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Effect of clomazone+ 2, 4-DEE on growth and productivity of rice and on total bacteria in soil

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ABSTRACT

A field experiment was conducted during *kharif* '2000 and *boro*' 2000 – 2001 at the Viswavidyalaya Farm, Kalyani, Nadia to find out the effect of clomazone + 2, 4-DEE on growth and productivity of rice and on total bacteria in soil. The results of the experiment revealed that hand weeding at 20 and 40 days after transplanting recorded the highest grain yield of rice due to higher weed control efficiency and better crop growth which was closely followed by clomazone 175 + 2, 4-DEE 270 g ha^{-1} in *kharif* and clomazone 200 + 2, 4-DEE 180 g ha^{-1} in *boro*. The herbicide mixture was phytotoxic to the crop but it disappeared within two or three weeks after application depending on the season of cultivation. Higher dose of clomazone showed a significant detrimental effect on total bacteria over that of its lower dose whereas the influence of 2, 4-DEE was the reverse of clomazone on total bacteria. However, the population of total bacteria decreased on the 60^{th} day as compared to the 3^{rd} day and then increased on the 85^{th} day.

Key words : Rice, weed, herbicide, bacteria

Rice is the staple food crop in India as well as in our state, West Bengal. One of the easier and simpler means to increase the productivity is the timely management of weeds. Weeds cause 18 – 20% yield losses under transplanted situation though the average loss due to weeds in rice is around 42% (Bhan, 1997). Increase of literacy percentage, changing of rural social life and gradual migration of people from rural to urban areas cause unavailability of labours in most of the rice growing areas. 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 and less risky herbicide mixture is always preferable to the sole application because of its broad – spectrum weed controlling ability. A herbicide mixture of clomazone with 2, 4-DEE, has been tested in this present investigation to find out its effect on weed flora, growth and productivity of rice as well as on the population of total bacteria in soil in this Inceptisol of West Bengal during both kharif and boro season as seasonal influence on weed flora exists in this region.

MATERIALS AND METHODS

The field experiment was carried out during kharif '2000 and boro' 2000–2001 at the Viswavidyalaya Farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal on a typical Gangetic Alluvium (Entisol) sandy loam soil having pH 6.9 and 6.9, organic carbon 0.65 and 0.65%, total nitrogen 0.056 and 0.06%, available P_2O_5 15.95 and 20.00 kg ha^{-1}, available K_2O 126.60 and 120.00 kg ha^{-1} during kharif and boro, respectively. The experiment was laid out in a RBD with 9 treatments replicated thrice. The treatments comprised unweeded control, hand weeding twice at 20 and 40 days after transplanting (DAT), butachlor 1.25 kg ha^{-1}, mixture of three different doses of clomazone (150, 175 and 200 g ha^{-1}) with two different doses of 2, 4-DEE (180 and 270 g ha^{-1}) of which all chemicals were applied pre-emergence at 3 DAT by a Knapsack sprayer fitted with a nozzle – WFN 0.40 with 500 l water hectare. The rice crop cv. IET 4786 was raised during both the seasons with recommended package of practices followed uniformly. Quadrate of 0.5 × 0.5 m^2 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 –

$$\text{WCE (\%)} = \frac{X - Y}{X} \times 100$$

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

The phytotoxicity caused by the herbicide mixture to the twice crop was recorded through visual scoring method. The enumeration of the population of total bacteria was done on agar plate containing appropriate media following serial dilution technique and pour plate method (Parmer and Schmidt, 1965). Thornton's agar medium (Thornton, 1922) was used for counting total number of viable bacteria.

RESULTS AND DISCUSSION

Phytotoxic effect on crop

The treatments where clomazone was used showed phytotoxicity to rice leaves. During boro season, the phytotoxicity to rice leaves was higher than that during kharif (Table 1). During both the seasons toxicity was more where dose of clomazone was higher. All the injured plants recovered within 15 days after spraying in kharif whereas in boro season, it took 6 days more for complete recovery. The toxic vapour released by clomazone after its application might be the cause of this phytotoxicity. Caseley et al., 1997 reported similar observation.

Effect on Weeds

The most important weed flora present in the experimental field were Echinochloa crus-galli, Leersia hexandra, Cyperus iria, Fimbristylis littoralis, Ludwigia parviflora and Marsilea quadrifolia. Hand weeding twice at 20 and 40 DAT recorded maximum weed control efficiency which was closely followed by clomazone 200 + 2, 4-DEE 180 g ha^{-1} in kharif and clomazone 175 + 2, 4 - DEE 270 g ha^{-1} in boro. The higher efficacy of clomazone + 2, 4-DEE might be due to its broad – spectrum weed controlling ability throughout the critical period of crop-weed competition in rice. Spiridinov et al., 1995 obtained good control of rice weeds by clomazone 240 g ha^{-1}.

Effect on Crop

All the doses of the herbicide mixture applied, recorded significantly higher value of LAI over unweeded control which recorded the lowest one. During both the season, hand weeding twice registered the maximum LAI in rice followed by clomazone 200 + 2, 4-DEE 180 g ha^{-1} which might be due to supplying the crop with more nutrients by controlling the competitive weeds most effectively and thereby resulting the crop more vigorous. The herbicide mixture significantly affected the grain yield of rice. Unweeded control recorded the lowest yield whereas the maximum was provided by hand weeding followed by clomazone 175 + 2, 4-DEE 270 g ha^{-1} in kharif and clomazone 200 + 2, 4-DEE 180 g ha^{-1} in boro due to their higher weed control efficiency. The higher grain yield obtained from these two combinations might be due to better control of more predominant broadleaved weeds in kharif by higher dose of 2, 4-DEE and of more prevalent grassy weeds in boro season by higher doses of clomazone. Similar observation was found by Ghosh *et al.*, 2002 working on clomazone + propanil.

Effect on total bacteria

Butachlor, herbicide mixtures and hand weeding rendered a significant increase in the population of total bacteria in soil. The increase in bacterial population by hand weeding might be due to the influence of available nutrients stimulatory to the bacterial flora. On the other hand, butachlor or herbicide. mixtures might furnish bacteria with nutrient and energy sources for higher proliferation. However, the influence of butachlor or herbicide combinations was significantly higher than that of hand weeding. Higher concentration of clomazone in mixture resulted in a significant detrimental influence on total bacteria over that of its lower concentration. On the other hand, higher level of 2, 4-DEE caused a significant enhancing influence on the population of total bacteria than that of the lower one in the rhizosphere soil of boro rice.The population of total bacteria decreased on the 60th day as compared to the 3rd day and then increased on the 85th day.

REFERENCES

Bhan, V. M. (1997). Vision – 2020. National Research Centre for Weed Science. Perspective Plan, pp. 53.

Caseley, J. C., Palgrave, C., Haas, E. and Valverde, B. (1997). Herbicides with alternative modes of action for the control of propanil and fenoxaprop-p- resistant Echinochloa colona. Brighton Crop Protection Conference, Weeds Proceedings of an International Conference, Brighton, UK, 17 – 20 November, 1997, Volume 1, pp. 215 – 220.

Ghosh, Pritam, Ghosh, R. K. and Bhowmik, Molay K. (2002). Bio-efficacy of mix formulation of Clomazone and Propanil for weed management in transplanted kharif paddy. *Environment & Ecology*. **20**(1) : 147 – 151.

Parmer, D. and Schmidt, E.D. (1965). Experimental soil microbiology. Burges Publishing Co. Minneapolis. 5 Minn.

Spiridinov, Yu. Ya., Shestakov, V. G., Yakovets, V. P., Ginevskii, N. K., Kolomiitsev, F. B. and Spiridinova, G. S. (1995). Herbicidal preparations of the new generation in weed control. Report 2. Effectiveness of Command in weed control in Soybean and Rice plantations in Far East Region of Russia. Agrokhimiya. No. 2 : 86 – 94.

Thornton, H. G. (1992). On the development of standardised agar medium for counting soil bacteria with special regard to the repression of spreading colonies. *Ann. Appl. Biol.* **9** *:* 241.

Table 1 : Phytotoxic effect of treatments (Rice leaf injury)

Treatment	Dose (g ha^{-1})	Time of application (DAT)	Time for recovery (days after spraying)							
			Kharif *'2000*			Boro' *2000 - 2001*				
			3	9	15	3	9	15	18	21
Unwedded control	–	–	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hand weeding	–	20 and 40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Butachlor	1250	3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Clomazone + 2, 4-DEE	150 + 180	3	0.00	0.00	0.00	0.67	0.33	0.00	0.00	0.00
Clomazone + 2, 4-DEE	150 + 270	3	0.00	0.00	0.00	1.33	1.00	0.33	0.00	0.00
Clomazone + 2, 4-DEE	175 + 180	3	1.00	0.00	0.00	3.00	1.33	0.33	0.00	0.00
Clomazone + 2, 4-DEE	175 + 270	3	1.00	1.00	0.00	3.00	1.67	1.33	0.33	0.00
Clomazone + 2, 4-DEE	200 + 180	3	2.00	1.00	0.00	3.33	2.67	2.00	1.00	0.00
Clomazone + 2, 4-DEE	200 + 270	3	2.00	1.00	0.00	3.67	2.67	2.00	1.33	0.00

Table 2 : Effect of treatments on WCE (%), LAI and yield of rice

Treatment	WCE at 50 DAT		LAI at 60 DAT		Grain yield (kg ha^{-1})	
	Kharif '2000	Boro' 2000 - 2001	Kharif '2000	Boro' 2000 - 2001	Kharif '2000	Boro' 2000 - 2001
Unweeded control	-	-	4.0	4.8	1376	3985
Hand weeding at 20 and 40 DAT	90.23	97.92	4.9	6.1	2215	6241
Butachlor 1.25 kg ha^{-1}	65.28	87.33	4.3	5.0	1948	5240
Clomazone 150+2, 4-DEE 180 g ha^{-1}	65.76	82.64	4.3	5.3	2000	5278
Clomazone 150+2, 4-DEE 270 g ha^{-1}	79.39	85.87	4.3	5.5	2107	5407
Clomazone 175+2, 4-DEE 180 g ha^{-1}	78.46	89.44	4.4	5.6	2039	5463
Clomazone 175+2, 4-DEE 270 g ha^{-1}	81.76	94.38	4.6	5.7	2128	5574
Clomazone 200+2, 4-DEE 180 g ha^{-1}	87.41	90.33	4.9	6.0	1820	5722
Clomazone 200+2, 4-DEE 270 g ha^{-1}	87.11	79.48	4.7	5.9	1974	5648
CD at 5%			0.15	0.17	223	750

Table 3 : Effect of treatments on the population of total bacteria in soil during *boro*'2000 - 2001(CFU × 10^6g^{-1}soil)

Treatment	Stage I (3 DAT)	Stage II (60 DAT)	Stage III (85 DAT)	Mean
Unweeded control	135.000 (1.633)	37.000 (1.633)	46.333 (2.867)	72.778
Hand weeding at 20 and 40 DAT	137.000 (1.633)	4.667 (0.471)	49.000 (3.266)	63.556
Butachlor 1.25 kg ha^{-1}	62.667 (17.969)	11.000 (0.816)	57.000 (2.449)	43.556
Clomazone 150 + 2, 4-DEE 180 g ha^{-1}	53.000 (0.816)	18.333 (1.247)	79.333 (0.471)	50.222
Clomazone 150 + 2, 4-DEE 270 g ha^{-1}	55.000 (5.715)	34.333 (2.867)	64.000 (1.633)	51.111
Clomazone 175 + 2, 4-DEE 180 g ha^{-1}	62.333 (6.128)	19.333 (6.128)	78.333 (2.055)	53.333
Clomazone 175 + 2, 4-DEE 270 g ha^{-1}	38.333 (2.055)	66.000 (0.816)	67.333 (2.867)	57.222
Clomazone 200 + 2, 4-DEE 180 g ha^{-1}	69.000 (6.532)	44.000 (1.633)	83.333 (2.055)	65.444
Clomazone 200 + 2, 4-DEE 270 g ha^{-1}	85.000 (1.633)	28.000 (0.816)	83.000 (3.266)	65.333
Mean	77.481	29.185	67.519	
Sources	**CD at 5% level**	**CD at 1% level**		**S.Em (±)**
Treatment (Tr)	5.22	6.97		1.8398
Stage (S)	3.02	4.02		1.0622
Treatment × State (Tr × S)	9.05	12.07		3.1866

Values in the parenthesis indicate standard deviation.