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Effect of weed management practices on growth and yield of transplanted rice (*Oryza sativa* L.) under system of rice intensification

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Abstract
A field experiment was carried out in wetland farms of TNAU, Coimbatore during summer 2021 to evaluate efficient weed management practices for transplanted rice under the System of Rice Intensification (SRI). The treatments consisted of different combinations of weed management practices including herbicides *viz.*, butachlor 1.25 kg ha^{-1} and bispyribac sodium 40 g ha^{-1}, cono weeding and hand weeding and were compared with unweeded control. The predominant weed flora present in the experimental field was *Echnichloa colona* (L.), *Echnichloa crusgalli* (L.), among grasses, *Cyperus difformis* (L.), among sedges and *Eclipta alba* (L.), *Ammania baccifera* (L.), among broad leaved weeds. The results revealed that application of early post emergence herbicide bispyribac sodium @ 40 g ha^{-1} at 15 DAT + cono weeding at 30 and 40 DAT recorded lesser weed density (4.18, 2.88 no. m^{-2} at 40 and 60 DAT), weed dry weight (3.20, 1.61 g m^{-2} at 40 and 60 DAT) and higher weed control efficiency (82.1 and 93.6 per cent at 40 and 60 DAT) which resulted in increased number of productive tillers m^{-2} (445) and filled grains per panicle (176). Application of early post emergence herbicide bispyribac sodium @ 40 g ha^{-1} + cono weeding at 30 and 40 DAT recorded higher grain and straw yields of 6975 kg ha^{-1} and 9905 kg ha^{-1}, respectively. This treatment was on par with application of early post emergence herbicide bispyribac sodium 40 g ha^{-1} + cono weeding at 30 DAT and hand weeding at 40 DAT.

Keywords: Weed management, butachlor, bispyribac sodium, cono weeding, SRI

1. Introduction
Rice (*Oryza sativa* L.) is a staple food for more than 60 per cent of the world's population and its cultivation provides a living for over two billion people. Rice is grown on 43.79 million hectares in India, with a production of 112.91 million tonnes and average productivity of 2.5 t ha^{-1} (Agricoop, 2018) [1]. Rice is grown in an area of 1.85 million hectares in Tamil Nadu, with a production of 6.95 million tonnes and average productivity of 3.7 t ha^{-1} (Agricultural statistics at a glance, 2019) [2].

Weeds are the most significant biotic constraint which reduces the productivity of rice in different systems of cultivation. Approximately 60 per cent of weeds emerge in transplanted rice within one week to one month of transplanting. These emerging weeds compete with rice during the active tillering stage and reduce the number of panicles leads to a decrease in grain yield (Thura, 2010) [17]. Weeds reduced grain yield by 45 to 51 percent in transplanted rice (Veeraputhiran and Balasubramanian, 2013) [19].

When compared to the yield obtained from conventional practices, SRI increases the rice yield by two to threefold (Uphoff, 2002) [18]. However, excessive weed growth is one of the major constraints in the SRI due to intermittent irrigation practice. Competition posed by the weeds could be solved by weeding early and frequently with a cono or rotary weeder (Stoop *et al*., 2002) [16]. Weeds that are buried through cono weeding in the fields improved the crop yields rather than removal. Furthermore, the soil is aerated, and the weeds decompose and turn into organic matter in the soil. As a result, the root and plant grow healthier and higher yields could be obtained. SRI not only improves productivity but also input use efficiency (Ghouh *et al*., 2007) [4]. Though cono-weeding is considered to be an efficient mechanical weed management strategy, non-availability of labour for cono-weeding and escalating labour cost and timely weeding during the initial period of crop growth have made it imperative to use chemicals for weed control in the SRI. Thus, there is a need to involve herbicide weed control along with cono weeding. Hence, in the present study different combinations of weed management practices involving chemical, mechanical and manual weeding were evaluated instead of cono weeding alone along with SRI practices in transplanted rice.

2. Materials and Methods

A field experiment was carried out in wetland farms, Department of Agronomy, Tamil Nadu Agricultural University, Coimbatore during summer, 2021 to evaluate different combinations of weed management practices under System of Rice Intensification (SRI). The soil found in the experimental field was clay loam in texture having pH of 8.1, EC of 0.42 dSm^{-1} and organic carbon content of 0.63 per cent. The nutrient status of the soil was low in nitrogen (260 kg ha^{-1}), medium in P_2O_5 (19.5 kg ha^{-1}) and high in K_2O (440 kg ha^{-1}). Rice variety CO (R) 51 was taken for this field study. Seeds were sown on raised bed nursery and transplanted 14 days old single seedling per hill with a spacing of 25 cm x 25 cm. The experiment was laid out in randomized block design with nine treatments, replicated thrice. The treatments included were T_1- PE butachlor @ 1.25 kg ha^{-1} + cono weeding at 30 DAT and 40 DAT, T_2- PE butachlor @ 1.25 kg ha^{-1} + cono weeding at 30 and hand weeding at 40 DAT, T_3- PE butachlor @ 1.25 kg ha^{-1} + hand weeding at 40 DAT, T_4- EPOE bispyribac sodium @ 40 g ha^{-1} + cono weeding at 30 DAT and 40 DAT, T_5- EPOE bispyribac sodium @ 40 g ha^{-1} + cono weeding at 30 DAT and hand weeding at 40 DAT, T_6- EPOE bispyribac sodium @ 40 g ha^{-1} + hand weeding at 40 DAT, T_7- Two hand weeding at 20 DAT and 40 DAT, T_8- Cono weeding at 10, 20, 30 and 40 DAT and T_9- Unweeded control. The weed management practices were adopted as per the treatment schedule Pre-emergence herbicide butachlor @ 1.25 kg ha^{-1} was applied at 3 DAT on T_1, T_2 and T_3 with a thin film of water maintained in the field at the time of application. Early post emergence herbicide bispyribac sodium @ 40 g ha^{-1} was applied at 15 DAT on T_4, T_5 and T_6. An unweeded control was kept undisturbed for the entire cropping period. Observations on individual weed density and dry matter production of weeds were recorded at 20, 40 and 60 DAT and weed control efficiency was calculated by using the formula given by Mani *et al*. (1968) [9]. Observations on growth parameters of rice were recorded at 30, 60 and 90 DAT. Yield parameters of rice grain yield and straw yields were recorded at the harvest stage of the rice crop. Data on weed dry weight and weed density were subjected to square root transformation and analysis was done. Data on weed observations, growth and yield attributes and yield were statistically analyzed as per the method suggested by Gomez and Gomez (1984) [5].

3. Results and Discussion

3.1 Effect of treatments on weeds

In transplanted ecosystems broad spectrum of weed flora including grasses, sedges and broad leaved weeds was reported from several studies. In this experimental field, the predominant weed flora observed were *Echinochloa crusgalli, Echinochloa colona* among grasses, *Cyperus difformis* among sedge and *Ammania baccifera, Eclipta alba* among broad leaved weeds. Similar observations were also reported by Manishankar *et al*. (2021) [10], Hemalatha *et al*. (2020) [6] and (Bommayasamy and Chinnamuthu, 2021) [3].

Among the different weed management treatments, application of early post emergence herbicide bispyribac sodium 40 g ha^{-1} with cono weeding at 30 and 40 DAT (T_4) recorded minimum weed density of 4.18 and 2.88 no. m^{-2} at 40 and 60 DAT, respectively and it was statistically on par application of early post emergence herbicide bispyribac sodium 40 g ha^{-1} with cono weeding at 30 DAT + hand weeding at 40 DAT (T_5) at 40 and 60 DAT. The lesser density of weeds might be due to the control of weeds at the 2-3 leaf stage by bispyribac sodium and late emerging weeds controlled by cono weedings. Similar results were also reported by Raghavendra *et al*. (2015) [13] and Shukla *et al*. (2014) [14]. At all stages, unweeded control (T_9) recorded significantly higher weed density of 6.98, 9.79 and 11.04 no. m^{-2} at 20, 40 and 60 DAT, respectively among all other treatments.

Significant variations were observed in weed dry weight at 40 and 60 DAT due to weed management practices. At 40 DAT, application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 and 40 DAT (T_4) registered lower weed dry weight (3.20 g m^{-2}) followed by application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 DAT + hand weeding at 40 DAT (T_5) (3.25 g m^{-2}). At 60 DAT, the lowest weed dry weight was observed with the application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 and 40 DAT (T_4) (1.61 g m^{-2}) and was on par with the application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 DAT + hand weeding at 40 DAT (T5) (1.70 g m^{-2}) and four times cono weeding from 10 DAT at 10 days interval (T_8) (1.73 g m^{-2}). This might be due to lesser total weed density during the cropping period. These results conform with the findings of Kumaran *et al*. (2015) [8]. The highest weed dry weight was observed in unweeded control plots (T_9).

Weed control efficiency was greatly influenced by different weed management practices (Fig. 1). As pre-emergence application of butachlor 1.25 kg ha^{-1} at 3 DAT + cono weeding at 30 and 40 DAT recorded higher weed control efficiency at 20 DAT. However, application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 and 40 DAT (T_4) registered highest weed control efficiency of 82.1 and 93.6 per cent at 40 and 60 DAT. This was followed by application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 DAT + hand weeding at 40 DAT (T_5) (80.9 and 93.0 per cent) and cono weeding from 10, 20, 30 and 40 DAT (79.8 and 92.9 per cent) at 40 and 60 DAT, respectively. The increased weed control efficiency in the herbicide applied treatment might be due to efficient and broad spectrum control of weeds at different stages of crop growth which was supplemented with cono weeding or hand weeding. These findings were in conformity with the findings of Kumar *et al*. (2005) [7].

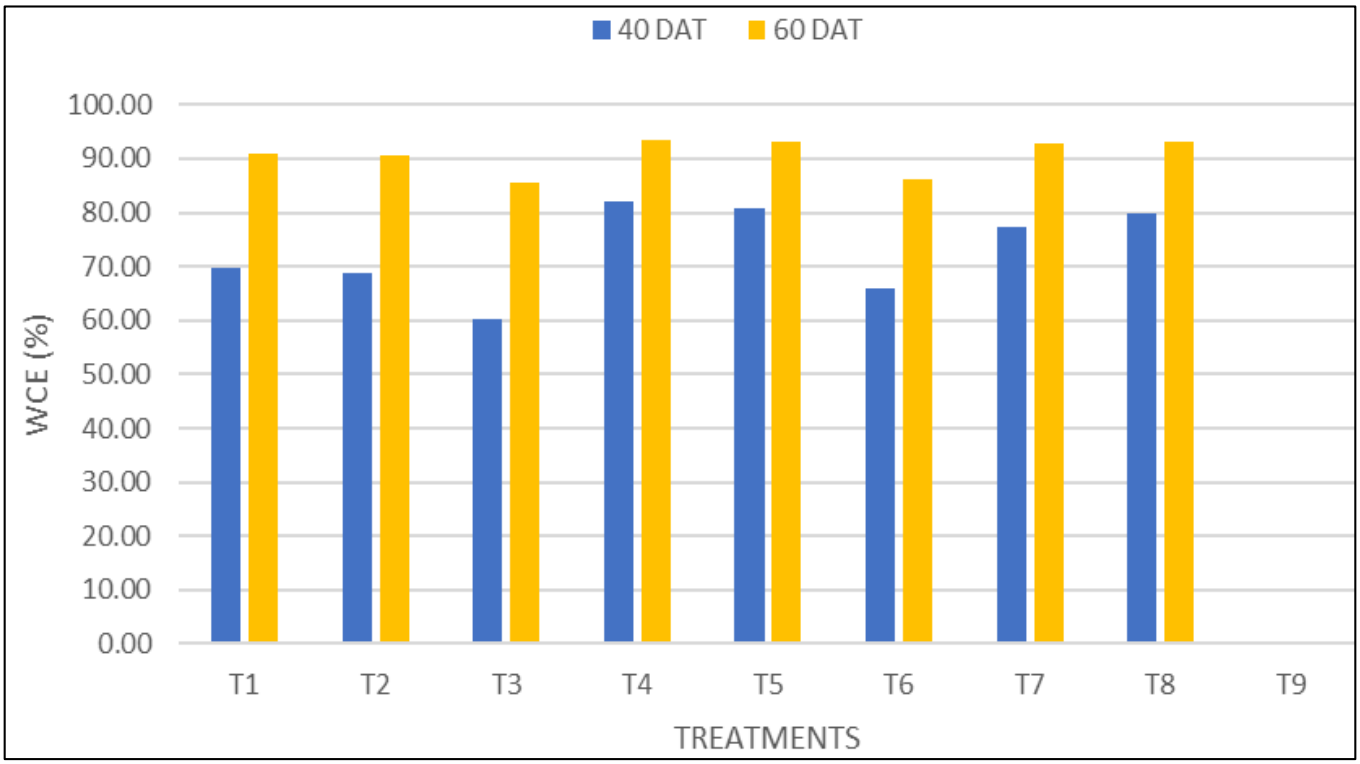

Fig 1: Effect of weed management practices on weed control efficiency (%) in transplanted rice under SRI.

3.2. Effect of treatments on growth parameters of rice

Growth parameters of rice *viz.*, plant height, number of tillers m^{-2} and crop dry matter production were significantly influenced by different weed management practices. Application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 and 40 DAT (T_4) recorded higher plant height (79.5 cm), number of tillers m^{-2} (430) and dry matter production (6915 kg ha^{-1}) at 60 DAT. This was followed by the application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 DAT + hand weeding at 40 DAT (T_5). Increased plant height and higher number of tillers in this treatment might be due to the better weed control throughout growth stages of rice and higher availability of all resources *viz.*, light, moisture, space and nutrients to rice. This is in line with the findings of Singh *et al*. (2021) [15] and Manisankar *et al*. (2021) [10]. Increased growth attributes might also be due to cono weeding through improved soil aeration and incorporation of weeds which accelerates nutrient availability to the crop at their active stages. Similar findings are also reported by Vijayakumar *et al*. (2006) [20]. The lowest plant height, number of tillers and dry matter production were recorded with unweeded control at all stages of the crop growth. Severe weed competition in unweeded control plots throughout the cropping period resulted in lower availability of all resources to the rice which in turn might have reduced the growth attributes of rice.

3.3. Effect of treatment on yield attributes and yield

Yield attributes of rice were significantly influenced by different weed management practices in transplanted rice. More productive tillers m^{-2} (445) and filled grains per panicle (176) were observed with the application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 and 40 DAT (T_4). It was comparable with the application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 DAT + hand weeding at 40 DAT (T_5). This might be due to less weed density and higher weed control efficiency as a result of reduced weed competition which is attributed to increased growth parameters of rice. Similar results are reported by Nalini *et al*. (2012) [11] who reported that more productive tillers and number of filled grains per panicle with the application of bispyribac sodium at 40g ha^{-1}. Unweeded control (T_9) recorded the lowest number of productive tillers m^{-2} and number of filled grains per panicle.

Adoption of different weed management practices significantly influenced the grain and straw yields of transplanted rice under SRI (Fig. 2). Application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 and 40 DAT (T_4) recorded higher grain and straw yields of 6975 kg ha^{-1} and 9905 kg ha^{-1}, respectively. This was comparable with the application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 DAT + hand weeding at 40 DAT (T_5). This was followed by cono weeding four times at 10, 20, 30 and 40 DAT. Higher grain yield under herbicide with cono weeding or hand weeding combinations might be due to decreased weed competition created by the combined effect of bispyribac sodium which controlled the weeds at the early stage of the crop growth and cono weeding at 30 and 40 DAT kept the field with reduced weed competition under the critical stage of the rice crop. Further, cono weeding at 30 and 40 DAT, incorporated the weeds and aerated the soil created favourable for microbial activity and increased nutrient availability to the crop which might have positively influenced the growth of rice from the early stage of the crop up to harvest, leading to the production of more number of productive tillers and number of filled per panicle and grain yield. These results are in confirmation with the findings of Parthipan *et al*. (2013) [12]. The unweeded control (T_9) registered the lowest grain yield and straw yield compared to all other treatments. This might be due to increased competition posed by the weeds which in turn reduced the growth and yield attributes of rice and also the grain yield.

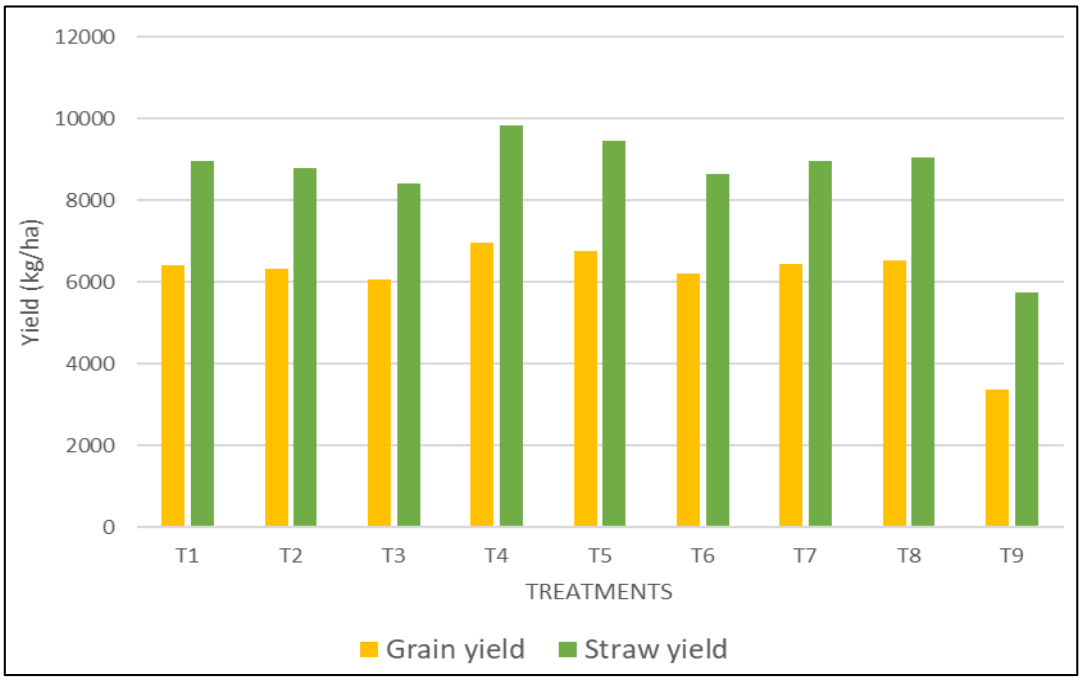

Fig 2: Effect of weed management practices on grain and straw yield (kg ha^{-1}) of transplanted rice under SRI

Table 1: Effect of weed management practices on weed density (no. m^{-2}), weed dry weight (g m^{-2}) and weed control efficiency in transplanted rice at 20, 40 and 60 DAT

	Treatments	Weed density (no. m^{-2})		Weed dry weight (g m^{-2})				Weed control efficiency (per cent)		
		20 DAT	40 DAT	60 DAT	20 DAT	40 DAT	60 DAT	20 DAT	40 DAT	60 DAT
T_1	PE Butachlor 1.25 kg ha^{-1} + cono weeding at 30 and 40 DAT	2.07	5.41	3.42	1.50	4.10	2.17	92.1	69.8	90.8
		(3.80)	(28.82)	(11.20)	(1.75)	(16.30)	(4.20)			
T_2	PE Butachlor 1.25 kg ha^{-1} + cono weeding at 30 DAT + hand weeding at 40 DAT	2.00	5.50	3.45	1.45	4.16	2.23	92.8	68.8	90.6
		(3.50)	(29.79)	(11.40)	(1.60)	(16.80)	(4.50)			
T_3	PE Butachlor 1.25 kg ha^{-1} + hand weeding at 40 DAT	2.06	6.20	4.25	1.52	4.85	2.88	92.2	60.2	85.5
		(3.75)	(38)	(17.60)	(1.80)	(23)	(7.80)			
T_4	EPOE Bispyribac sodium 40 g ha^{-1} + cono weeding at 30 and 40 DAT	4.00	4.18	2.88	2.73	3.20	1.61	67.9	82.1	93.6
		(15.50)	(17.04)	(7.80)	(6.97)	(9.75)	(2.10)			
T_5	EPOE Bispyribac sodium 40 g ha^{-1} + cono weeding at 30 DAT + hand weeding at 40 DAT	4.09	4.32	2.99	2.77	3.25	1.70	66.5	80.9	93.0
		(16.20)	(18.18)	(8.45)	(7.20)	(10.05)	(2.40)			
T_6	EPOE Bispyribac sodium 40 g ha^{-1} + hand weeding at 40 DAT	4.04	5.74	4.15	2.81	4.35	2.80	67.3	65.9	86.2
		(15.80)	(32.50)	(16.80)	(7.40)	(18.40)	(7.35)			
T_7	Hand weeding at 20 and 40 DAT	1.58	4.71	3.06	1.17	3.74	1.82	95.9	77.2	92.7
		(2.00)	(21.71)	(8.89)	(0.88)	(13.50)	(2.80)			
T_8	Cono weeding at 10, 20, 30 and 40 DAT	1.52	4.45	3.00	1.10	3.60	1.73	96.3	79.8	92.9
		(1.80)	(19.29)	(8.51)	(0.72)	(12.50)	(2.50)			
T_9	Unweeeded control	6.98	9.79	11.04	5.83	9.22	9.83	-	-	-
		(48.30)	(95.40)	(121.5)	(33.50)	(84.50)	(96.20)			
	SEd	0.06	0.23	0.19	0.07	0.93	0.13			
	CD (P = 0.05)	0.14	0.48	0.40	0.15	1.97	0.28			

PE- Pre-emergence, EPOE- Early post emergence: Figures in parentheses are original values.

Table 2: Effect of weed management practices on plant height, total number of tillers and dry matter production of transplanted rice at 60 DAT.

	Treatments	Plant height (cm)	No. of tillers m^{-2}	Dry matter production (kg ha^{-1})
T_1	PE Butachlor 1.25 kg ha^{-1} + cono weeding at 30 and 40 DAT	69.3	375	6304
T_2	PE Butachlor 1.25 kg ha^{-1} + cono weeding at 30 DAT + hand weeding at 40 DAT	66.5	362	6232
T_3	PE Butachlor 1.25 kg ha^{-1} + hand weeding at 40 DAT	64.2	343	5961
T_4	EPOE Bispyribac sodium 40 g ha^{-1} + cono weeding at 30 and 40 DAT	79.5	430	6915
T_5	EPOE Bispyribac sodium 40 g ha^{-1} + cono weeding at 30 DAT + hand weeding at 40 DAT	76.2	417	6522
T_6	EPOE Bispyribac sodium 40 g ha^{-1} + hand weeding at 40 DAT	63.5	351	6138
T_7	Hand weeding at 20 and 40 DAT	70.8	387	6398
T_8	Cono weeding at 10, 20, 30 and 40 DAT	72.1	395	6690
T_9	Unweeeded control	50.2	205	3969
	S.Ed	3.5	15.2	259
	CD (P = 0.05)	7.4	32	548

Table 3: Effect of weed management practices on yield attributes and yield of transplanted rice

	Treatments	No. of productive tillers m^{-2}	No. filled grains per panicle	1000 grain weight (g)	Grain yield (kg ha^{-1})	Straw yield (kg ha^{-1})
T_1	PE Butachlor 1.25 kg ha^{-1} + cono weeding at 30 and 40 DAT	387	158	16.45	6400	8960
T_2	PE Butachlor 1.25 kg ha^{-1} + cono weeding at 30 DAT + hand weeding at 40 DAT	374	150	16.59	6332	8801
T_3	PE Butachlor 1.25 kg ha^{-1} + hand weeding at 40 DAT	340	141	16.42	6050	8410
T_4	EPOE Bispyribac sodium 40 g ha^{-1} + cono weeding at 30 and 40 DAT	445	176	16.64	6975	9905
T_5	EPOE Bispyribac sodium 40 g ha^{-1} + cono weeding at 30 DAT + hand weeding at 40 DAT	428	171	16.55	6746	9444
T_6	EPOE Bispyribac sodium 40 g ha^{-1} + hand weeding at 40 DAT	353	145	16.46	6220	8646
T_7	Hand weeding at 20 and 40 DAT	395	160	16.54	6440	8952
T_8	Cono weeding at 10, 20, 30 and 40 DAT	402	166	16.59	6520	9063
T_9	Unweeeded control	235	125	15.92	3350	5750
	S.Ed	16	6.9	0.6	202	380
	CD (P = 0.05)	35	14.5	NS	430	807

4. Conclusion

Among different weed management practices**,** early post emergence application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 and 40 DAT (T_4) effectively controlled weeds and produced higher grain yield which was comparable with early post emergence application bispyribac sodium 40 g ha^{-1} with cono weeding at 30 DAT + hand weeding at 40 DAT (T_5). This was followed by cono weeding four times at 10, 20, 30 and 40 DAT.

The result of this field experiment indicated that in view of the scarcity of human labour and timely weed control, application of bispyribac sodium 40 g ha^{-1} with cono weeding at 30 and 40 DAT (T_4) could be an ideal weed management option in transplanted rice with System of Rice Intensification (SRI) for obtaining higher grain yield.

5. References

1. Agricoop. 2018. http://agricoop.gov.in/agristatglance.htm
2. Agricultural statistics at a glance, Directorate of Economics and Statistics, Ministry of Agriculture and Farmers Welfare, Government of India, 2019. https://eands.dacnet.nic.in/
3. Bommayasamy N, Chinnamuthu CR. Effect of encapsulated herbicides on weed control, productivity and nutrient uptake of rice (*Oryza sativa*). Journal of Environmental Biology 2021;42(2):319-25.
4. Ghouh A, Rao KS, Pandey MP, Poonam A. System of rice intensification–A holistic management towards enhancing rice production in future. Towards a learning Alliance–SRI in Orissa 2007, 35.
5. Gomez KA, Gomez AA. Statistical procedures for agricultural research. John Wiley & Sons 1984.
6. Hemalatha K, Singh Y, Kumar S. Leaf colour chart-based nitrogen and weed management impacts on weeds, yield and nutrient uptake in dry direct-seeded rice. Indian Journal of Weed Science 2020;52(4):318-21.
7. Kumar S, Kerketta D, Agashe RD, Chouksey R. Effect of weed management in transplanted rice (*Oryza sativa* L.). Journal of Weed Science 2005;37(3, 4):197-201.
8. Kumaran ST, Kathiresan G, Arthanari PM, Chinnusamy C, Sanjivkumar V. Efficacy of new herbicide (bispyribac sodium 10% SC) against different weed flora, nutrient uptake in rice and their residual effects on succeeding crop of green gram under zero tillage. Journal of Applied and Natural Science 2015;7(1):279-85.
9. Mani VS, Gautam KC, Chakraborty TK. Losses in crop yield in India due to weed growth. International Journal of Pest Management C 1968;14(2):142-58.
10. Manisankar G, Ramesh T, Rathika S. Evaluation of Different Weed Management Practices on Yield attributes and Yield of Transplanted Rice. Int. J. Curr. Microbiol. App. Sci 2021;10(05):390-9.
11. Nalini K, Murali AP, Chinnusamy C. Early post emergence herbicidal weed management in transplanted rice. Proceedings of Biennial Conference of Indian Society of Weed Science on "Weed Threat to Agriculture, Biodiversity and Environment 2012, 74.
12. Parthipan, T, Ravi V, Subramanian E, Ramesh T. Integrated weed management on growth and yield of transplanted rice and its residual effect on succeeding black gram. Journal of Agronomy 2013;12(2):99-103.
13. Raghavendra BM, Susheela R, Madhavi M, Mahantheswara B. Influence of weed management practices on nutrients uptake and wet seeded Rice (*Oryza sativa* L.) sown through Drum seeder. Annals of Plant Protection Sciences 2015;23(1):153-7.
14. Shukla UN, Srivastava VK, Singh S, Sen A, Kumar V. Growth, yield and economic potential of rice (*Oryza sativa*) as influenced by different age of seedlings, cultivars and weed management under system of rice intensification. Indian Journal of Agricultural Sciences. 2014;84(5):628-36.
15. Singh AK, Yadav RS, Kumar D, Kumar G, Kumar S. Impact of planting methods and weed control practices on growth, yield and quality of paddy 2021.
16. Stoop WA, Uphoff N, Kassam A. A review of agricultural research issues raised by the system of rice intensification (SRI) from Madagascar: opportunities for improving farming systems for resource-poor farmers. Agricultural systems 2002;71(3):249-74.
17. Thura S. Evaluation of weed management practices in the System of Rice Intensification (SRI). M. Sc.(Agronomy) Thesis 2010.
18. Uphoff N. System of Rice Intensification (SRI) for enhancing the productivity of land, labour and water. J. Agric. Resour. Manage 2002;1(1):43-9.
19. Veeraputhiran R, Balasubramanian R. Evaluation of bispyribac-sodium in transplanted rice. Indian journal of weed science 2013;45(1):12-15.
20. Vijayakumar M, Ramesh S, Chandrasekaran B, Thiyagarajan TM. Effect of system of rice intensification (SRI) practices on yield attributes yield and water productivity of rice (*Oryza sativa* L.). Research Journal of Agriculture and Biological Sciences 2006;2(6):236-42.