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Study of bio-efficacy and Phytotoxicity of New Generation Herbicides on Triafamone and Ethoxysulfuron in Direct Seeded Rice (*Oryza sativa*)

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ABSTRACT

The herbicides triafamone + ethoxysulfuron at (200g/ml/ha and 225 g/ml/ha) and triafamone (225 g/ml/ha) applied at 15 days after planting recorded the zero weed counts of individual species viz., grasses, sedges and broad leaf weeds, weed dry matter production and weed control index favoring to higher grain yield of (5.2 and 5.34 t/ha). Triafamone + ethoxysulfuron (175 g/ml/ha) recorded the least weed count, weed dry matter and cent percent weed control index recorded at 42 days after application (DAA). Ethoxysulfuron (150g/ml/ha) was next in order. No phytotoxicity symptoms was observed in the treatments including double the recommended dose of triafamone + ethoxysulfuron (450 g/ml/ha and 225 g/ml/ha) in respect of leaf chlorosis, tip burning, necrosis, epinasty, hyponasty, vein clearing, wilting and rosetting.

Key words: Direct seeded rice, bio-efficacy, phytotoxicity, triafamone, ethoxysulfuron.

Introduction

Rice is a staple food crop of Asian continent and 50 per cent of the world's population that resides in this continent, where occurs 90 % area and 91 % of world rice productivity respectively. In India, rice is cultivated over an area of 45 million hectares with a production of 100 mt and the estimated rice production of our country in 2013 in around 104.3 mt and it would be 150 mt during 2020 (Anonymous, 2013). The cauvery deltaic region, popularly known as 'Granary' of Tamil Nadu, contributes a major share for the rice production. The low rice production in India is attributed to infestation of pests and diseases, weeds, poor water and fertility management besides low yielding varieties. The losses caused by weeds exceed the losses caused by any other category of agricultural pests. Of the total annual loss in agriculture produce, weeds account for 45%, insect 30%, disease 20% and other pests 5% (Jha *et al.*, 2011). Accordingly research programme on vegetation management strategies capable of minimizing weed infestation and simultaneously favouring sustainable crop production that is economical and environmentally acceptable strategies for alleviating yield losses due to pests, including weeds, insects and diseases needs attention (Rao *et al.,* 2007).

Materials and methods

Experiments were conducted at Experimental Farm, Faculty of Agriculture, Annamalai University during rabi seasons of 2011-2012. The soils of the experimental site clayey loam with a pH of 7.8 and EC of 0.46mhos/cm^{-1}, low in available nitrogen (210$kgha^{-1}$), medium in available phosphorus (17.96$kgha^{-1}$) and high in available potassium (320.8$kgha^{-1}$). The experimental farm located at 11º 24' N latitude, 79 º 41' E longitudes at an altitude of 256m above mean sea level. Ten different treatments (Table.1) compared and were laid out in randomized block design with three replications. The planting of paddy crop of CO-43 variety was done at 20 x 15 cm spacing. The recommended dose of 150 kg N, 50 kg P_2O_5 and 50kg K_2O was applied along with farmyard manure (FYM) at12.5 tha^{-1}. The whole quantity of P_2O_5, FYM and half dose of nitrogen and potassium were applied at the time of field preparation. Remaining half dose of N and K_2O were applied under favorable

weather condition. The herbicides were sprayed three days after sowing (DAS) of pre-emergence and 15 days after sowing (DAS) of post emergence by using knapsack sprayer fitted with flood jet nozzle spray volume of 300 lit/ha as per the treatments. The treatments as of 1-5 when sprayed after 24 hrs irrigated immediately. The phytotoxicity symptoms were observed in respect of leaf chlorosis, tip burning, necrosis, epinasty, hyponasty, vein clearing, wilting and rosetting.

Results and Discussion

Effect on weeds

The predominant weeds of experimental field were observed *L.chinensis*, *E.colonum* and *C.dactylon* of grasses, *Cyperus* Sp and *Scirpus* Sp of sedges and broad leaf weeds of *E.alba, B.capansis and S.cylonica*. Triafamone + ethoxysulfuron (200 g/ml/ha and 225 g/ml/ha) and triafamone (225 g/ml/ha) was recorded the zero weed counts (Table.4) weed dry matter and cent percent weed indices. Triafamone + ethoxysulfuron (175 g/ml/ha and ethoxysulfuron 150 g/ml/ha) was next in order. Butachlor at 2500 ml/ha, pyrazosulfuron ethyl at 150 ml/ha and Cyhalofop p butyl 10 EC 750 ml/ha had higher weed density and weed dry weight than ethoxysulfuron 150 ml/ha. Similar results were obtained by the earlier (Gangwar and Singh. 2010). The results are conformity with the findings of (Sushma *et al.,* 2013).

Effect on crop

The highest grain yield of 5375and 5165 kg/ha was observed with the treatments of triafamone + ethoxysulfuron (200 g/ml/ha and 225 g/ml/ha). This was at par with 175 ml and 225 ml and hand weeding were significantly higher than rest of the treatments. These all the treatments were significantly superior than the untreated control that recorded the least grain yield of 2670 kg/ha. This is conformity with the chemical control of weeds (Gangwar and Singh 2010 and Jha *et al.,* 2011). Triafamone + ethoxysulfuron all the doses performed significantly superior to butachlor, pyrazosulfur on ethyl and cyhalofop p butyl.

The better results concluded that the application of triafamone + ethoxysulfuron is attributed to efficient and safe weed control. No phytotoxity was observed in all the treatments including two times recommended dose of triafamone + ethoxysulfuron (450

g/ml/ha and 225 g/ml/ha) in respect of leaf chlorosis, tip burning, necrosis, epinasty, hyponasty, vein clearing, wilting and rosetting.

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Table 1. Effect of herbicide treatments on weed species count at 42 DAA (m^{-2})

Treatments	Grasses			Sedges		Broad leaf weeds		
	L. chinensis	***E. colonum***	***C. dactylon***	***Cyperus sp***	***Scirpus sp***	***E.alba***	***B.capansis***	***S.cylonica***
Triafamone 20% + Ethoxysulfuron 10-30% WG (175 g/ml/ha)	(3.0) 1.87	(2.0) 1.58	(2.5) 1.73	(2.0) 1.58	(1.5) 1.41	(1.8) 1.51	(1.0) 1.22	(1.5) 1.41
Triafamone 20% + Ethoxysulfuron 10-30% WG (200 g/ml/ha)	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01
Triafamone 20% + Ethoxysulfuron 10-30% WG (225 g/ml/ha)	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01
Triafamone 20%SC (225 ml/ha)	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01
Ethoxysulfuron 15% WG (150 g/ml/ha)	(4.0) 2.12	(5.0) 2.34	(4.0) 2.12	(6.0) 2.54	(4.0) 2.12	(3.0) 1.87	(2.0) 1.58	(2.0) 1.58
Butachlor 50% EC (2500 ml/ha)	(5.0) 2.34	(6.0) 2.54	(5.0) 2.34	(6.5) 2.64	(5.5) 2.44	(4.0) 2.12	(3.0) 1.87	(2.0) 1.58
Pyrazosulfuron ethyl (Saathi) 10 WP (150 ml/ha)	(6.0) 2.54	(5.5) 2.44	(5.0) 2.34	(3.5) 2.00	(5.5) 2.44	(4.0) 2.12	(3.5) 2.00	(3.0) 1.87
Cyhalofop p butyl 10 EC (750 ml/ha)	(7.0) 2.73	(6.0) 2.54	(5.5) 2.44	(6.0) 2.54	(5.4) 2.42	(4.5) 2.23	(4.0) 2.12	(3.5) 2.00
Hand weeding	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01	(0.0) 0.01
Untreated control (Water Spray)	(18.0) 4.30	(19.0) 4.41	(15.0) 3.93	(17.0) 4.18	(13.0) 3.67	(14.0) 3.80	(12.0) 3.53	(11.0) 3.39
$S.E_D$	0.12	0.32	0.19	0.48	0.35	0.18	0.18	0.08
CD (P=0.05)	0.25	0.65	0.39	0.96	0.71	0.36	0.36	0.17

Figures in parenthesis indicate original values before subjecting them to transformation using the formula $\sqrt{(X+0.5)}$

Table 2. Effect of herbicide treatments on weed dry matter production (g) at 42 DAA (m^{-2})

Treatments	Grasses			Sedges		Broad leaf weeds		
	L. chinensis	***E. colonum***	***C. dactylon***	***Cyperus sp***	***Scirpus sp***	***E.alba***	***B.capansis***	***S.cylonica***
Triafamone 20% + Ethoxysulfuron 10-30% WG (175 g/ml/ha)	40.0	39.0	90.0	55.0	45.0	70.5	67.0	72.0
Triafamone 20% + Ethoxysulfuron 10-30% WG (200 g/ml/ha)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triafamone 20% + Ethoxysulfuron 10-30% WG (225 g/ml/ha)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Triafamone 20%SC (225 ml/ha)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ethoxysulfuron 15% WG (150 g/ml/ha)	66.0	59.0	85.0	64.0	50.0	66.0	70.0	73.0
Butachlor 50% EC (2500 ml/ha)	70.0	60.0	92.0	68.0	58.0	74.0	72.0	80.0
Pyrazosulfuron ethyl (Saathi) 10 WP (150 ml/ha)	56.0	74.0	83.0	67.15	61.0	69.0	68.0	78.0
Cyhalofop p butyl 10 EC (750 ml/ha)	75.0	71.0	80.0	73.0	65.0	81.0	76.0	85.0
Hand weeding	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Untreated control (Water Spray)	255	127	120	117	115	126	133	160
$S.E_D$	2.0	1.50	2.50	2.0	2.50	2.25	1.50	3.5
CD (P=0.05)	4.0	3.0	5.0	4.0	5.0	4.50	3.0	7.0

Table 3. Effect of herbicide treatments on weed control index at 42 DAA (m^{-2}) and grain yield kg/ha

Treatments	Grasses			Sedges		Broad leaf weeds			Grain Yield (Kg/ha)
	L. chinensis	*E. colonum*	*C. dactylon*	*Cyperus sp*	*Scirpus sp*	*E.alba*	*B.capansis*	*S.cylonica*	
Triafamone 20% + Ethoxysulfuron 10-30% WG (175 g/ml/ha)	(84.31) 66.67	(69.29) 56.34	(25.00) 30.00	(52.99) 46.71	(59.82) 50.66	(44.04) 41.57	(49.62) 44.78	(55.00) 47.86	4530
Triafamone 20% + Ethoxysulfuron 10-30% WG (200 g/ml/ha)	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	5165
Triafamone 20% + Ethoxysulfuron 10-30% WG (225 g/ml/ha)	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	5375
Triafamone 20%SC (225 ml/ha)	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	4770
Ethoxysulfuron 15% WG (150 g/ml/ha)	(74.11) 59.41	(53.54) 47.02	(29.16) 32.68	(45.29) 42.29	(56.52) 48.74	(47.61) 43.63	(47.36) 43.48	(54.37) 47.50	4520
Butachlor 50% EC (2500 ml/ha)	(72.54) 58.39	(52.75) 46.57	(23.33) 28.88	(41.88) 40.32	(49.56) 44.74	(41.26) 40.00	(45.86) 42.62	(50.00) 45.00	4930
Pyrazosulfuron ethyl (Saathi) 10 WP (150 ml/ha)	(78.03) 62.00	(41.73) 40.23	(30.83) 3372	(42.60) 40.74	(46.95) 43.25	(45.23) 42.26	(48.38) 44.07	(51.25) 45.71	4690
Cyhalofop p butyl 10 EC (750 ml/ha)	(70.58) 57.15	(44.09) 41.60	(31.49) 34.13	(37.60) 37.82	(43.48) 41.25	(35.71) 36.70	(42.85) 40.88	(46.87) 43.20	4910
Hand weeding	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	(100.00) 90.00	5060
Untreated control (Water Spray)	(0.00) 0.01	(0.00) 0.01	(0.00) 0.01	(0.00) 0.01	(0.00) 0.01	(0.00) 0.01	(0.00) 0.01	(0.00) 0.01	2670
$S.E_D$	3.63	4.66	1.34	2.21	1.75	1.03	0.65	1.25	33.75
CD (P=0.05)	7.26	9.32	2.68	4.42	3.5	2.06	1.30	2.50	67.50

Figures in parenthesis indicate original values before subjecting them to angular transformation.