

Effect of herbicides in integration with *halod*—an indigenous method of weed control in direct sown puddled rice

S. S. RANA AND N. N. ANGIRAS

Department of Agronomy, Himachal Pradesh Krishi Vishvavidyalaya, Palampur 176 062

Received: December 1997

ABSTRACT

The efficacy of some potent herbicides in conjunction with *halod* (interculture in standing rice crop with *desi* plough) for control of weeds in direct seeded puddled rice was studied during 1994 and 1995 at Palampur. The major weeds found were : *Echinochloa* sp., *Ammania baccifera*, *Scirpus* sp., *Cyperus iria* and *C. difformis*. Pre-emergence application of pretilachlor (0.80 kg/ha) and butachlor (1.50 kg/ha before the imposition of *halod* being statistically at par with post-*halod* hand weeding as and when required were significantly better than all the post-*halod* herbicide treatments with regard to weed control, yield attributes and yield. However, all the post-*halod* herbicides decreased the population and dry matter accumulation by weeds significantly in comparison to only *halod*. Amongst the post-*halod* herbicide treatments, tank mixed combinations of butachlor 0.75 kg/ha and pretilachlor 0.40 kg/ha with 2, 4-DEE 0.50 kg/ha being statistically at par with farmer's practice of *halod* followed by hand weeding, produced perceptible increase in grain yield over *halod* only.

Key words: Halod, Integrated weed control, Puddled rice, Herbicide

Direct sown rice on puddled soil faces a severe infestation from a large number of weeds which reduce the yield to an extent of 78% (Singh *et al.*, 1996). For combating weeds, farmers use age old indigenous technology locally called as *halod*, *hod* or *myan*. In this method fields are intercultured 18-25 days after sowing in 5-7 cm standing water with bullock drawn indigenous plough along with manual weeding and uniform distribution of rice seedlings. It is followed by one or more hand weeding to control the existing and subsequent flushes of weeds effectively. In general, manual weeding is time consum-

ing and costly, so it is being replaced with chemical weed control. Presently available herbicides for weed control in puddle sown rice are recommended to be applied 6-7 days after sowing for effective control of weeds. However, due to one or more reasons, most of the farmers skip the application of herbicides at this time and same is used after the imposition of *halod*. It is therefore, imperative to find out the efficacy of these herbicides after the imposition of *halod*. The present study was therefore conducted to study the comparative efficacy of herbicides before and after the imposition of *halod* and

to find out the promising weed control measure after imposition of *halod* in broadcast seeded rice on puddled soil.

MATERIALS AND METHODS

A field experiment was conducted during *kharif* 1994 and 1995 at Himachal Pradesh Krishi Vishvavidyalaya, Palampur. The soil of the test site was silty clay loam in texture, acidic in reaction (pH 5.8), medium in available N (364 kg/ha) and P (21 kg/ha) and high in K (326 kg/ha). Sprouted seeds of the rice variety 'HPU-2216' were sown @ 100 kg/ha by broadcast method on to the puddled soil on 19 and 26 June during 1994 and 1995, respectively. The experiment involved 11 treatment combinations of pretilachlor (0.80 kg ai/ha) and butachlor (1.50 kg/ha) pre and post *halod*, 2,4-DEE (0.50 kg/ha) alone and in mixture with butachlor (0.75 kg/ha) and pretilachlor (0.40 kg/ha) as post *halod* followed by hand weeding as and when required, *halod* followed by one hand weeding, *halod* only and weedy check. All recommended package and practices were followed for raising the crop. The *halod* operation (interculture with desi plough in standing crop) was carried out 30 and 22 days after sowing during 1994 and 1995, respectively. Pre *halod* herbicides were applied at 7 DAS whereas application of post *halod* herbicides was made 5 days after imposition of *halod* with Maruyama power sprayer using 600 litres water per hectare.

RESULTS AND DISCUSSION

The weed flora in the experimental field comprised *Echinochloa crus-galli* (L.) Beauv., *Echinochloa colonum* (L.) Link, *Scirpus* sp., *Ammania baccifera* L., *Cyperus iria* L., *Cyperus difformis* L., *Cyperus esculentus* L., *Aeschynomene indica* L., *Monochoria vaginalis* Presl., *Panicum* sp., and

Commelina forskalli. Out of these, *Echinochloa* sp., *Scirpus* sp., *A. baccifera* and *Cyperus* sp. as a whole constituted 83.8 and 87.4% of the total weed flora during 1994 and 1995, respectively.

Effect on weeds

Population and dry matter accumulation of all the weeds were significantly reduced with all the weed control treatments under study over unweeded check (Tables 1 & 2). Hand weeding as and when required resulted in significantly lower number and dry weight of all the weeds. However, it was statistically at par with pretilachlor 0.8 kg/ha (pre *halod*) in reducing the dry matter of *Echinochloa* sp., population and dry matter of *A. baccifera* and *Cyperus* sp., with one hand weeding in reducing the dry weight of *Echinochloa* sp., and post *halod* applied pretilachlor + 2,4-DEE in reducing the population and dry weight of *Scirpus* sp.

All the post *halod* herbicide treatments except 2,4-DEE were significantly superior to only *halod* in reducing the population and dry weight of *Echinochloa* sp. It indicates that butachlor and pretilachlor alone and in mixture with 2,4-DEE controlled the subsequent flushes of this weed effectively appearing after the imposition of *halod*, whereas 2,4-DEE alone was less effective. These results are in conformity with those of Bernasor and De Datta (1986). Post-*halod* applied butachlor and pretilachlor alone though were ineffective in reducing the population of *A. baccifera*, *Scirpus* sp. and *Cyperus* sp. over *halod* only, their tank mixed combinations with 2,4-DEE as well as 2,4-DEE alone were significantly superior to only *halod* and their alone application (post-*halod*) in controlling these weeds. These herbicide combinations were as effective as farmer's practice (*halod* followed by hand-

Table 1. Effect of treatments on population (no./m²) of weeds

Treatment	Time of application	Dose (kg ai/ha)	<i>Echinochloa</i> sp.	<i>A. baccifera</i>	<i>Scirpus</i> sp.	<i>Cyperus</i> sp.	Other weeds	Total weed population
Weedy check	—	—	10.45	9.28	10.72	8.22	7.80	20.60
<i>Halod</i> only	—	—	(108.7)	(85.7)	(114.0)	(67.0)	(60.4)	(425.8)
Hand weeding	Post <i>halod</i>	—	8.04	7.60	8.71	6.18	6.28	16.57
			(64.3)	(57.3)	(75.4)	(37.7)	(39.0)	(274.0)
			2.75	4.46	4.30	3.24	2.74	7.85
Hand weeding as and when required	Post <i>halod</i>	—	(7.0)	(19.4)	(18.0)	(10.0)	(7.0)	(61.3)
			0.96	1.94	2.08	0.71	1.22	2.98
			(0.4)	(3.3)	(3.7)	(0.0)	(1.0)	(8.4)
Butachlor	Pre- <i>halod</i>	1.50	3.98	3.54	5.19	3.35	2.63	8.34
			(15.3)	(12.0)	(26.3)	(10.7)	(6.4)	(69.0)
Pretilachlor	Pre- <i>halod</i>	0.80	3.24	2.49	3.78	1.79	1.48	5.79
			(9.4)	(5.7)	(13.7)	(2.7)	(1.7)	(33.0)
Butachlor	Post <i>halod</i>	1.50	6.85	6.60	7.77	5.30	5.02	14.19
			(46.4)	(43.0)	(59.9)	(27.4)	(24.7)	(201.0)
Pretilachlor	Post <i>halod</i>	0.80	6.40	6.44	7.34	5.53	4.95	13.72
			(40.4)	(41.0)	(53.0)	(30.0)	(24.0)	(188.4)
2, 4-DEE	Post <i>halod</i>	0.50	7.69	4.19	4.64	4.02	6.04	12.20
			(58.0)	(17.4)	(21.0)	(15.7)	(36.0)	(178.4)
Butachlor + 2, 4-DEE	Post <i>halod</i>	0.75 +	6.24	3.63	3.73	3.19	3.77	9.42
		0.50	(38.4)	(12.7)	(13.4)	(9.7)	(13.7)	(88.7)
Pretilachlor + 2, 4-DEE	Post <i>halod</i>	0.40 +	6.18	3.67	3.29	2.68	3.50	8.92
		0.50	(37.7)	(13.0)	(10.3)	(6.7)	(11.7)	(79.7)
CD (P = 0.05)			0.88	1.30	1.62	1.28	1.32	2.20

The data given in parentheses are the means of original values.

weeding) and pre-*halod* applied pretilachlor or butachlor in controlling the above mentioned weeds. The effective control of sedges and broad-leaved weeds with 2, 4-DEE alone (Bernasor and De Datta, 1986) and of grasses, broad-leaved weeds and sedges with mixture of butachlor + 2,4-DEE at 0.4-0.75 + 0.27-0.5 kg/ha (Mukhopadhyay and Banerjee 1993) has also been documented.

The effective control of all the weeds with hand weeding as and when required resulted in significantly lowest total weed pop-

ulation. However, it was statistically at par with pretilachlor (pre-*halod*) and farmer's practice in reducing the total weed dry weight. All the post-*halod* herbicide treatments, though decreased the total weed population and dry weight significantly over only *halod* but were significantly inferior to pre-*halod* herbicides due to their less post emergence activity.

Kandasamy and Palaniappan (1990) also reported least effectiveness of post emergence application of butachlor alone and in

Table 2. Effect of treatments on dry matter (g/m²) accumulation of weeds

Treatment	Time of application	Dose (kg ai/ha)	<i>Echinochloa</i> sp.	<i>A. baccifera</i>	<i>Scirpus</i> sp.	<i>Cyperus</i> sp.	Other weeds	Total weed dry wt.
Weedy check			334	24.2	22.8	4.43 (19.1)	24.4	425
<i>Halod</i> only			203	16.1	17.4	3.45 (11.5)	17.3	265
Handweeding	Post <i>halod</i>		15	4.6	3.2	1.24 (1.10)	2.3	26
Hand weeding as and when required	-do-		3	0.5	0.9	0.82 (0.20)	2.1	5
Butachlor	Pre- <i>halod</i>	1.50	37	2.5	6.4	1.47 (2.30)	2.1	50
Pretilachlor	-do-	0.80	20	1.9	4.6	1.03 (0.63)	0.4	28
Butachlor	Post <i>halod</i>	1.50	157	10.7	13.5	2.87 (7.80)	11.1	200
Pretilachlor	-do-	0.80	140	9.6	12.4	2.99 (8.60)	9.8	181
2, 4-D EE	-do-	0.50	192	4.7	5.9	1.86 (3.20)	14.7	221
Butachlor + 2, 4-D EE	-do-	0.75+ 0.50	134	2.8	3.4	1.48 (1.90)	6.3	148
Pretilachlor + 2, 4-D EE	-do-	0.40+ 0.50	128	2.8	2.5	1.45 (1.70)	5.3	140
CD (P = 0.05)			31	2.1	2.3	0.42	2.5	34

The data given in parentheses are the means of original values

combination with 2,4-DEE. Due to significantly better control of *A. baccifera*, *Scirpus* sp. and *Cyperus* sp. over post-halod butachlor and pretilachlor alone and of *Echinochloa* sp. over 2,4-DEE alone. The mixtures of pretilachlor and butachlor with 2,4-DEE were significantly superior in reducing the total weed population and dry weight amongst post halod herbicide treatments.

Effect on crop

Owing to significantly better control of weeds right from early stages before the start of critical period of crop-weed competition, pre halod applied pretilachlor 0.80 kg/ha and butachlor 1.50 kg/ha being statistically at par with halod followed by handweeding as and when required increased the grain yield significantly by increasing the number of effective tillers, spikelets per panicle,

1000-grain weight and panicle length (Table 3). Moorthy and Manna (1982) also reported that pretilachlor (0.50 kg/ha) and recommended dose of butachlor (1.50 kg/ha) were equally effective to that of weed free control.

All the post halod herbicides except 2,4-DEE increased the number of panicles, spikelets per panicle, panicle length and grain yield significantly over only halod by controlling the weeds effectively, but they were inferior to pre halod herbicides in influencing the grain yield due to poor weed control over the latter treatments. However, tank mixtures of pretilachlor and butachlor with 2,4-DEE were as effective as farmer's practice in increasing the grain yield. Weeds in unweeded check reduced the grain yield by 55.5% over farmer's practice, by 48.8% over post-halod applied pretilachlor and by 62.2% over the pre-halod applied

Table 3. Effect of treatments on yield attributes and yield of rice

Treatment	Time of application	Dose (kg ai/ha)	Panicles (no./m ²)	Spikelets/panicle (no.)	Spikelet fertility (%)	1000-grain wt. (g)	Panicle length (cm)	Grain yield (q/ha)
Weedy check			184	71.4	77.3	21.00	15.8	18.2
Halod only			215	75.3	79.7	21.70	17.0	26.3
Handweeding	Post halod		310	91.4	83.9	23.42	18.5	40.8
Hand weeding as and when required	-do-		330	97.0	83.9	23.72	20.2	44.5
Butachlor	Pre-halod	1.50	325	95.1	84.3	23.70	19.9	44.6
Pretilachlor	-do-	0.80	351	97.6	84.2	23.82	20.1	48.1
Butachlor	Post halod	1.50	271	81.4	82.9	22.13	18.1	34.8
Pretilachlor	-do-	0.80	272	83.7	81.7	22.18	18.3	35.3
2,4-DEE	-do-	0.50	234	77.4	80.7	21.37	17.5	29.9
Butachlor + 2,4-DEE	-do-	0.75+0.50	276	86.2	82.7	22.62	18.7	36.6
Pretilachlor + 2,4-DEE	-do-	0.40+0.50	278	88.2	83.7	22.97	18.7	37.7
CD (P = 0.05)			40	5.4	3.1	1.04	1.02	4.4

pretilachlor.

REFERENCES

- Bernasor, P. C. and De Datta, S. K. 1986. Chemical and cultural control of bulrush (*Scirpus maritimus* L.) and annual weeds in lowland rice (*Oryza sativa* L.). *Weed Research, UK* 26 (4) : 233-244.
- Kandasamy, O. S. and Palaniappan, S.P. 1990. Weed control in dry and wet seeded irrigated rice. *International Rice Research Newsletter* 15 (3) : 33.
- Moorthy, B. T. S. and Manna, G. B. 1982. Herbicides for weed control in puddle

of seeded rice. In : *Abstracts of papers of Annual Conference, Indian Society of Weed Science.*

- Mukhopadhyay, S. K. and Banerjee, K. 1993. Weed control by new herbicides in direct seeded flooded rice. *Integrated weed management for sustainable agriculture. In : Proceeding of International Symposium, organised by Indian Society of Weed Science, at Hisar, India, 16-20 November 1993, Vol. III, pp. 162-165.*
- Singh, C. M., Angiras, N. N. and Suresh Kumar. 1996. *Weed Management*. M.D. Publications Pvt. Ltd, New Delhi, p. 152.