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Water-saving Rice Production Technologies in Krishna Western Delta Command of Andhra Pradesh – An Economic Analysis[1]

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Abstract

The economic analysis of water-saving rice production technologies, viz. system of rice intensification (SRI), semi-dry and rotational irrigation vis-à-vis farmers' practice has been carried out based on the study executed in Modukuru pilot area of Guntur district of Andhra Pradesh. Among the three water-saving rice production technologies analyzed, the total cost of cultivation has been recorded highest in SRI (Rs 58645/ha), followed by rotational (Rs 47140/ha) and semi-dry (Rs 39321/ha). But, the per hectare yield has been found highest in SRI (6.85 t), followed by semi-dry (6.66 t) and rotational (6.2 t), inferring that all the three technologies have recorded higher yields over farmers' practice of 5.5 t/ha. However, the net returns and B-C ratio are maximum in semi-dry (Rs 43,484/ha; 1.11), followed by rotational (Rs 30,085; 0.64) and SRI (Rs 26,466/ha; 0.45) methods. Similarly, the water-use efficiency has been found highest in SRI (8.53 kg/ ha-mm), followed by semi-dry (8.02 kg/ha-mm) and rotational (7.33 kg/ ha-mm) methods, while the water-use efficiency benefit (Rs/ha-mm) has been recorded maximum in semi-dry (52.39), followed by SRI (42.08) and rotational (35.56) methods. With the initiation of Andhra Pradesh Water Management Project, Bapatla, the area under semi-dry rice cultivation has been found increasing over a period of four years, from 0.6 ha in 2004-2005 to 22 ha in 2007 -2008.

Introduction

Water plays an important role not only in agriculture, but also in several other sectors, viz. industry, domestic, power generation, etc. Realizing the importance of water, the United Nations General Assembly has declared the decade 2005-2015 as the International Decade for action on 'Water for Life'.

Although the global water availability has been estimated as 1400 million cubic kilometres, only 0.26 per cent of it is available as surface run-off and ground water. Therefore, it becomes extremely necessary to maintain, conserve and use this natural resource with utmost care in every sphere of life. Water makes a significant contribution to food security, as it directly affects agricultural productivity. The irrigated areas that comprise 17 per cent of agricultural land produce nearly 40 per cent of food and other agricultural commodities. Currently, there are some 250 million ha of irrigated area, almost three-quarters of which are in the developing countries. The water used for irrigation in developing countries makes up over 80 per cent of freshwater-use.

The per capita availability of water in Andhra Pradesh is estimated to decline from the present level of 1400 cum to 1000 cum by 2025 (AP Water Vision, 2003). The water utilization by agricultural sector in the state is estimated to increase from the present level of 2268 tmc to 3814 tmc by 2025. Rice is the predominant crop in Andhra Pradesh and more than 95 per cent of rice area is under irrigated conditions, consuming 67 per cent of irrigation water in the state. Rice crop occupied an area of 3.98 Mha with a total production of 17.81 Mt. The present irrigated rice yield is recorded at 5.3 t/ha and is estimated to be increased to 7.1 t/ha to meet the demand without increase in

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prices, which would adversely affect the poor (Roland *et al*.).

Under the present situation of decreasing per capita availability of agricultural land and water, research should be focused on increasing land productivity and achieving more crop per drop of water. With this objective in view, the FAO-funded Andhra Pradesh Water Management (APWAM) Project has started functioning with the main centre at Bapatla, since 2003. The present study is part of the research work carried out under the APWAM Project.

Objectives

As part of project mandate, the present study on economic analysis of water-saving rice production technologies was carried out with the following objectives:

- To compare the economics of water-saving rice production technologies vis-à-vis farmers' practice, and
- To study the water-use efficiency of water-saving rice production technologies vis-à-vis farmers' practice.

Methodology

The study was conducted in one of the selected pilot areas of APWAM Project, viz. Modukuru village of Tsunduru mandal in the Guntur district. A total of 214 farmers with a cultivated area of 264 ha were covered under the selected Modukuru branch No. 2 canal for the present study. The three identified water-saving rice production technologies, viz. SRI (System of Rice Intensification), Semi-dry and Rotational irrigation were demonstrated in farmers' fields, over a period of four years, from 2004-05 to 2007-08, and were compared with the farmers' practice for analysing the economics of cost of cultivation and returns. The water-use efficiency was calculated by using CRIWAR model (Rob Kselik, 2005) for all the three selected technologies and was compared with the farmers' practice.

Results and Discussion

The details about the three identified water-saving rice production technologies, viz. SRI, semi-dry and rotational irrigation along with farmers' practice taken up in Modukuru village since *kharif* 2004, are given in Table 1. It was observed that the area under semi-dry cultivation has increased over the past three years, reflecting the advantages associated with this technology.

Costs and Returns

The costs and returns of all the three water-saving rice production technologies along with the farmers'

Table 1. Details of water saving rice production technologies used under APWAM project: 2004-05 to 2007-08

Year	Particulars	Farmers' practice	SRI	Semi-dry	Rotational
2004-05	Total area (ha)	1.0	-	0.6	0.4
	Yield (t/ha)	5.5	-	5.6	5.6
2005-06	Total area (ha)	0.4	0.2	1.6	0.52
	Yield (t/ha)	4.9	7.0	6.6	6.0
	Depth of water (mm)	1100	572	828	707
	Water-use efficiency (kg/ha-mm)	4.4	12.2	8.0	8.5
2006-07	Total area (ha)	1.2	0.10	9.48	21.46
	Yield (t/ha)	5.5	6.8	6.1	5.9
	Depth of water (mm)	1074	580	714	821
	Water-use efficiency (kg/ha-mm)	5.1	11.7	8.5	7.1
2007-08	Total area (ha)	1.2	0.8	22.0	19.6
	Yield (t/ha)	5.8	6.9	6.6	6.2
	Depth of water (mm)	918	629	829	846
	Water-use efficiency (kg/ha-mm)	6.3	10.9	8.0	7.3

Source: Annual Reports of A P Water Management Project, different years

Table 2. Comparative yield and income measures of water saving rice production technologies

Particulars	Farmers' practice	Semi-dry	Rotational	SRI	Percentage differential over farmers' practice		
					Semi-dry	Rotational	SRI
Yield (t/ha)	5.50	6.66	6.2	6.85	21.09	12.72	24.55
Price (Rs/t)	12133	12133	12133	12133	-	-	-
Total cost of cultivation(Rs/ha)	45681	39321	47140	58645	-13.92	3.19	28.38
Gross income(Rs/ha)	68733	82805	77225	85111	20.47	12.35	23.82
Net returns(Rs/ha)	23052	43484	30085	26466	88.64	30.50	14.81
B:C ratio	0.50	1.11	0.64	0.45	122.00	28.00	-0.1

Table 3. Water-use efficiency of water saving rice production technologies

Particulars	Farmers' practice	Semi-dry	Rotational	SRI	Percentage differential over farmers' practice		
					Semi-dry	Rotational	SRI
Yield (kg/ha)	5500	6660	6200	6850	21.09	12.73	24.55
Net returns (Rs/ha)	23052	43485	30085	26467	88.64	30.50	14.81
Water-use (mm)	918	830	845	803	-9.59	-7.95	-12.53
Water-use efficiency (kg/ha-mm)	5.99	8.02	7.33	8.53	33.89	22.37	42.40
Water-use efficiency benefit (Rs/ha-mm)	25.11	52.39	35.56	42.08	108.64	41.61	67.58

practice have been presented in Table 2. The highest yield of 6.85 t/ha was recorded in SRI, followed by 6.66 t/ha in semi-dry and 6.2 t/ha in rotational irrigations as compared to 5.5 t/ha in farmers' practice. The higher yields in all the three new technologies were reflected in increased gross income of 12-24 per cent and increased net returns of 15-89 per cent over farmers' practice. The net benefit-cost ratio was maximum in semi-dry (1.11), followed by rotational (0.64), farmers' practice (0.50) and SRI (0.45).

Although the yield and gross income were high in SRI, the net benefit-cost ratio was high in semi-dry, owing to its lesser cost of cultivation, as compared with other technologies, viz. SRI and rotational. Thus, the net benefit-cost ratio was more than double in the semi-dry over the farmers' practice. The B-C ratio was lower in SRI than farmers' practice, because of higher cost of cultivation in SRI.

Water-use Efficiency

The water-use efficiency (WUE) of rice production in all the three water saving rice production technologies along with the farmers' practice has been recorded in Table 3.

The water-use was recorded maximum in farmers' practice (918 mm), followed by rotational (845 mm), semi-dry (830 mm) and SRI (803 mm) methods. It reflected the highest water-use efficiency of 8.53 kg/ha-mm in SRI, followed by semi-dry (8.02 kg/ha-mm), rotational (7.33 kg/ha-mm) and farmers' practice (5.99 kg/ha-mm). The results are in concurrence with the results of Rao *et al.* (2008), wherein it was reported that semi-dry and rotational systems of irrigation gave similar or slightly higher grain yields in paddy with higher water-use efficiency, as compared with farmers' practice of continuous flooding in the Krishna Western Delta command area of Andhra Pradesh. The water-use efficiency benefit was found maximum in semi-dry (52.39 Rs/ha-mm), followed by SRI (42.08 Rs/ ha-mm), rotational (35.56 Rs/ha-mm) and least in farmers' practice (25.11 Rs/ ha-mm).

Conclusions

Among the three water-saving rice production technologies analyzed, the total cost of cultivation has been recorded highest in SRI (Rs 58645/ha), followed by rotational (Rs 47140/ha) and semi-dry (Rs 39321/

ha) methods. But, the per hectare yield is maximum in SRI (6.85 t), followed by semi-dry (6.66 t) and rotational (6.2 t), inferring that all the three technologies have recorded higher yields over the farmers' practice with 5.5 t/ha. However, the net returns and B-C ratio are high in semi-dry (Rs 43,484/ha; 1.11), followed by rotational (Rs 30,085; 0.64) and SRI (Rs 26,466/ha; 0.45) methods. Similarly, the water-use efficiency has been found highest in SRI (8.53 kg/ha-mm), followed by semi-dry (8.02 kg/ha-mm) and rotational (7.33 kg/ha-mm) irrigations, while the water-use efficiency benefit (Rs/ha-mm) was high in semi-dry (52.39), followed by SRI (42.08) and rotational (35.56).

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