Indian Journal of Weed Science **49**(2): 176–178, 2017
DOI: 10.5958/0974-8164.2017.00044.2

Short communication

Herbicidal management of Chinese sprangletop (*Leptochloa chinensis)* in direct-seeded rice

Geethu Jacob, Meera V. Menon* and C.T. Abraham
College of Horticulture, Kerala Agricultural University, Thrissur, Kerala 680 656

Received: 14 April 2017; Revised: 6 June 2017

Key words: Bispyribac-sodium, Fenoxaprop-p-ethyl, Herbicides, Wet-seeded rice

Leptochloa chinensis (L.) Nees. (Chinese sprangletop or Red sprangletop) is one of the most important invasive weeds in direct-seeded rice fields (Chin 2001). In Kerala, Chinese sprangletop was reported as a new weed specific to the alkaline soils of Chittoor taluk (Vidya *et al*. 2004). Though this weed is listed as an indicator plant for alkaline conditions, it is now seen spreading rapidly in acidic soils of Kerala also with typical example of weed shift. Continuous use of bispyribac-sodium, which is one of the most popular rice herbicides among farmers in Kerala, to control barnyard grass resulted in the dominance of Chinese sprangletop. In view of the growing menace of *Leptochloa chinensis* in the rice fields of Kerala, it is important to develop a new herbicide strategy by making use of the new molecule herbicides or the pre- and post- emergence herbicides already in use for effective control.

A field experiment in wet seeded rice was conducted during second crop season of 2012 in a farmer's field of Thrissur district ($75^0$58' latitude and $76^0$11' longitude and 1m below MSL), Kerala. The soil was clay loam with pH 5.2, organic C of 1.4%, available N of 890 kg/ha, available P of 24 kg/ha and available K of 281 kg/ha. The crop received 165.5 mm rainfall during 2012. The mean monthly minimum and maximum temperature were 33.9°C and 23.2°C. The experiment comprised 12 treatments. The herbicide oxyfluorfen 23.5 EC was sprayed as pre-emergence at 3 days after sowing (DAS), while butachlor 50 EC and pretilachlor 50 EC were applied at 6 DAS. Pyrazosulfuron-ethyl 10 WP was applied as early post-emergence at 8 DAS whereas cyhalofop butyl 10 EC, fenoxaprop-p-ethyl 6.9 EC, bispyribac- sodium 10 SC, metamifop 10 EC, azimsulfuron 50 DF and penoxsulam 24 SC were applied at 20 DAS. Hand-weeding twice at 20 and 40 DAS and weedy check were kept as controls. The treatments were applied in a randomized block design with three replications and a plot size of 20 m^2. The rice variety used was '*Jyothi (PTB 39)*'.The seed rate for sowing was 100 kg/ha. The crop was fertilized with 90, 35, 45 kg/ha of N, P_2O_5, and K_2O respectively. One third dose of N and K and half of P were applied at I5 DAS, one third dose of N and K and half of P at 35 DAS and remaining one third N and K at 55 DAS (KAU, 2011). Observations on weed density and weed dry weight for total weeds and *L.chinensis* were recorded separately with the quadrate (0.25 x 0.25 m) placed randomly in each plot at 30 DAS, 60 DAS and at harvest. The data on weed count were subjected to square root transformation ($\sqrt{x+0.5}$) to normalize the distribution. Weed control efficiency (WCE) was computed separately for *L. chinensis* and total weeds by using weed dry weight, and weed index (WI) was computed using grain yield of weed free check and yield of treated plot. Yield attributing characters like panicles/m^2, grains per panicle, fertility % and 1000 grain weight were recorded at harvest by placing the quadrate (0.25 x 0.25 m) in each plot. The cost of cultivation was worked out based on the labour and input cost incurred towards rice cultivation in different treatments. The data were analyzed using ANOVA and the least significant difference (LSD) values at 5% level of significance were calculated.

***Corresponding author:** m_vmenon@yahoo.com

Weed flora and density

The major weed species found in experimental plot were grasses. At 60 DAS, the relative density was highest in the grasses *Leptochloa chinensis* (31%) and *Echinochloa* sp. (8.6%), followed by the sedges *Fimbristylis miliacea* (21.3%) and *Cyperus* sp. (16.5%), and the lowest was in the broad-leaved weeds *Lindernia crustacea* (10.7%), *Ludwigia parviflora* (8.3%) and *Alternanthera* sp. (3.6%). The higher proportion of grasses compared to sedges and broad-leaf weeds in rice in *Kole* lands was also reported by Joy *et al*. (1993) and Sindhu (2008).

The weeds, especially the sedges and broad-leaved weeds, were present in all treatments except that of pretilachlor, where sedges were not recorded, and of bispyribac-sodium, where broad-leaved weeds were absent. Azimsulfuron and penoxsulam, though broad-spectrum herbicides, were found less effective compared to bispyribac-sodium in controlling broad-leaved weeds. Metamifop was seen to be the least effective against sedges, and also less effective against grasses and broad-leaf weeds. At 30 DAS, *L. chinensis* was absent in the fenoxaprop-p-ethyl, hand-weeded control, pyrazosulfuron-ethyl, oxyfluorfen, pretilachlor and butachlor treatments (**Table 2**). At 60 DAS the population increased, and so the dry weight also increased as compared to 30 DAS.

Table 1. Effect of herbicides on weed density, total weed dry weight and weed control efficiency (WCE%)

Treatment	Weed density (no./m^2)									Total weed dry weight (kg/ha)			WCE (%)		
	30 DAS			60 DAS			Harvest								
	G	S	B	G	S	B	G	S	B	30 DAS	60 DAS	Harvest	30 DAS	60 DAS	Harvest
Butachlor-50 EC	3.80^{f} (14)	4.06^{h} (16)	3.81^{e} (14)	9.62^{e} (92)	3.14^{h} (9.4)	2.92^{f} (8)	7.31^{e} (53)	2.92^{e} (8)	2.12^{i} (4)	60.10^{i}	993.37^{b}	764.50^{d}	64.54^{d}	6.83^{k}	30.75^{i}
Oxyfluorfen-23.5 EC	2.55^{g} (6)	3.39^{i} (11)	5.34^{b} (28)	7.52^{h} (56)	4.53^{e} (20)	2.92^{f} (8)	5.70^{g} (32)	2.34^{f} (5)	4.06^{f} (16)	136.99^{c}	809.60^{d}	704.00^{e}	19.20^{j}	24.66^{i}	36.23^{h}
Pretilachlor-50 EC	0.71^{i} (0)	0.71^{k} (0)	4.95^{c} (24)	5.34^{i} (28)	3.54^{g} (12)	6.67^{c} (44)	4.18^{h} (17)	1.60^{g} (2)	6.04^{d} (36)	88.00^{g}	578.76^{h}	527.13^{h}	48.10^{f}	46.14^{e}	52.25^{e}
Pyrazosulfuron-ethyl-10 WP	0.71^{i} (0)	4.52^{g} (20)	2.92^{f} (8)	10.22^{c} (104)	3.81^{f} (14)	2.12^{g} (4)	7.78^{c} (60)	1.22^{gh} (1)	2.92^{h} (8)	25.33^{k}	595.46^{g}	478.00^{i}	85.06^{b}	44.59^{f}	56.70^{d}
Azimsulfuron-50 DF	4.53^{d} (20)	5.70^{f} (32)	4.53^{d} (20)	10.79^{b} (116)	3.54^{g} (12)	2.92^{f} (8)	7.78^{c} (60)	0.71^{i} (0)	4.53^{e} (20)	78.40^{h}	637.80^{f}	792.50^{c}	53.76^{e}	40.65^{g}	28.21^{j}
Bispyribac sodium-10 SC	5.61^{b} (31)	6.07^{e} (36)	0.71^{h} (0)	10.12^{d} (102)	4.53^{e} (20)	2.12^{g} (4)	8.09^{b} (65)	2.92^{e} (8)	2.12^{i} (4)	110.00^{e}	652.86^{e}	614.00^{g}	35.11^{h}	39.25^{h}	44.38^{f}
Cyhalofop-butyl-10 EC	2.55^{g} (6)	8.03^{d} (64)	5.34^{b} (28)	4.95^{j} (24)	8.28^{c} (68)	5.96^{d} (36)	3.54^{i} (12)	6.67^{c} (44)	8.03^{b} (64)	94.26^{f}	436.53^{j}	406.00^{j}	44.41^{g}	59.38^{c}	63.23^{c}
Fenoxaprop-p-ethyl-6.9 EC	0.71^{i} (0)	8.27^{c} (68)	4.95^{c} (24)	0.71^{k} (0)	7.52^{d} (56)	7.97^{b} (63)	2.12^{h} (4)	7.45^{b} (55)	6.67^{c} (44)	29.30^{j}	362.35^{k}	340.12^{k}	82.72^{c}	60.70^{b}	69.19^{b}
Metamifop-10 EC	4.06^{e} (16)	9.08^{b} (82)	5.34^{b} (28)	9.41^{f} (88)	9.41^{b} (88)	6.04^{d} (36)	7.52^{d} (56)	5.79^{d} (33)	4.53^{e} (20)	144.00^{b}	903.37^{c}	880.70^{b}	15.05^{k}	7.56^{j}	11.17^{k}
Penoxsulam-24 SC	5.28^{c} (24)	3.99^{h} (15)	3.81^{e} (14)	8.51^{g} (72)	3.54^{g} (12)	3.80^{e} (14)	7.11^{f} (50)	0.71^{i} (0)	3.54^{g} (12)	115.80^{d}	448.50^{i}	685.40^{f}	31.70^{i}	58.26^{d}	37.92^{g}
Handweeded control	1.58^{h} (2)	2.74^{j} (7)	1.87^{g} (3)	0.71^{k} (0)	1.22^{i} (1)	0.71^{h} (0)	0.71^{j} (0)	0.71^{i} (0)	1.87^{j} (3)	20.17^{l}	4.80^{l}	16.22^{l}	88.11^{a}	100.0^{a}	97.0^{a}
Unweeded control	6.04^{a} (36)	10.7^{a} (115)	6.36^{a} (40)	12.66^{a} (161)	11.44^{a} (130)	8.75^{a} (76)	9.61^{a} (92)	9.87^{a} (97)	9.19^{a} (84)	169.5^{a}	1074.6^{a}	1104.0^{a}	-	-	-
LSD (P=0.05)	5.67	6.33	4.78	5.02	3.63	3.57	4.07	3.87	3.82	2.37	5.87	3.72	1.43	0.53	0.31

G - Grasses, S - Sedges, B - Broad-leaf weeds, DAS - Days after sowing. *$\sqrt{x+0.5}$ transformed values. Original values are given in the parentheses

Table 2. Effect of herbicides on *Leptochloa chinensis* count, dry weight and weed control efficiency (WCE)

Treatment	30 DAS			60 DAS			Harvest		
	Count (no./m^2)	Dry weight (kg/ha)	WCE %	Count (no./m^2)	Dry weight (kg/ha)	WCE %	Count (no./m^2)	Dry weight (kg/ha)	WCE %
Butachlor-50 EC	*0.71^{g} (0)	0	100^{a}	5.06^{g} (25.7)	139.20^{h}	76.00^{d}	4.16^{f} (17.3)	186.40^{h}	69.64^{e}
Oxyfluorfen-23.5 EC	0.71^{g} (0)	0	100^{a}	5.77^{f} (33.3)	185.60^{f}	67.70^{f}	4.0^{f} (16.0)	192.22^{g}	68.70^{ef}
Pretilachlor-50 EC	0.71^{g} (0)	0	100^{a}	4.65^{h} (21.7)	116.10^{i}	79.80^{c}	2.89^{g} (8.3)	96.00^{i}	84.40^{d}
Pyrazosulfuron-ethyl-10 WP	0.71^{g} (0)	0	100^{a}	6.11^{e} (37.3)	173.03^{g}	69.90^{e}	5.06^{e} (25.7)	288.00^{f}	53.10^{f}
Azimsulfuron-50 DF	3.65^{c} (13.3)	23.30^{c}	59.81^{c}	7.98^{d} (63.7)	368.20^{d}	36.00^{h}	6.11^{d} (37.3)	336.0^{e}	45.30^{g}
Bispyribac-sodium-10 SC	4.69^{a} (22.0)	34.80^{b}	40.20^{e}	10.33^{a} (106)	417.60^{b}	27.30^{j}	7.53^{a} (56.7)	527.70^{b}	14.05^{j}
Cyhalofop-butyl-10 EC	2.36^{e} (5.7)	11.60^{d}	80.00^{b}	2.82^{i} (8.0)	23.30^{j}	96.00^{b}	2.16^{h} (4.7)	48.00^{j}	92.20^{c}
Fenoxaprop-p-ethyl-6.9 EC	0.71^{g} (0)	0	100.00^{a}	0.71^{j} (0)	0	100.00^{a}	1.38^{i} (2)	10.20^{k}	98.33^{b}
Metamifop-10 EC	2.99^{d} (9.0)	23.40^{c}	60.10^{c}	8.48^{c} (72.0)	200.80^{e}	65.03^{g}	6.73^{b} (45.3)	432.50^{d}	29.60^{h}
Penoxsulam-24 SC	3.69^{c} (13.7)	23.80^{c}	59.00^{d}	7.98^{d} (63.7)	371.40^{c}	35.32^{i}	6.43^{c} (45.3)	477.40^{c}	22.25^{i}
Hand weeded control	1.22^{f} (1)	0	100^{a}	0.71^{j} (0)	0	100^{a}	0.71 (0)	0	100^{a}
Unweeded control	4.20^{b} (17.7)	58.00^{a}	-	9.75^{b} (95.0)	574.23^{a}	-	6.81^{b} (46.3)	614.00^{a}	-
LSD (p=0.05)	1.69	3.36	2.79	1.79	3.17	1.17	2.06	3.44	0.27

DAS – Days after sowing. *Original data in parentheses are subjected to square root transformation

Table 3. Effect of treatments on yield attributes and yield of direct-seeded rice

Treatment	Height (cm)	Panicles (no./m^2)	Grains/ panicle (no.)	1000 grain weight (g)	Fertility (%)	Weed Index (%)	Grain yield (t/ha)	Straw yield (t/ha)	B:C ratio
Butachlor-50 EC	89.49^{ab}	368.0^{bcd}	85.53^{de}	27.57^{b}	81.43^{ab}	37^{d}	4.74^{h}	5.19^{de}	1.6
Oxyfluorfen-23.5 EC	88.63^{ab}	306.7^{de}	89.33^{cde}	27.00^{f}	76.53^{ef}	34de	4.76^{g}	4.99^{e}	1.6
Pretilachlor-50 EC	86.51^{bcd}	324.0^{de}	92.15^{cde}	27.33^{d}	76.30^{ef}	43^{bc}	4.53^{j}	5.20^{de}	1.5
Pyrazosulfuron-ethyl-10 WP	86.65^{bc}	374.7^{bcd}	95.40^{cd}	27.27 ^{e}	80.45^{abc}	29^{ef}	4.67^{i}	5.63^{bc}	1.5
Azimsulfuron-50 DF	90.50^{a}	341.3^{cde}	99.20^{bc}	27.87^{a}	73.13^{g}	35^{d}	4.83^{f}	4.92^{f}	1.6
Bispyribac sodium-10 SC	85.07^{cd}	372.0^{bcd}	108.50^{ab}	27.33^{d}	79.53^{bcd}	38^{cd}	5.02^{d}	5.25^{d}	1.7
Cyhalofop-butyl-10 EC	89.17^{ab}	409.3^{bc}	109.40^{ab}	27.67^{a}	82.40^{ab}	25^{fg}	5.46^{c}	5.74^{b}	1.9
Fenoxaprop-p-ethyl-6.9 EC	90.47^{a}	441.37^{ab}	112.50^{a}	27.57^{b}	83.33^{a}	20^{g}	5.88^{b}	5.74^{b}	2.1
Metamifop-10 EC	90.49^{a}	341.0^{cde}	91.30^{cde}	26.87^{g}	73.80^{fg}	46^{b}	4.48^{k}	5.37^{c}	1.4
Penoxsulam-24 SC	83.62^{d}	340.0^{cde}	72.13^{f}	27.17^{f}	76.07^{ef}	33de	4.93^{e}	5.64^{bc}	1.6
Handweeded control	86.97^{bc}	461.3^{a}	111.8^{a}	27.43^{c}	78.43^{cde}	-	6.46^{a}	5.87^{a}	1.9
Unweeded control	85.20^{cd}	272.0^{e}	81.20^{ef}	27.33^{d}	77.43^{de}	56^{a}	4.07l	5.37^{c}	1.3
LSD (p=0.05)	2.68	0.31	10.04	0.92	2.76	0.05	0.26	0.70	

In a column, means followed by same superscript do not differ significantly at 5% level of significance in DMRT

Weed dry weight and weed control efficiency

All grasses, sedges and broad-leaf weeds persisted till harvest, and dry weight (**Table 1**) was the highest in the unweeded plot. Hand-weeding resulted in the lowest total weed and *L. chinensis* dry matter production. At 30 DAS, herbicides, *viz*. cyhalofop, pretilachlor, azimsulfuron, butachlor, fenoxaprop-p-ethyl, and pyrazosulfuron ethyl showed less weed dry matter production (**Table 1**). At 60 DAS, the weed dry weight increased to the tune of six times in unweeded control and the lowest dry weight was noticed in fenoxaprop-p-ethyl treated plots followed by the treatment cyhalofop-butyl. At 30 DAS the population and dry weight of *L. chinensis* (**Table 2**) were low compared to that at 60 DAS and at harvest, indicating subsequent germination of this weed probably due to well managed water level in the plots initially. At 30 DAS, *L. chinensis* was absent in the treatment fenoxaprop-p-ethyl, and cyhalofop butyl recorded the lowest weed dry weight of 11.6 kg/ha. The highest weed control efficiency (WCE) was recorded with fenoxaprop-p-ethyl, followed by cyhalofop-butyl while lowest was in bispyribac-sodium treated plot.

Yield and economics

The highest number of panicles/m^2, filled grains per panicle , and grain yield were registered in hand-weeding (**Table 3**). The highest grain yield of 6.46 t/ ha was recorded in hand-weeded control plot followed by fenoxaprop-p-ethyl (5.88 t/ha) and cyhalofop-butyl (5.46 t/ha), and the lowest yield of 4.07 t/ha was obtained in unweeded control. An analysis of the economics of rice cultivation showed that application of fenoxaprop-p-ethyl provided the highest B:C ratio (2.1), (**Table 3**).

SUMMARY

A field experiment was conducted to study the herbicidal management of *Leptochloa chinensis* (L.) Nees. during *Rabi* season in a farmer's field at Pullu in Thrissur district during the period November 2012 -March 2013. Post-emergence application of fenoxaprop-p-ethyl 60 g/ha or cyhalofop-butyl 80 g/ ha can be recommended in *L. colona* infested fields. Wherever this weed is not a problem, bispyribac-sodium 30 g/ha can be recommended.

REFERENCES

Azmi M, Chin DV, Vongsaroj P, and Johnson DF. 2005. Emerging issues in weed management of direct seeded rice in Malaysia, Vietnam and Thailand. 198 p. In: *Rice is life: Scientific perspective for the 21st century*. (Eds. Heong KI and Hardy B), Tsukuba publications, Japan.

Chin DV. 2001. Biology and management of barnyard grass, red sprangletop and weedy rice. *Weed Biology Management* **1**: 37-41.

Joy PP, Syriac EK, Ittyaverah PJ, and Joseph CA. 1993. Herbicidal technology for weed control in low land rice of Kerala. pp. 135-137. In: *Proceedings of the 5th Kerala Science Congress*, January 1993, Kottayam. Kerala State Council for Science, Technology and Environment.

KAU [Kerala Agricultural University], 2011. *Package of Practices Recommendations: Crops* (13th Ed.). Kerala Agricultural University, Thrissur, 334 p.

Rekha BK, Raju MS, and Reddy MD. 2003. Effect of herbicides on weed growth, grain yield and nutrient uptake in rainfed lowland rice. *Indian Journal of Weed Science* **35**(2): 121-122.

Sindhu PV. 2008. Ecofriendly management of weeds in rice. *Ph.D thesis*, Kerala Agricultural University, Thrissur, 274 p.

Vidya AS, Abraham CT, and Krishnan S. 2004. Weed biodiversity in the rice ecosystems of Kerala and its implications for weed management. pp. 401-411. In: *Sixteenth Kerala Science Congress 29-31 Jan, 2004, Kozhikode.*