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Herbicide Efficacy in Seeded Rice with Different Methods under Wet and Dry Conditions

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ABSTRACT

Field experiment was conducted at CCS HAU College of Agriculture Farm, Kaul, Haryana during **kharif** 2005 and 2006 to find out effective and viable system of controlling complex flora of weeds in direct seeded rice. Among different herbicidal treatments, pendimethalin at 1.5 kg/ha (PE) and cyhalofop butyl at 90 g/ha controlled *Echinocloa* very effectively but failed to check *Cyperus*, whereas pretilachlor+safener at 0.5 kg/ha provided excellent control of *Cyperus*. The grain yield was almost similar under the treatment of pendimethalin at 1.5 kg/ha fb HW at 30 DAS in all the sowing methods. Under wet seeding methods, pre-emergence application of pretilachlor+safener resulted in significantly higher grain yield of rice, whereas under dry seeding methods higher grain yield was recorded in the treatment of pre-emergence application of pendimethalin.

Key words : Direct seeded rice, puddled, unpuddled, zero tillage, reduced tillage, weeds

INTRODUCTION

Rice production systems are undergoing several changes and one of such change is shift from transplanted rice to direct seeding. The main driving forces of these changes are the rising wage rate, non availability of labour and scarcity of water. Direct seedling offers certain advantages i. e. saves labour, faster and easier planting helps in timely sowing, less drudgery, early crop maturity by 7-10 days, less water requirements, high tolerance to water deficit, often higher yield, low production cost and more profit, better soil physical conditions for following crops and less methane emission (Balasubranmanian and Hill, 2002). Despite several advantages, various production obstacles are also encountered and heavy weed infestation is major one. Weeds inflict major losses in upland rice culture resulting in total crop failures. Manual removal of weeds is labour intensive, tedious, back breaking and does not ensure weed removal at critical stage of crop-weed competition. The rice herbicides presently used are mainly pre-emergence and weeds coming at later stages of crop growth are not controlled as effectively as at emerging stage. No single approach i. e. either uses of herbicides or manual/ mechanical weeding is convenient in containing the weed menace. Hence, the present investigation was carried out to study the relative efficacy of some pre-emergence and post-emergence herbicides in combination with hand weeding for controlling weeds in direct seeded rice (DSR) under different crop establishment methods.

MATERIALS AND METHODS

A field experiment was conducted at CCS HAU College of Agriculture Farm, Kaul, Haryana during **kharif** 2005 and 2006. The experiment comprising seven weed control treatments viz., (1) Weedy check, (2) Weed free check, (3) pendimethalin at 1.5 kg/ha (pre-emergence), (4) cyhalofop at 90 g/ ha (15-20 DAS), (5) pretilachlor+safener at 0.5 kg/ ha (pre-emergence), (6) pendimethalin at 1.5 kg/ha (pre-emergence) fb one hand weeding at 30 DAS and (7) dhaincha (*Sesbania aculeata*) fb 2, 4-D at 0.5 kg/ha (30 DAS) in sub-plots and crop establishment methods (1) puddled, (2) unpuddled, (3) zero-tillage and (4) dry seeding as main plot treatments was laid out in a split plot design. Rice cultivar HKR 126 was sown on June 13, 2005 and June 19, 2006 using 30 kg/ha seed rate. Crop was raised with recommended package of practices. The field was dominated by *Echinochloa* and *Cyperus* spp.

For puddled DSR (wet seeded), the field was prepared dry with two harrowings followed by planking in summer. One day before seeding, plots were flooded

with water and puddled twice by disc harrow followed by planking. After puddling sprouted paddy seeds were broadcast uniformly in the field. In unpuddled DSR (wet seeded) the field was prepared dry with two harrowings followed by planking. Field was flooded with water and sprouted paddy seeds were broadcast uniformly in the field. In dry seeding, the field was prepared dry with two harrowings followed by planking. Dry seeds of paddy were sown with a seed drill in a well pulverized field at a row spacing of 17.5 cm like any other upland crop with seed placed in moist soil. Under zero-tillage drill sown rice, after wheat harvest, the plots kept undisturbed without subjecting to any preparatory tillage. Weeds were allowed to germinate and then controlled by spraying a non-selective herbicide glyphosate (Round up 1.5% solution) 10 days before sowing. Paddy seeds were sown by a zero till drill at a row spacing of 17.5 cm. *Sesbania* was sown by broadcasting with paddy seeds and allowed to grow for 25-30 days. Subsequently *Sesbania* crop was knocked down with 2, 4-D at 0.5 kg/ha. The herbicide killed the *Sesbania* alongwith other broad leaf weeds, but did not affect rice plants. The crop was harvested on 29 and 31 October in 2005 and 2006, respectively. The data of actual number of weeds were transformed by angular transformation for statistical analysis.

RESULTS AND DISCUSSION

Effect on Weeds

Application of pendimethalin at 1.5 kg/ha (PE) or cyhalofop-butyl at 90 g/ha controlled *Echinochloa* very effectively but failed to check *Cyperus*. Pretilachlor+safener at 0.5 kg/ha provided excellent control of *Cyperus*. The minimum density and dry weight of *Echinochloa* were recorded due to pendimethalin at 1.5 kg/ha and cyhalofop at 90 g/ha as compared to pretilachlor+safener at 0.5 kg/ha but reverse was true in case of sedges. The next best treatment against aforesaid weeds was intercropping of *Sesbania* fb spray of 2, 4-D.

In general, weed density and dry weight due to pendimethalin 1.5 kg/ha (PE) fb hand weeding at 30 DAS were low as a result of effective control of weeds by pendimethalin during initial stages and by hand weeding at later stages. These observations indicated that the weeds in DSR could be kept at low levels with respect to their density and dry weight by integrating chemical and mechanical methods of weed control. Similar results were reported by Singh *et al*. (2002) and Sinha *et al*. (2006).

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Effect on Crop

The interaction effect of planting methods and weed control treatments on grain yield of DSR was found significant. The grain yield in weedy check plots was higher in wet seeded methods (puddled and unpuddled) as compared to dry seeded methods (zero-tillage and reduced tillage). It implies that there was more reduction in yield under dry seeded methods as compared to wet seeded methods due to weeds (Table 1). Among various methods of direct seeding, wet seeded rice recorded higher grain yield than dry seeded (Ho and Romli, 2002). Almost similar yield of rice was recorded under the treatment of pendimethalin at 1.5 kg/ha (PE) fb hand weeding (30 DAS) under all the sowing methods. This could be possible mainly due to integration of hand weeding at 30 DAS. Singh *et al*. (2006) also recorded highest grain yield with pre-emergence application of pendimethalin at 1.5 kg/ha supplemented with one hand weeding in all the rice establishment methods. However, due to alone application of herbicides, yield was significantly affected under different planting methods. Under wet seeding methods, pre-emergence application of pretilachlor+safener resulted in significantly higher grain yield of rice, whereas under dry seeding methods higher grain yield was recorded in the treatment of pre-emergence application of pendimethalin (Table 2). The difference in yield might be due to differences in application mode and efficacy of herbicides against specific weed species. Pretilachlor and cyhalofop were applied in standing water condition which was congenial in wet seeded rice, whereas pendimethalin applied under moist field condition was proper under dry direct seeded rice. Sinha *et al*. (2006) also reported that application of pendimethalin at 1.0 kg/ha in dry seeding after three days of seeding and one hand weeding at 25 DAS produced higher yield. Similar results were also reported by Vairavan *et al*. (2000).

Table 1. Effect of different planting methods and weed control treatments on plant population (No./m^2) and dry weight of *Echinochloa* and *Cyperus* spp. at 30 and 90 DAS

Treatments	Density of *Echinochloa* spp.				Density of *Cyperus* spp.				Dry weight of *Echinochloa* spp.				Dry weight of *Cyperus* spp.			
	30 DAS		90 DAS		30 DAS		90 DAS		30 DAS		90 DAS		30 DAS		90 DAS	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
Planting methods																
Unpuddled	4.6	5.4	4.2	5.0	5.5	6.2	3.8	4.9	19.4	20.4	320.6	423.7	17.3	19.7	96.1	90.9
	(25)	(40)	(20)	(29)	(39)	(51)	(18)	(26)								
Puddled	4.4	5.1	4.0	4.8	5.0	6.0	3.6	4.8	17.3	18.6	302.0	343.5	16.4	19.4	73.0	76.1
	(24)	(35)	(17)	(27)	(33)	(47)	(15)	(26)								
Zero-tillage	4.1	5.3	4.2	5.2	5.1	6.6	4.1	5.3	17.7	18.7	335.7	447.7	14.7	22.1	87.4	98.6
	(21)	(37)	(22)	(33)	(33)	(57)	(19)	(31)								
Reduced tillage	4.2	5.2	4.3	5.4	5.2	6.6	4.1	5.3	16.4	20.7	368.0	448.3	17.7	23.1	88.0	102.0
	(23)	(35)	(22)	(34)	(34)	(58)	(19)	(31)								
S. Em±	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.8	0.9	17.0	21.4	0.8	0.9	4.8	4.7
LSD (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Weed control treatments																
Weed free check	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	(0)	(0)	(0)	(0)	(0)	(0)	(0)	(0)								
Weedy check	8.0	10.6	7.5	8.9	8.8	11.4	6.7	6.7	44.2	49.5	659.9	770.5	30.2	37.2	207.3	171.5
	(63)	(114)	(56)	(79)	(77)	(129)	(44)	(44)								
Sesbania fb	3.3	4.1	5.0	4.8	2.4	3.1	3.4	4.9	13.8	14.7	282.5	388.2	8.3	92.0	38.5	60.8
2,4-D (35 DAS)	(10)	(16)	(24)	(23)	(5)	(9)	(11)	(23)								
Pendimethalin at 1.5 kg/ha	5.2	6.4	3.0	4.2	8.0	9.9	2.7	4.6	17.3	22.2	238.5	329.8	26.5	32.0	33.3	40.2
(PE)+HW (30 DAS)	(28)	(43)	(8)	(17)	(63)	(98)	(7)	(21)								
Pendimethalin	4.9	6.7	3.6	5.8	8.1	9.5	5.5	6.6	18.8	23.3	407.5	521.2	28.3	37.0	149.5	150.8
at 1.5 kg/ha (PE)	(25)	(48)	(12)	(34)	(65)	(90)	(29)	(43)								
Pretilachlor+safener	5.3	5.3	5.7	6.5	2.9	3.8	3.1	5.4	19.8	17.0	459.5	534.7	7.5	10.5	40.3	44.3
at 0.5 kg/ha (PE)	(30)	(29)	(33)	(42)	(8)	(14)	(9)	(29)								
Cyhalofop-butyl at	2.6	2.8	3.4	4.5	5.2	5.7	5.0	6.3	10.3	10.5	275.9	336.1	15.0	22.0	134.3	175.7
90 g/ha (15-20 DAS)	(6)	(7)	(11)	(19)	(26)	(32)	(25)	(38)								
LSD (P=0.05)	0.3	0.4	0.3	0.4	0.4	0.5	0.3	0.4	2.9	3.2	51.3	65.6	2.5	3.2	15.2	16.4

Figures in parentheses represent the original values, which were subjected to square root transformation $\sqrt{X+1}$ before analysis. NS–Not Significant.

Table 2. Interaction effect of planting methods and weed control treatments on grain yield (kg/ha) of DSR during 2005 and 2006

Weed control treatments	Planting methods							
	Unpuddled		Puddled		Zero-tillage		Reduced tillage	
	2005	2006	2005	2006	2005	2006	2005	2006
Weed free check	5972	5525	5972	5691	6527	5470	6258	5359
Weedy check	1015	1011	1015	1547	2083	944	1075	889
Sesbania fb 2,4-D (35 DAS)	4633	4254	4633	4653	5065	4127	4854	4017
Pendimethalin at 1.5 kg/ha (PE)+HW (30 DAS)	5601	4973	5601	5083	5725	5249	5972	5116
Pendimethalin at 1.5 kg/ha (PE)	2018	1967	2018	1989	2133	3039	4167	2928
Pretilachlor+safener at 0.5 kg/ha (PE)	3105	2879	3105	3093	3320	1541	1870	1597
Cyhalofop-butyl at 90 g/ha (15-20 DAS)	2712	2534	2712	2624	2777	2376	2644	2265

	2005	**2006**
LSD (at 5%) for comparing two weed control treatments under a planting method =	707	527
LSD (at 5%) for comparing two planting methods treatments =	755	536

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