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Evaluation of Metribuzin for Control of *Rumex* spp. in Wheat

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ABSTRACT

The present study was carried out during Rabi season of 2017-18 at Department of Agronomy, Chaudhary Charan Singh Haryana Agricultural University, Hisar (Haryana) to evaluate the efficacy of metribuzin as a pre emergence intervention against Rumex spp. in wheat crop. It was applied at three doses (0.5X, X and 2.0X) in pot experiment under Completely Randomised Design (CRD) replicated thrice with four populations of Rumex spp. named as HHH (HAU Hisar), UPH (Ujha, Panipat), JHH (Jind) and JJR (Jhajjar) collected from farmers fields of Haryana. One unsprayed control was also kept for each population for comparison. In observations, plant height, chlorophyll fluorescence, electrical conductivity (EC), percent control, fresh weight and dry weight were recorded. Metribuzin as pre-emergence intervention provided 100 per cent control of all biotypes. No emergence was found in pots sprayed with metribuzin even at half of the recommended dose of this herbicide. This is the key finding of this study because pre-emergence intervention with metribuzin could resolve the problem of resistant Rumex biotypes being faced by the farmers.

Keywords: *Chlorophyll fluorescence, Metribuzin, Rumex spp., Population*

INTRODUCTION

Wheat (*Triticum aestivum* L.) is most important, widely cultivated and leading staple food crop of world with an area, production and productivity of 221.3 mha, 726.9 mt and 3290 kg/ha respectively (FAO STAT, 2016). In India, it occupies second rank after rice with 30.6 mha area with 99.8 mt production and 3220 kg/ha productivity (Anonymous, 2018). Haryana is the major wheat growing state of India with an area of about 2.53 mha, 11.7 mt production and 4.62 t/ha productivity (Anonymous, 2018a). Weed management is the key issue in the production package of wheat crop. Losses due to weeds in wheat productivity can be in range of 15-40% or even higher besides lowering down the quality of produce (Chopra et al., 2001). In some extreme cases, weeds can also cause complete failure of crop (Malik and Singh, 1995). Wheat is infested with diverse weed flora because it is grown in diverse agro-climatic conditions, under different cropping sequences, tillages and irrigation regimes (Chhokar et al., 2012).

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Reduced tillage or no till wheat with higher moisture in rice – wheat system favours the infestation of broad leaf weeds like *Malwa parviflora* and *Rumex dentatus.* At world level herbicide is a major tool of weed management in wheat due to its cost and time effectiveness. *R. dentatus* is a major broadleaf weed of *Rabi* season and is a serious problem of irrigated wheat particularly in rice-wheat cropping system in north-western Indo-Gangetic alluvial plains of India comprising of the state of Haryana, Punjab, and Western Uttar Pradesh (Sandhu & Dhaliwal, 2016). This weed is highly competitive and yield losses up to 55% have been reported (Heap, 2014).

MATERIALS AND METHODS

2.1. Experimental sites*:* The experiment was conducted during *Rabi* season of 2017-18 in screen house at Department of Agronomy, Chaudhary Charan Singh Haryana Agricultural University, Hisar.

2.2. Treatment details: Metribuzin was applied as pre-emergence intervention at three doses (0.5X, X and 2.0X) in pot experiment under Completely Randomized Design with three replications.

2.3. Planting material: Seeds of four populations of *Rumex* spp. named as HHH (HAU Hisar), UPH (Ujha, Panipat), JHH (Jind), and JJR (Jhajjar) collected from farmers fields of Haryana state. Seeds collected from research farm, CCSHAU, Hisar were used as standard check for comparison. One unsprayed control was also kept for each population for comparison.

2.4. Pot preparation*:* Soil of Agronomy Research Farm area was used for filling the pots. The soil was free from seeds of *Rumex* spp. and did not have any herbicide exposure in the preceding two years. Plastic pots (6″ diameter) were filled with 2 kg material mixture of sand, field soil and vermi-compost.

RESULTS

Metribuzin dose-response studies

The pre-emergence application of metribuzin @ 105 g/ha, 210 g/ha and 420 g/ha provided 100 per cent control in all biotypes. The efficacy of metribuzin even at half of the dose is the significant finding of this study (Table 3).

The metribuzin was applied as pre-emergence intervention and it provided 100 per cent control at all the three doses, hence no weed plant was available for recording plant height, Plant chlorophyll fluorescence, Electrical conductivity (EC) and Fresh and dry weight in any of the herbicide treatments. These observations were recorded only in control treatments for different biotypes.

Plant height recorded in control treatment for the different biotypes at spraying, 2 and 4 WAT showed no significant variation (Table 1). Significant variation was found in plant chlorophyll fluorescence **(Fv/Fm)** at 7 DAT among different biotypes. The plant chlorophyll fluorescence **(Fv/Fm)** recorded in HHH (HAU Hisar), UPH (Ujha, Panipat), JHH (Jind) and JJR (Jhajjar) population at 7 DAT was 0.85, 0.91, 0.91 and 0.84 respectively (Table 2). No significant difference was observed among different biotypes with respect to electrical conductivity (Table 4).

The fresh and dry weight of *Rumex* biotypes recorded at harvest (120 DAS) in control treatment showed significant variation. The highest fresh and dry weight was observed in UPH (2.14-0.81) followed by JHH (1.91-0.71), HHH (1.74-0.62), and JJH (0.81-0.60).

Table 1: Plant height of *Rumex* biotypes as influenced by metribuzin at spraying, 2 and 4 WAT

Populations	Plant height (cm)														
	Spraying					2 WAT					4 WAT				
	MTZ (g/ha)														
	0	105	210	420	Mean	0	105	210	420	Mean	0	105	210	420	Mean
HHH	0	0	0	0	0	7.3	0	0	0	1.8	15.0	0	0	0	3.8
UPH	0	0	0	0	0	7.7	0	0	0	1.9	15.7	0	0	0	3.9
JHH	0	0	0	0	0	7.7	0	0	0	1.9	16.0	0	0	0	4.0
JJH	0	0	0	0	0	6.7	0	0	0	1.7	14.7	0	0	0	3.7
Mean	0	0	0	0	0	7.3	0	0	0	0	15.3	0	0	0	0
CD (P=0.05)															
Population	NS					NS					NS				
MTZ	NS					0.2					0.3				
Population x MTZ	NS					NS					NS				

MTZ, metribuzin; WAT, weeks after treatment

Table 2: Plant chlorophyll fluorescence (Fv/Fm) of *Rumex* biotypes as influenced by metribuzin at 1, 2 and 7 DAT

Populations	Chlorophyll fluorescence (Fv/Fm)														
	1 DAT					2 DAT					7 DAT				
	MTZ (g/ha)														
	0	105	210	420	Mean	0	105	210	420	Mean	0	105	210	420	Mean
HHH	0	0	0	0	0	0	0	0	0	0	0.85	0	0	0	0.21
UPH	0	0	0	0	0	0	0	0	0	0	0.91	0	0	0	0.23
JHH	0	0	0	0	0	0	0	0	0	0	0.91	0	0	0	0.23
JJH	0	0	0	0	0	0	0	0	0	0	0.84	0	0	0	0.21
Mean	0	0	0	0	0	0	0	0	0	0	0.88	0	0	0	0
CD (P=0.05)															
Population	NS					NS					0.01				
MTZ	NS					NS					0.01				
Population x MTZ	NS					NS					0.01				

MTZ, metribuzin; DAT, days after treatment

Table 3: Percent control of *Rumex* biotypes as influenced by metribuzin at 1, 2 and 4 WAT

Populations	Mortality (%)														
	1 WAT					2 WAT					4 WAT				
	MTZ (g/ha)														
	0	105	210	420	Mean	0	105	210	420	Mean	0	105	210	420	Mean
HHH	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)
UPH	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)
JHH	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)
JJH	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)	0 (0)	89 (100)	89 (100)	89 (100)	67 (75)
Mean	0 (0)	89 (100)	89 (100)	89 (100)		0 (0)	89 (100)	89 (100)	89 (100)		0 (0)	89 (100)	89 (100)	89 (100)	
CD (P=0.05)															
Population	NS					NS					NS				
MTZ	NS					NS					NS				
Population x MTZ	NS					NS					NS				

Original figures in parenthesis were subjected to angular transformation. MTZ, metribuzin; WAT, weeks after treatment.

Table 4: EC of *Rumex* biotypes before and after boiling as influenced by metribuzin at 1 WAT

Populations	EC (ds/m)									
	Before boiling					After boiling				
	MTZ (g/ha)									
	0	105	210	420	Mean	0	105	210	420	Mean
HHH	0.017	0	0	0	0.004	0.027	0	0	0	0.007
UPH	0.017	0	0	0	0.004	0.027	0	0	0	0.007

JHH	0.017	0	0	0	0.004	0.027	0	0	0	0.007
JJH	0.013	0	0	0	0.003	0.027	0	0	0	0.007
Mean	0.016	0	0	0		0.027	0	0	0	
CD (P=0.05)										
Population	NS					NS				
MTZ	0.002					0.003				
Population x MTZ	NS					NS				

EC, electrical conductivity; MTZ, metribuzin; DAT, days after treatment

Table 5: Fresh and dry weight of *Rumex* biotypes as influenced by metribuzin at harvesting (120 DAS)

Populations	**Weight (g/pot)**									
	Fresh Weight					**Dry weight**				
	MTZ (g/ha)									
	0	**105**	**210**	**420**	**Mean**	**0**	**105**	**210**	**420**	**Mean**
HHH	6.97	0	0	0	1.74	2.47	0	0	0	0.62
UPH	8.57	0	0	0	2.14	3.23	0	0	0	0.81
JHH	7.63	0	0	0	1.91	2.83	0	0	0	0.71
JJH	3.23	0	0	0	0.81	2.40	0	0	0	0.60
Mean	6.60	0	0	0		2.73	0	0	0	
CD (P=0.05)										
Population	0.16					0.10				
MTZ	0.16					0.10				
Population x MTZ	0.31					0.21				

MTZ, metribuzin

DISCUSSION

Rumex biotypes were found highly sensitive to pre-emergence application of metribuzin. It provided complete control in all biotypes. No emergence was found in pots treated with metribuzin. It is due to inhibition of photosystem II. These results are in conformity with findings of Malik et al. (2005) and Chhokar et al. (2006).

SUMMARY AND CONCLUSION

All the *Rumex* biotypes were found highly sensitive to pre-emergence application of metribuzin. This herbicide provided complete control in all biotypes even at half of the recommended dose of herbicide. This is the key finding of this study because pre-emergence intervention with metribuzin could resolve the problem of resistant *Rumex* biotypes being faced by the farmers without incurring extra cost as pre-emergence application of metribuzin also integrated for the control of grassy weeds. The dose callibration of metribuzin with respect to the complex weed flora in wheat crop may prove as highly efficacious and cost effective weed management practice.

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