Yield improvement of non-puddled transplanted *Aman* rice as influenced by effective weed control under conservation agricultural systems

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Introduction

Traditional puddled transplanting (PT) can successfully be replaced by strip-tilled non-puddled transplanting (STNT) because it saves energy, fuel, labour and cost of cultivation (Haque *et al*., 2016; Islam *et al*., 2012). Moreover, STNT provides better rice yield than the conventional PT (Haque *et al*., 2016). But heavy weed infestation can cause a significant yield loss in STNT (Zahan *et al*., 2014). While conservation agriculture (CA) systems highly relies on herbicide for controlling weeds (Muoni *et al*., 2014), this study was undertaken to find out the effective herbicidal weed control for strip-tilled non-puddled transplanted *aman* rice that can ensure the optimum grain yield.

Materials and Methods

The experiment was conducted at the Agronomy Field Laboratory, Bangladesh Agricultural University, Mymensingh from June to October, 2014. The study comprised of 15 weed control treatments using combinations of five herbicides (pyrazosulfuron-ethyl, butachlor, orthosulfamuron, butachlor + propanil and 2,4-D amine) along with weedy and weed-free check. Before setting up the experiment, previous crop mungbean was harvested by keeping 50% of biomass in the field as residue. Then pre-planting non-selective herbicide, Roundup® (glyphosate 41% SL- IPA salt), was applied @ 75 mL/ 10 L water (2.25 L ha^{-1}) one week before strip tillage (at 20 cm line spacing) by Versatile Multi-Crop Planter (VMP) (Haque *et al.*, 2016). Just before strip tillage, the land was fertilized at recommended rate and then the land was inundated to 3-5 cm depth of standing water for 48 hours. Twenty-five-day-old rice seedlings cv. Bina dhan-7 were transplanted on 20 July 2014 at 15 cm spacing between hills allocating three seedlings per hill. Weed samples were taken from randomly selected three locations of 0.25 m^2 each at 20, 35 and 50 days after transplanting (DAT). The crop was harvested at maturity on 25 October 2014 and data on yield and related attributes were recorded before harvesting rice. Data were subjected to 'ANOVA' and means were compared by Tukeys's HSD using 'STAR nebula' developed by IRRI (version 2.0.1, January 2014).

Results and Discussion

Herbicide treatments reduced weed biomass significantly ($p<0.001$) compared to the weedy check by 15, 36 and 19% at 20, 35 and 50 DAT, respectively (Table 1). Consistently, the highest weed biomass reduction was obtained from sequential application of pyrazosulfuron-ethyl, orthosulfamuron and butachlor + propanil. Earlier studies also found that sequential herbicide application was effective in controlling weeds under direct seeded rice (Awan *et al*., 2015; Ahmed and Chauhan, 2014). In strip-tilled non-puddled situation, weed competition for the entire growing season reduced *aman* rice yield by 54% compared with the weed-free control. In this experiment, sequential application of pre-, early post- and late post-emergence herbicides increased grain yield by 79-119%, application of pre- and late post-emergence herbicides increased 49-99%, application of early post- and late post-emergence herbicides increased 60-72% and sole pre-emergence or early post-emergence application provided 20-

44% increased yield over weedy control. However, sequential application of pyrazosulfuron-ethyl, orthosulfamuron and butachlor + propanil ensured about 1 % higher grain yield over weed-free control. Therefore, the study offered a wide range of herbicidal control, from which farmers can choose and rotate herbicide combinations for strip-tilled non-puddled transplanted *ama* rice within a cropping pattern to improve yield. But, application of same herbicide molecules with different trade names or different herbicide with same mode of action in the same field without rotation is strictly prohibited. Herbicides should be applied at the recommended rate only.

References

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Table 1. Effects of herbicide treatments on weed biomass at 20, 35 and 50 days after transplanting and change (%) in grain yield over the weedy control of transplanted *aman* rice in strip-tilled non-puddled field at Bangladesh Agricultural University, Mymensingh during 2014[1]

Treatments	**Weed biomass (g m^{-2})**			**YOC**
	20	**35**	**50**	**(%)**
T_1=Weedy check	11.9 a	23.8 a	61.3 a	-
T_2=Weed-free check	-	-	-	117
T_3=Pyrazosulfuron-ethyl (pyrazosulfuron)	3.7 de	10.1 c	29.5 c	44
T_4=Butachlor	5.3 bcd	13.6 b	37.5 b	20
T_5=Orthosulfamuron	4.8 b-e	7.0 de	12.6 e	43
T_6=Pyrazosulfuron fb butachlor + propanil	3.8 cde	4.2 fg	5.4 ij	99
T_7=Butachlor fb butachlor + propanil	5.5 bc	6.1 def	19.2 d	60
T_8=Orthosulfamuron fb butachlor + propanil	4.4 cde	1.9 hi	7.9 f-i	104
T_9=Pyrazosulfuron fb 2,4-D amine	3.9 cde	6.4 def	10.9 ef	72
T_{10}=Butachlor fb 2,4-D amine	6.3 b	8.1 cd	12.5 e	49
T_{11}=Orthosulfamuron fb 2,4-D amine	4.4 cde	5.0 efg	9.5 efg	39
T_{12}=Pyrazosulfuron fb orthosulfamuron fb butachlor + propanil	1.1 g	1.2 i	2.6 j	119
T_{13}=Butachlor fb orthosulfamuron fb butachlor + propanil	3.5 ef	3.6 gh	6.2 hi	104
T_{14}=Pyrazosulfuron fb orthosulfamuron fb 2,4-D amine	1.9 fg	3.3 ghi	7.5 ghi	114
T_{15}=Butachlor fb orthosulfamuron fb 2,4-D amine	5.1 b-e	4.9 efg	9.2 fgh	79
S.E.D.	0.46	0.62	0.89	-
Level of significance	***	***	***	-
CV (%)	11.88	10.75	6.59	-

[1]fb = followed by, S.E.D. = standard error of the mean differences, CV = co-efficient of variance, *** = significant at 0.1 % level of significance [In a column, figures having same letter(s) are not significantly different at 5 % level as per HSD]