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Testing of New Brand Formulations of Sulfonylurea Herbicides for Control of Mixed Weed Flora in Wheat

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ABSTRACT

A field experiment was conducted during *rabi* 2013-14 to test two new brands of sufonyl urea herbicides from Markfed- Mark sulfo @ 0.024 kg a.i/ha (new brand of sulfosulfuron) and Markpower @ 0.03 kg a.i./ha (new brand of sulfosulfuron+metsulfuron) in wheat. Standard check herbicide Leader @ 0.024 kg a.i/ha (sulfosulfuron) against Mark sulfo was tested and recorded weed control and grain yield at par in both the treatments. Similarly, Markpower @ 0.03 kg a.i./ha (new brand of sulfosulfuron+metsulfuron) was tested against Total @ 0.03 kg a.i./ha (standard check) in wheat which resulted in weed control and grain yield at par with check herbicide.

Key Words: Sulfosulfuron, Sulfosulfuron+Metsulfuron, Weed control, Wheat

INTRODUCTION

Wheat is the most important cereal crop of North India. All type of weeds are not controlled by one type of herbicide and continuous use of that, over the time leads to increase in weed resistance to herbicides (Hall *et al* 1999). Isoproturon resistance is now common throughout the Indo-Gangetic Plains of India covering more than 1 M ha area. For control of mixed weed flora, both grassy and broad leaf weeds in wheat; farmers are applying either tank-mix of clodinafop/fenoxaprop with 2, 4-D/metsulfuron; isoproturon with 2, 4-D or ready-mix application of sulfosulfuron+metsulfuron/ mesosulfuron+ iodosulfuron/ metribuzin+fenoxaprop in one go (Anonymous, 2014).

Sulfonylurea group (acetolactate synthase inhibitor herbicides) are the low dose herbicides as compared to conventional herbicides (Rusel *et al* 2002) and are characterized by broad-spectrum weed control, good crop selectivity, and very low acute and chronic animal toxicity. The sulfonylurea herbicides are a relatively new group of compounds which control broad-leaved weeds and some grasses in cereal crops. This class of herbicides acts through inhibition of acetolactate synthase (also known as acetohydroxyacid synthase), thereby blocking the biosynthesis of the branched-chain amino acids like valine, leucine and isoleucine. This inhibition leads to the rapid cessation of plant cell division and growth. Growth ceases soon after spraying and then soon followed the chlorosis and the necrosis of these tissues (Rao, 2000). Therefore to control complex weed flora, combinations of herbicides are required. Further testing of brands of a particular herbicide is also required as some spurious brands of sulfonylurea herbicides are prevailing in the market and are being sold to the farmer. The sulfonylurea being residual in nature and can cause damage to the crop, if sprayed improperly. Further, herbicide efficacy is affected by inert matter/surfactant/filler used for making any brand formulation. So, the experiment was conducted to test the bioefficacy of two new brands of sulfonylurea herbicides in wheat.

MATERIALS AND METHODS

The experiment was laid out on the experimental farm of the Department of Agronomy, Punjab Agricultural University, Ludhiana during *rabi* 2013-14 in RBD with three replications. The soil of the experimental site was

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loamy sand with normal soil reaction and electrical conductivity, low in organic carbon and available nitrogen and medium in available phosphorus and potassium. The field was ploughed with disc harrow and a fine seed-bed was prepared with two ploughings with tractor drawn cultivator and two plankings after *rauni* irrigation. The wheat variety HD 2967 was sown on 14.11.2013 and the crop was raised with recommended package of practices. The herbicides Leader @ 0.024 kg a.i./ha (standard check), Marksulfo @ 0.024 kg a.i./ha (new brand of sulfosulfuron), Total @ 0.03 kg a.i./ha and Markpower @ 0.03 kg a.i./ha (new brand of sulfosulfuron+metsulfuron) alongwith respective surfactant were applied with knap sack sprayer fitted with flat fan nozzle by dissolving in 500 l of water/ha at 30-35 days after sowing (DAS). Unsprayed check was kept for comparison. The species wise weed count observations were taken from three random spots per plot at 60 DAS. The weed data were subjected to square root transformation before analysis. Dry matter of weeds was recorded at 60 DAS. The data on total weed dry matter, plant height, effective tillers and grain yield was recorded at the time of crop harvest.

RESULTS AND DISCUSSION

Effect on weeds

The prominent grass weed in the field was *Phalaris minor*. Among the broadleaf weeds *Chenopodium album, Anagallis arvensis, Medicago denticulata, Rumex dentatus, Coronopus didymus, Malva parviflora* were present.

Marksulfo 75 WG a new brand of sulfosulfuron at 0.024 kg a.i./ha significantly reduced population of narrow and broad leaf weeds at 60 DAS which was at par with already recommended herbicides Leader and significantly better than unweeded control (Table 1). *Phalaris minor* was significantly less in Marksulfo and Leader plots. The population of *Coronopus didymus* and *Medicago denticulata* was negligible in the Marksulfo and Leader plots. Complete kill of these two species was recorded in these treatments. However, these two brands showed poor control of *Malva parviflora*. Similar

Table 1. Bio-efficacy of new brand formulation Marksulfo 75 WG (sulfosulfuron) for control of weeds at 60 DAS in wheat.

Treatment	Weed count (No./m²)						Weed dry matter (g/m²)		WCE (%)	
	Phalaris minor	*Rumex dentatus*	*Coronopus didymus*	*Medicago denticulata*	*Chenopodium album*	*Malva parviflora*	Grasses	BLW	Grasses	BLW
Unsprayed check	4.8 (23)	6.6 (43)	3.5 (11)	3.6 (13)	3.1 (9)	2.7 (7)	26.2	55.8	-	-
Marksulfo 75 WG @ 0.024 kg a.i./ha	2.9 (7)	3.9 (14)	1.0 (0)	1.0 (0)	2.0 (3)	2.0 (3)	7.8	7.9	70.2	85.8
Leader 75 WG @ 0.024 kg a.i./ha	2.9 (8)	4.1 (16)	1.0 (0)	1.0 (0)	2.2 (4)	1.9 (3)	7.9	8.6	69.8	84.6
LSD (p=0.05)	0.6	0.6	0.1	0.1	0.4	0.2	2.7	3.9	-	-

Figure within parenthesis are original means. Weed data is subjected to square root transformation.

observation was recorded for *Rumex dentatus.* They had suppressed the weeds but complete kill was not recorded. Similar trend was recorded in case of weed dry matter in grasses as well as broadleaf weeds in which significantly less dry matter was recorded in both the brands of herbicides as compared to unsprayed check.

The weed control efficiency (WCE) ranged between 84.6 to 85.8 per cent. Balyan (2001) also reported satisfactory control of *Avena ludoviciana, Phalaris minor, Chenopodium album, Melilotus indica, Anagallis arvensis* and *Lathyrus aphaca* with sulfosulfuron 25 g a.i. + 0.1% NIS (non-ionic surfactant), isoproturon 1000 g a.i. and tank mixture of isoproturon+metsulfuron methyl 750+4 g a.i./ha . All these herbicides gave 52-88 per cent control of broad leaf weeds and 55-85 per cent control of grassy weeds. Baghestani *et al* (2006) also reported that sulfosulfuron at 19.95 and 24.90 g a.i./ ha was suitable for broadleaf and grass weed control in wheat.

Markpower 75 WG a new brand of sulfosulfuron+metsulfuron at 0.03 kg a.i./ha recorded very effective control of grass and broadleaf weeds and at par with already check herbicide Total at 0.03 kg a.i./ha (Table 2). WCE ranged between 88.9 to 89.7 per cent in the two herbicides. Sij *et al* (2007) reported that sulfonylurea herbicides were more efficient in terms of weed control. Lair and Redente (2004) reported that sulfonylurea herbicide application increased stability and biomass of crop as much as 43 per cent over auxin herbicide and grass weeds were reduced up to 71 per cent by application of sulfonylurea herbicide. Many studies reported that ready mixture of sulfosulfuron + metsulfuron provided excellent control of resistant population of *Phalaris minor* and broad-leaved weeds (Malik *et al* 2007, Punia *et al* 2008, Chhokar *et al* 2011, Singh *et al* 2011). Farmers are preferably using sulfonylurea herbicides because of kill of the resistant population as well as the broad spectrum control of weeds.

Effect on wheat crop

Marksulfo 75 WG at 0.024 kg a.i./ha recorded significantly more grain yield (54.0 q/ha) as

Table 2. Bio-efficacy of new brand formulation Markpower 75 WG for control of weeds at 60 DAS in wheat.

Treatment	Weed count (No./m²)						Weed dry matter (g/m²)		WCE (%)	
	Phalaris minor	*Rumex dentatus*	*Coronopus didymus*	*Medicago denticulata*	*Chenopodium album*	*Malva parviflora*	Grasses	BLW	Grasses	BLW
Unsprayed check	4.8 (23)	6.7 (45)	3.5 (12)	3.7 (13)	3.1 (9)	2.1 (4)	26.2	7.5 (56)	-	-
Markpower 75 WG @ 0.03 kg a.i./ha	2.4 (5)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.2 (0)	2.9	1.1 (0)	88.9	99.3
Total 75 WG] @ 0.03 kg a.i./ha	2.3 (4)	1.0 (0)	1.0 (0)	1.0 (0)	1.0 (0)	1.1 (0)	2.7	1.1 (0)	89.7	99.5
LSD (p=0.05)	0.3	0.3	0.1	0.1	0.2	0.2	2.1	0.5	-	-

Figure within parenthesis are original means. Weed data is subjected to square root transformation.

Table 3. Bio-efficacy of new brand formulations Marksulfo 75 WG on yield attributes and grain yield of wheat.

Treatment	Plant height (cm)	Panicle length (cm)	Effective tillers/ m^2	Grain yield (q/ha)	Biological yield (q/ha)
Unsprayed check	77.7	9.9	220.6	36.5	137.2
Marksulfo 75 WG @ 0.024 kg a.i./ha	84.0	12.4	329.4	54.0	149.7
Leader 75 WG @ 0.024 kg a.i./ha	87.0	12.8	325.6	54.6	151.8
LSD (p=0.05)	4.8	1.2	15	8.6	19.7

Table 4. Bio-efficacy of new brand formulation Markpower 75 WG on yield attributes and grain yield of wheat.

Treatment	Plant height (cm)	Panicle length (cm)	Effective tillers/ m^2	Grain yield (q/ha)	Biological yield (q/ha)
Unsprayed check	77.7	9.9	220.6	36.5	137.2
Markpower 75 WG @ 0.03kg a.i./ha	87.8	12.8	325.7	54.1	149.5
Total 75 WG@ 0.03kg a.i./ha	88.9	13.0	327.8	54.4	148.5
C.D. (p=0.05)	6.9	1.3	10.7	5.7	10.3

compared to unweeded control (36.5 q/ha). The plant height was significantly more in two brands under comparison than unsprayed check. The panicle length and effective tillers/m^2 were significantly more in both Marksulfo and Leader as compared to unsprayed check. Both the herbicidal treatments were at par with each other (Table 3). This leads to increase in grain yield in these herbicide treatments. The new brand recorded grain yield statistically at par with the recommended herbicide Leader (54.6 q/ha). Similar trend was recorded in case of biological yield.

Markpower 75 WG at 0.03 kg a.i./ha recorded significantly more grain yield (54.1 q/ha) as compared to unweeded control (36.5 q/ha). The plant height recorded was significantly less in unsprayed check due to presence of more weeds as compared to herbicide treatments (Table 4). The panicle length and effective tillers/m^2 recorded were significantly more in new brand Markpower which was at par with Total. The new brand recorded grain yield statistically at par with the recommended herbicide Total (54.4 q/ha). Similarly, significantly more biological yield was recorded in the herbicide treatments than unsprayed check. Sulfonyl ureas are being widely used by the farmers because of better efficacy but these herbicides have to be sprayed with caution with respect to crops being grown, varieties and cropping system being followed. Further, double spray, more moisture in the soil at the time of spray can leads to slight yellowing in wheat crop which recovers later on and have no adverse effect on grain yield.

CONCLUSION

Post emergence application of Marksulfo 75 WG (sulfosulfuron) at 0.024 kg a.i./ha or alternatively Markpower 75 WG (sulfosulfuon+metsulfuron) at 0.03 kg a.i./ha applied at 30-35 days of sowing provided effective control of weeds in wheat. These new brand formulations of sulfosulfuron (Marksulfo) and sulfosulfuron+metsulfuron (Markpower) will help in controlling broad spectrum weeds in wheat and also creates healthy competition in the market.

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