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RESEARCH ARTICLE

ECONOMICS OF CLIMATE RESILIENT PRACTICE IN RICE: A CASE OF DIRECT SEEDED RICE IN ANDHRA PRADESH, INDIA

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ABSTRACT

Rice is an important crop for billions of people and Asia is the biggest consumer of rice to an extent of 90% of the total world rice production. Most of the irrigated land in the world is under rice crop. On the other hand, water availability is also affected due to the climate change and variability. Rice is also labour-intensive crop and requires about 200 labour days per hectare. Timely availability of labour and water for various activities of rice is becoming a problem. Hence, to overcome labour shortage and sustain rice production with less water, the recent phenomenon observed in Andhra Pradesh state is the Direct Seeded Rice. Field level observations from 2010-14 found that the cost reduction in direct seeded rice mainly comes from skipping the initial activities like puddling, nursery raising, transplantation cost compared to traditional transplantation method. The timely operations and reduced cost of cultivation are driving forces in direct seeded rice adoption. The cost benefit ratio also indicates that Rs 10000-25000 additional returns per hectare in Direct seeded rice is realised compared to transplantation method.

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INTRODUCTION

The primary resource affected by the climate change is water. In arid and semi-arid regions of India, any shortfall in water supply due to climate change will enhance competition for water use for a wide range of economic, social and environmental applications. The population growth with the improved living conditions also increases the demand for food production and thereby increasing the demand of water in multiple folds in the river basins (UNESCO-WWAP, 2009). The major portion of water available in the Indian River basins is used for irrigation of rice and thus poses major challenges to water management, especially during unfavourable weather or climatic conditions. Around 95% of the cultivated area under rice is irrigated, and requires about 1200 mm to 2500 mm of water depending on the soil texture, structure and profile conditions (Reddy and Reddi, 1995). Of all the major cereal crops grown in India, rice constitutes 24% of the total food grains produced contributing 96 million tonnes. The method of rice cultivation used to be transplanting in ponded water, which ensured steady yields (Chen *et al*., 2009). However, the projected climate scenarios for mid (2021-2050) and end centuries (2071-2100) in the Krishna River Basin of India shows a change in the future water availability (Palanisami *et al*., 2011). The cost of labour hiring as an input has also significantly increased during recent years (Farooq *et al*., 2011). For example, in the lower Krishna river basin (Krishna, Guntur and Prakasam districts) of Andhra Pradesh state, costs for labour in rice cultivation accounted for 29 % of the total cultivation costs during 2006-07, and it is increased to 49 % in 2010-11 (Technical program, 2011). Hence, to sustain rice production and ensure food security with these challenges new adaptation strategies have to be developed and up-scaled. The delayed onset of monsoon, insufficient irrigation water at the tail ends of canal commands, increased labour requirement and costs are forcing farmers to adapt to different management practices like Direct SeededRice (DSR) (Mahajan *et al*., 2013, Yamaji, 2011). Much of the scientific or technical information developed on DSR was at research level (Yadav *et al*., 2011) with modelling (Palanisami *et al*., 2015). Hence, the present study analysed the economic performance of DSR in actual field conditions and presented the results.

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MATERIALS AND METHODS

The direct seeded rice has less tillage and labour costs due to less numbers of irrigations and reduced labour needs in

transplantation. Large scale adoption of the direct seeding was achieved during 2012-2014 in the Guntur district of Andhra Pradesh, India due to active stakeholders' involvement (i.e. farmers, agriculture department, scientists from international and state agricultural university, etc.) in awareness and training programs. The study was conducted in Guntur district of Andhra Pradesh during 2010-2014. Data were collected and analysed from NagarjunaSagar Project and Krishna Western Delta rice growing farmers in Guntur district. Every year 50 farmers practising DSR based on awareness programs were collected from the randomly selected farmers of major DSR growing villages in Guntur district from 2010-2014. As upscale of DSR adoption in the district was initiated for first time, data related to economics in adapting DSR was collected, analysed and presented.

Table 1. Economics of DSR -Field observations from 2011-2014 (INR/ha)

N= 50

Particulars	2010 Kharif		2011 Kharif		2012 Kharif		2013 Kharif		2014 Kharif	
	DSR	Traditional	DSR	Traditional	DSR	Traditional	DSR	Traditional	DSR	Traditional
Nursery	0	1150	0	1423	0	1764	0	2282	0	3023
Land Preparation	2200	5687	2400	5787	3825	5234	4762	5431	4357	9555
Seed & Sowing	1540	6440	1540	6720	2348	8565	2852	8903	2315	7976
Manures & Fertilizers	8000	7221	9000	8240	13274	16184	14794	17856	13198	13483
Plant protection	6011	6123	6214	6324	6678	9425	7254	9548	13559	13183
Cost of irrigation	1000	899	1200	1000	1780	1155	1984	2108	1700	1700
Weeding	4200	3576	4100	3765	2825	4210	7068	7750	4098	3262
Harvesting, Threshing, Winnowing & Transportation	14721	14647	15732	15652	19179	17012	21824	21786	15950	15885
Interest on Variable Cost	589	715	628	764	780	993	946	1182	862	1064
Total Variable cost	38261	46458	40814	49675	50689	64542	61484	76846	56040	69130
Land tax	625	625	750	750	750	750	750	750	750	750
Land lease	16456	16456	17000	17000	19320	20526	27900	27082	29716	29631
Interest on Fixed Cost	285	285	296	296	335	355	478	464	508	506
Total Fixed cost	17366	17366	18046	18046	20405	21631	29128	28295	30973	30887
Total Cost	55626	63823	58860	67721	71093	86173	90611	105142	75540	88895
Yield (qt/ha)	48	46	67	66	60	54	68	66	68	67
Price realisation (Rs/qt)	1132	1132	1152	1152	1857	1857	1710	1710	1720	1720
Straw Yield (q/ha)	198	204	208	215	212	217	210	213	212	222
Straw Price (Rs/ha)	6000	6000	7000	7000	10000	10000	11000	11000	10000	10000
Gross returns	59804	57676	84622	82606	121420	110278	127280	123860	127354	125491
Net returns	4178	-6148	25762	14885	50327	24105	36669	18718	51814	36596
Production cost (Rs/100Kg)	1170	1398	874	1032	1185	1596	1333	1593	1107	1324
Benefit Cost Ratio (BCR)	1.08	0.90	1.44	1.22	1.71	1.28	1.40	1.18	1.69	1.41

RESULTS

The validated field observations of direct seeded rice illustrate that the seed and sowing cost was reduced to 68-77% when compared to the traditional transplantation method (Table 1). The variable cost was also significantly less which range from 8000 to 15000 □/ha. This was mainly due to the reduction in land preparation, raising nursery and transplantation costs. Fertilizer and pesticide application did not vary at significant level with DSR adoption.The weed problem was more during the initial phase of the crop in DSR. However, use of pre- and post-emergence herbicides have addressed the problem (Chauhan and Opeña, 2012). The weed control cost has mixed results, where in the initial phase of the adoption (2010 & 2011) cost was higher and reduced in the later state (2012 & 2013) of the adoption. The weed control cost in DSR was high in 2014 Kharif as well compared to the transplantation method. This implies that the weed control cost not only depends on the sowing method but also depends on the climatic conditions and water availability in the particular season. The yield difference between DSR and the transplantation method also range from 100-600 kg/ha. The gross margins and cost benefit ratio over the years also depict the benefits of the DSR (Table 1). The net returns also indicate that Rs 10000-25000 additional returns per hectare in direct seeded method is realised compared to transplantation method.Overall the net returns realised is best in 2012 among the study years in both the methods of rice cultivation, mainly due to higher price realised for unit of paddy in 2012 compared with other years. The yields under direct seeded method is little higher than the traditional transplantation method of rice cultivation. Population maintenance might have contributed to the better yields in DSR method compared to transplantation method though not considerable variation. The Benefit Cost Ratio (BCR) in direct deeded method is ranged between 1.08 to 1.71, while it is 0.90 to 1.41 in transplantation method of rice cultivation. The difference in BCR is higher in 2012 i.e., 1.71 in direct seeded method while it is only 1.28 in transplantation method. It is due to both better yields and reduced variable costs in direct seeded method. Cost of production for quintal of paddy ranged from Rs874 toRs 1,333 in DSR, while the same ranged between Rs 1,032 to Rs 1,596. Overall similar expenditure was observed with regard to fixed costs while reduction in variable costs contributed to the reduced expenditure in direct seeded method. Among the years under study 2012 considered as the best year for direct seeded method.

Conclusion

Farmers in Guntur district, especially in the tail end of the canals are increasingly adopting direct seeded method of rice cultivation over traditional transplantation method. The DSR method showed promising results as demonstrated from the five years study results. The method is efficient in terms of economics addressing the resource scarcity. Further promotion of DSR practise as an alternative to traditional paddy at a wider scale in the state/country requires more training, capacity building and awareness to farmers. Close cooperation between the scientific community, officials and farmers would help in upscaling.

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