

"IN SITU" EVALUATION OF RESIDUAL TOXICITY OF HERBICIDES ON SUCCEEDING CROPS IN DRILL SOWN RICE

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ABSTRACT

A field experiment was conducted to study the residual effect of herbicides on germination and seedling growth of succeeding crops in drill sown rice at the Main Research Station, Bangalore during the *Kharif* season of 1985. *In situ* studies revealed no significant effect on germination and seedling growth of maize, sunflower, soybean, groundnut, cowpea, cucumber and peas. However, the germination and seedling growth of sunflower was significantly reduced by 2,4-D at 1.00 kg a.i. ha⁻¹. *Bhendi* was susceptible to the residues of butachlor at 1.00 kg a.i. ha⁻¹.

KEYWORDS: Herbicides, Rice, Residual toxicity.

Herbicides offer the most practical, effective and economical means of reducing weed competition and crop losses particularly in areas where labour is costly and scarce. Residual effect of herbicides for a considerable length of time is one of the important factors which affects their use, if sufficient care is not taken. In the application of proper dose and correct type of herbicides to main crop, residual toxicity of herbicides may have adverse effect on the succeeding crop in rotation. Earlier studies revealed the susceptible nature of *Bhendi* to the residual effect of herbicides (Mallappa, 1973), no adverse effect on crop stand, yield and modulation of succeeding crop of greengram (Vijayaraghavan, 1974), wheat, brassica and Linseed (Pawankumar and Gill, 1981). However, comprehensive studies on the residual effect of herbicides in drill sown rice are scanty. A field experiment was therefore laid out to study the residual effect of herbicides on germination and seedling growth on succeeding crops in drill sown rice.

MATERIAL AND METHODS

The experiment was conducted at the wet land, Main Research Station, University of Agricul-

tural Science, Bangalore, during the *Kharif* season of 1985. The experiment was laid out in randomised complete block design with three replications in a sandy clay soil. There were 15 treatments comprising of five pre-emergence and one post-emergence herbicides each at two doses. The lower dose of herbicide was 75 per cent of higher dose in four chemicals and 50 per cent of higher dose in one chemical. In case of lower dose treatment, one hand weeding was given 45 days after sowing (DAS). These herbicidal and integrated treatments were compared with two hand weedings and unweeded control (Table 1). After the harvest of the rice crop, hundred seeds of each crop viz. maize, sorghum, sunflower, soybean, groundnut, cowpea, *bhendi*, cucumber and peas were dibbled in two lines in undisturbed soil in each plot. Germination counts were taken at 10 DAS. The dry weight was recorded from 10 randomly selected plants in each treatment at 30 DAS. These results were statistically analysed and the residual toxicity *in situ* was evaluated.

RESULTS AND DISCUSSION

The results indicated no significant effect on the

germination percentage of different crops sown after the harvest of rice except sorghum (Table 1). Application of 2, 4-D at 1.00 kg a.i. ha⁻¹ significantly reduced the germination percentage of sorghum (6.25%) as compared to hand weeded twice (37.5%) butachlor at 1.00 kg.a.i. ha⁻¹ (52.5%) and 2,4-D and 0.75 kg.a.i. ha⁻¹ plus one hand weeding (66.25%) (Table 1). *Bhendi* seemed to be sensitive to the residues of benthio-carb (6.25 to 11.25%). Soybean (25.0 to 48.75%) and *Bhendi* (6.25 to 56.25%) recorded lower germination percentage while, other crops recorded higher germination percentage.

Dry weight plant⁻¹ of all the succeeding crops except sorghum and *Bhendi* did not differ significantly due to residual toxicity of different herbicides sprayed to the previous rice crop (Table 2). These results are in agreement with Pastro and Prusty (1978), and Vijayaraghavan and Gill (1981). Absorption of herbicides by clay particles and organic matter, leaching and break down of the chemicals due to microbial

degradation might reduce the residual toxicity of herbicides in the soil (Bartha *et al.* 1967; Bartha and Pramer 1967). In case of sorghum, dry weight reduced significantly due to residues of 2, 4-D at 1.00 kg.ha⁻¹ and oxadiazon at 1.00 kg.a.i.ha⁻¹ respectively as compared to 2,4-D at 0.75 kg a.i. ha⁻¹. plus one hand weeding and hand weeded twice. In case of *bhendi*, butachlor at 1.00 kg a.i. ha⁻¹ significantly reduced the dry weight as compared to hand weeded once, twice and oxyflurofen at 0.25 kg a.i. ha⁻¹ plus one hand weeding.

In situ studies on the residual toxicity of herbicides thus revealed that the germination and seedling growth of sorghum was significantly reduced by residues of 2,4-D at 1.00 kg.a.i. ha⁻¹ and *bhendi* was susceptible to the residues of butachlor at 1.00 kg.a.i. ha⁻¹. The germination and seedling growth of maize, sunflower, soybean, groundnut, cowpea, cucumber and peas were not significantly affected by the residues of any of the herbicides studied.

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Table 1. Residual effect of herbicides on the germination (%) of different crops

Treatments	Maize	Sorghum	Sun-flower	Soy-bean	Ground-nut	Cowpea	Bhendi	Cucum-ber	Peas
2,4-D 1.00 kg a.i./ha ⁻¹ 25 DAS	47.50	6.25	47.50	32.50	76.25	67.50	29.00	45.00	25.00
2,4-D 0.75 kg a.i./ha ⁻¹ 25 DAS + 1 HW	55.00	66.25	35.00	37.50	76.25	73.75	25.00	48.75	41.25
Butachlor 1.00 kg a.i./ha ⁻¹ Pre-em.	58.75	52.50	47.50	45.00	53.75	75.00	21.25	42.50	13.75
Butchlor 0.75 kg a.i./ha ⁻¹ Pre-em. + 1 HW	51.25	50.00	43.75	33.75	61.25	60.00	35.00	52.50	22.50
Pendimethalin 1.00 kg a.i./ha ⁻¹ Pre-em.	55.00	38.75	55.00	25.00	80.00	66.25	13.75	37.50	20.00
Pendimethalin 0.75 kg a.i./ha ⁻¹ Pre-em. + 1 HW	52.50	33.75	46.25	42.50	88.75	70.00	18.25	75.00	35.00
Oxyfluorfen 0.50 kg a.i./ha ⁻¹ Pre-em.	36.25	21.35	45.00	38.50	70.00	68.75	56.25	60.00	61.25
Oxyfluorfen 0.25 kg a.i./ha ⁻¹ Pre-em. + 1 HW	41.25	31.25	58.75	40.00	57.50	55.00	25.00	56.25	25.00
Oxadiazon 1.00 kg a.i./ha ⁻¹ Pre-em.	30.00	16.00	53.75	37.50	75.00	67.50	33.75	73.75	38.75
Oxadiazon 0.75 kg a.i./ha ⁻¹ Pre-em. + 1 HW	51.25	21.25	61.25	48.75	50.00	68.75	16.25	51.25	16.25
Benthiocarb 1.00 kg a.i. ha ⁻¹ Pre-em.	52.50	17.50	41.25	35.00	60.00	71.25	11.25	47.50	13.75
Benthiocarb 0.75 kg a.i. ha ⁻¹ Pre-em. + 1 HW	58.75	33.75	38.75	41.25	71.25	72.50	6.25	45.00	31.25
Hand weeding once at 45 DAS.	50.00	15.00	56.00	33.75	62.50	85.00	35.00	60.00	18.75
Hand weeding twice at 20 and 45 DAS	58.75	37.50	56.25	46.25	77.50	62.50	21.25	50.00	50.00
Unweeded control	37.50	13.75	40.00	25.00	77.50	53.75	22.50	55.00	42.50
S.Em ±	6.99	9.97	11.14	2.84	13.64	8.39	12.05	8.76	13.26
C.D. at (5%)	NS	30.16	NS	NS	NS	NS	NS	NS	NS

NS : Not significant

1 HW : One Hand Weeding 45 DAS

DAS : Days after sowing

Pre-em. : Pre emergence

Table 2. Residual effect of herbicides on the dry weight (g.plant⁻¹) of different crops.

Treatments	Maize	Sorghum	Sun-flower	Soy-bean	Ground-nut	Cowpea	Bhendi	Cucum-ber	Peas
2,4-D 1.00 kg a.i./ha ⁻¹ 25 DAS	0.61	0.04	0.60	0.32	0.39	0.20	0.12	0.26	0.22
2,4-D 0.75 kg a.i./ha ⁻¹ 25 DAS + 1 HW	0.53	0.18	0.64	0.34	0.55	0.38	0.18	0.25	0.26
Butachlor 1.00 kg a.i./ha ⁻¹ Pre-em.	0.41	0.31	0.72	0.29	0.41	0.27	0.06	0.40	0.28
Butchlor 0.75 kg a.i./ha ⁻¹ Pre-em. + 1 HW	0.52	0.43	0.63	0.39	0.48	0.23	0.10	0.23	0.22
Pendimethalin 1.00 kg a.i./ha ⁻¹ Pre-em.	0.45	0.07	0.81	0.36	0.43	0.31	0.07	0.29	0.21
Pendimethalin 0.75 kg a.i./ha ⁻¹ Pre-em. + 1 HW	0.63	0.14	0.66	0.47	0.59	0.23	0.16	0.40	0.16
Oxyflurofen 0.50 kg a.i./ha ⁻¹ Pre-em.	0.26	0.06	0.49	0.28	0.44	0.21	0.09	0.17	0.30
Oxyflurofen 0.25 kg a.i./ha ⁻¹ Pre-em. + 1 HW	0.57	0.11	1.18	0.43	0.55	0.31	0.28	0.58	0.27
Oxadiazon 1.00 kg a.i./ha ⁻¹ Pre-em.	0.25	0.03	0.38	0.38	0.50	0.27	0.09	0.20	0.26
Oxadiazon 0.75 kg a.i./ha ⁻¹ Pre-em. + 1 HW	0.44	0.11	0.87	0.46	0.54	0.31	0.10	0.53	0.28
Benthiocarb 1.00 kg a.i. ha ⁻¹ Pre-em.	0.43	0.05	0.34	0.33	0.38	0.23	0.10	0.27	0.22
Benthiocarb 0.75 kg a.i. ha ⁻¹ Pre-em. + 1 HW	0.67	0.09	1.34	0.45	0.47	0.22	0.10	0.62	0.27
Hand weeding once at 45 DAS	0.51	0.07	0.74	0.48	0.52	0.23	0.27	0.69	0.20
Hand weeding twice at 20 and 45 DAS	0.72	0.17	1.75	0.61	0.53	0.31	0.21	0.70	0.35
Unweeded control	0.27	0.05	0.34	0.20	0.39	0.25	0.09	0.31	0.26
S.Em ±	0.11	0.02	0.29	0.06	0.04	0.06	0.03	0.17	0.05
C.D. at (5%)	NS	0.06	NS	NS	NS	NS	NS	NS	NS

NS : Not significant

1 HW : One Hand Weeding 45 DAS

DAS : Days after sowing

Pre-em. : Preemergence