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Weed population, weed biomass and grain yield of wheat as influenced by herbicides application

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ABSTRACT

A field experiment was conducted during *Rabi* seasons of 2015-16 and 2016-17 at Banka (Bihar) to evaluate the weed population, weed biomass and grain yield as influenced by herbicide application in wheat (*Triticum aestivum* L.). Seven weed species, *viz. Phalaris minor*, *Cynodon dactylon*, *Chenopodium album*, *Oxalis purpurea*, *Anagallis arvensis*, *Medicago denticulata* and *Rumex dentatus* infested the wheat field. Post-emergence application of sulfosulfuron 75% WG (25 g/ha) + metsulfuron-methyl 20% WP (2 g/ha) at 30 days after sowing (DAS) was very effective against broad-leaf weeds and annual grasses, and recorded significantly lower density and biomass of these weeds at 60 DAS as compared to isoproturon 75% WP 1.0 kg/ha, sulfosulfuron 75% WG 50 g/ha, metsulfuron-methyl 20% WP 4 g/ha and weedy check. Ear length, effective tillers/m^2, grains/spike, grain and straw yields were also significantly higher in sulfosulfuron (25 g/ha) + metsulfuron-methyl (2 g/ha) as compared to other herbicide treatments.

Weeds are one of the major biotic constraints in wheat production as they compete with crop for nutrients, moisture, light and space (reference). Weeds possess many growth characteristics and adaptations which enable them to successfully exploit the numerous ecological niches. Apart from an ineffective control measure against mimicry weeds like *Phalaris minor* and *Avena ludoviciana*, manual weeding also involves high cost (Chhokar *et al.* 2012). The present situation of labour shortage and increase in wages has only worsened the situation. Under such situations, herbicides are far cheaper and more readily available resources than labor for hand weeding. When there is complex weed flora, infestation in wheat crop, the efficacy achieved by one herbicide belonging to single group is limited because of narrow spectrum of weed control. Uncontrolled weeds are reported to cause up to 66% reduction in wheat grain yield (Kumar *et al.* 2011) or even more depending upon the weed density, type of weed flora and duration of infestation. Loss in yield depends upon weed type, density, timing of emergence, wheat density, wheat cultivar and soil and environmental factors (Chhokar and Malik 2002). Among the grasses, *Phalaris minor* and broad-leaved weeds *ie*. *Rumex dentatus*, *Chenopodium album*, *Anagallis arvensis*, *Medicago denticulata*, *Melilotus alba*, *Fumaria parviflora*, *Coronopus didymus etc*. are of major concern in wheat under rice–wheat system (Chhokar *et al.* 2006). Chemical weed control is a preferred practice due to scarce and costly labour as well as lesser feasibility of mechanical or manual weeding especially in broadcast wheat. Recent investigations have vouched the importance of herbicide combinations in enhancing wheat productivity through control of wide spectrum of weeds.

A field experiment was conducted during *Rabi* seasons of 2015-16 and 2016-17 at farmer's field of Banka District as an On Farm Trial to evaluate the effect of herbicides namely, isoproturon, sulfosulfuron and metsulfuron-methyl on weed population dynamics and weed biomass in wheat crop. The geographical location of the farm lies at 24°30'N latitude and 86°30'E latitude at an altitude of 79 m from the mean sea level. The soil of experimental site was sandy-clay-loam in texture with neutral pH value (7.17). It was low in organic C (0.49%) and available N (197.5 kg/ha), medium in available P (16.4 kg/ha) and available K (210.9 kg/ha). The field experiment involving six weed management practices (weedy check, isoproturon 1.0 kg/ha at 30 DAS, sulfosulfuron 50 g/ha at 30 DAS, metsulfuron-methyl 4 g/ha at 30 DAS, sulfosulfuron 25 g/ha + metsulfuron-methyl 2 g/ha at 30 DAS and weed free)

was conducted in a randomized block design replicated thrice with the wheat cultivar *'HD-2733'*. The land was prepared by giving two ploughing each followed by planking with the help of a tractor-drawn cultivator. The sowing of wheat was done behind the plough after preparation of field on November 24, 2015 and November 20, 2016 at 22.5 cm row spacing. A uniform fertilizer dose of 120, 60, 40 kg N, P_2O_5 and K_2O/ha in the form of urea, di-ammonium phosphate and muriate of potash was applied to each experimental unit, respectively. Full dose of phosphorus, potassium and half dose of nitrogen were applied at sowing and remaining half dose of nitrogen was top dressed in two split doses after first and third irrigation. Treatment-wise post-emergence herbicides were applied at 30 DAS by knapsack sprayer fitted with flat-fan nozzle using water volume of 300 L/ha. Wheat was harvested at full physiological maturity, sun-dried for a week and threshed manually. Weed and crop samples were collected from each individual plot for studying various crop and weed characters. Weed samples were collected by placing a quadrat (0.5 × 0.5 m) randomly at two places in each plot. The data on weed density and weed biomass were subjected to square root $(\sqrt{x+1})$ transformation before statistical analysis to obtain homogeneity of variances. The data on density and biomass of total weeds were taken at 60 DAS and grain yield (t/ha) was recorded at the time of harvesting.

Density and biomass of weeds

The experimental field was infested with two grassy weeds, *viz. Phalaris minor* and *Cynodon dactylon* and five broad-leaved weeds, *viz. Chenopodium album, Oxalis purpurea, Anagallis arvensis, Medicago denticulata* and *Rumex dentatus*. Herbicidal treatments significantly reduced the density and biomass of grasses and broad-leaved weeds than weedy check. Sulfosulfuron (25 g/ha) + metsulfuron-methyl (2 g/ha) was found to be the most effective against broad-leaf weeds and annual grasses, and recorded significantly lower density and biomass of these weeds at 60 DAS than isoproturon at 1.0 kg/ha, sulfosulfuron at 50 g/ha, metsulfuron-methyl at 4.0 g/ha and weedy check (**Table 1**). Application of sulfosulfuron (25 g/ha) + metsulfuron-methyl (2 g/ha) reduced the weed population and weed biomass by 72.3% and 72.2%, respectively. Owing to synergetic enhancement or additive effects, herbicidal combinations in general were better than sole application of herbicides in effectively reducing the total weed population and weed biomass. This is in conformity with the findings of (Katara *et al.* 2015, Ahmadi and Nazari Alam 2013, Sheibani and Ghadiri 2011).

Among the different treatments, 100 per cent weed control efficiency against grassy and broad-leaved weeds was recorded in weed free followed by sulfosulfuron 25 g/ha + metsulfuron-methyl 2.0 g/ha, metsulfuron-methyl 4.0 g/ha, sulfosulfuron 50 g/ha and isoproturon 1.0 kg/ha at 30 DAS.

Effect on crop

All the weed control measures recorded significantly higher yield attributes and grain yield over weedy check (**Table 2**). Application of sulfosulfuron 25 g/ha + metsulfuron-methyl 2.0 g/ha recorded longer ear, more effective tillers/m^2, heavier 1000-grain weight, more grain and straw yields which were significantly higher than those in metsulfuron-methyl 20% WP 4 g/ha, sulfosulfuron 50 g/ha and isoproturon 1.0 kg/ha applied plot, weed free treatment. These results are in conformation with those of (Baghestani *et al.* 2008, Chhokar *et al.* 2008, Santos 2009 and Singh *et al.* 2012) who

Table 1. Weed population, weed biomass and weed control efficiency as influenced by herbicide application in wheat (pooled data of 2 years)

Treatment	60 DAS						WCE (%)		
	Weed population (no./m^2)			Weed biomass (g/m^2)					
	P. minor	BLW	Total weed	Biomass of *P. minor*	Biomass of BLW	Total weed biomass	Grassy weeds	Broad-leaved weeds	Total weeds
Isoproturon 1000 g/ha 30 DAS	3.0(9.8)	3.3(11.6)	6.1(38.0)	9.6 (93.9)	7.5(57.5)	17.0(290.0)	51.42	56.35	54.79
Sulfosulfuron 50 g/ha 30 DAS	1.7(4.0)	1.9(4.8)	3.7(14.4)	6.0(36.6)	4.5(21.2)	10.5(110.4)	81.05	83.95	82.79
Metsulfuron-methyl 4 g/ha 30 DAS	1.5(3.1)	1.7(3.9)	3.2(11.0)	5.0(26.3)	3.9(16.4)	9.0(81.3)	86.39	87.53	87.33
Sulfosulfuron + metsulfuron-methyl 25 + 2 g/ha 30 DAS	1.2(2.4)	1.3(2.6)	2.4(7.0)	4.1(17.8)	2.9(9.6)	7.0(50.6)	90.78	92.68	92.11
Weedy check	4.0(17.4)	4.9(24.8)	8.9(79.5)	13.9(193.4)	11.4(131.9)	25.3(641.6)	0.00	0.00	0.00
Weed free	1.0(0)	1.0 (0)	1.0(0)	1.0(0)	1.0(0)	1.0(0)	100	100	100
LSD (p=0.05)	0.30	0.31	0.59	0.84	0.96	1.87	-	-	-

*Data subjected to square root $(\sqrt{x+1})$ transformation and figures in parenthesis are original value

Table 2. Yield attributes and yield of wheat as influenced by herbicide application (pooled data of two years)

Treatment	Dose (g/ha)	Time of application (DAS)	Ear length (cm)	Yield attributes			Yield (t/ha)		Harvest index (%)
				Effective tillers/m^2	1000-grain weight	Grains /spike	Grain	Straw	
Isoproturon	1000	30	7.32	136.80	37.39	35.52	3.19	4.54	41.26
Sulfosulfuron	50	30	7.60	149.83	36.77	37.97	3.49	5.04	40.93
Metsulfuron-methyl	4	30	7.87	152.23	36.98	39.30	3.55	5.21	40.54
Sulfosulfuron + metsulfuron-methyl	25+2	30	8.81	171.81	37.93	43.62	3.98	5.82	40.60
Weedy check	-	-	6.53	103.81	37.95	30.59	2.50	3.49	41.73
Weed free	-	-	9.00	185.19	37.36	44.51	4.32	6.32	40.58
LSD (p=0.05)			0.88	17.38	NS	4.22	0.41	0.57	NS

reported that herbicides offer sizeable increase in crop productivity corresponding to their weed control spectrum.

The minimum yield was found with weedy check due to higher infestation of weeds resulting in strong competition of weeds with crop for growth factors (moisture, light, nutrients and space). The present results are in conformity with the findings of Sharma *et al*. (1999) and Rana *et al*. (2017).

The differences in 1000-grain weight and harvest index due to weed management treatments were non-significant. The herbicide treatments metsulfuron-methyl 4.0 g/ha, sulfosulfuron 50 g/ha and isoproturon 1.0 kg/ha were on par with each other in recording more ear length, effective tillers/m^2 and grain yield after sulfosulfuron 25 g/ha + metsulfuron-methyl 2.0 g/ha and weed free. Guillen-Portal *et al.* (2006) revealed that the grain number/spike significantly decreased in the presence of weed. The higher spike in herbicides treated plots may be attributed to effective weed control and allocation of more resources to crop plants than weeds (Cheema and Akhtar 2005).

It is concluded that all herbicide treatments reduced weed population and biomass and increased wheat grain and straw yields as compared with the weedy check. Among herbicides, sulfosulfuron 25 g/ha+ metsulfuron-methyl 2.0 g/ha provided maximum reduction in the total weed population and biomass and the highest yields which were at par with weed free conditions and significantly higher than all other treatments of weed management.

REFERENCES

Ahmadi A and Nazari Alam J. 2013. Efficiency of new herbicide of sulfosulfuron plus metosulfuron in weed control of wheat. *International Journal of Agronomy Plant Production* **4**: 714–718.

Baghestani MAZE, Soufizadeh S, Beheshtian M, Haghighi A, Barjasteh A, Birgani DG and Deihimfard R. 2008. Study on the efficacy of weed control in wheat with tank mixtures of grass herbicides with broad-leaved herbicides. *Crop Protection* **27**: 104–111.

Cheema MS and Akhtar M. 2005. Efficacy of different post-emergence herbicides and their application methods in controlling weeds in wheat. *Pakistan Journal of Weed Science Research* **11**(1-2): 23–30.

Chhokar RS and Malik RK. 2002. Isoproturon resistant *Phalaris minor* and its response to alternate herbicides. *Weed Technology* **16**: 116–123.

Chhokar RS, Sharma RK, Chauhan DS and Mongia AD. 2006. Evaluation of herbicides against *Phalaris minor* in wheat in north-western plains. *Weed Research* **46**: 40–49.

Chhokar RS, Sharma RS and Sharma I. 2012. Weed management strategies in wheat-A review. *Journal of Wheat Research* **4**(2): 1–21.

Chhokar RS, Singh S and Sharma RK. 2008. Herbicides for control of isoproturon resistant little seed canary grass (*Phalaris minor*) in wheat. *Crop Protection* **27**: 719–726.

Guillen Portal FR, Stougaard RN, Xue Q and Eskridge KM. 2006. Compensatory mechanisms associated with the effect of spring wheat seed size on wild oat competition. Crop *Science* **46:** 935–945.

Kumar S, Angiras NN and Rana SS. 2011. Bio-efficacy of clodinafop-propargyl + metsulfuron-methyl against complex weed flora in wheat. *Indian Journal of Weed Science* **43:**195–198.

Katara P, Kumar S and Rana SS. 2015. Influence of pinoxaden in combination with other herbicides on nutrient depletion by weeds in wheat. *Indian Journal of Weed Science* **47**(4): 371–375.

Rana SS, Badiyala D and Brari Parita. 2017. Evaluation of herbicide combinations for controlling complex weed flora in wheat. *Indian Journal of Weed Science* **49**(4): 335–340.

Santos BM. 2009. Drip-applied metam potassium and herbicides as methyl bromide alternatives for *Cyperus* control in tomato. *Crop Production***28**: 68–71.

Sharma BD, Nanwal RK and Panwar RS. 1999. Evaluation of herbicides for weed control in wheat (*Triticum aestivum* L.). *Indian Journal of Weed Science* **31**(1&2): 99–100.

Sheibani S and Ghadiri H. 2011. Integration effects of split nitrogen fertilization and herbicide application on weed management and wheat yield. *Journal of Agronomy Science and Technology* **14**: 77–86.

Singh R, Shyam R, Singh VK, Kumar J, Yadav SP and Rathi SK. 2012. Evaluation of bio-efficacy of clodinafop-propargyl+ metsulfuron-methyl against weeds in wheat. *Indian Journal of Weed Science* **44**(2): 81–83.