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Effect of Irrigation Regimes and Weed Control Measures on Economics of Lowland Transplanted Rice during *Boro* Season

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ABSTRACT

Rice (Oryza sativa L.) is one of the most important staple foods for the people of Southeast Asia including India. Rice is consequently the most important agricultural ecosystem and present and future food security of the country mostly depends on it. A field experiment was conducted at Balindi research complex of Bidhan Chandra Krishi Viswavidyalaya during boro season of 2012-13 and 2013-14, to study the influence of different irrigation regimes and weed control measures on performance of lowland transplanted rice during boro season. The field experiment was laid out in split plot design with different irrigation regimes (I_1-Continuous submergence of 5±2; I_2-Rotational water supply 4days on 3 days off; I_3- Rotational water supply 3days on 2 days off; I_4- Rotational water supply 2days on 1day off; I_5-Continuous saturation) in main plots and weed management practices(W_1-Unweeded check; W_2-Weed-free check; W_3-Pretilachlor 50 EC 500 g a.i. ha^{-1} on 1 DAT + hand weeding on 40 DAT; W_4-Bispyribac sodium 10 SC 30 g a.i. ha^{-1} on 20 DAT + hand weeding on 40 DAT; W_5-Hand weeding twice on 20 and 40 DAT) in sub plots with three replications. Among the different treatment combinations, the highest cost of cultivation (Rs. 54,937) was recorded with any level of irrigation in weed free check, whereas the lowest cost of cultivation (Rs. 39,497) was noted under any irrigation with unweeded control treatment combinations. The highest benefit-cost ratio (2.48) was obtained under the continuous submergence 5±2 cm along with PE pretilachlor at 1 DAT + HW at 40 DAT (I_1W_3) treatment combination followed by continuous submergence 5±2 cm (I_1) along with PoE application of bispyribac-sodium at 20 DAT + HW at 40 DAT (I_1W_4).

Key words: *Rice, Economics, Weed control, Irrigation regimes*

INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important staple foods for the people of Southeast Asia including India. About 60% of the world population are dependent on this crop. It occupies about 23.3% of gross cropped area of the country. Rice contributes 43% of the total food grain production and 46% of the cereal production of the country.

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Rice is consequently the most important agricultural ecosystem and present and future food security of the country mostly depends on it. Rice area in our country is about 43 million ha with production of 101 million tonnes in the year 2012[1].Weeding is a major production cost, with estimates of 50-150 person-days ha^{-1} required for manual weeding, depending on the number of weedings and type of rice culture[2]. Chemical weeding is vital for effective and cost-efficient weed control in such situations, where weeds compete with the main crop at early stages. However, exclusive reliance on chemical herbicides has led to concern about contamination of environment by the pressure of herbicide residue in soil, water and plants, shift in weed flora, appearance of resistant weed species, and threat to human health[3]. Integration of chemical and manual weeding becomes essential for effective management of weeds and for increasing water use efficiency. Therefore pre-emergence and new post-emergence herbicides were tested alone and in combination with manual weeding to develop an effective and viable weed management practice along with different irrigation regimes in lowland transplanted rice during *boro* season.

MATERIALS AND METHODS

Field experiment was conducted in the Balindi Research Complex of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur during *boro* season (December to May) of 2012-2014. The farm is located in the New Alluvial Zone of West Bengal at 22° 57′ N latitude, 88° 32′ E longitude and at an altitude of 9.75 m above mean sea level. The soil of the experimental field was deep clayey with moderate drainage. Composite soil samples were collected prior to the experiment and analyzed for various physical and chemical characteristics. The soil fertility status was medium in available nitrogen (290 & 282 kg ha^{-1}), high in available phosphorus (45 & 42 kg ha^{-1}) and high in available potassium (380 & 374 kg ha^{-1}), respectively during 2012-13 & 2013-14. The pH of the soil was 6.53.

The field experiment was laid out in split plot design with different irrigation regimes (I_1-Continuous submergence of 5±2; I_2-Rotational water supply 4days on 3 days off; I_3-Rotational water supply 3days on 2 days off; I_4- Rotational water supply 2days on 1day off; I_5-Continuous saturation) in main plots and weed management practices (W_1-Unweeded check; W_2-Weed-free check; W_3-Pretilachlor 50 EC 500 g a.i. ha^{-1} on 1 DAT + hand weeding on 40 DAT; W_4-Bispyribac sodium 10 SC 30 g a.i. ha^{-1} on 20 DAT + hand weeding on 40 DAT; W_5-Hand weeding twice on 20 and 40 DAT) in sub plots with three replications.Economic evaluation was done by calculating the gross return, net return and cost of cultivation. The Benefit / Cost (B/C) ratio based on the prevalent market rate was also worked out using the formula:

$$\text{B:C} = \frac{\text{Gross return (Rs.)}}{\text{Cost of cultivation (Rs.)}}$$

RESULTS AND DISCUSSION

The mean data of two years showed that the levels of irrigation in combination with different methods of weed control directly influenced the production economics of transplanted rice (Table 1). The data on cost of cultivation was summarized in Table. Among the different treatment combinations, the highest cost of cultivation (Rs. 54,937) was recorded with any level of irrigation in weed free check followed by any irrigation treatment in combination with hand weeding twice at 20 and 40 DAT. This was mainly due to the fixed cost of the variables. Weed free check and hand weeding twice treatments recorded highest cost of cultivation. Similar type of findings was reported by Mirza Hasanuzzaman[4] and Ahmed[5]. However, the lowest cost of cultivation (Rs. 39,497) was noted under any irrigation with unweeded control treatment combinations.The gross returns was summarized in the Table showed that the maximum return (Rs. 103,398) was received under continuous submergence 5±2 cm along with combination weed free check (I_1W_2) followed by continuous submergence

5±2 cm along with PE pretilachlor @ 500 g a.i. ha^{-1} at 1 DAT + HW at 40 DAT (I_1W_3) (Rs. 100,739) combination which might be due to maximum grain and straw yields[6,7]. The lowest gross returns (Rs. 56,205) were found under continuous saturation along with unweeded control (I_1W_1) combination. The highest benefit-cost ratio (2.48) was obtained under the continuous submergence 5±2 cm along with PE pretilachlor at 1 DAT + HW at 40 DAT (I_1W_3) treatment combination followed by continuous submergence 5±2 cm (I_1) along with PoE application of bispyribac-sodium at 20 DAT + HW at 40 DAT (I_1W_4) combination which might be due to maximum grain and straw yields with less cost of cultivation[8]. The lowest benefit-cost ratio (1.42) found under continuous saturation along with unweeded control (I_1W_1) combination. Continuous saturation irrigation along with PE pretilachlor at 1 DAT + hand weeding at 40 DAT treatment combination can be recommended cost effective measures for water scarcity areas of West Bengal, where practice of lowland transplanted rice during *boro* season is common.

Table 1. Effect of different levels of irrigation and methods of weed control on economics of rice

Treatment	Grain yield (Kg ha^{-1})	Straw yield (Kg ha^{-1})	Gross returns (Rs.)	Cost of cultivation (Rs.)	Net returns (Rs.)	B:C
I_1W_1	4448	6964	63932	39497	24435	1.62
I_1W_2	7343	8624	103398	54937	48461	1.88
I_1W_3	7170	8121	100739	40697	60042	2.48
I_1W_4	6622	7701	93184	40097	53087	2.32
I_1W_5	6769	7794	95202	47217	47985	2.02
I_2W_1	4258	6783	61296	39497	21799	1.55
I_2W_2	7081	8074	99521	54937	44584	1.81
I_2W_3	6894	7915	96941	40697	56244	2.38
I_2W_4	6349	7489	89418	40097	49321	2.23
I_2W_5	6446	7556	90758	47217	43541	1.92
I_3W_1	4315	6841	62094	39497	22597	1.57
I_3W_2	7176	8166	100845	54937	45908	1.84
I_3W_3	7083	7976	99471	40697	58774	2.44
I_3W_4	6577	7549	92473	40097	52376	2.31
I_3W_5	6588	7609	92674	47217	45457	1.96
I_4W_1	4144	6748	59757	39497	20260	1.51
I_4W_2	6991	8006	98288	54937	43351	1.79
I_4W_3	6807	7854	95737	40697	55040	2.35
I_4W_4	6159	7251	86731	40097	46634	2.16
I_4W_5	6237	7336	87833	47217	40616	1.86
I_5W_1	3883	6601	56205	39497	16708	1.42
I_5W_2	6890	7876	96852	54937	41915	1.76
I_5W_3	6744	7783	94859	40697	54162	2.33
I_5W_4	6144	7161	86472	40097	46375	2.16
I_5W_5	6168	7189	86804	47217	39587	1.84

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