The Effect of Alternative Wetting and Drying Technology to Minimise the Water Crisis of Northern Bangladesh

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Abstract: *The present study was conducted to know the effect and benefit of using Alternate Wetting and Drying (AWD) technology with respect to minimise the use of water and reduce the cost of production. Eighteen participatory field demonstrations were conducted in Sonakhuli village under Saidpur Upazila and Dhormopal and Araji villages under Jaldhaka Upazila of Nilphamari district with two rice varieties namely, BRRIdhan28 and BRRI dhan29.The highest grain yield (7.26 t/ha) was observed in BRRI dhan29 demo fields compared to neighboring farmers fields (7.24 /ha) at Jaldhaka. On the other hand in case of BRRI dhan28, slight higher yield (5.83t/ha) was observed in AWD demonstration plots compared to farmers practices (5.61 t/ha)(Table 1.1). In case of both the varieties, there observed no significant yield difference between AWD demo. fields and farmers existing practices of irrigating rice fields. Considering frequency of irrigation application, the l2 irrigations were needed in case of AWD whereas 18 irrigations were applied by the neighboring farmers in cultivating BRRI dhan29. Similar result was found for BRRI dhan28 where 17 irrigations were required in case of farmers' practice while in AWD 11 irrigations were required. Although no significant yield difference was observed between AWD and farmers practicing conventional irrigation farmers' fields but lower irrigation cost for AWD and higher irrigation cost incurred in conventional irrigation of neighboring farmers fields for growing BRRI dhan29 and BRRI dhan28 justified the use of AWD.*

Keywords: *Irrigation, Water Crisis, Alternative Wetting and Drying, Boro Rice Production cost, Yield*

INTRODUCTION

Boro rice seeds are normally sown in November-December and harvested in late April to May under fully irrigated condition. Due to introduction of Shallow Tube Well (STW), Deep Tube Well (DTW) and Motorized machines Boro rice cultivation in Bangladesh has increased from 9% in 1966-67 to 90% in 2012[1]. With the increased in groundwater use and expansion of irrigated area inefficient water distribution and inadequate supply limit crop growth in irrigated fields[2]. Due to massive use of underground water in irrigating land during Boro season, ground water tables are declining alarmingly in northern Bangladesh thus water scarcity is increasing. Among the costs items for producing MV Boro paddy, human labour was the vital one. Cost of irrigation was the second highest which is essential for MV Boro paddy production[3]. Irrigation accounts for 09% to 18% of total Boro rice production cost. Anzuman Ferdous and Hasneen Jahan observed that the cost of irrigation is increasing. Their research showed that in 1992 the irrigation cost was 09% of total cost but it has increased 18% in 2013[4]. Farmers usually use 3,500 - 5,000 liters of water for producing 1 kg of rice against optimum amount of water required (2000-2500 liters)[5].To overcome such a situation, the Alternate Wetting and Drying (AWD) technology is getting importance worldwide as a water-saving system for rice production. This system can save 25% to 30% irrigation water thus saving energy and fuel consumption and ultimately reduces production cost significantly. The water level in the soil is monitored by perforated PVC pipes or plastic water bottles, which is inserted into the rice field (12-15 days after transplanted). Apparently though the water level drops below the soil surface, the soil is still saturated and thus water is still available for the rice plant. Hence, no yield loss is expected despite water levels in the rice field drop up to 15 cm below the soil surface. However, AWD requires irrigation when the water level goes down beyond 15 cm below the soil surface.

OBJECTIVES OF THE STUDY

i) to know the effect of using Alternate Wetting and Drying (AWD) technology to minimise the water crisis in Boro season; and

ii) to state the impact of AWD in reducing production cost in rice based technology.

MATERIALS AND METHODS

Eighteen participatory AWD field demonstrations were conducted in Jaldhaka and Saidpur Upazillas of Nilphamari during February 2014 to April 2014 to assess the effect and benefits of using AWD technology. The demos were conducted in 18 farmers' fields. Demo area of each farmer was around 30 decimals. The varieties used are BRRI dhan28 and BRRI dhan29. These are very popular Boro season rice varieties in Bangladesh. Study used 35-45 days old seedlings and transplanted during 6-25 February 2014. PVC pipes (perforated) were placed after 10-15 days of transplanting in the demo fields. AWD technology was followed till initiation of panicles. Fertilizers were

applied as per farmers' practice. Weeding, irrigation and plant protection measures were done as and when necessary. Data on yield attributes were collected and recorded from one square meter of each plot area. Rice yield data were recorded from 5 square meter also. Rice grain and straw were harvested during 10-25 May 2014. Labor cost, inputs and outputs were also recorded and data analysis was done by using Cropstat7. Similar data were recorded from neighboring 18 farmers' fields of the same varieties where AWD was not followed. Cost and return was estimated according to local market prices.

RESULT AND DISCUSSION

Demo on use of AWD technology was conducted in 18 farmers' fields of 3 villages (Dhormopal and Sonakhuli) of Jhaldhaka and Saidpur respectively under Nilphamari district. In case of both rice varieties (BRRI dhan 29 and BRRI dhan28) there observed no significant yield difference between AWD demonstration and no-AWD farmers' fields in all location (Table1.1). The higher gross margins were found in AWD demo fields compared to non-AWD fields i.e. farmers' practices (Table 1.2).

Table 1.1 *Yield and Yield attributes of AWD and FP for BRRI dhan28 and 29, Jaldhaka and Saidpur, Boro'2014*

Upazila	Variety	Treatment	Irrigation(No.)	Plant height(cm	Panicle /m2	Grain /panicle	1000-Wt (g)	Yield (t/ha)
Jaldhaka	BRRI dhan29	AWD(6)	12	101	284.833	108.167	23.8833	7.2622
	BRRI dhan29	FP(6)	18	102	282.833	109.16	23.7333	7.2527
Jaldhaka	BRRI dhan28	AWD(6)	11	99	284.833	92.3333	22.350	5.77364
	BRRI dhan28	FP(6)	17	102	283.333	91.1667	22.316	5.6077
Saidpur	BRRI dhan28	AWD(6)	11	99	308.333	91.1667	22.458	5.83798
	BRRI dhan28	FP(6)	17	101	289.667	83.6667	22.4500	5.61705
LSD(0.05)			1.4	3.34	11.98	6.167	0.172014	0.393289
CV(%)			7.6	2.7	3.2	5.0	0.6	4.9

Note: (6) – 6 No. demonstration plots raised, AWD=Alternative Wetting and Drying, FP= Farmer Practice

The highest yield (7.2622 t/ha) was found in AWD demonstration with the variety of BRRI dhan29 at the field of Jhaldhaka and 7.2527 t /ha in the plots of farmers practices with same varieties (Table 1.1). The yield differences between AWD demo. fields and non-AWD farmers' field were found higher in case of both the rice varieties(Table 1.1). AWD used plot's grain weight was higher(23.8833 g/1000) and similarly number of panicle and grain panicle were more than the farmer practice. Farmer's practice plot's plant height was higher (102cm) against AWD used plots((101cm) but it did not effect on yield. The least significant difference (LSD) was 0.39 and the coefficient of variance of yield was 4.9%. Noteworthy, 12 irrigations were needed at the plots of AWD. On the other hand, it was needed 18 irrigations at the plots of farmer practice with the same variety.

Table 1.2 *Economic benefits of AWD and FP for BRRI dhan28 and 29, Jaldhaka and Saidpur, Boro'14*

Upazilla	Variety	Treatment	Production cost (BDT/ha)	Gross return (BDT/ha)	Gross margin (BDT/ha)
Jaldhaka	BRRI dhan29(6)	AWD	48261.1	108933.	60672.1
	BRRI dhan29(6)	FP	52830.6	108791	55960.1
	BRRI dhan28(6)	AWD	45968.8	87116.3	41147.5
	BRRI dhan28(6)	FP	52063.9	86604.6	34540.7
Saidpur	BRRI dhan28(6)	AWD	47447.3	87569.8	40122.4
	BRRI dhan28(6)	FP	50703.6	84255.8	33552.2
LSD(0.05)			2534.36	5899.34	7090.77
CV(%)			4.0	4.9	12.5

Price: 15000 BDT/M.T

Higher gross margins 60672 BDT/ha was obtained in Jhaldhaka for using alternative wetting and drying technology compared to 55960 BDT/ha in the plots with farmers practice respectively (table 1.2). Here difference between the gross margins of alternative wetting and drying (AWD) and farmers' practices was

found 4,712 BDT/hector. The research data showed that alternative wetting and drying (AWD) is a cost saving technology and it gives more production that means it is profitable also.

CONCLUSION

Considering production cost reduction and saving underground water, use of AWD technology was beneficial to the farmers. But farmers opined that they will be more benefitted from this technology if pump owners charge less for reduction of fuel/ electricity cost in Boro scheme. Farmers' interest is growing to use AWD technology in their fields. As a result, for preventing misuse of underground water and reducing production cost of the farmers in Boro season, potentiality of adoption of AWD technology is high.

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