Transplanting rice seedling in dry strip-tilled soil: A strategy to minimize soil disturbance during non-puddled transplanting

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Introduction

Continuation of soil puddling for rice transplanting will negate the benefits of conservation agriculture (CA) particularly minimum soil disturbing in other crops in the rotation as is reported for the rice–wheat system (Singh et al., 2011). Although, development of non-puddled transplanting of rice with minimum soil disturbance methods has created the opportunity to adopt CA in rice-based cropping systems (Haque et. al., 2016), critics suggest that during transplanting of rice seedling, significant soil disturbance has occurred in non-puddled field due to foot-steps or wheel traffic of the transplanter. To minimize the soil disturbance during transplanting rice seedling in non-puddled condition, two experiments were conducted at Durgapur and Godagari upazila of Rajshahi, Bangladesh during the boro rice season of 2016.

Materials and Methods

The treatments for land preparation and transplanting of rice seedlings were (i) Transplanted in Dry Strip (TDS) - in fallow dry land, 3-4 cm wide and 5-6 cm deep strips were made by Versatile Multi-crop Planter (VMP) (Haque et. al., 2011) in a single pass operation. Afterwards transplanting of seedlings was done manually in the tilled strip prior to irrigation. (ii) Transplanting in Wet Strip (TWS) - 3-4 cm wide and 5-6 cm deep strips were made by VMP in fallow dry land with a single pass operation, followed irrigation to inundate the field for 18 to 24 hours before transplanting. (iii) Conventional Transplanting (CT) - four rotary tillage passes followed by land leveling was done by 2-wheel tractor (2WT). Two-three seedlings were manually transplanted in rows with hill spacing of 20 x 20 cm for all treatments. Forty and fifty-five day old seedlings of *Jira Shail* boro rice variety was transplanted on 26 January 2016 at Godagari and 7 March 2016 at Durgapur, respectively. The experiments were laid out in a randomized complete block design with three replications. Data on grain yield and yield contributing characters, and economics were collected and analyzed by MSTAT-C program.

Results and Discussion

The highest number of dead hills/m^2 (4) at 15 days after transplanting (DAT) were found in TDS at Durgapur while no dead hills were recorded at Godagari. Although the number of effective tiller/hill were not affected by different crop establishment method at Durgapur, the effective tiller number/hill with CT was higher (18 tillers/m^2) than TDS (13 tillers/m^2) in Godagari. In Durgapur, the grain yield with TWS (5.36 t ha^{-1}) and CT (5.25 t ha^{-1}) were higher than TDS (4.65 t ha^{-1}). However, the grain yield was greater in TWS (5.98 t ha^{-1}) than CT (4.79 t ha^{-1}) and the lowest in TDS (4.19 t ha^{-1}) in Godagari site (Table 1). Although the straw yield was not significantly affected by crop establishment method, the highest straw yield was recorded in Durgapur site than Gogagari site. In Godagari site, the straw yield was higher in TWS (5.23 t ha^{-1}) followed by TDS (4.49 t ha^{-1}) and lowest in CT (4.01 t ha^{-1}). Benefit cost ratio (BCR) were maximum in TWS (1.02) and CT (1.03) treatments but was lower in TDS (0.90) in Durgapur site, while the highest BCR was recorded in TWS (1.93) followed by CT (1.41) and lowest in TDS (1.14) in Godagari site. In Durgapur, the higher air temperature (34 ^oC) and dehydration of seedlings exposed to the sun, low soil water content (<12%), delay of

application of first irrigation (at Durgapur), and low relative humidity during TDS might have contributed to higher rate of seedling mortality and poor crop establishment, which could be associated of depressed grain yield.

Conclusion

Although the first-year trials of dry transplanting of rice seedling reported the lowest grain yield, it was mostly due to inexperience with establishing rice seedlings in TDS condition. Further TDS trials in 2017 are planned to incorporate the learning and limitations from the first-year.

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Table 1. Effect of rice establishment method on yield performance and economic analysis of boro rice under different locations in North-west Bangladesh

Location	Method	Number of dead hills m^{-2} at 15 DAT	Number of effective tiller $hill^{-1}$	Grain yield ($t\ ha^{-1}$)	Straw yield ($t\ ha^{-1}$)	BCR
Durgapur	TDS	4a	16ab	4.65c	5.19a	0.90e
	TWS	0b	16ab	5.36b	5.07a	1.02d
	CT	0.3b	15ab	5.25b	5.14a	1.03d
Godagari	TDS	0b	13b	4.19d	4.49b	1.14c
	TWS	0b	16ab	5.98a	5.23a	1.93a
	CT	0b	18a	4.79c	4.01c	1.41b
LS		*	*	**	**	**

LS = Level of significance; ** and * mean significant at 1 and 5 %, respectively. TDS = Transplanted in Dry Strip; TWS = Transplanting in Wet Strip; CT = Conventional Transplanting; DAT = Days After Transplanting; and BCR = Benefit Cost Ratio. Mean values with the same letter within a column are not significantly different (at $P < 0.05$ [*] and <0.01 [**]).