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Effectiveness of New Herbicides in the Management of *Leptochloa chinensis* in Direct Seeded Rice

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ABSTRACT

A field experiment was conducted during the kharif 2012 at Students' Farm of College of Agriculture, CCS Haryana Agricultural University; Kaul campus to study the effectiveness of new herbicides in management of Leptochloa chinensis in direct seeded rice. The herbicidal treatments included two pre emergence herbicides i.e. pendimethalin 1000 g/ha and oxadiargyl 100 g/ ha and four post emergence herbicides (bispyribac sodium 25 g/ha, fenoxaprop 67 g/ha, ethoxysulfuron 18.75 g/ha and metsulfuron methyl 10% + chlorimuron ethyl 10% WP ready mix (Almix) 4 g/ha). Weed free and weedy check were also included. The results showed that among herbicidal treatments, lowest density (4.5. 4.2 and 3.5/m^2) and dry weight (8.5, 14.7 and 16.5 g/m^2) of L. chinensis was obtained under pendimethalin 1000 g/ha fb fenoxaprop 67 g/ha at 75, 105 DAS and at harvest. Higher weed control efficiency from 45 DAS till harvest was obtained under pre emergence application of pendimethalin 1000 g/ha or oxadiargyl 100 g/ha followed by post-emergence application of fenoxaprop 67 g/ha alone or with ethoxysulfuron 18.75 g/ha, metsulfuron methyl + chlorimuron ethyl 4 g/ha. The regression analysis indicated that there was negative linear relationship between grain yield and dry weight of L. chinensis both at 45 DAS and at harvest (y = -0.0082x + 3.6213, R^2= 0.1611 and y = -0.0036x + 3.5665, R^2 =0.1017).

Key words: *Grain yield, Kharif, Regression analysis, Weed control efficiency, Weed density*

INTRODUCTION

Rice (*Oryza sativa* L.) is the most important cereal crop of India and a staple food of more than 65% of its population. In India, rice is grown over an area of 43.50 mha with a productivity of 2400 kg/ha[1]. In India, it is commonly grown by transplanting seedlings into puddled soil. Repeated puddling adversely affects soil physical properties, require large amount of water and labour[4,11]. All these factors demand a major shift from puddle-transplanted rice (CT-TPR) to direct seeding of rice (DSR) in irrigated areas. Weed control is a major limitation for the success of DSR[2]. Aerobic systems are subjected to much higher weed pressure than conventional puddled transplanting system[9] in which weeds are suppressed by standing water and by transplanted rice seedlings, which have a "head start" over germinating weed seedlings[7].

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Therefore, the major challenge for farmers is effective weed management, as failure to eliminate weeds may result in very low or no yield[12]. A weed-free period for the first 30-45 days after sowing (DAS) is required to avoid any loss in yield because the dry weight of weeds increases greatly from 30 DAS in dry-DSR. Rice field is mainly infested with *Echinochloa crusgalli, Echinochloa colona, Cyperus* spp. *Leptochloa chinensis, Dactyloctenium aegyptiacum, Commelina benghalensis, Digitaria sanguinalis, Trianthema portulacastrum, Digera arvensis, Amaranthus viridis, Ammania baccifera, Eclipta alba* etc[5,13]. *L. chinensis* is a strongly tufted, annual grass with glabrous leaves and fibrous roots, is fast becoming a serious weed in direct seeded rice[8]. So, the present investigation was undertaken to test the performance of different herbicides alone or in combination to control *L. chinensis* in direct seeded rice.

MATERIAL AND METHODS

The field experiment was conducted during the *kharif* 2012 at Students‟ Farm of College of Agriculture, CCS Haryana Agricultural University; Kaul campus situated at latitude 29°5' N and longitude 76°41'E at an elevation of 241 m above mean sea level. The soil of the experiment field was clay loam in texture and slightly alkaline in reaction. The soil was low in organic carbon (0.41%), low in available nitrogen (141 kg/ha), medium in available phosphorus (21 kg/ha) and high in available potassium (301 kg/ha). The experiment was laid out in randomized block design with three replications. The experiment was laid with 14 treatments (Table 1). Rice variety PUSA 1121 was seeded on 19th June 2012 in rows 22.5 cm apart using seed drill. Seed rate of 20 kg/ha was used. The herbicides were sprayed uniformly using knapsack sprayer fitted with flat fan nozzle calibrated to deliver 500 l/ ha water volume. Weed density (no. /m^2) and weed biomass (g/ m^2) were recorded in each plot at 25, 45, 75, 105 DAS and at harvest using quadrate of 50 cm × 50 cm (0.25 m2) from the area selected randomly for observations. The weed control efficiency (WCE) was calculated by using the following formula[6].

WCE = (DMC-DMT)/DMC x 100

equation (i)

Where, DMC is dry matter of weeds (g) in weedy check and DMT is dry matter of weeds (g) in a particular treatment.

The data recorded for different weeds and crop parameters were analysed using analysis of variance (ANOVA) technique[3], for randomized block design using SAS 9.1 software[10], Where ANOVA was significant, the treatment means were compared using LSD procedure at 5% level of significance (*$p<0.05$). The data on weed density and weed dry were square root transformed ($\sqrt{x+1}$) before statistical analysis.

RESULTS AND DISCUSSION

Weed density and weed dry weight:

All the treatments significantly reduced the density of *L. chinensis* at 75 DAS, 105 DAS and at harvest (Table. 1). Among different weed control treatments, pre-emergence application of pendimethalin 1000 g/ha *fb* fenoxaprop 67 g/ha at 25 DAS resulted in lower density of *L. chinensis* at 75 DAS, 105 DAS and at harvest (4.5, 4.2 and 3.5/m^2, respectively). The next best herbicidal treatment was pendimethalin 1000 g/ha PRE *fb* fenoxaprop 67 g/ha and metsulfuron methyl + chlorimuron ethyl 4 g/ha (5.0, 4.6 and 3.8/m^2). Application of fenoxaprop 67 g/ha gave effective control of *L. chinensis* which was not controlled by bispyribac-sodium 25 g/ha. The effectiveness of fenoxaprop against *L. chinensis* was also reported by Singh *et al.*[13].

The dry weight of *L. chinensis* increases from 75 DAS till harvest. However, among herbicide treatments, lowest dry weight was observed under the application of pendimethalin 1000 g/ha PRE *fb* fenoxaprop 67 g/ha as POST, at all three stages of crop growth (8.5, 14.7 and 16.5 g/m^2, respectively) which was followed by pendimethalin 1000 g/ha PRE *fb* fenoxaprop 67 g/ha and metsulfuron methyl + chlorimuron ethyl 4 g/ha

POST (9.3, 16.2 and 18.1/m^2 at 75, 105 and at harvest, respectively).

Weed control efficiency:

Among herbicidal treatments, highest weed control efficiency was recorded under pendimethalin 1000 g/ha PRE *fb* fenoxaprop 67 g/ha POST from 45 DAS till harvest (92.7, 91.6, 90.7 and 89.9 % at 45, 75, 105 and at harvest, respectively).

Table 1: Effect of different weed control treatments on density and dry weight of *Leptochloa chinensis* at 75, 105 DAS and at harvest

	Treatment	Dose (g /ha)	Time DAS	Weed density (No/.m^2)			Weed dry weight (g/m^2)		
				75DAS	105 DAS	At harvest	75DAS	105 DAS	At harvest
T1	Pendimethalin *fb* bispyribac-Na	1000 *fb* 25	3 *fb* 25	5.9(33.9)	5.7(31.4)	5.2(26.1)	8.0(63.3)	10.5(109.8)	11.1(122.9)
T2	Pendimethalin *fb* bispyribac-Na +ethoxysulfuron	1000 *fb* 25 +18.75	3 *fb* 25	5.4(28.0)	5.2(25.9)	4.8(21.6)	7.3(52.4)	9.6(90.8)	10.1(101.6)
T3	Pendimethalin *fb* bispyribac-Na +Almix	1000 *fb* 25 +4	3 *fb* 25	5.8(32.6)	5.6(30.1)	5.1(25.1)	7.9(60.9)	10.3(105.5)	10.9(118.1)
T4	Pendimethalin *fb* fenoxaprop	1000 *fb* 67	3 *fb* 25	2.4(4.5)	2.3(4.2)	2.1(3.5)	3.1(8.5)	4.0(14.7)	4.2(16.5)
T5	Pendimethalin *fb* fenoxaprop +ethxysulfuron	1000 *fb* 67 + 18.75	3 *fb* 25	2.5(5.1)	2.4(4.8)	2.2(4.0)	3.2(9.6)	4.2(16.6)	4.4(18.6)
T6	Pendimethalin *fb* fenoxaprop +Almix	1000 *fb* 67 + 4	3 *fb* 25	2.4(5.0)	2.4(4.6)	2.2(3.8)	3.2(9.3)	4.1(16.2)	4.4(18.1)
T7	Oxadiargyl *fb* bispyribac-Na	100 *fb* 25	3 *fb* 25	5.8(33.3)	5.6(30.8)	5.1(25.7)	7.9(62.3)	10.4(107.9)	11.0(120.7)
T8	Oxadiargyl *fb* bispyribac-Na +ethoxysulfuron	100 *fb* 25 + 18.75	3 *fb* 25	5.9(34.5)	5.7(32.1)	5.2(26.7)	8.0(64.8)	10.6(112.2)	11.2(125.5)
T9	Oxadiargyl *fb* bispyribac-Na + Almix	100 *fb* 25 + 4	3 *fb* 25	6.3(39.2)	6.1(36.4)	5.6(30.3)	8.6(73.5)	11.3(127.4)	11.9(142.5)
T10	Oxadiargyl *fb* fenoxaprop	100 *fb* 67	3 *fb* 25	2.4(5.0)	2.4(4.6)	2.2(3.8)	3.2(9.3)	4.1(16.2)	4.4(18.1)
T11	Oxadiargyl *fb* fenoxaprop +ethoxysulfuron	100 *fb* 67 + 18.75	3 *fb* 25	2.7(6.3)	2.6(5.8)	2.4(4.9)	3.6(11.8)	4.6(20.4)	4.9(22.8)
T12	Oxadiargyl *fb* fenoxaprop +Almix	100 *fb* 67 + 4	3 *fb* 25	2.6(6.0)	2.4(5.6)	2.4(4.8)	3.5(11.5)	4.6(20.0)	4.8(22.3)
T13	Weed free			1.0(0.0)	1.0(0.0)	1.0(0.0)	1.0(0.0)	1.0(0.0)	1.0(0.0)
T14	Weedy check			7.3(54.3)	7.0(50.1)	6.4(41.9)	10.1(101.3)	12.6(157.3)	12.8(164.0)
	SE(m) ±			0.3	0.3	0.3	0.3	0.4	0.4
	CD at 5%			1.0	0.9	0.8	0.9	1.2	1.2

*Original values are in parenthesis and before statistical analysis were subjected to square root transformation (√x+1)

The lowest weed control efficiency against *L. chinensis* was observed under Oxadiargyl 100 g/ha PRE *fb* bispyribac-Na 25 g/ha + and metsulfuron methyl + chlorimuron ethyl 4 g/ha POST (36.1, 27.4, 19.0 and 13.1% at 45, 75, 105 and at harvest, respectively)(Fig.1.).

Correlation and regression:

Regression analysis indicated that there was negative linear relationship between grain yield and weed biomass at 45 DAS and at harvest. In regression analysis, the equations Y = -0.0082x + 3.6213 (Fig. 2) and Y= -0.0036x + 0.1017 (Fig. 3) were found to be fit for the rice grain yield and weed biomass where Y is grain yield and X is weed biomass. Correlation between grain yield and weed biomass at 45 DAS was R^2 = 0.1611 (Fig.2) and at harvest was R^2 = 0.1017 (Fig.3). The R^2 values indicated a low degree of negative correlation between dry weight of *L. chinensis* and grain yield.

CONCLUSION

Pre-emergence application of pendimethalin 1000 g/ha *fb* post emergence application of fenoxaprop 67 g/ha with lowest weed density, weed dry weight and highest WCE provided excellent control of *L. chinensis* in direct seeded rice.

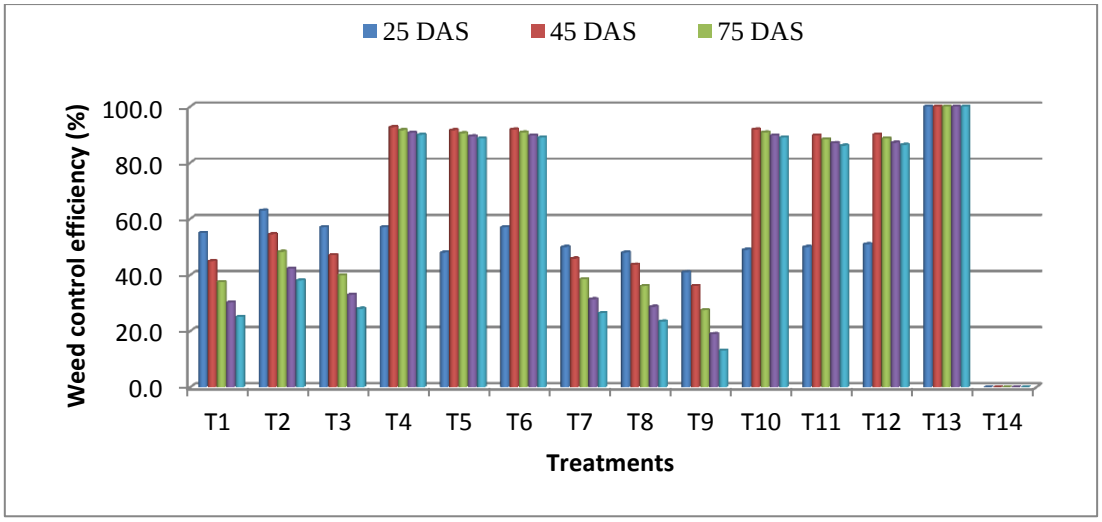

Fig. 1: Effect of different weed control treatments on weed control efficiency at 25, 45, 75, 105 DAS and at harvest

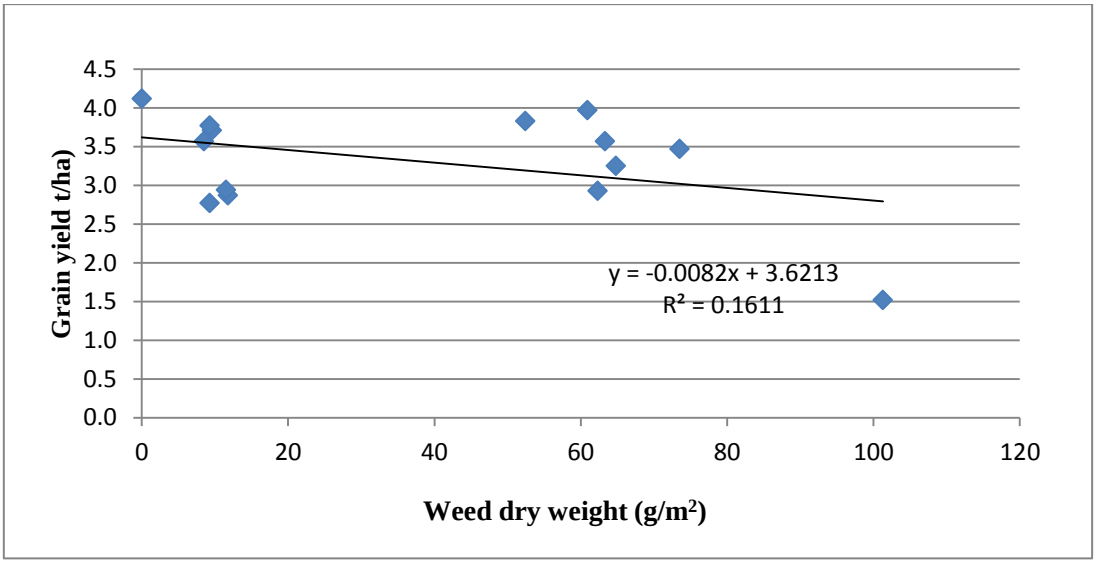

Fig. 2: Effect of dry weight of *L. chinensis* on grain yield of rice (at 45 Days after sowing)

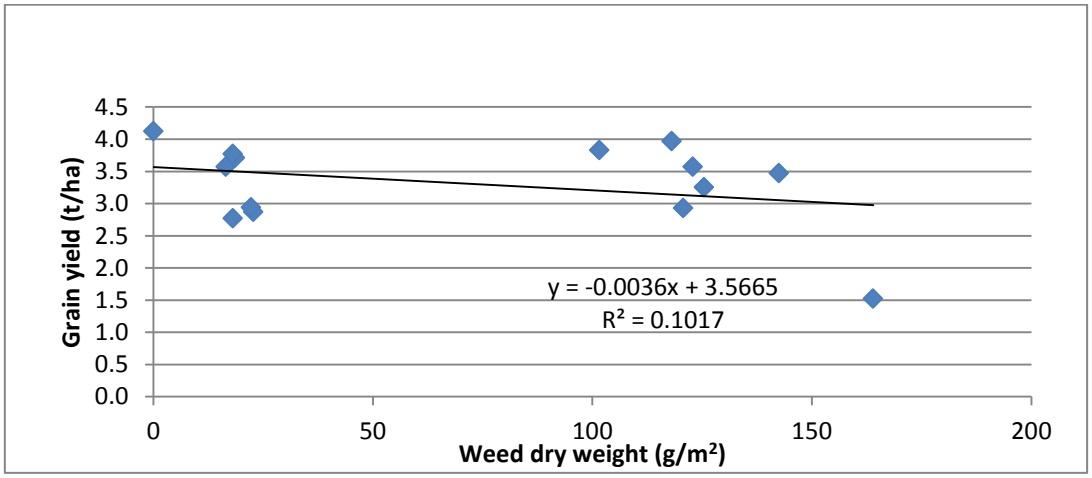

Fig. 3: Effect of dry weight of *L. chinensis* on grain yield of rice (at harvest)

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