Mechanical weed control by Versatile Multi-Crop Planter in strip-planted wheat

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Introduction

Non-control of weeds will reduce wheat grain yield significantly (Sing et al., 2015). In Bangladesh, farmers use 2-6 tillage passes by 2-wheel tractor (2WT) to control pre-plant weeds and prepare the land to sow the seeds. Minimum soil disturbance is one of the key principles of conservation agriculture (CA). However, minimum soil disturbance planting systems could enhance weed infestation (Sing et al., 2015) if pre-plant weeds are not controlled properly. Although the use of herbicide is increasing quite rapidly in Bangladesh (Hossain, 2015), the use of non-selective herbicide (e.g., glyphosate) to control pre-plant weeds is limited due to higher price of glyphosate and non-availability at farmers' level. The Versatile Multi-crop Planter (VMP) (Haque et al., 2011) performs strip planting of various crop seeds and application of fertilizer in lines, and covering seeds simultaneously in a single pass operation. To manage pre-plant weeds in the field, the rotary shaft of VMP was redesigned with small blades attached between strips to cut the existing weeds while sowing seeds in the field. To evaluate the performance of the VMP for controlling pre-plant weeds in wheat crops, experiments were conducted at Rajbari, Rajshahi, and Thakurgaon districts of Bangladesh during 2015-16.

Materials and Methods

Experiments were established on three soil types and agro-ecological zones on 7 December 2015 at Rajbari (Baliakandi upazila), 9 December 2015 at Rajshahi (Durgapur upazila), and 25 November 2015 at Thakurgaon (Sadar upazila) during the rabi (November to February) season of 2015-16. The treatments in triplicate were (i) Conventional Tillage [CT] - four rotary tillage passes and two land leveling passes was done by locally hired 2-wheel tractor (2WT); (ii) Strip Planting with Glyphosate [SPG] - the non-selective herbicide, Roundup® (glyphosate 4 l ha^{-1}), was applied at 3.75 L ha^{-1} 24 hrs prior to strip planting of wheat by VMP; and (iii) Strip Planting with Small Blade [SPSB] - small blades attached between strips with the redesigned VMP shaft to cut weeds at ground level during planting. In SPG and SPSB, wheat cv. BARI Gom 26 was sown at 120 kg ha^{-1} and Di-amonium Phosphate fertilizer at 234 kg ha^{-1} was banded at planting time, and the other basal fertilizers (murate of potash 175 kg ha^{-1}, gypsum 175 kg ha^{-1}, zinc 11 kg ha^{-1}) were applied prior to sowing. In CT, the wheat and basal fertilizers were broadcasted prior to last tillage operation. To control broadleaf weeds, the early post emergence herbicide Affinity was applied 0.75 kg ha^{-1} at 25 days after sowing (DAS). Weed population, effective tiller number, grain yield and straw yield was recorded and analyzed by MSTAT-C.

Results and Discussion

Irrespective of treatments, the weed population m^2 was statistically similar in all three locations. The higher weed (majority *Cyprus rotundus (*L.*)*, *Brassica Eaculenta* (L.), *Alternanthera Sessilis* (L.), *Chenopodium Album (*L.*)* population at 25 days after sowing (DAS) and 15-day after Affinity application was reported in Thakurgaon followed by Rajbari, and the lowest in Rajshahi (Table 1). The highest number of effective tiller m^2 was found in SGP and

SPSB in Thakurgaon and the lowest number of effective tiller m^2 was recorded for CT in Rajshahi. Significantly higher wheat grain yield was reported in SPG in all locations. SPSB had the second highest grain yield of wheat, which was statistically similar to CT (Table 1). Similar trend was also found in straw yield.

Conclusions

The use of Roundup in strip-planted wheat provided highest grain yield. However, the use of VMP with small tines between strips to cut weeds (e.g., SPSB) could be advised as mechanical weed control where Roundup is not available. More trials are needed to confirm the benefit of as mechanical weed control by VMP before final recommendation of SPSB.

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Reference:

Haque, M.E., Bell, R.W., Islam, A.K.M.S., Sayre, K., Hossain, M.M., 2011. Versatile multi-crop planter for two-wheel tractors: an innovative option for smallholders. In: 5th World Congress of Conservation Agriculture. 26–29 September 2011, Brisbane, Australia, pp. 102-103.

Hossain, M.M. 2015. Recent perspective of herbicide: Review of demand and adoption in world agriculture. J. Bangladesh Agril. Univ. 13(1): 19 - 30.

Malik, R.K. and Singh, S., 1995. Littleseed canarygrass (Phalaris minor Retz.) resistance to isoproturon in India. Weed Technology 9: 419-425.

Sing, A.P., Makhan, S.B, Ramawatar, Y., and Chowdhury, T., 2015. Weed management in zero-till wheat. Indian Journal of Weed Science 47(3): 233–239.

Table 1. Effect of conventional tillage (CT), strip Planting with glyphosate (SPG), and strip planting with small blade (SPSB) on weed population effective tiller, grain and straw yield in Durgapur, Thakurgaon and Rajshahi, Thakurgaon, and Rajbari districts of Bangladesh, 2015-16

Location	Treatments	Weed plants m^2				Number of effective wheat tiller m^2	Grain yield (t ha^{-1})	Straw yield (t ha^{-1})
		Prior to wheat planting	Before Affinity spray (25 DAS)	15-day after Affinity spray (40 DAS)	After wheat harvest			
Rajshahi	CT	85	12d	1d	1d	5d	4.04b	3.49c
	SPG	52	10d	0.3d	1d	13ab	4.85a	4.46ab
	SPSB	84	10d	1d	0.6d	13ab	4.13b	4.28b
Thakurgaon	CT	86	45a	41ab	19b	7cd	4.08b	3.53c
	SPG	94	50a	41ab	27a	15a	4.89a	4.50ab
	SPSB	95	40ab	35bc	23ab	15a	4.17b	4.32ab
Rajbari	CT	91	20bc	2d	6cd	8c	4.15b	3.60c
	SPG	88	25bc	0d	8c	12b	4.96a	4.57a
	SPSB	51	16cd	0.3d	6cd	13b	4.24b	4.39ab
LS		NS	*	*	*	*	*	*

LS = Level of significance; * mean significant at 5 %.