Indian Journal of Weed Science **48**(1): 60–63, 2016
DOI: 10.5958/0974-8164.2016.00013.7

Short communication

Herbicide combinations for weed management in transplanted rice

K. Sreelakshmi*, R. Balasubramanian, R. Babu and K. Balakrishnan
Agriculture College and Research Institute, Tamil Nadu Agricultural University, Madurai, Tamil Nadu 625 104

Received: 14 November 2015; Revised: 25 January 2016

Key words: Transplanted rice, Sequential application, Tank mixture, Weed control efficiency

Rice (*Oryza sativa* L.) is the world's most important food crop catering half of the world's population. Generally, rice is grown in four broad ecosystems namely rainfed upland, rainfed lowland, puddled direct-seeded and puddled transplanted (Sharma, 2007). Among this the transplanting of rice has been the traditional system, where availability of water is in abundance. Weeds are major problem limiting the growth and yield of rice. Transplanted rice faces diverse type of weed flora, consisting of grasses, broad-leaved weeds and sedges. They usually grow faster than rice and absorb available water, nutrient earlier than the rice and suppress rice growth. Effective control of weeds had increased the grain yield by 85.5% (Mukherjee and Singh 2005). Single application of herbicide may provide effective control of weeds, but continuous use of such herbicides leads to the evolution of weeds resistant to several herbicides. Persistence of the herbicides in the field is only up to 30 DAT (Balasubramanian *et al.* 1996) So, single application of pre- and post-emergence herbicide is ineffective in controlling the weed flora in transplanted rice ecosystem. Under such situations, application of herbicide either as mixture or in sequence may be useful for broad-spectrum weed control in transplanted rice. Keeping this in view, a field experiment was carried out to evaluate the effect of herbicide applied in combination as well as in sequence for managing complex weed flora in transplanted rice.

An experiment was conducted during *Rabi* 2012-13 at Agriculture College and Research Institute, Madurai to study the effect of herbicide applied in mixtures and sequence for managing complex weed flora in transplanted rice. The soil of the experimental field was sandy clay loam with a pH of 7.2 and was high in available nitrogen and potassium and medium in available phosphorus.

***Corresponding author:** cheeku4sree@gmail.com

A set of 15 treatments was laid out in random block design with three replications (Table 1). The pre-emergence herbicides butachlor, pretilachlor, pyrazosulfuron and bensulfuron-methyl + pretilachlor were applied at 3 DAT. The post–emergence application of bispyribac-Na, metsulfuron-methyl + chlorimuron-ethyl, ethoxysulfuron was done at 25 DAT.

The rice variety *'ADT 49'* was transplanted at a spacing of 20 x 15 cm. Recommended dose of 150 kg N, 50 kg P_2O_5 and 50 kg K_2O NPK/ha was applied to the crop. Entire quantity of phosphorus and one third of the recommended N and K were applied basally at the time of sowing. Remaining two thirds of the recommended N and K was top dressed in three equal splits at 20, 45 and 65 DAT. Bio-fertilizers like azospirillum and phosphobacteria at 1000 g/ha were used for root dipping. All the intercultural practices were carried out as need based. The data on weed counts and dry matter production (DMP) were recorded at 60 DAT and weed control efficiency (WCE) of different treatments was computed using data on weed population. The observations recorded on rice were plant height, number of productive tillers and grain yield.

Weed flora

The predominant weeds of the experimental plot were *Echinochloa crusgalli, Cynodon dactylon, Panicum repens* under grasses, *Cyperus rotundus, Cyperus iria, Cyperus difformis* and *Fimbristylis milliaceae* among sedge and *Sphenoclea zeylanica, Eclipta alba* and *Marselia quadrifoliata* among broad-leaved weeds (BLW). All the weed control treatments caused significant reduction in total weed density and weed DMP when compared to unweeded control.

Effect on weed growth

Density of grassy weeds was significantly reduced to 19.12 /m^2 by tank mixture application of bispyribac-Na and at metsulfuron-methyl + chlorimuron-ethyl at 60 DAT. This was on par with sequential application of pretilachlor *fb* metsulfuron-methyl + chlorimuron-ethyl at 750/4 g/ha with grass weed density of 19.12/m^2. It was same in the case of sedge and broad-leaved weeds density. In all tank mixture application of bispyribac-Na and metsulfuron-methyl + chlorimuron-ethyl found to be more effective in managing weed population with sedge weed density of 0.84 no./m^2 and BLW density of 3.83 no./m^2. This was comparable with sequential application of pretilachlor *fb* metsulfuron-methyl + chlorimuron-ethyl. Among the single application of herbicide treatment, bispyribac-Na 25 g/ha was superior in controlling BLW compared to other single application of herbicide treatments.

All the weed control treatments caused significant reduction in total weed density and weed Dry Matter Production (DMP) when compared to unweeded control. Tank mixture application of bispyribac-Na + metsulfuron-methyl + chlorimuron-ethyl g/ha reduced the weed count upto 4.86/m^2 and weed DMP to 7.21 kg/ha and increased the WCE of 92% on 60 DAT. This was at par with the sequential application of pretilachlor *fb* metsulfuron-methyl + chlorimuron-ethyl 750/4 g/ha with the weed count (5.25/m^2), weed DMP (7.80 kg/ha) and WCE (91%) on 60 DAT. This might be due to the fact that the use of two or more herbicide in combination provided broad spectrum of weed control. The next best treatment was sequential application of pre-emergence herbicide pretilachlor and post-emergence application of metsulfuron-methyl + chlorimuron-ethyl on 25 DAT. Pretilachlor as a pre-emergence was effective in controlling weeds during the crop emergence period. The effectiveness of herbicide over weed would be lost after 30 days of its application. Therefore, applying metsulfuron-methyl + chlorimuron-ethyl as post-emergence herbicide at 25 DAT might be effective in controlling weeds that appear during the later stage of the crop. Pre-emergence followed by post-emergence application of almix were found to be on par with hand weeding twice. Sequential application of pre-and post-emergence herbicides and herbicide mixtures provide broad-spectrum of weed control. This is in accordance with those of Muthukrishnan *et al*. (2010). Metsulfuron-methyl + chlorimuron-ethyl as single application might be effective against broad-leaved weeds and sedges at a lower application rate

Table 1. Effect of herbicide combination on weed density, weed control efficiency and weed dry matter at 60 DAT in transplanted rice

Treatment	Weed density (no./m^2)				WCE	Total weed
	Grasses	Sedges	BLW	Total	(%)	DMP (kg/ha)
Butachlor alone on 3 DAT as PE	8.86 (78.0)	2.73 (6.98)	4.52 (20.0)	10.27 (105)	66.2	15.29 (233.4)
Pretilachlor alone on 3DAT as PE	9.03 (81.2)	2.96 (8.32)	5.79 (33.0)	11.09 (122)	60.6	16.51 (272.3)
Pyrazosulfuron alone on 3DAT as PE	8.28 (68.2)	2.81 (7.41)	4.42 (19.1)	9.75 (94.7)	69.6	14.52 (210.5)
Bensulfuron-methyl + pretilachlor alone on 3 DAT as PE	5.87 (34.0)	3.03 (8.74)	4.57 (20.4)	7.97 (63.8)	79.7	11.86 (140.4)
Bispyribac-Na alone on 25 DAT as PoE	6.13 (37.1)	2.08 (3.83)	3.88 (14.6)	7.48 (55.5)	82.1	11.13 (123.4)
Metsulfuron-methyl + chlorimuron-ethyl alone on 25 DAT as PoE	5.03 (24.9)	1.63 (2.17)	4.61 (20.8)	6.95 (47.8)	84.6	10.33 (106.4)
Bispyribac-Na + PoE metsulfuron-methyl + chlorimuron-ethyl on 25 DAT as PE	4.42 (19.1)	0.84 (0.22)	2.08 (3.8)	4.86 (23.2)	92.5	7.21 (51.5)
Bispyribac-Na + ethoxysulfuron on 25 DAT as PoE	5.47 (29.4)	1.58 (2.02)	3.32 (10.5)	6.51 (42.0)	86.5	9.68 (93.3)
Pretilachlor + ethoxysulfuron on 25 DAT as PoE	5.39 (28.6)	1.59 (2.03)	3.11 (9.2)	6.35 (39.8)	87.2	9.43 (88.6)
Pretilachlor *fb* PoE metsulfuron-methyl + chlorimuron-ethyl on as PE	4.74 (22.0)	0.84 (0.22)	2.32 (4.9)	5.25 (27.1)	91.3	7.80 (60.4)
Butachlor *fb* PoE metsulfuron-methyl + chlorimuron-ethyl on 25 DAT as PE	5.75 (32.6)	2.18 (4.26)	3.39 (11.0)	6.95 (47.9)	84.6	10.33 (106.4)
Pyrazosulfuron *fb* manual weeding on 25 DAT as PE	5.30 (27.6)	1.01 (0.54)	3.45 (20.2)	6.99 (48.4)	84.4	10.39 (107.6)
Butachlor *fb* manual weeding on 25 DAT as PE	5.55 (30.4)	1.43 (1.57)	3.45 (11.5)	6.62 (43.4)	86.0	9.85 (96.5)
Hand weeding twice at 25 and 45 DAT	4.97 (24.0)	0.92 (0.36)	3.11 (9.2)	6.08 (36.53)	88.3	8.66 (74.5)
Control	12.03 (144)	5.31 (27.8)	11.81 (139)	17.65 (311)	-	32.21 (1037)
LSD (0.05)	0.193	0.14	0.153	0.20	-	0.17

Data subjected to square root transformation; Values in parentheses are original; PE-Pre-emergence, PoE-Post-emergence

and was in line with the findings of Mukherjee and Singh (2005). Unweeded control registered the highest weed count (17.65/m^2) and weed DMP 32.21 kg/ha (Table 1) showing greater weed competition.

Effect on rice growth and yield

Maximum plant height was observed in tank mixture application of bispyribac- Na + metsulfuron-methyl + chlorimuron-ethyl at 25/4 g/ha and was significantly superior to the rest of the treatments by recording a plant height of 103.89 cm. Maximum plant DMP (4210 kg/ha) as well as number of productive tillers (361.43/m^2) and LAI (2.72) were recorded during active tillering stage for the above best treatment. This might be due to the better environment provided for the full development of the canopy as a result of an effective weed control achieved by the mixture of herbicides at the early stage of crop weed competition.

The increased grain yield clearly indicated the influence of weed free environment on grain production (Table 2). Herbicide combination of bispyribac-Na and metsulfuron-methyl + chlorimuron-ethyl recorded higher grain yield of 6.3 t/ha. The effective control of weeds starting from the early growth stage might have resulted in better growth and yield of rice. The variation in grain yield (as represented in Table 2) under different treatments was the result of variation in weed density and weed biomass. This is in conformity with the findings of Suganthi *et al.* (2010) and Mukherjee and Maity (2011). All these improved performance of the crop under favorable weed free condition lead to higher grain yield.

Different weed control methods involved different amount of cost which affected the total cost of cultivation of transplanted rice. Hand weeding is laborious and generally more expensive. From the computation of weed control it was observed that the maximum cost of weed control was required for hand weeding twice at 25 and 45 DAT with a B:C ratio of 2.46, which was due to maximum labour requirement. Patra *et al.* (2011) supported this finding with similar result. It was revealed that application of herbicide mixture of bispyribac-Na and metsulfuron-methyl + chlorimuron-ethyl registered lower cost of cultivation with B:C ratio of 3.11 and this increase in B:C ratio was due to increased yield of rice crop resulted from the favorable environment of weed free condition and lesser cost of weeding by the treatments.

Table 2. Effect of herbicide combination applied in mixture and sequence on growth, grain yield and B:C ratio of transplanted rice

Treatment	Plant height (cm)	LAI	No. tillers/ plant (no/m^2)	Plantdry matter (t/ha)	Grain yield (t/ha)	B:C ratio
Butachlor alone on 3 DAT as PE	90.5	1.91	263.9	2.80	5.10	2.62
Pretilachlor alone on 3DAT as PE	85.7	1.86	259.0	2.74	5.00	2.54
Pyrazosulfuron alone on 3DAT as PE	90.6	1.96	276.6	2.99	5.20	2.70
Bensulfuron-methyl + pretilachlor alone on 3 DAT as PE	90.2	2.02	280.1	3.23	5.30	2.59
Bispyribac-Na alone on 25 DAT as PoE	91.4	2.38	297.7	3.54	5.60	2.73
Metsulfuron-methyl + chlorimuron-ethyl alone on 25 DAT as PoE	95.1	2.42	302.1	3.65	5.60	2.89
Bispyribac-Na + PoE metsulfuron-methyl + chlorimuron-ethyl on 25 DAT as PE	103.9	2.72	361.4	4.21	6.30	3.11
Bispyribac-Na + ethoxysulfuron on 25 DAT as PoE	95.1	2.07	289.5	3.43	5.40	2.61
Pretilachlor + ethoxysulfuron on 25 DAT as PoE	92.8	2.19	292.5	3.48	5.50	2.76
Pretilachlor *fb* PoE metsulfuron-methyl + chlorimuron-ethyl on as PE	102.7	2.68	347.2	3.96	6.00	3.03
Butachlor *fb* PoE metsulfuron-methyl + chlorimuron-ethyl on 25 DAT as PE	95.6	2.12	283.2	3.36	5.40	2.72
Pyrazosulfuron *fb* manual weeding on 25 DAT as PE	91.2	2.49	325.2	3.71	5.60	2.69
Butachlor *fb* manual weeding on 25 DAT as PE	101.7	2.52	331.4	3.72	5.70	2.75
Hand weeding twice at 25 and 45 DAT	101.7	2.55	337.2	3.93	5.80	2.46
Control	69.2	1.65	228.0	2.02	3.20	1.76
LSD (0.05)	3.3	0.08	10.7	0.12	0.12	-

PE-Pre-emergence, PoE-Post-emergence

SUMMARY

A field experiment was conducted during 2012-13, to study the effect of herbicides applied in mixture and sequence for managing complex weed flora in transplanted rice. Among the herbicides applied, bispyribac-Na applied in combination with almix as tank mixture recorded the least weed count, weed dry matter and highest WCE. Significantly higher yield attributes, *viz.* number of grains/panicle and grain yield were also recorded when bispyribac-Na and metsulfuron-methyl + chlorimuron-ethyl were applied as tank mixture. Pre-emergence application of pretilachlor *fb* post-emergence application of metsulfuron-methyl + chlorimuron-ethyl and hand weeding twice at 25 and 45 DAT were also equally effective. Application of pre- and post-emergence herbicide alone were found to be less effective in reducing weed density and weed dry matter.

REFERENCES

Balasubramanian R, Veerabadran V, Mark Devasagayam M, Krishnasamy S and Jayapaul P. 1996. Influence of herbicides on weed management in lowland rice. *Pestology* **XX**(12): 18-20.

Dharumarajan S, Sankar R and Arun S. 2009. Evaluation of bioefficacy and residues of pretilachlor in transplanted rice. *Indian Journal of Weed Science* **41**(1&2): 62-66.

Mukherjee PK and Maity SK. 2011. Weed control in transplanted and wet seeded rainy season rice. *Indian Journal of Weed Science* **81**: 134-139.

Mukherjee D and Singh RP. 2005. Effect of low doses of herbicides on weeds, nutrient uptake and yield of transplanted rice. *Indian Journal of Agronomy* **50:** 194-196.

Muthukrishnan P, Subbalakshmi L and Sathiya K. 2010. Weed distribution and management in rice, pp 15. In**:** *National conference on challenges in weed management in agro-ecosystems, present status and future strategies*, 30 Nov. 1 Dec, 2010 Tamil Nadu Agricultural University, Coimbatore.

Patra AK, Halder J and Mishra MM. 2011. Chemical weed control in transplanted rice in Hirakud command area of Orissa. *Indian Journal of Weed Science* **43**(3&4): 175-177.

Suganthi M, Kandasamy OS, Subbian P and Rajkumar R. 2010. Bioefficacy evaluation and residue analysis of pretilachlor for weed control in transplanted rice-rice cropping system. *Madras Agricultural Journal* **97**(4-6): 138-141.