57	2688	1747	ADT 45
13.	Tmt.M.Vasantha Vairapuram	26	21	13000	10250	0.38	0.59	2642	1694	ADT 45
14.	Th.G.Elumalai Kilvayalamur	27	19	13500	9750	0.33	0.58	2947	1728	ADT 37
15.	Th.N.Sundharrajan Kongarampondi	26	21	13000	10250	0.36	0.56	2795	1772	ADT 37
16.	Th.V.Narasimman Kongarampondi	24	19	12000	9750	0.43	0.62	2330	1598	ADT 37
17.	Th. M.Krishnan, Marur	27	22	13500	10500	0.38	0.58	2673	1710	ADT 37
18.	Th. N. Nirmala Kilvayalamur	30	24	13700	10250	0.34	0.55	2926	1796	ADT 37
19.	Th.K.Manivannan Melperadikuppam	30	25	12500	8750	0.34	0.64	2941	1557	ADT 37
20.	Th. N. Nagaraj Kilvayalamur	30	26	13900	10200	0.34	0.58	2926	1721	ADT 37
21.	Tmt.M.Aanathi Melperadikuppam	30	24	12000	9000	0.39	0.64	2561	1547	ADT 37
22.	Th. K. Manikkam Kollar	30	24	12800	9900	0.35	0.54	2843	1821	ADT 37
23.	Th.N.Elumalai Aazhiyur	28	24	13500	9750	0.33	0.58	2947	1728	ASD 16
24.	Th.R.Venkatachalam Kilvayalamur	29	24	13000	9500	0.37	0.63	2669	1580	ADT 37
25	Th.N.Mohan Aazhiyur	30	23	12000	8500	0.45	0.69	2222	1440	ADT 37

Table.2. Water productivity in conventional irrigation practice and alternate wetting and drying

Sl. No	Name of the Farmer	No. of Irrigation		Litre of water / kg of grain		Water Productivity (kg/m^3)		WR (m^3)		Variety
		FP	AWDI	FP	AWDI	FP	AWDI	FP	AWDI	
1.	Th.G.Jayamurthy V.salai	27	19	2523	1619	0.39	0.62	13500	9750	BPT 5204
2.	Th.D.Sridhar Konkrampundi	26	17	2490	1529	0.40	0.65	13000	8950	BPT 5204
3.	Th.M.Elumalai Aralavadi	24	16	2343	1536	0.43	0.66	12000	8300	ADT 37
4.	Th.P.Yoganathan Nemur	23	16	2432	1349	0.41	0.74	13500	8300	ADT 37
5.	Th.V.Chellapan Vairapuram	25	17	2475	1488	0.40	0.67	12500	8500	ADT 37

Sl. No	Name of the Farmer	No. of Irrigation		Litre of water / kg of grain		Water Productivity (kg/m^3)		WR (m^3)		Variety
		FP	AWDI	FP	AWDI	FP	AWDI	FP	AWDI	
6.	Th.E.Mani, Kedar	24	15	2580	1428	0.40	0.70	12000	7500	ADT 45
7.	Th.B.Dharmadurai Agaramchithamur	28	18	2755	1706	0.38	0.59	14000	9300	ADT 39
8.	Th.P.Shanmugam Vairapuram	25	17	2427	1491	0.41	0.67	12500	8800	ADT 37
9.	Th.D.Ganeshkumar Vairapuram	26	18	2476	1570	0.40	0.64	13000	9250	ADT37
10	Th.G.Viswanathan Kilvayalamur	27	17	2903	1708	0.34	0.58	13500	8750	ADT 37
11.	Th.A. Gnanavel Periyathachur	24	15	2376	1456	0.42	0.68	12000	8100	ADT 37
12.	Th. M. Kaliyamoorthy Navamalmarudhur	28	23	2621	1681	0.38	0.59	13500	9750	CO 51
13.	Th.M. Krishnamorthi Navamalmarudhur	30	24	2475	1681	0.40	0.59	12500	9500	CO 51
14.	Th. M. Arumugam Aliyur	25	18	2549	1757	0.39	0.56	13000	9750	ADT 37
15.	Th. S. Deivanayagam Aliyur	28	22	2626	1666	0.38	0.6	13500	9500	ADT 37
16.	Th. M. Narayanan Aliyur	29	21	2366	1531	0.42	0.65	12000	8500	ADT 37
17.	Th. S.Venkatachalam Aliyur	30	23	2631	1875	0.38	0.53	13500	10500	ADT 37
18.	Th.S.Krishnagovindan Navamalmarudhur	28	23	2330	1725	0.42	0.57	12000	9750	NLR 91
19.	Th. V.Narayanan Aliyur	30	24	2647	1926	0.37	0.51	13500	10500	ADT 37
20.	Th. S.Bathrachalam Aliyur	29	24	2450	1460	0.40	0.68	12500	8400	ADT 37
21.	Th. S. Selvaraj Aliyur	28	22	2376	1586	0.42	0.66	12000	8500	ADT 37
22.	Th. N.Santhakumar NavamalMaruthur	30	23	2325	1741	0.40	0.57	12000	9750	CO 51
23.	Th. D. Prabhu Aliyur	30	22	2450	1710	0.40	0.58	12500	9750	ADT 37
24.	Th.D. Prakash Aliyur	30	23	2637	1853	0.37	0.53	13500	10250	ADT 37
25.	Th.T. Duraikannu Aliyur	28	22	2534	1773	0.39	0.56	13000	9750	ADT 37

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