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Research Article

BIO-EFFICACY OF POST-EMERGENCE HERBICIDE TOPRAMEZONE AGAINST WEED CONTROL OF MAIZE (*Zea mays* L.)

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Abstract- The field experiments were carried out during *Kharif* season of 2009 and 2010 at experimental farm, Zonal Agricultural Research Station, Chandangaon, Chhindwara (Madhya Pradesh) under rainfed conditions. The soil of the experimental field was clay loam. The predominant weed-flora of experimental field were *Echinochloa colona* (L.) link, *Echinochloa crusgalli, Digetaria adsendence*, *Dinebra Arabica*, *Elusineindi c*agaretn., *Sateriagluaca*, *Cynodondectylon* among grasses, *Ageratum conyzoides* (L.), *Commelina benghalensis* (L.), *Euphorbia geniculata* forsk, *Euphorbiahirta, Aclyphaindica, Amarenthus viridis, Commelina communis, Corcorus spp., Phylenthus niruri* among broad leaf weeds and *Cyperusrotundus* L. among sedges. The results revealed that dry weight of weeds (g) was significantly superior over all the treatments as compare to weedy check in both years of the investigation. Higher weed dry weight was recorded under weedy check. All the topramezone treatments were found superior over weedy check. Number of cob/plant were non significant in all treatments over weedy check. Cob length (cm) and cob girth (cm) over weedy check were significantly superior. All the weed control measures resulted in significantly higher grain yield than weedy check. Post emergence herbicide topramezone 20.1 & 25.2 g a.i./ha produce higher yield than lowest dose 13.4 g a.i./ha. Same trend was observed in topramezone with adjuvant.

Keywords- Weed-flora, Weed density, Post-emergence, Maize, Yield.

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Introduction

Due to heavy weed infestation during *Kharif* season, maize yields are lowering down. Weed management at early stage of maize growth is very essential from growth and yield point of view. The heavy infestation of weeds is due to wider row planting and slow growth of plant during initial stage. *Deshmukh, et. al.,* 2008 [1] highlighted that yield losses due to weeds ranges between 28-93 percent, depending on the weed flora and their intensity, nature and duration of crop-weed competition. Atrazine, Pendimethalin and Alachlor are widely used for control of weeds in maize. However, these herbicides used as pre-emergence but post-emergence herbicides are not available in the market as per need/requirement. Hence newer herbicide Topramezone as for post-emergence testing is proposed in maize crop. However, *Paradkar and Sharma* 1993 [2] found that atrazine did not provide effective control of *Echinochloa spp., Digitaria sanguinalis, Panicum spp. and Setaria spp.* Walia, *et al.,* 2007 [3] and *Paradkar and Sharma* 1993 [2] observed that uncontrolled group of weed flora present in the field takes over others and may after severe competition to crop. Moreover, continuous use of single herbicide leads to evolution of herbicide resistant weed species and shift in weed flora. Under such circumstances to for effective control of weeds post-emergence application of herbicides is one of the best options. Keeping this fact in view, post emergence herbicide *i.e*., Topramizone was proposed to evaluate for its bio-efficacy against controlling weed of maize during *Kharif* season.

Materials and Methods

The field experiments were conducted under rainfed conditions during *Kharif* season of 2009 and 2010 at experimental farm, Zonal Agricultural Research Station, Chandangaon, Chhindwara, Madhya Pradesh. The soil of the experimental field was clay loam in texture neutral in reaction (pH 7.2), with normal (EC 0.32 dS/m). The soil was analyzing low in available nitrogen (214 kg/ha), medium in available phosphorus (17.2 kg/ha) and high in available potassium (352 kg/ha) contents. Ten treatments, comprising the post-emergence application of Topramezone with four different rates (13.4, 20.1, 25.2 and 33.6) and four same rates with adjuvant, atrazine 50 percent WP 1000 g plus weedy check were tested in randomized block design with three replications. Maize variety cv. HQPM-1 was sown on 24th June 2009 and 26th June 2010 in rows 60 cm apart, using 16 kg/ha seeds. Crop was fertilized with 100 kg N + 50 kg P_2O_5+ 60 kg K_2O/ha. Two third quantity of N along with full quantity of phosphorus and potassium was applied as basal while one third N was top dressed 30 DAS. The nitrogen, phosphorus and potassium were supplied through urea, single super phosphate and muriate of potash respectively. Thinning was done 15 DAS to maintain plant to plant distance of 25 cm. Topramezone was sprayed 18 DAS and application of atrazine as pre-emergence just after to sowing of crop to next day's sowing using flat fan nozzle during both the years of investigations. The quadrates of 0.5mx0.5m size were placed randomly in each plot at 30, 45 and 60 DAS and weeds in the quadrates were removed. And after removal the weeds more kept for drying in oven (70^0±10^0 for 72 hours) dry weight of weeds was recorded and reported as per square meter. Weed control efficiency (WCE) was also calculated.

The climate of the region is subtropical characterized by summers with well distributed rainfall and congenial to maize crop. The total rainfall of 868.0 and 883.0 mm in 53 &42 rainy days during 2009 and 2010 respectively.

Results & Discussion

Weed flora

The experimental field was infested with the weed-flora *viz. Echinochloa colona* (L.) link, *Echinochloa crusgalli, Digetaria adsendence, Dinebra arabica, Elusineindi* cagaretn., *Sateriagluaca, Cynodondectylon* among grasses. *Ageratum conyzoides* (L.), *Commelina benghalensis* (L.), *Euphorbia geniculata* forsk, *Euphorbia hirta*, *Aclyphaindica*, *Amarenthusviridis*, *Commelina communis*, *Corcorus spp*., *Phylenthus niruri* among broad leaf weeds and *Cyperusrotundus* L. among sedges.

Effect on weeds

All the weed control treatments were significantly affecting in reducing the weed density as compared to weedy check in both the years except 30 DAS first year. Post emergence herbicide topramezone lower dose was less effective against weed in comparison to its higher dose of topramezone. Same trend was obtained of weed control in topramezone with adjuvant and atrazine (pre-emergence) herbicide was found effective significantly in controlling against weed (30 DAS) during 2009 as compared to rest of the treatments. At 45 DAS and 60 DAS all the doses topramezone at all rates of its application significantly controlled weed during both the years as compared to weedy check. All the doses of topramezone were significantly effective against weed (45 DAS & 60 DAS) as compared to atrazine. Atrazine was found effective in checking weeds against weed check in both the years of investigation. Dry weight of weeds (g) was significantly superior over all the treatments as compare to weedy check in both years of the investigation. All the treatments of topramezone proved significantly superior compare to atrazine. Higher weed dry weight was recorded under weedy check. All the topramezone treatments were found superior over weedy check. But higher dose of topramezone (33.6 g a.i./ha)was also found significantly superior over lower dose of topramezone (13.4 g a.i./ha). Similar findings were also reported by Chopra and Angiras, 2008 [4], Paradkar and Sharma, 1993 [2] and Walia, *et al.,* 2007 [3] wherein topramezone + adjuvant treatments all four doses were being at par with each other but they were significantly superior over atrazine. Topramezone 336g/L SC @33.6 recorded higher weed control efficiency and herbicide efficiency index during both years of investigation.

Table-1 *Effect of application topramezone rate with adjuvant on weed density, weeds dry weight and weed control efficiency*

Treatment	Rate (g a.i./ha)	Weed density (m^{-2})						Weed dry weight(g)		Weed Control Efficiency (%)		Herbicide Efficiency Index (HEI)	
		30 DAS		45 DAS		60 DAS							
		2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010
Topramezone 336g/L SC	13.4	7.0	6.2	4.3	6.2	5.3	6.6	36.0	36.8	84.1	83.6	3.36	3.47
Topramezone 336g/L SC	20.1	5.7	5.8	2.7	3.5	4.3	5.9	32.2	33.3	85.8	85.2	4.12	4.02
Topramezone 336g/L SC	25.2	6.3	4.1	2.3	3.4	4.7	5.6	25.6	27.0	88.7	88.0	5.11	5.00
Topramezone 336g/L SC	33.6	5.0	4.2	3.3	3.6	3.7	5.1	18.8	20.1	91.7	91.0	6.72	6.53
Topramezone 336g/L SC + MSO Adjuvant	13.4	5.3	6.8	3.7	3.1	4.3	5.3	29.9	30.5	86.8	86.4	4.10	4.32
Topramezone 336g/L SC + MSO Adjuvant	20.1	5.1	2.5	3.3	3.2	3.3	4.5	29.8	30.2	86.9	86.5	4.32	4.73
Topramezone 336g/L SC + MSO Adjuvant	25.2	5.0	2.1	4.7	3.6	5.3	5.2	31.4	31.2	86.2	86.1	4.16	4.57
Topramezone 336g/L SC + MSO Adjuvant	33.6	3.0	6.8	3.3	2.9	3.3	2.9	25.2	25.0	88.9	88.9	5.04	5.63
Atrazine 50 % WP	1000.0	3.3	6.1	5.3	6.8	11.7	7.6	53.9	51.8	76.3	76.9	2.16	2.3
Weedy Check	0.0	82.7	78.5	82.7	82.3	90.7	84.9	227.0	224.3	0.0	0.0	0.00	0.0
CD 5 %	--	4.6	3.8	4.4	3.1	5.2	4.7	3.7	2.5	--	--	-	-

Effect on crops

All the post emergence (tropramezone) and pre emergence (atrazine) herbicide recorded significantly higher plant height over weedy check. Number of cob/plant were non significant in all treatments over weedy check. Cob length (cm) and cob girth (cm) over weedy check were significantly superior. Significantly lowest 100 grain weight was recorded under weedy check. However, 100 grain weight did not differ significantly among themselves in all other weed control treatments. All the weed control measures resulted in significantly higher grain yield than weedy check. Post emergence herbicide topramezone 20.1 & 25.2 g a.i./ha produce higher yield than lowest dose 13.4 g a.i./ha. The same pattern was seen in topramezone with adjuvant. All topramezone doses were significantly produced higher yield as compare to pre emergence application of atrazine. Lower yields were recorded in weedy check and these results are in accordance with Arvadiya, *et al.,* 2012 [5], Dwivedi, *et al.,* 2012 [6] and Deshmukh, *et al.,* 2008 [1]). Topramezone 336g/L SC + MSO Adjuvant @ 33.6 g a.i./ha fetch higher net return (Rs.18778/ha) followed by topramezone 336g/L SC @ 20.1g a.i./ha (Rs.18544/ha) in descending order. B:C ratio of topramezone 336g/L SC + MSO Adjuvant @ 33.6 g a.i./ha and topramezone 336g/L SC @ 20.1 g a.i./ha was alike.

Table-2 *Effect of application topramezone rate with Adjuvant on yield and yield attributing characters of maize.*

Treatment	Rate (g a.i./ha)	Plant height (cm)		No of cob/plant		Cob length (cm)		Cob girth (cm)		100 grain weight (g)		Grain yield (kg/ha)		Net return (pooled of 2 year)	B:C ratio (pooled of 2 year)
		2009	2010	2009	2010	2009	2010	2009	2010	2009	2010	2009	2010		
Topramezone 336g/L SC	13.4	165	164	1.0	1.0	15.2	15.0	10.2	10.6	25.04	25.26	4490	4851	17364	1.90
Topramezone 336g/L SC	20.1	167	166	1.0	1.0	14.6	15.2	10.8	11.0	25.42	25.94	4640	4996	18544	1.93
Topramezone 336g/L SC	25.2	170	174	1.1	1.0	14.6	14.8	11.4	11.8	25.82	26.08	4618	5011	18516	1.93
Topramezone 336g/L SC	33.6	171	173	1.1	1.1	14.2	14.6	11.6	11.8	26.42	26.66	4560	4959	18076	1.90
Topramezone 336g/L SC + MSO Adjuvant	13.4	159	165	1.0	1.0	15.6	15.4	10.8	11.0	25.22	25.48	4510	4969	17766	1.88
Topramezone 336g/L SC + MSO Adjuvant	20.1	167	165	1.1	1.1	14.8	15.2	11.4	11.8	25.56	25.82	4592	5122	18706	1.93
Topramezone 336g/L SC + MSO Adjuvant	25.2	158	168	1.1	1.1	14.6	15.2	12.0	12.2	26.06	26.16	4614	5118	18778	1.93
Topramezone 336g/L SC + MSO Adjuvant	33.6	161	168	1.1	1.0	15.2	15.6	11.2	10.6	26.52	26.94	4566	5092	18482	1.92
Atrazine 50 % WP	1000.0	157	169	1.0	1.0	14.4	15.2	10.4	10.8	24.24	24.78	4433	4788	16884	1.84
Weedy Check	0.0	153	157	0.7	0.7	13.4	13.6	10.0	10.4	21.02	22.54	2929	3129	6232	1.35
CD 5 %		9.1	7.7	NS	NS	1.1	0.9	0.8	0.6	1.62	1.56	253	344	-	-

Conclusion

Based on the result findings of research investigation, it can be concluded that post emergence herbicide topramezone @ 20.1 & 25.2 g a.i./ha produce higher yield of maize than lowest dose 13.4 g a.i./ha. The same pattern was seen in topramezone with adjuvant at this rate of application. All topramezone doses were significantly produced higher grain yield as compare to pre emergence application of atrazine.

Application of research: Research is applicable for maize growing farmers of Madhya Pradesh.

Abbreviations: Gram active ingredient/hectare (g a.i./ha), Day after sowing (DAS), Weed control efficiency (WCE), Herbicidal Efficiency Index (HEI).

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