Journal of Applied and Natural Science 9 (3): 1844 –1847 (2017)

JANS

Bio-efficacy of pyrazosulfuron ethyl 10% wp against weeds in transplanted rice

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Received: December 2, 2016; Revised received: March 16, 2017; Accepted: August 25, 2017

Abstract: An experiment was conducted during *Kharif* 2012 and 2013 at Agricultural Research Station, Dhadesugur, University of Agricultural Sciences, Raichur, Karnataka, India, to evaluate the phytotoxicity and bio-efficacy of pyrazosulfuron ethyl 10 % WP (wettable Powder) @ 5, 10, 15 and 20 g a.i./ha against the weeds in transplanted rice. Sprays of Saathi (Market Sample) @ 15 g a.i./ha (gram active ingredient/hectare), Pretilachlor 50% EC @ 500 ml a. i/ha, hand weeding at 15 and 40 days after planting (weed free check) and a weedy check (untreated check) were also maintained. The dominant weeds were *Echinochloacolona, Panicum repens, Cynodondoctylon, Ludwigiaparviflora, Leptochloachinensis and Cyperus sp.* Application of pyrazosulfuron ethyl 10 % WP @ 20 g a.i./ha was recorded significantly higher grain yield (6266 kg/ha) by controlling the associated weeds in transplanted rice without any phytotoxic effect.

Keywords: Bio-efficacy, Dry weight, Grain yield, Phytotoxicity, Weeds

INTRODUCTION

Agriculture has been a forefront agenda at national and international level for food security and management of natural resources. Cereals are the most important part of our diet throughout the world and thus, play a major role in our food security. Among cereals, rice has been staple food for more than 60 per cent of the world population, providing energy for about 40% of the world population where every third person on earth consumes rice every day in one form or other . Therefore, crop paddy (*Oryza sativa* L.) is an important crop which is extensively grown in tropical and subtropical regions of the world. It is cultivated in area of 43.9 million hectares with an annual production of 106.5 million tonnes in India (Annonymous, 2015).

Weeds may cause yield reduction up to 60 per cent in rice. Hand weeding is the traditional weed control measure and still being the most popular in rice. However, due to high labour cost, non-availability of labour and huge time requirement for manual weeding, farmers are inevitable to go for other alternative measures like chemical weed control. Many herbicides are being used successfully for weed control in transplanted rice-as pre -emergence spray. New herbicides are available in the market and use of herbicides of different composition is desirable to reduce the problem of residue build up, shift in weed problem. The recent trend of herbicide use is to find out an effective weed control measure by using low dose with high efficiency herbicides which will not only reduce the total volume of herbicide use but also the application become easier and economical (Pal *et al.,* 2012). Studies on bio-efficacy and phytotoxicity of pyrazosulfuron ethyl 10 % WP for pre-emergence weed control in transplanted rice are scanty. Therefore, The present experiment was undertaken to study the bio-efficacy and phytotoxicity of pyrazosulfuron ethyl 10 % WP in pre-emergence control of major weeds in transplanted rice and to determine an optimum dosage of application that can be recommended to rice growing farmers.

MATERIALS AND METHODS

An experiment was conducted during *Kharif* 2012 and 2013 at Agricultural Research Station, Dhadesugur, University of Agricultural Sciences (UAS), Raichur, Karnataka, India, (situated at 15.6' N latitude and 76.8' E longitude with an altitude of 358 m above mean sea level). The soil was deep black clay in texture having a pH of 8.1, organic Carbon 0.21%, total N 160 kg/ha, available P26.0 kg/ha and available K 486 kg/ha (Jackson, 1967). The experiment was laid out in a randomized block design with eight treatments, *viz.* T_1- Pyrazosulfuron ethyl 10 % WP at 5 g a.i./ha, T_2- Pyrazosulfuronethyl 10 % WP at 10 g a.i./ha, T_3- Pyrazosulfuron ethyl 10 % WP 15 g a.i./ha, T_4- Pyrazosulfuronethyl 10 % WP at 20 g a.i./ha, T_5- Saa-

thi at 15 g a.i. /ha, T_6- Pretilachlor 50% EC @ 500 ml a. i/ha T_7- weed free check (weeding at 15 days after sowing) and T_8- weedy check (Untreated check) and replicated thrice. The rice variety used was *'BPT-5204'* of 150 days duration. The crop was transplanted during 1st week of August in both the years. The test herbicide pyrazosulfuron ethyl 10 % WP at 4 different doses along with standard herbicide Saathi and Pretilachlor were sprayed at early pre-emergence stage (3 Days After transplanting) with the spray volume of 500 l/ha using knapsack sprayer with flat fan nozzle. An area was selected randomly at two spots by making a quadrant of 0.25 m^2(Marshall, 1988). Weed species were counted from that area and density was expressed in number per m^2. The collected weeds were first sun-dried and then kept in an electric oven at 700^0C till the weight became constant and weed biomass was expressed as g/m^2. As wide variation existed in data, number and biomass of weeds were transformed through square-root method before analysis of variance. Comparison of treatment means for significance at 5% level was done using the critical differences as

Table 1. Effect of Pyrazosulfuron ethyl 10% WP on different weed population (count/m^2) in transplanted paddy (Pooled data of *Kharif* 2012 and 2013).

Treatment details	*Echinichloacolona*			*Panicum repens*			*Cynodondoctylon*		
	15 DAA	30 DAA	60 DAA	15 DAA	30 DAA	60 DAA	15 DAA	30 DAA	60 DAA
T_1:Pyrazosulfuron ethyl 10% WP @ 5 g a. i. /ha	6.31 (2.70)	5.51 (2.54)	4.91 (2.42)	5.72 (2.59)	5.28 (2.49)	4.93 (2.42)	5.50 (2.55)	4.92 (2.42)	4.51 (2.34)
T_2:Pyrazosulfuron ethyl 10% WP @ 10 g a. i. /ha	5.96 (2.64)	5.28 (2.50)	4.59 (2.36)	5.24 (2.50)	4.78 (2.40)	4.51 (2.35)	5.20 (2.48)	4.62 (2.41)	4.28 (2.27)
T_3:Pyrazosulfuron ethyl 10% WP @ 15 g a. i. /ha	5.15 (2.47)	4.31 (2.30)	3.83 (2.20)	4.22 (2.28)	3.87 (2.21)	3.35 (2.08)	4.17 (2.22)	3.91 (2.20)	3.41 (2.08)
T_4:Pyrazosulfuron ethyl 10% WP @ 20 g a. i. /ha	4.36 (2.31)	3.53 (2.12)	3.26 (2.06)	3.41 (2.10)	3.02 (1.99)	2.73 (1.92)	3.67 (2.10)	3.30 (2.05)	2.84 (1.94)
T_5:Saathi (Market Sample) @ 15 g a. i. /ha	5.13 (2.47)	4.34 (2.30)	3.85 (2.20)	4.34 (2.31)	4.00 (2.24)	3.51 (2.12)	4.27 (2.28)	3.87 (2.20)	3.51 (2.12)
T_6:Pretilachlor 50% EC @ 500 ml a. i/ha	5.64 (2.57)	4.86 (2.41)	4.50 (2.33)	4.83 (2.41)	4.40 (2.32)	3.74 (2.17)	5.05 (2.45)	4.34 (2.28)	4.16 (2.24)
T_7:Weed free check	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)
T_8:Weedy check	8.69 (3.11)	8.96 (3.15)	9.63 (3.26)	7.34 (2.88)	8.17 (3.02)	8.81 (3.13)	6.73 (2.77)	7.35 (2.85)	8.28 (3.02)
S.Em±	0.05	0.06	0.04	0.07	0.08	0.06	0.06	0.05	0.06
CD at 5%	0.16	0.18	0.14	0.21	0.25	0.20	0.18	0.15	0.18

DAA: Days after application

Table 1a. Effect of Pyrazosulfuron ethyl 10% WP on different weed population (count/m^2) in transplanted paddy (Pooled data of *Kharif* 2012 and 2013).

Treatment details	*Ludwigiaparviflora*			*Leptochloachinensis*			*Cyperus Spp.*		
	15 DAA	30 DAA	60 DAA	15 DAA	30 DAA	60 DAA	15 DAA	30 DAA	60 DAA
T_1:Pyrazosulfuron ethyl 10% WP @ 5 g a. i. /ha	5.50 (2.55)	5.18 (2.48)	4.66 (2.37)	5.84 (2.61)	5.41 (2.52)	4.98 (2.43)	6.94 (2.81)	6.10 (2.66)	5.38 (2.52)
T_2:Pyrazosulfuron ethyl 10% WP @ 10 g a. i. /ha	5.01 (2.45)	4.62 (2.37)	4.21 (2.28)	5.29 (2.50)	4.90 (2.42)	4.37 (2.30)	5.95 (2.63)	5.40 (2.53)	4.90 (2.43)
T_3:Pyrazosulfuron ethyl 10% WP @ 15 g a. i. /ha	3.94 (2.17)	3.71 (2.16)	3.32 (2.07)	4.44 (2.33)	4.05 (2.25)	3.53 (2.13)	5.18 (2.47)	4.65 (2.37)	4.08 (2.25)
T_4:Pyrazosulfuron ethyl 10% WP @ 20 g a. i. /ha	3.28 (2.06)	2.96 (1.98)	2.65 (1.90)	3.57 (2.13)	2.98 (1.99)	2.70 (1.91)	4.44 (2.32)	4.26 (2.28)	3.84 (2.18)
T_5:Saathi (Market Sample) @ 15 g a. i. /ha	4.06 (2.24)	3.79 (2.18)	3.49 (2.12)	4.51 (2.34)	4.20 (2.28)	3.71 (2.16)	5.39 (2.52)	4.81 (2.41)	4.11 (2.26)
T_6:Pretilachlor 50% EC @ 500 ml a. i/ha	4.45 (2.30)	4.24 (2.28)	3.87 (2.19)	4.82 (2.41)	4.50 (2.34)	4.11 (2.25)	5.78 (2.60)	5.19 (2.49)	4.63 (2.37)
T_7:Weed free check	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)
T_8:Weedy check	6.99 (2.82)	7.95 (2.96)	8.56 (3.07)	6.98 (2.82)	7.74 (2.95)	8.63 (3.10)	8.91 (3.14)	9.42 (3.22)	10.38 (3.36)
SEm±	0.06	0.06	0.70	0.07	0.09	0.08	0.06	0.04	0.02
CD at 5%	0.18	0.20	2.12	0.21	0.29	0.25	0.20	0.13	0.08

DAA: Days after application

Table 2. Effect of Pyrazosulfuron ethyl 10% WP on total dry weight of weeds (g/m^2) and weed control efficiency in transplanted paddy (Pooled data of *Kharif* 2012 and 2013).

Treatment details	Total dry weight of weeds (g/m^2)			Weed control efficiency (%)		
	15 DAA	30 DAA	60 DAA	15 DAA	30 DAA	60 DAA
T_1:Pyrazosulfuron ethyl 10% WP @ 5 g a. i. /ha	22.82	19.36	16.48	64.47	71.90	80.50
T_2:Pyrazosulfuron ethyl 10% WP @ 10 g a. i. /ha	21.02	16.83	14.32	67.29	76.55	83.38
T_3:Pyrazosulfuron ethyl 10% WP @ 15 g a. i. /ha	17.79	14.18	12.68	72.31	79.44	86.02
T_4:Pyrazosulfuron ethyl 10% WP @ 20 g a. i. /ha	14.42	9.46	7.48	76.88	87.39	91.33
T_5:Saathi (Market Sample) @ 15 g a. i. /ha	17.56	14.56	10.93	72.13	79.06	86.29
T_6:Pretilachlor 50% EC @ 500 ml a. i/ha	20.18	16.52	12.38	68.10	76.58	85.41
T_7:Weed free check	--	--	--	100.0	100.0	100.0
T_8:Weedy check	64.26	68.42	83.46	--	--	--
S.Em±	1.04	1.70	1.15	1.58	2.77	1.68
CD at 5%	3.14	5.10	3.45	4.75	8.33	5.04

DAA: Days after application

Table 3. Effect of weed control treatments on growth, yield and yield parameters of transplanted paddy (Pooled data of *Kharif* 2012 and 2013).

Treatment details	Plant height (cm)	Number of productive tillers per hill	Panicle length (cm)	Number of filled grains per panicle	1000 grain weight (g)	Grain yield (kg/ha)	Straw yield (kg/ha)
T_1:Pyrazosulfuron ethyl 10% WP @ 5 g a. i. /ha	70.5	19.2	20.4	261	17.1	5556	6714
T_2:Pyrazosulfuron ethyl 10% WP @ 10 g a. i. /ha	72.4	20.6	20.3	263	18.1	5683	6836
T_3:Pyrazosulfuron ethyl 10% WP @ 15 g a. i. /ha	81.6	23.3	22.2	270	17.2	6013	7216
T_4:Pyrazosulfuron ethyl 10% WP @ 20 g a. i. /ha	82.2	25.1	23.1	275	18.2	6266	7465
T_5:Saathi (Market Sample) @ 15 g a. i. /ha	79.5	22.4	21.6	268	17.5	5898	7105
T_6:Pretilachlor 50% EC @ 500 ml a. i/ha	73.2	21.7	21.2	265	18.5	5795	6973
T_7:Weed free check	85.4	26.6	24.5	279	17.1	6424	7611
T_8:Absolute Control (Untreated check)	65.6	14.7	18.4	212	16.2	4183	5029
S.Em±	1.83	1.20	0.86	5.30	1.18	177	171
CD at 5%	5.48	3.60	2.58	15.9	3.53	530	508

DAA: Days after application

suggested by Gomez and Gomez (1984). Weed control efficiency (WCE) was worked out using the formula as suggested by Mani *et al.,* 1973 and Gill and Vijayakumar, 1969. In transplanted paddy, five plants were randomly selected in each plot of each replication and were tagged for the purpose of recording observations on growth parameters *viz.,* plant height and number of productive tillers per hill at harvest. Yield parameters *viz.,* panicle length, test weight and number of filled grains per panicle. Similarly, paddy from each net plot in each replication was harvested and dried. The grains after threshing were weighed and recorded as grain yield per net plot. Further, this net plot grain yield was converted to grain yield per hectare.

RESULTS AND DISCUSSION

Effect on weeds, weed control efficiency and total dry weight of weeds: In the experimental plots, the dominant weeds were*Echinochloacolona, Panicum repens, Cynodondoctylon, Ludwigiaparviflora, Leptochloachinensis and Cyperus sp.* All the herbicides showed effective control of all categories of dominant weeds resulting in less weed dry matter and higher weed control efficiency as compared to untreated check (Table 1 and 1a). The number of dominant broad-leaved, grass and sedge weeds was gradually decreased with the increase of doses of tested herbicide pyrazosulfuron ethyl 10 % WP in all the three dates of observation. Better weed control was observed with application of pyrazosulfuron ethyl 10 % WP at 20 g a.i./ha of the tested herbicide. Pal *et al.* (2012) reported that, the number of dominant broad-leaved, grass and sedge weeds was gradually decreased with the increase of doses of pyrazosulfuron-ethyl application in transplanted rice. Lower weed biomass at 15 days after herbicide application was recorded with pyrazosulfu-

ron ethyl 10 % WP at 20 g a.i./ha. Angiras and Kumar (2005) also found that broadcast application of pyrazosulfuron-ethyl at 15 g/ha mixed with sand at 150 kg/ha was effective to control weeds in rice which resulted in significantly lower weed density and biomass without any phytotoxic effect on rice plant. Similarly, Chopra and Chopra, 2003 also found that, application of Pyrazosulfuron-ethyl at 20 and 25 g/ha significantly reduced weed density and total weed biomass of *Cyperusiria, Echinochloacolona etc.* when applied at 3 to 10 days after transplanting. None of tested doses was phytotoxic to rice when applied alone. Application of Pyrazosulfuron ethyl 10 % WP at 20 g a.i./ha given higher weed control efficiency (76.88, 87.39 and 91.33% at 15, 30 and 60 DAA, respectively) when applied at 3 days after sowing. It was closely followed by the application of Pyrazosulfuron ethyl 10 % WP at 15 g a.i./ha (72.31, 79.44 and 86.02% at 15, 30 and 60 DAA, respectively) and Saathi at 15 g a.i./ha (72.13, 79.06 and 86.29% at 15, 30 and 60 DAA, respectively). Further, total dry weight of weeds (14.42, 9.46 and 7.48 g/m^2 at 15, 30 and 60 DAA, respectively) was lower with application of Pyrazosulfuron ethyl 10 % WP at 20 g a.i./ha. It was closely followed by the application of Pyrazosulfuron ethyl 10 % WP at 15 g a.i./ha (17.79, 14.48 and 12.68 g/m^2 at 15, 30 and 60 DAA, respectively) and Saathi at 15 g a.i./ha (17.56, 14.56 and 10.93g/m^2 at 15, 30 and 60 DAA, respectively). Overall result showed that the tested herbicide pyrazosulfuron ethyl 10 % WP at 20 g a. i./ha was comparatively more effective against broad-leaved, grassy and sedge weeds.

Effect on growth parameters of transplanted paddy: Significantly taller plants and more number of productive tillers per hill were observed in weed free treatment and which was onpar in the treatment with the application of Pyrazosulfuron ethyl 10% WP @ 20g a.i./ha (82.2 cm and 25.1, respectively), Pyrazosulfuron ethyl 10% WP @ 15 g a. i. /ha (81.6 cm and 23.3, respectively) and Saathi (Market Sample) @ 15 g a.i. /ha (79.5 cm and 22.4) compared to other weed control treatments. Whereas, shorter plants and less number of productive tillers per hill were recorded in the weedy check treatment (Table 3).

Effect on yield and yield parameters of transplanted paddy: Similarly**,** significantly (p=0.05) higher grain (6266 kg/ha) and straw yield (7465 kg/ha) were observed in weed free treatment and which was onpar with the application of Pyrazosulfuron ethyl 10% WP @ 20g a.i./ha, Pyrazosulfuron ethyl 10% WP @ 15 g a. i. /ha (6013 and 7216 t/ha, respectively) and Saathi (Market Sample) @ 15 g a. i. /ha (5898 and 7105 kg/ ha, respectively) compared to other weed control treatments. Similar trend was recorded with respect to yield parameters of paddy. Pyrazosulfuron-ethyl at 20 and 25 g/ha provided grain yield of rice statistically similar to weed free treatment (Chopra and Chopra 2003).Whereas, lower grain and straw yield were recorded in weedy check plot. This is due to the high infestation of weeds.

Conclusion

Results indicated that the application of pyrazosulfuron ethyl 10 % WP @ 20 g a.i./ha effectively controlled all types of weeds in transplanted rice and resulted higher grain yield (6266 kg/ha).

ACKNOWLEDGEMENTS

The authors are very much thankful to Coromandel International Limited, Coromandel House, # 1-2-10, Sardar Patel Road, Secunderabad- 500 003, India for providing the herbicides and other facilities for carrying out this experiment.

REFERENCES

Angiras, N.N. and Kumar, S. (2005). Efficacy of pyrazosulfuron-ethylagainst weeds in rice nursery under mid hill conditions of Himachal Pradesh. *Indian Journal of Weed Science,* 37(3&4):151–154

Annonymous, (2015). Annual report 2014-15, Department of Agriculture and Cooperation Ministry of Agriculture, Government of India Krishi Bhavan, New Delhi

Chopra, N.K. and Chopra, N. (2003). Effect of doses and stages of application of pyrazosulfuron ethyl on weeds in transplanted rice. *Indian Journal of Weed Science,* 35 (1&2): 42–46

Gill, H.S. and Vijayakumar (1969). Weed index–a new method for reporting weed control trial. *Indian Journal of Agronomy,* 14(1):96–98

Gomez, K.A. and Gomez, A.A. (1984). *Statistical Procedures for Agricultural Research*, John Wiley & Sons. Inc., New York.

Jackson, M.L. (1967). *Soil Chemical Analysis*. Prentice Hall of India Pvt. Ltd., New Delhi, pp. 183-192

Mani, V.S., Pandita, M.L., Gautam, K.C. and Das, B. (1973). Weed killing chemicals in potato cultivation. *Indian Farming* 23: 7–13

Marshall, E. J. P. (1988). Field-scale estimates of grass weed populations in arable land. *Weed Research*, 28(3):191-198

S. Pal, R.K. Ghosh, H. Banerjee, R. Kundu and A. Alipatra, (2012). Effect of pyrazosulfuron-ethyl on yield of transplanted rice. *Indian Journal of Weed Science,* 44(4): 210 –213, 2012