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Effect of chemical weed control on growth and yield of direct seeded puddled rice (*Oryza sativa* L.)

K.S. MOHAN[1], T.V. MUNIYAPPA[1], K.N. KALYANA MURTHY[1], Y.M. RAMESHA[1] AND H.R. SAVITHA*
Department of Soil Science and Agricultural Chemistry, University of Agricultural Sciences, G.K.V.K., BANGALORE (KARNATAKA) INDIA

ABSTRACT

Field experiment was carried out on effect of chemical weed control on growth and yield of direct seeded puddle rice Zonal Agricultural Research Station, Mandya. Results revealed that better weed control and higher grain yield of rice was achieved with pre-emergent application of Butachlor @ 1.0 kg ai ha^{-1} + Safener (5334 kg ha^{-1}) followed by Pretilachlor @ 0.4 kg ai ha^{-1} + Safener (5100 kg ha^{-1}). However, the minimum yield (5562 kg ha^{-1}) was recorded with hand weeding twice at 20+40 DAS. The toxicity of the herbicides on rice plant was very low and plant stand was better compared to other treatments. They also recorded higher plant height and low grain sterility.

Key words : Toxicity, Weed population, Plant density, Weedy check

INTRODUCTION

Rice is an important staple food crop of the world and India. It is grown under different ecosystems *viz.,* irrigated, rainfed lowland, rainfed upland and flooded conditions by small and poor farmers with labour intensive methods of production. In most of the Asian countries rice is established through transplantation, which is time consuming, laborious and costly. Whereas, the direct seeding methods are easy, time and labour saving and low cost methods with grain yield equivalent or even higher than transplantation method (IRRI, 1969 and De Datta, 1988). Broadcasting of pre-germinated seeds on the puddled soil is one of the methods of direct seeding. In direct seeded rice weed infestation and competition is very severe, because the crop and the weed seeds germinate simultaneously and compete for same pool of resources. In recent years several herbicides have been made available to manage the weeds in varied situations. Therefore, the present study was conducted to know the bio-efficacy of the pre-emergent herbicides to control the weeds and their effect on growth and yield of rice.

MATERIALS AND METHODS

Field experiment was conducted during *Kharif* 2005 at Zonal Agricultural Research Station, V.C. Farm, Mandya (Karnataka) to study the bio-efficacy of pre-emergent herbicides to control weeds and their effect on growth and yield of rice. The soil of the experimental site was sandy loam in texture, neutral in reaction and medium in soil fertility. The experiment consisted of 14 treatments, which include herbicides like Anilophos 30 EC, Pendimethalin 30 EC, Butachlor 50 EC and Pretilachlor 50 EC. All tried alone at different concentrations and in combination with 2,4-D 36 EC. The experiment was replicated thrice and laid out in RCBD. The pre-germinated seeds of Rasi (IET-1444) were broadcasted uniformly on the puddle soil. The herbicides were applied uniformly as per the treatments at 4 DAS. The spray solution was used at the rate of 700 litres per hectare. The experimental data was analyzed statistically at 5 per cent level of probability. The weed count and the weed dry weight data was subjected to square root transformation and analyzed statistically (Sundar Raj *et al.,* 1972)

RESULTS AND DISCUSSION

The results obtained from the present investigation are summarized below :

Effect on weeds:

The predominant weed flora noticed in the experimental plots were *Echinochloa crusgalli, Leptochloa chinenensis* and *Panicum repens* among the grasses and *Cyperus iria, Cyperus difformis* and *Fimbristillis miliace* among the sedges and *Eclipta alba, Marsilia quadrifolia*, *Centella asiatica* and *Monochoria veginalis* among the dicot weeds.

The visual observations on toxicity of herbicides revealed that all the herbicidal treatments caused phytotoxic effect on rice crop except Butachlor @ 1.0 kg ai ha^{-1} + Safener and Pretilachlor @ 0.4 kg ai ha^{-1} + Safener. Very low or no toxic effects were observed with these herbicidal treatments could be attributed to the

* **Author for correspondence &** Present Address : College of Agriculture, BIJAPUR (KARNATAKA) INDIA

Table 1 : Plant density and phyto toxicity ratings at different crop growth periods as influenced by weed control treatments in direct seeded rice under puddled condition

Treatments	Concentration Kg a.i ha^{-1}	Plant density (No m^{-2})	Phyto toxicity ratings at different days interval			
			10 DAS	15 DAS	20 DAS	25 DAS
T_1 Anilophos (30 EC)	0.4	29	6	6	5	5
T_2 Anilophos (30 EC)	0.3	41	6	6	5	5
T_3 Anilophos + 2,4-D (30 +36 EC)	0.3+0.4	32	7	7	6	6
T_4 Pendimethalin (30 EC)	1.0	74	2	2	2	2
T_5 Pendimethalin (30 EC)	0.5	81	3	3	3	3
T_6 Pendimethalin+2,4-D(30 + 36EC)	0.5+0.5	76	5	4	4	4
T_7 Butachlor (50 EC)	1.5	92	3	3	2	2
T_8Butachlor+Safener(50 EC)	1.0	114	1	1	1	1
T_9 Butachlor+Safener+2,4-D(50+ 36EC)	0.5+0.5	95	3	3	2	2
T_{10} Pretilachlor (50 EC)	0.5	90	4	4	3	3
T_{11}Pretilachlor+Safener (30EC)	0.4	106	1	1	1	1
T_{12}Pretilachlor+Safener+2,4-D(30+36EC)	0.3+0.4	88	2	2	2	2
T_{13}Hand weeding at 20 and 40 DAS		118	1	1	1	1
T_{14} Weedy check		129	1	1	1	1
S.E.±		0.94	-	-	-	-
C.D. (P=0.05)		2.82	-	-	-	-

Toxicity symptoms ratings	Phytotoxicity
1	Healthy plants –No toxic symptoms
2	Very mild toxic symptoms.
3	Mild with significant symptoms.
4	Severe toxic symptoms
5	Stunted, very thin and chloratic plants.
6 to 9	Severe damage to total kill.

DAS : Days after sowing

Safener present in these herbicides minimized the toxic effect of the herbicides on rice crop (Table 1). Similar findings were also observed by Mabbayad and Moody (1991) and Prakash *et al.* (1995).

All the weed control treatments recorded lesser weed dry weight at 30 DAS (0.2 to 1.7 g per 0.25 m^2) compared to weedy check (6.0 g per 0.25 m^2). Whereas, at 60 DAS hand weeding at 20 + 40 DAS recorded significantly lower weed dry weight (1.2 g per 0.25 m^2) followed by Butachlor @ 1.0 kg ai ha^{-1} + Safener, Butachlor + Safener + 2,4-D @ 0.5 +0.5 kg ai ha^{-1}, Pretilachlor + Safener + 2,4-D @ 0.3+0.4 kg ai ha^{-1}, Pretilachlor @ 0.5 kg ai ha^{-1} and Pretilachlor + Safener at 0.4 kg ai ha^{-1} (Table 2).

Effect on growth and yield:

Significant differences in grain yield were observed due to weed control treatments. Hand weeding twice at 20 + 40 DAS recorded significantly higher grain yield (5562 kg ha^{-1}) followed by pre-emergent application of Butachlor + Safener @ 1.0 kg ai ha^{-1} (5334 kg ha^{-1}) and Pretilachlor + Safener @ 0.4 kg ai ha^{-1} (5100 kg ha^{-1}) which were at par with each other (Table 3). The higher grain yield is attributed to better plant stand (106 to 118 plants per m^2) due to less toxicity of these herbicides and lower grain sterility (6.9 to 7.5 %) and higher plant height (97.2 to 98.1 cm) achieved as a result of better weed control during the early crop growth stages. The numbers of productive tillers were high with hand weeding twice at 20 + 40 DAS (22.1 hill^{-1}) due to better weed control and no toxicity, as it is a non- chemical treatment (Table 2). Higher number of productive tillers recorded with pre-emergent application of Anilophos at different concentrations was due to minimum plat population per unit area and less number of weeds, which helped the crop plants to utilize maximum resources without competition. Weedy check recorded lowest number of productive tillers (12.2 hill^{-1}) due to maximum crop weed competition. The results are similar to the findings of Balasubramanian and Veerabadran (1998), Mathew and Jagadesh Kumar (1999) and Moorthy and Saha (1999).

In conclusion, pre-emergence application of

Table 2 :Growth parameters as influenced by weed control treatments in direct seeded rice under puddled condition

Treatments	Concentration Kg a.i ha^{-1}	Total dry matter production of weeds (g 0.25 m^{-2})				Growth parameters of rice		
		30 DAS	60 DAS	90 DAS	Harvest	Plant height (cm)	No. of productive tillers $hill^{-1}$	Total dry matter production (g $hill^{-1}$)
T_1 Anilophos (30 EC)	0.4	1.5 (1.7)	4.0 (15.7)	8.1 (64.8)	8.6 (74.0)	95.7	19.2	57.8
T_2 Anilophos (30 EC)	0.3	1.6 (1.9)	4.1 (16.0)	7.9 (63.3)	8.9 (78.7)	94.3	19.0	50.8
T_3 Anilophos + 2,4-D (30+36 EC)	0.3+0.4	1.4 (1.6)	3.5 (11.5)	7.5 (55.3)	8.3 (68.6)	91.6	18.4	48.0
T_4 Pendimethalin (30 EC)	1.0	1.4 (1.5)	3.7 (13.6)	6.9 (47.4)	7.1 (51.0)	93.9	14.5	39.5
T_5 Pendimethalin (30 EC)	0.5	1.5 (1.7)	4.1 (16.0)	7.0 (49.7)	7.0 (48.8)	93.3	14.7	37.6
T_6 Pendimethalin+2,4-D (30 + 36EC)	0.5+0.5	1.4 (1.5)	3.6 (12.4)	6.4 (41.6)	6.7 (44.8)	93.5	14.2	38.1
T_7 Butachlor (50 EC)	1.5	1.3 (1.2)	2.8 (7.4)	6.4 (39.8)	6.2 (38.1)	97.1	14.9	38.6
T_8Butachlor+Safener (50 EC)	1.0	1.2 (1.1)	2.5 (5.8)	6.4 (40.3)	5.9 (34.5)	97.4	16.5	49.7
T_9 Butachlor+Safener+2,4-D (50+ 36EC)	0.5+0.5	1.4 (1.4)	2.6 (6.0)	6.0 (36.1)	5.7 (32.9)	96.2	14.2	38.6
T_{10} Pretilachlor (50 EC)	0.5	1.3 (1.4)	3.2 (9.8)	6.3 (40.0)	6.7 (45.3)	95.4	15.9	32.3
T_{11}Pretilachlor+Safener (30EC)	0.4	1.2 (1.1)	3.3 (10.1)	5.9 (33.8)	6.5 (42.5)	97.2	15.8	37.6
T_{12}Pretilachlor+Safener+2,4-D (30+36EC)	0.3+0.4	1.3 (1.2)	2.9 (8.3)	6.3 (40.0)	6.4 (40.1)	96.8	14.7	30.2
T_{13}Hand weeding at 20 and 40 DAS		0.8 (0.2)	1.3 (1.2)	3.3 (10.6)	3.9 (14.9)	98.1	22.1	51.0
T_{14} Weedy check		2.5(6.0)	4.2 (17.5)	9.5(90.5)	9.6 (92.6)	91.4	12.2	30.9
S.E. ±		0.139	0.134	0.273	0.342	0.46	0.42	0.350
C.D. (P=0.05)		0.418	0.401	0.819	1.027	1.42	1.26	1.050

Values in parenthesis represent original values DAS : Days after sowing

Table 3 :Yield and yield parameters as influenced by weed control treatments in direct seeded rice under puddled condition

Treatments	Concentration Kg a.i ha^{-1}	Panicle length (cm)	Sterility percentage (%)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1 Anilophos (30 EC)	0.4	22.5	12.80	3705	2543
T_2 Anilophos (30 EC)	0.3	21.6	15.70	3666	2114
T_3 Anilophos + 2,4-D (24 +32 EC)	0.3+0.4	21.8	17.70	3695	2629
T_4 Pendimethalin (30 EC)	1.0	18.3	17.70	4000	4246
T_5 Pendimethalin (30 EC)	0.5	18.0	18.60	4541	4271
T_6 Pendimethalin+2,4-D (30 + 36EC)	0.5+0.5	18.1	17.60	4543	4229
T_7 Butachlor (50 EC)	1.5	18.9	15.30	4643	5257
T_8Butachlor+Safener (50 EC)	1.0	20.1	7.30	5334	5613
T_9 Butachlor+Safener+2,4-D (50+ 36EC)	0.5+0.5	19.5	12.90	4565	4886
T_{10} Pretilachlor (50 EC)	0.5	18.3	10.90	4577	4914
T_{11}Pretilachlor+Safener (30EC)	0.4	18.6	7.50	5100	5986
T_{12}Pretilachlor+Safener+2,4-D (30+36EC)	0.3+0.4	18.5	12.90	4734	4686
T_{13}Hand weeding at 20 and 40 DAS		19.7	6.90	5562	6400
T_{14} Weedy check		15.5	30.20	3452	4214
S.E. ±		0.24	-	1.349	0.018
C.D. (P=0.05)		0.71	NA	4.047	0.053

NA : Not analyzed

Butachlor @ 1.0 kg ai ha^{-1} + Safener or pre- emergence application of Pretilachlor + Safener @ 0.4 kg ai ha^{-1} were found promising herbicides for effective weed control and higher grain yield in direct seeded puddle rice

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