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EVALUATION OF NEW HERBICIDE MOLECULES IN DIRECT SEEDED RICE

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Abstract— An experiment was conducted at Field Experimental Block, Regional Research and Technology Transfer Station, Keonjhar, during Kharif season of two consecutive years of 2015 and 2016 under RKVY project to evaluate new herbicide molecules in direct seeded rice. The experiment was laid out in a Randomized Complete Block Design with eight treatments combinations and three replications. The eight treatment combinations studied were as follows: T1: Oxadiargyl (Topstar 80% WP) @ 87.5 g/ha as PE (2 DAS) fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS, T2: Pyrazosulphuron Ethyl (Saathi-10%WP)-@ 200g/h as PE-2DAS fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS, T3: Pendimethalin (Pendiherb 30% EC) @ 3000ml/ha as PE fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS, T4:Pretilachlor(Rifit-50% EC) @ 1000ml/ha -2DAS as PE fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS, T5: Pretilachlor(Rifit-50% EC) @ 1000ml/ha as PE 2DAS fb Metsulphuron Ethyl+Chlorimuron Methyl (Almix-20%) @ 40g/ha POE 45 DAS , T6: Penoxulam (Granite-12.7% EC)@ 92.3 ml/ha as POE 15 DAS, T7: Hand weeding twice at 25 and 50 DAS, T8 : Un-weeded Control. . Results revealed that application of Penoxsulam @ 20 ml/ha at 15 DAS as PoE (T6) produced grain yield of 38.1 q/ha and weed control efficiency (WCE) of 89.1% at par with hand weeding at 25 & 50 DAS (T7) with grain yield of 41.8 q/ha and WCE of 92.3%, but found superior in respect of net return (Rs.23430/ha) and B:C ratio (2.0)

Key words: herbicide , direct seeded rice, weed control efficiency , net return

INTRODUCTION

Transplanting is the main method of crop establishment in India.Puddling and transplanting consumes 30 per cent of the total water requirement of rice. In addition to water scarcity, the farmers are facing the problem of acute labour shortage and hike in wage rate. This causes increased cost of production and reduced profits to farmers.

Because of these reasons there has been shift in crop establishment from transplanting to DSR in India. The upland rice area is around 5.5 million hectares which accounts or 12.33% of the total rice area of the country. Out of the losses due to various biotic stresses, weeds are known to account for nearly one third. Weeds are responsible for heavy rice yield losses, to the extent of complete crop loss under extreme conditions (Singh et al., 2014)

In direct seeded rice, the concurrent emergence of competitive weeds, absence of water to suppress the weeds at the time of seedling emergence and prevalence and difficulty in controlling weeds are the major reasons for the severe infestation of weeds . These weeds adversely affects the yield, quality and cost of production due to competition for various growth factors (Singh, 2008), mainly due to the wide adaptability and faster growth, these weeds dominate the crops habitat and reduce the yield potential (Rao, 2011). The several factors associated weed flora like degree of infestation, rice ecosystem, growing season, cultivar raised, cultural and management practices followed are the main causes of the yield loss. On an average, yield loss, due to weed competition ranges from 15 to 20 per cent, but in severe cases it may exceed 50 per cent (Hasanuzzaman *et al*., 2009) or even complete crop failure (Jayadeva *et al*., 2011). Raj *et al*. (2013) conducted studies at Rice Research Station, Moncompu and reported that, season long weed competition in wet seeded rice caused 69.71 and 67.40 per cent reduction in grain yield during *kharif* and *rabi* season, respectively. Similarly according to Singh et al., 2005 in an experiment revealed that uncontrolled weeds reduced the grain yield by 75.8, 70.6 and 62.6% under dry-seeded rice (DSR), wet seeded rice and transplanted rice (TPR), respectively. Thus, weed control is major prerequisite for improved rice productivity and production using different methods of rice establishment.

Proper weed management technologies if adapted can result in an additional rice production. Thus weed management would continue to play a key role to meet the growing food demands of increasing population in India. As the weed problems are multi-pronged, a holistic multi-disciplinary integrated approach would be imperative. In this context, integrated weed management with new generation herbicides was tested to provide a more sustainable approach to rice production.

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MATERIAL AND METHOD

The experiment was conducted at Field Experimental Block, Regional Research and Technology Transfer Station, Keonjhar, during *Kharif* season of two consecutive years of 2015 and 2016 under RKVY project. The soil of the experimental field was loamy having pH 6.5 with low status of N(274 kg/ha) whereas P (22 kg/ha) and K (224 kg/ ha) status was medium. The experiment was laid out in a Randomized Complete Block Design with eight treatments combinations and three replications. The eight treatment combinations studied were as follows: T_1: Oxadiargyl (Topstar 80% WP) @ 87.5 g/ha as PE (2 DAS) fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS, T_2: Pyrazosulphuron Ethyl (Saathi-10%WP)-@ 200g/h as PE-2DAS fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS, T_3: Pendimethalin (Pendiherb 30% EC) @ 3000ml/ha as PE fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS, T_4:Pretilachlor(Rifit-50% EC) @ 1000ml/ha -2DAS as PE fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS, T_5: Pretilachlor(Rifit-50% EC) @ 1000ml/ha as PE 2DAS fb Metsulphuron Ethyl+Chlorimuron Methyl (Almix-20%) @ 40g/ha POE 45 DAS , T_6: Penoxulam (Granite-12.7% EC)@ 92.3 ml/ha as POE 15 DAS, T_7: Hand weeding twice at 25 and 50 DAS, T_8 : Un-weeded Control. The crop was sown on 31 July 27 July in 2015 and 2016 respectively at a rate of 50 kg ha−1 and with row spacing of 20 cm, using a power tiller operated seed drill fitted with a fluted-type seed-metering device. Herbicides were applied using a knapsack-sprayer fitted with three flat fan nozzles on a boom, delivering 350 L of solution ha−1. In T7 plots weeds were removed manually. In T8 plots weeds allowed to grow throughout the season. It may result in an almost 100% yield loss in DSR systems(Sing *et al*., 2005). Fertilizers were applied at the rate of 80-40-40kg ha−1 of N, P, K. 20:40:40 kg N:P_2O_5:K_2O/ha as basal and top dressing of N @ 40kg/ha at 21 DAS & 20 kg/ha at panicle initiation i.e. 42 DAS. Light irrigation was supplied just after sowing .

RESULTS AND DISCUSSION

The experimental field was predominantly infested with *Echinochloa colonum, Cynodon dactylon, Digitaria sanguinalis, Dactyloctenium aegyptium, Paspalum conjugatum, Leptochloa chinensis* and *Chloris barbata* among grasses; *Cyperus rotundus, Cyperus iria* and *Scirpus articulate* among sedges; *Eclipta alba, Euphorbia hirta* and *Bergia capensis* among broad leaved weeds. All the

weed control treatments significantly reduced the weed dry weight over unweeded check at all the stages of observations (Table 1).

The lower weed dry matter production(13.3g/m^2), weed population / m^2 (29.5) and higher weed control efficiency (89.1%) was recorded with application of Penoxulam (Granite-12.7% EC)@ 92.3 ml/ha as POE 15 DAS(T_6) which was on par (9.3 g/m^2 , 22.1, 92.3% respectively) with hand weeding twice at 25 and 50 DAS(T_7) .

Weedy check recorded the lowest yield (25.3 q ha-1) with 65.2% reduction in yield due to severe weed competition. Application of Penoxsulam @ 20 ml/ha at 15 DAS as PoE (T_6) produced grain yield of 38.1 q/ha at par with Hand weeding at 25 & 50 DAS (T_7) with grain yield of 41.8 q/ha but found superior in respect of net return (Rs.23430/ha) and B:C ratio (2.0) (Table 2,3). The increased grain yield could be attributed to cumulative effect of lower weed dry weight and higher weed control efficiency

CONCLUSION

Farmers of NCPZ are advised to apply penoxsulam @ 20 ml/ha at 15 DAS (2 to 3 leaf stage of weed) in DSR under upland and medium land conditions for maximization of net income.

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Table1: Effects of weed management treatments on weed population, weed dry weight and WCE of DSR (cv. Lalat) (2 years mean data)

Treatments	**Weed population/ m^2**			**Weed dry weight/m^2 (g)**			**WCE (%)**		
	2015	**2016**	**Mean**	**2015**	**2016**	**Mean**	**2015**	**2016**	**Mean**
T_1 (Oxadiargyl (Topstar 80% WP) @ 87.5 g/ha as PE (2 DAS) fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS)	42.7	45.8	44.2	17.1	17.8	17.4	85.8	85.4	85.6
T_2 (Pyrazosulphuron Ethyl (Saathi-10%WP)-@ 200g/h as PE-2DAS fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS)	36.0	38.6	37.3	15.4	15.6	15.5	87.2	87.2	87.2
T_3 (Pendimethalin (Pendiherb 30% EC) @ 3000ml/ha as PE fb Bispyribac sodium (Fujisuper	35.3	30.5	32.9	15.9	14.8	15.3	86.8	87.9	87.3

10% SC) @200 ml/ha as POE at 25 DAS)									
T_4 (Pretilachlor(Rifit-50% EC) @ 1000ml/ha -2DAS as PE fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS)	37.7	44.8	41.2	16.7	17.9	17.3	86.2	85.3	85.7
T_5 (Pretilachlor(Rifit-50% EC) @ 1000ml/ha as PE 2DAS fb Metsulphuron Ethyl+Chlorimuron Methyl (Almix-20%) @ 40g/ha POE 45 DAS)	34.7	40.7	37.7	15.3	16.1	15.7	87.5	86.8	87.1
T_6 (Penoxulam (Granite-12.7% EC)@ 92.3 ml/ha as POE 15 DAS)	30.7	28.3	29.5	13.5	13.1	13.3	89.0	89.2	89.1
T_7 (Hand weeding twice at 25 and 50 DAS)	20.0	24.2	22.1	9.0	9.6	9.3	92.6	92.1	92.3
T_8(Un-weeded Control)	259.3	272.6	265.9	120.8	122.4	121.6	0.0	0.0	0.0
CD (0.05)	16.7	17.3	17.0	8.2	7.6	7.9	4.0	5.4	4.7

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Table 2: Effects of weed management treatments on plant height and Grain yield of DSR (cv. Lalat) (2 years mean data)

Treatments	**Plant height (cm)**			**Grain yield (q/ha)**		
T_1 (Oxadiargyl (Topstar 80% WP) @ 87.5 g/ha as PE (2 DAS) fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS)	107.1	105.3	106.2	32.6	31.9	32.2
T_2 (Pyrazosulphuron Ethyl (Saathi-10%WP)-@ 200g/h as PE-2DAS fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS)	101.5	102.5	102.0	33.8	34.2	34.0
T_3 (Pendimethalin (Pendiherb 30% EC) @ 3000ml/ha as PE fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS)	105.5	104.6	105.1	34.6	35.6	35.1
T_4 (Pretilachlor(Rifit-50% EC) @ 1000ml/ha -2DAS as PE fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS)	105.8	106.4	106.1	34.6	33.1	33.8
T_5 (Pretilachlor(Rifit-50% EC) @ 1000ml/ha as PE 2DAS fb Metsulphuron Ethyl+Chlorimuron Methyl (Almix-20%) @ 40g/ha POE 45 DAS)	105.3	106.2	105.8	36.1	34.8	35.4
T_6 (Penoxulam (Granite-12.7% EC)@ 92.3 ml/ha as POE 15 DAS)	106.2	104.3	105.3	38.7	37.6	38.1
T_7 (Hand weeding twice at 25 and 50 DAS)	110.6	112.1	111.4	41.3	42.3	41.8

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T_8(Un-weeded Control)	100.7	102.4	101.6	26.1	24.6	25.3
CD (0.05)	3.4	3.9	3.65	3.8	4.6	4.2

Table 3:Economics of weed management practices in DSR (cv. Lalat) (2 years mean data)

Treatments	**Cost of Treatment (Rs/ha)**	**Cost of cultivation (Rs/ha)**	**Gross Return (Rs/ha)**	**Net Return (Rs/ha)**	**B:C ratio**
T_1 (Oxadiargyl (Topstar 80% WP) @ 87.5 g/ha as PE (2 DAS) fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS)	3225	23225	38700	15475	1.7
T_2 (Pyrazosulphuron Ethyl (Saathi-10%WP)-@ 200g/h as PE-2DAS fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS)	3100	23100	40800	17700	1.8
T_3 (Pendimethalin (Pendiherb 30% EC) @ 3000ml/ha as PE fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS)	4105	24105	42120	18015	1.7
T_4 (Pretilachlor(Rifit-50% EC) @ 1000ml/ha -2DAS as PE fb Bispyribac sodium (Fujisuper 10% SC) @200 ml/ha as POE at 25 DAS)	3725	23725	40620	16895	1.7
T_5 (Pretilachlor(Rifit-50% EC) @ 1000ml/ha as PE 2DAS fb Metsulphuron Ethyl+Chlorimuron Methyl (Almix-20%) @	2675	22675	42540	19865	1.9

40g/ha POE 45 DAS)					
T_6 (Penoxulam (Granite-12.7% EC)@ 92.3 ml/ha as POE 15 DAS)	2350	22350	45780	23430	2.0
T_7 (Hand weeding twice at 25 and 50 DAS)	10000	30000	50160	20160	1.7
T_8(Un-weeded Control)	0	20000	30420	10420	1.5