

Effect of Herbicides Soil Microbial Population and Productivity of Rice in North Eastern Coastal Plain Zone of Odisha

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Abstract-A field experiment was conducted at RRTTS, Ranital, Bhadrak during kharif 2009 to study the bio-efficacy and phytotoxicity of chemical weed control in transplanted rice. *Echinochloa colona*, *Leersia hexendra* among grasses, *Marselia quadrifolia*, *Scirpus mucronatus*, *Monocharia vaginalis* among broadleaf weeds and *Cyperus iria* among sedge were found dominant weeds in the experimental plot. Hand weeding twice recorded lowest weed biomass and maximum grain yield. However, Metsulfuron methyl + Chlorimuron ethyl @6g a.i. ha⁻¹ as pre emergence herbicide executed at par grain yield with hand weeding and Pyrazosulfuron ethyl and was found to be economic and effective in controlling weeds over farmers practice (hand weeding). All the herbicides significantly reduced the microbial population upto 15 days after application but recovered later on. Oxadiargyl @ 100g a.i./ ha showed temporary phytotoxic effects on plants which was not reflected in the yield.

I. INTRODUCTION

Rice is the staple food crop in India as well as in our state, Odisha. Odisha expects to produce around 7 million tonne of rice, which is about 6.7 percent of country's total rice-output.

Weeds are one of the most important agricultural pests. It affects the plant height, leaf architecture, tillering habit, shading ability, growth pattern and life duration of rice cultivars. Poor weed control is one of the major factors for yield reduction of rice depending on the type of weed flora and their intensity. Weed reduced the grain yield in transplanted rice by 16-48 percent and yield loss up to 90 percent is not unheard of. This loss is therefore, a serious threat for the food deficit. So one of the easier and simpler means to increase the productivity is the timely management of weeds. Chemicals appear to be a good substitute for mechanical cum manual method of weed control as they are time-saving, cheaper, available in time and thus are gaining popularity among the farmers. The low dose, less risky and high efficacy herbicide is always preferable to hand weeding because

of its better weed controlling ability. Different herbicides have been tested in this present investigation to find out its effect on soil microflora, weed flora, growth and productivity of rice during kharif season.

II. MATERIALS AND METHOD

A field experiment was carried out at the RRTTS farm, Ranital, Bhadrak, Odisha during kharif season of 2009. The rice variety was swarna. The experiment was laid out at Randomized Block Design having seven treatments with three replications. Soil type was clay loam in texture with having pH 6.8. The treatment comprised unweeded control, hand weeding at 21 and 42 days after transplanting (DAT), Butachlor @1.25 kg ha⁻¹ and Pretilachlor @0.5 kg ha⁻¹ were applied at 3 DAT where Oxadiargyl @0.1 kg ha⁻¹ and Metsulfuron methyl + Chlorimuron ethyl @ 6 g ha⁻¹ applied at 5 DAT and Pyrazosulfuron ethyl (PSE) @30 g ha⁻¹ at 10 DAT by a Knapsack sprayer fitted with a nozzle- WFN 0.40 with 500 L water hectare. The rice crop Swarna was raised during kharif season with recommended package of practices followed uniformly. Quadrate of 0.5 X 0.5 m² was used twice in each plot randomly to record the weeds for their dry weight at 30 and 50 DAT and the weed control efficiency (WCE) was calculated on the basis of dry weight of weeds accordingly as follows –

$$WCE (\%) = (X - Y) / X * 100$$

Where, X = Weed dry weight in weedy check or unweeded control plots, Y = Weed weight in treated plots.

III. RESULTS AND DISCUSSION

Impact of different treatments on weed biomass

The herbicidal treatments significantly reduced the total weed biomass at harvest over weedy check. MSM+CME recorded the lowest weed biomass of 0.76 g m⁻² (Table 2). This was followed by Oxadiargyl, PSE and Pretilachlor. All these chemicals and hand weeding exhibited significantly lower weed biomass than Butachlor.

MSM+CME recorded the highest weed control efficiency closely followed by Oxadiargyl.

Phytotoxic effects of different herbicidal treatments

Except Oxadiargyl, all other chemical treatments did not exhibit any phytotoxic effects on rice plants (Table-1). Oxadiargyl @100g ha⁻¹ showed more severe but not lasting phytotoxicity on rice plants upto 15 days after application. However, at later stages the plant growth picked up well. Caseley et al., 1997 working on Propanil and Fenoxaprop-p-ethyl reported similar observation.

Table 1: Effect of different weed management on Crop Toxicity Rating in rice

Treatments	Crop Toxicity Rating
T ₁ (Check)	1
T ₂ (Butachlor)	1

T ₃ (Pretilachlor)	1
T ₄ (Oxadiargyl)	3*
T ₅ (PSE)	1
T ₆ (MSM+CME)	1
T ₇ (HW twice)	1

1: No reduction or injury; 3*: more severe and not lasting

Effect on crop

All the treatments except Butachlor recorded significantly higher plant height over weedy check (Table 2). MSM+CME exhibited highest plant height which was followed by hand weeding, Oxadiargyl treatments. Among all treatments, MSM+CME produced highest number of effective tillers per plant, grains per panicle which was at par with hand weeding and PSE. Again, MSM+CME recorded the highest yield (54.6 q ha⁻¹), which was at par with hand weeding treatment, and weedy check had the lowest value (42.1 q ha⁻¹). The herbicidal treatments Oxadiargyl, PSE and Pretilachlor were at par and exhibited higher yield over Butachlor and Weed check.

Table 2: Treatment effects on weed biomass at harvest, growth, yield attributing characters, yield of rice and economics

Treatments	Weed biomass (g m ⁻²)	WCE (%)	Plant Ht. (cm)	Effective Tillers/plant	Grains/panicle	Test wt. (g)	Grain yield (q ha ⁻¹)	Additional Return per rupee invested
T ₁ (Check)	15.60	-	98.1	5.70	120.3	19.81	42.1	-
T ₂ (Butachlor)	9.12	41.5	99.6	6.60	134.7	20.16	46.6	6.29
T ₃ (Pretilachlor)	3.14	79.8	101.6	6.77	137.3	20.37	48.1	9.84
T ₄ Oxadiargyl)	1.11	92.8	102.5	6.80	138.6	20.35	48.7	7.62
T ₅ (PSE)	1.26	91.9	101.7	6.70	139.7	20.36	48.6	7.86
T ₆ (MSM+CME)	0.76	95.1	104.4	6.90	144.4	20.51	54.6	17.72
T ₇ (HW twice)	8.16	47.7	102.6	6.83	140.2	20.50	51.2	3.21
SE(m)+	0.252		1.074	0.153	1.837	0.756	1.334	
CD(P=0.05)	0.776		3.310	0.472	5.662	NS	4.111	

IV. ECONOMICS OF DIFFERENT TREATMENTS

Among all treatments, MSM+CME recorded highest return per rupee investment (17.72) followed by Pretilachlor (9.84) and PSE (7.86). Hand weeding twice recorded the lowest value among all because of higher additional cost involvement.

Effect on total bacteria

Among all treatments hand weeding rendered a significant increase in the population of total bacteria in soil. This might be due to the influence of available nutrients stimulatory to the bacterial flora (Ghosh et al., 2007). All the herbicides exhibited detrimental influence on soil microflora upto 15 days after application which was recovered later on. Oxadiargyl @0.1 kg ha⁻¹ showed minimum bacterial population at 15 DAP which may be attributed to phytotoxic effect of this chemical on rice plant and soil.

Table 3: Treatment effects on population of total bacteria of rice soil (CFU* X 10⁶g⁻¹ soil) during kharif'2009

Treatments	Stage I (3 DAP)	Stage II (15 DAP)	Stage III (45 DAP)
T ₁ (Check)	130	115	120
T ₂ (Butachlor)	100	65	102
T ₃ (Pretilachlor)	95	62	98

T ₄ (Oxadiargyl)	80	44	90
T ₅ (PSE)	110	70	105
T ₆ (MSM+CME)	90	55	94
T ₇ (HW twice)	132	120	125

*CFU- Colony Forming Unit

V. CONCLUSION

Application of Metsulfuron Methyl 10% + Chlorimuron ethyl 10% @6g a.i. ha⁻¹ (MSM+CME) at 5 DAT as pre emergence herbicide was found to be economic and effective in controlling weeds over farmers practice (hand weeding), hence recommended for North Eastern Coastal Plain Zone of Odisha.

REFEENCES

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