Broadleaved weed management in wheat with post-emergence herbicides under strip tillage system

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Introduction

Conventionally wheat is grown in well prepared land followed by 3-4 full tillage which carry out degradation of natural resources and contribute to an increased cost of cultivation. Adopting strip tillage (single shallow pass) technology in wheat reduces the expenditure on field preparation and saves more than 30-60% fuel and time as well as advances the sowing time compared to conventional tillage practices (Mahal *et al*., 2009). But, early season weed control is critical for successful strip-till production (Mitchell *et al*., 2009). Moreover, weed can cause grain yield reduction in wheat by 50-80% (Montazeri *et al*., 2005). Both grass and broadleaved weeds infest wheat, but heavy broadleaved weed infestation causes significant wheat yield reduction (Zand *et al*., 2007), deteriorates the quality of wheat resulting low market value and also causes obstruction in harvesting. Broadleaved weed control in wheat could be easy and convenient if appropriate post-emergence herbicide can apply. Therefore, the study had taken to evaluate the efficacy of available post-emergence herbicides to control broadleaved weeds and to select a number of efficient post-emergence herbicides under strip tillage system.

Materials and Methods

The experiment was conducted at Bangladesh Agricultural University, Mymensingh during November 2013-March 2014. Eight treatments comprising combination of one pre-emergence herbicide, two early post-emergence and three late post-emergence herbicides were used in the experiment along with a weedy check (untreated control) in a randomized complete block design (RCBD) with three replications. Two weeks before of wheat sowing, non-selective herbicide Roundup® was applied @ 2.25 L ha^{-1}. Just before strip tillage, fertilizers were applied at recommended dose and then seeds of BARI Gom-26 @ 120 kg ha^{-1} were sown at 20 cm row spacing in a strip on 23 November 2013 with Versatile Multi-Crop Planter. Weed samples were randomly collected from three quadrates of 0.25 m^2 per plot and weed density and dry matter were recorded. The crop was harvested at maturity on 19 March 2014 from the central 3 m^2 areas (1.5m x 2.5m) and yield data were recorded. The collected data were statistically analyzed by following standard protocol.

Results and Discussions

The highest weed infestation was observed in weedy plots having 28.7 g grass, 7.6 g sedge and 68.1 g broadleaved weeds in m^{-2} area (Table 1). Study results indicated that broadleaved weed infestation was the highest under strip tillage system among the three types of weeds. Results also demonstrated that herbicides had significant effect on dry matter of grass, sedge and broadleaved weeds at 50 days after sowing and all herbicide treatments gave 100% control on broadleaved weeds compare to control except pendimethalin fb HW fb pendimethalin. This might be happened due to the less efficiency of pendimethalin to offer full control over broadleaved weeds those were escaped from hand weeding. Application of pendimethalin fb (carfentrazone-ethyl+isoproturon), pendimethalin fb pyrazosulfuron-ethyl fb 2,4-D amine and pendimethalin fb ethoxysulfuron fb carfentrazone-ethyl provided effective

control on all types of weeds and therefore these treatments produced 4.74-4.54 t ha^{-1} grain yield (Fig. 1a). On the other hand, pendimethalin fb ethoxysulfuron, pendimethalin fb 2,4-D amine and pendimethalin fb carfentrazone-ethyl provided full control on broadleaved weeds, but gave less control on grass and sedge weeds and as consequence these treatments produced 3.85-4.15 t ha^{-1} grain yield. The lowest grain yield (0.96 t ha^{-1}) was found from weedy plots. On the contrary, because of providing effective weed control, herbicide treated plots had 291-395% increased grain yield over weedy plots. The regression analysis result also expressed that grain yield of wheat was strongly negatively associated with weed dry matter (R^2 = 0.948) (Fig 1b). Therefore, the study results suggest application of pendimethalin fb carfentrazone-ethyl+isoproturon or application of pendimethalin with or without ethoxysulfuron/ pyrazosulfuron-ethyl followed by carfentrazone-ethyl/ 2,4-D amine could be effective for weed control under this system and optimum yield also can be achieved. However, it is strongly cautioned for repeated use of same herbicide or different herbicide with same mode of action to reduce the risks of herbicide resistance development in weeds.

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References

Mahal JS, Ahuja SS, Shukla LN and Singh K. 2009. Strip-till-drill in Punjab-a study. Indian J. Agric. Res. 43(4), 243-250.

Mitchell J, Shrestha A, Mathews MC, Giacomazzi D, Goyal S, Bryant D and Hererra I. 2009. Strip-tillage in California's central valley. University of California Agricultural and Natural Resources ANR Publication 8361. p. 1-8. http://anrcatalog.ucdavis.edu.

Montazeri M, Zand E, Baghestani MA. 2005. Weeds and their control in wheat fields of Iran (1st eds.), Agricultural Research and Education Organization Press, Tehran.

Zand E, Baghestani MA, Soufizadeh S, Azar RP, Veysi M, Bagherani N, Barjasteh A, Khayami MM and Nezamabadi N. 2007. Broadleaved weed control in winter wheat (*Triticum aestivum* L.) with post-emergence herbicides in Iran. Crop Prot. 26, 746-752.

Table 1. Evaluation of herbicides against percentage of weed density reduction and weed dry matter (g m^{-2}) at 50 days after sowing in wheat under strip tillage system during 2013-14

Treatments	Weed dry matter (g m^{-2})		
	Grass	Sedge	Broadleaf
T_1=Weedy check	28.7 a	7.6 a	68.1 a
T_2=Pendimethalin fb HW fb pendimethalin	4.5 de	2.0 b	4.0 b
T_3=Pendimethalin fb ethoxysulfuron	11.5 b	0.0 d	0.0 c
T_4=Pendimethalin fb ethoxysulfuron fb carfentrazone-ethyl	6.1 cd	0.0 d	0.0 c
T_5=Pendimethalin fb carfentrazone-ethyl	7.8 c	1.6 bc	0.0 c
T_6=Pendimethalin fb pyrazosulfuron-ethyl fb 2,4-D amine	4.8 de	0.0 d	0.0 c
T_7=Pendimethalin fb 2,4-D amine	7.7 c	1.1 c	0.0 c
T_8=Pendimethalin fb (carfentrazone-ethyl + isopropturon)	2.1 e	0.7 cd	0.0 c
P value	<0.001	<0.001	<0.001
CV (%)	10.62	19.14	12.24

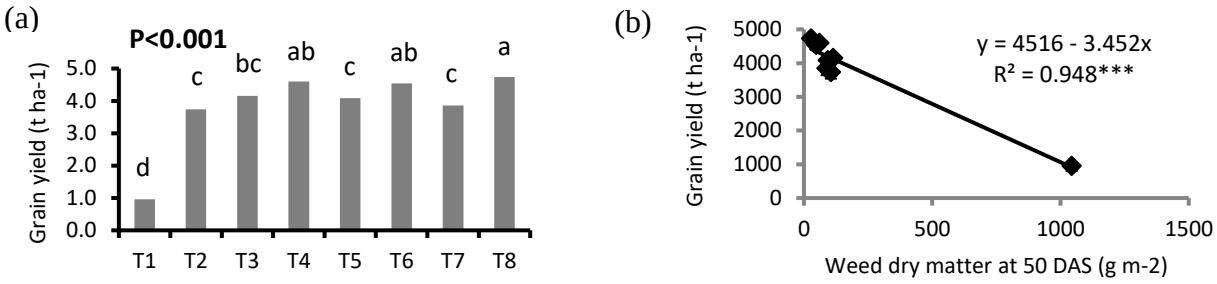

Figure 1. (a) Effect of herbicides on grain yield and (b) relationship between weed dry matter at 50 days after sowing and grain yield of wheat under strip tillage system during 2013-14