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Weed parameters and yield of aerobic rice (*Oryza sativa L.*) As influenced by weed management practices under different seeding methods

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Abstract
A field experiment was conducted at College Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University (PJTSAU), Rajendranagar, Hyderabad, during *kharif*, 2014. The soil of the experimental field was sandy loam in texture with pH of 7.6. The experiment was laid out in factorial randomized block design with two factors. Pretilachlor as pre-emergence herbicide, is not effective against grasses and sedges while azimsulfuron was the new selective, post-emergence herbicide was found to be most efficient against sedges and broadleaf weeds & less effective against grassy weeds. However, sequential application of herbicides along with one hand weeding was reported to be more effective than application of herbicides alone, hence the present investigation was undertaken to study the efficacy of sequential application of pre and post emergence herbicides. Herbicidal treatments significantly influenced the dry matter production of weeds as well as grain yield. Lowest weed dry matter (10.5) as well as higher WCE (95.5) was recorded with hand weeding thrice at 60 DAS. Which was at par with T6-(Pretilachlor 50%EC @ 0.75 kg ai /ha as PE fb Azimsulfuron 50%W.P@ 35g.ai/ha+ cyhalofop butyl 10% EC@ 75 g. ai/ha as PoE 15- 20 DAS fb HW at 50 DAS) with regard to WCE (95.3 %) and grain yield (3218.3 kg/ha) indicating that weeds are controlled efficiently with sequential application of herbicides resulted in Higher grain yield.

Keywords: aerobic rice, weed parameters, yield.

Introduction
Rice is the world's second most important cereal crop and staple food for about three billion people across the globe and the demand for food continue to increase as the population is increasing at faster rate (Carriger and Valle, 2007) [3]. Direct sown aerobic rice suffers more due to weed menace as the weeds and rice compete for growth factors together and weeds cause yield loss between 30 and 98 percent (Oerke and Dehne, 2004) [8].

In India, rice is cultivated round the year in one or other part of the country, in diverse ecologies of rainfed upland and low land and irrigated, spread over 44.6 m ha. The rainfed lowland and upland rice is usually established with direct seeded into dry soil. Whereas, the irrigated rice is established either by transplanting or direct seeding under puddled condition or dry seeding.

Direct seeded rice (DSR), however, offers certain advantages like labour saving, timely sowing, less drudgery, early crop maturity by 7-10 days, less water requirement, high tolerance to water deficit, low production cost, less methane emission and also preserves natural resources especially ground water and maintains physical properties of soil.

Water scarcity is becoming severe in many rice growing areas in the world, but introduction of aerobic rice can reduce water use in rice production as much as 50% (Bouman, 2001) [2]. However, direct-seeded aerobic rice is subject to more severe weed infestation than transplanted lowland rice, as in aerobic rice systems the weeds and rice emerge simultaneously in DSR, the proper time and method of weed control remains a complex phenomenon (Khaliq and Matloob, 2011) [6].

Poor seedling establishment, abundance of weeds and lodging are some of the problems responsible for low productivity of direct-seeded rice (Mahajan *et al*., 2006) [6]. Weeds in particular, cause yield loss between 30 and 98 percent (Oerke and Dehne, 2004) [8].

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Poor seedling establishment, abundance of weeds and lodging are some of the problems responsible for low productivity of direct-seeded rice (Mahajan *et al*., 2006) [6]. Weeds in particular, cause yield loss between 30 and 98 percent (Oerke and Dehne, 2004) [8].

Manual removal of weeds is supposed to be easy and ecofriendly but highly labour intensive, tedious, back breaking, expensive and does not ensure weed removal at critical stages due to non - availability of labour. Hence, it is necessary to develop alternative practices for controlling the weeds. The traditional hand weeding practice needs to be substituted by herbicides to control weeds timely and economically.To make aerobic rice more remunerative and to utilize diminishing water resources more efficiently there is a need to standardize agro techniques for aerobic rice in general, stand establishment and weed management practices in particular.

Materials and methods

Field experiment was carried out during *kharif*, 2014 at College Farm, Professor Jayashankar Telangana State Agricultural University, Hyderabad to evaluate the efficacy of sequential application of herbicides in different seeding methods in sandy loam soil. The experiment was conducted in factorial RBD with a plot size of 4 x 4m with three replications. Factor 1 includes seeding methods, broadcasting (S_1) and line sowing (S_2) Factor II includes weed management practices, T_1-Pretilachlor 50% EC as PE fb (metasulfuron methyl + clorimuron ethyl) 20% W.P as PoE + cyhalofop butyl 10% EC as PoE at 15-20 DAS, T_2-Pretilachlor 50% EC as PE fb azimsulfuron 50% W.P + cyhalofop butyl 10% EC as PoE 15-20 DAS, T_3-Pretilachlor 50% EC @ 0.75 kg ai/ha as PE fb pyrazosulfuron 10% W.P + cyhalofop butyl 10% EC as PoE at 15-20 DAS, T_4-bispyribacsodium 10% EC @ 25 g ai/ha. as early PoE fb 2-4-D 80% W.P @ 0.5 kg.ai/ha at 40 DAS, T_5- T_1 followed by HW at 50 DAS, T_6- T_2 followed by HW at 50 DAS, T_7- T_3 followed by HW at 50 DAS, T_8- T_4 followed by HW at 50 DAS, T_9- HW at 20, 40 and 60 DAS, T_{10}-unweeded control. The recommended fertilizer dose was 100-60-40 kg of N, P_2O_5 and K_2O/ha respectively.

Results and Discussion

Weed flora such as *Echinocloa colonam* L., *Cynodon dactylon* L., *Eleusine indica* among the grasses; *Cyperus rotundus* L among the sedges and *Eclipta alba* L., *Commelina bengalensis* L., *Ipomoea purpurea, Alternanthera sessillis, Physalis minima, Bacopa monnieri, Cyanotis cristata, Corchorus, Phyllanthus niruri, Ageratum conyzoides,* among the broad-leaved weeds, were found to be predominant weeds in aerobic rice.

Among seeding methods the higher grain yield was recorded with line sowing (S2) (3161.0 kg/ha) than the broadcasting (S1) (2366.0 kg/ha) method which might be due to the maintenance of less weed population and higher weed control efficiency.

Weed Density

The data pertaining to total weed density (No.m^{-2}) recorded at different intervals are presented in table 1 and 1a. The data revealed that weed density was significantly influenced by seeding methods and weed management practices.

Among the seeding methods at initial crop growth stage i.e. 20 DAS significantly more weed density was observed in the line sowing (S_2) (6.19) than the broadcasting (S1) (5.68) which might be due to the higher plant density and intra-specific competition for resources (Juraimi *at al*., 2013) [5]. However, at these stages (40, 60 DAS and at harvest) significantly lower weed density was observed in the line sowing than the broadcasting.

Scruiting of data shows that at initial crop growth stage i.e. 20 DAS the chemical treatments T_6 (5.08) was found effective in controlling all kinds of weeds and it was at par with T_5 (5.14) and T_7 (5.15), resulted in lowest weed density and these treatments were superior over that of T_1, T_3, T_4, T_8. The highest weed density was recorded with the weedy check (T_{10}) which was at par with T_9. At 20 DAS stage, the total weed population in the scheduled hand weeded plot was comparable with unweeded control. This was due to the fact that weed count was taken before imposing first hand weeding.

At 40 DAS, effective control of grasses, sedges and broad leaved weeds was noticed with handweeding thrice (20, 40 and 60 DAS) (6.17) which was significantly superior to other treatments. Which was followed by (T_6) (7.26) which in turn par with all other treatments T_7, T_5, T_8, T_1, T_3, T_4 and T_2 which are significantly superior over weedy check (T_{10}) (9.45). It might be due to fact that these weed management practices proved their capacity for better control of weeds with the application of pre and post emergence herbicides action. Azimsulfuron was found to be effective against Cyperus species (sedge) and broad leaf weeds as it was completely eliminated from treated plot (Singh, V.P *et al*. 2010) [5].

Further, the findings of the present investigation at 60 DAS and at harvest shown best results in the treatment T_9 as hand weeding (at 20, 40 and 60 DAS) recorded the lowest weed density and it was followed by T_6 which was on par with T_5, T_7 and T_8. Which were followed by T_2 was found at par with T_1, T_3 and T_4. This could be due to high bio-efficacy of sequential application of herbicides in controlling wide range of weed species (grasses, sedges and broad leaf weeds). It is attributed that *Echinochloa* was controlled by Cyhalofop butyl, sedges and broad leaf weeds by Azimsulfuron. Similar results were reported by Caseley *et al*, 1997.

Weed dry matter accumulation

The data pertaining to total weed dry matter accumulation (g m^{-2}) are presented in table 2 & 2a. The data revealed that weed dry matter accumulation was significantly influenced by

seeding methods and weed management practices. However, weed dry matter accumulation was not significantly influenced by the interaction of seeding methods and weed management practices.

Among the seeding methods, at initial stage of the crop growth at 20 DAS, less weed dry matter was observed in broadcasting (S_1) (3.50) than the line sowing (S_2) (3.94). Where as, at later stages the lowest weed density was observed with the line sowing than the broadcasting.

The lowest dry matter by weed was recorded with hand weeding (T_9) while highest with weedy check treatment (T_{10}) over rest of the treatments, at all growth stages of crop.

The dry matter accumulated by weeds at 20 DAS with handweeding thrice (20, 40 & 60 DAS) (T_9) treatment was comparable with unweeded control plot (T_{10}) as sampling was done before imposing the first hand weeding at 20 DAS.

At 40 DAS, the lowest dry weight of weeds was recorded in the handweeding thrice (T_9) which was at par with all other treatments which might be due to at this stage supplemental hand weeding along with sequential application of herbicides was not done hence there was no significant difference among those treatments. The superiority of Cyhalofop butyl might be that it controlled grassy weeds, while Chlorimuron ethyl + Metsulfuron methyl controlled sedges and broad leaf weeds simultaneously and resulted in lower weed density and lower weed dry weight. These results are in accordance with the findings of Abraham *et al*. (1999) [1] who opined that Cyhalofop-butyl was effective in controlling *Echinochloa sps* and reduced weed dry matter (Saini, 2005, Gopinath and Kundu, 2008) [9, 4].

Highest dry weight of weeds was recorded in unweeded control at all the stages of crop growth. At 60 DAS and at harvest, significantly lower weed dry matter was recorded with hand weeding which was followed by sequential application of herbicides along with hand weeding (T_6) and which in turn on par with (T_7), (T_5), (T_8); which are significantly superior over rest of the weed management practices. It might be due to the fact that application of herbicides alone controlled the weeds effectively at early stages of rice growth. However, a supplementary hand weeding controlled the weeds substantially at later stages of rice growth as evidenced by comparatively less dry weight of weeds. Thus, application of herbicides with hand weeding at 50 DAS provided broad spectrum weed control and maintained a lower crop-weed competition from the very commencement of the crop till maturity and registered the lowest weed dry matter. (Sanjoy Saha, 2005). Next best weed management practice was (T_2) which in turn par with (T_3), (T_1) and (T_4) which were significantly superior over un-weeded check (T_{10}).

Weed Control Efficiency (%)

Data presented in table 3 on weed control efficiency (per cent) and weed index (per cent) revealed that effect of weed management practices significantly influenced these parameters.

Among the seeding methods, significantly higher weed control efficiency was observed in the line sowing (S_2) than broadcasting (S_1). At 20 DAS, the highest weed control efficiency was noticed with T_6 (40.7 %) which was followed by T_7 treatment (37.3%). While at 40 DAS, it was with T_9 (59.7%) which was on par with T_6 (43.7%) and these two were closely followed by T_5 (43.0%).

At later crop growth stage (at 60 DAS), T_9 treatment recorded maximum weed control efficiency (95.5) and was closely followed by T_6 (95.3), T_5 (95.0), T_7 (94.9) and T_8 (94.8). Significantly lower weed dynamics resulted from supplemental hand weeding at 50 DAS in addition to sequential application of weedicides leading to extended period of weed control. Next treatment having higher weed control efficiency was T_2 followed by T_1, T_2, and T_3.

Table 1: Weed density (No m^{-2}) of aerobic rice at 20 and 40 DAS as influenced by weed management practices under different seeding methods.

T	Weed management practices	Seeding methods					
		20 DAS			40 DAS		
		S1	S2	Mean	S1	S2	Mean
T_1	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Metsulfuron methyl + Chlorimuron ethyl 4 g. ai ha^{-1} as PoE + Cyhalofop butyl 75 g. ai/ha as PoE at 15-20 DAS.	5.31 (27.3)	6.34 (39.2)	5.83 (33.3)	7.59 (56.8)	7.16 (50.4)	7.38 (53.6)
T_2	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Azimsulfuron 35g.ai ha^{-1} + Cyhalofop butyl 75 g. ai ha^{-1} as PoE 15-20 DAS.	5.24 (26.5)	6.00 (35.1)	5.62 (30.8)	7.53 (55.8)	7.09 (49.3)	7.31 (52.5)
T_3	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Pyrazosulfuron ethyl 20 g.ai ha^{-1} + Cyhalofop butyl 75 g. ai ha^{-1} as PoE at 15-20 DAS.	5.29 (27.0)	6.04 (35.6)	5.66 (31.3)	7.61 (57.0)	7.19 (50.7)	7.40 (53.9)
T_4	Bispyribac sodium 25 g ai ha^{-1} as early PoE fb 2-4-D 0.5 kg.ai ha^{-1} at 40 DAS.	5.47 (29.1)	6.35 (39.4)	5.91 (34.2)	7.58 (56.5)	7.18 (50.7)	7.38 (53.6)
T_5	T_1 fb Hand weeding at 50 DAS.	5.06 (24.7)	5.22 (26.5)	5.14 (25.6)	7.51 (55.5)	7.10 (49.5)	7.30 (52.5)
T_6	T_2 fb Hand weeding at 50 DAS.	5.01 (24.1)	5.16 (25.8)	5.08 (24.9)	7.47 (54.8)	7.05 (48.9)	7.26 (51.8)
T_7	T_3 fb Hand weeding at 50 DAS.	5.09 (25.0)	5.20 (26.2)	5.15 (25.6)	7.57 (56.5)	7.12 (49.7)	7.34 (53.1)
T_8	T_4 fb Hand weeding at 50 DAS.	5.26 (26.7)	6.13 (36.6)	5.69 (31.6)	7.54 (55.9)	7.12 (49.8)	7.33 (52.9)
T_9	Hand weeding at 20, 40, 60 DAS	7.49 (55.2)	7.70 (58.4)	7.60 (56.8)	6.23 (37.9)	6.10 (36.3)	6.17 (37.1)
T_{10}	Unweeded (control)	7.54 (55.9)	7.71 (58.5)	7.62 (57.2)	9.57 (90.6)	9.33 (86.1)	9.45 (88.41)
	Mean	5.71 (32.18)	6.21 (38.1)		7.62 (57.7)	7.24 (52.1)	
		SEm±	CD (0.05%)		SEm±	CD (0.05%)	
	F1	0.06	0.17		0.060	0.172	
	F2	0.13	0.39		0.134	0.38	
	F1×F2	0.19	NS		0.190	NS	

Note: Original values are given in parenthesis, which are transformed to $\sqrt{x} + 1$

Table 1a: Weed density (No m^{-2}) of aerobic rice at 60 DAS and at harvest as influenced by weed management practices under different seeding methods.

T	Weed management practices	Seeding methods					
		60 DAS			Harvest		
		S_1	S_2	Mean	S_1	S_2	Mean
T_1	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Metsulfuron methyl + Chlorimuron ethyl 4 g. ai ha^{-1} as PoE + Cyhalofop butyl 75 g. ai/ha as PoE at 15-20 DAS.	8.73 (75.3)	8.79 (76.4)	8.76 (75.8)	12.67 (159.9)	12.06 (148.5)	12.36 (154.2)
T_2	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Azimsulfuron 35g.ai ha^{-1} + Cyhalofop butyl 75 g. ai ha^{-1} as PoE 15-20 DAS.	8.70 (74.9)	8.39 (69.4)	8.54 (72.1)	12.52 (156.0)	12.09 (145.3)	12.31 (150.6)
T_3	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Pyrazosulfuron ethyl 20 g.ai ha^{-1} + Cyhalofop butyl 75 g. ai ha^{-1} as PoE at 15-20 DAS.	8.75 (75.7)	8.63 (73.6)	8.69 (74.7)	12.66 (160.0)	12.18 (147.5)	12.42 (153.7)
T_4	Bispyribac sodium 25 g ai ha^{-1} as early PoE fb 2-4-D 0.5 kg.ai ha^{-1} at 40 DAS.	8.77 (76.0)	8.71 (75.0)	8.74 (75.5)	12.70 (160.4)	11.95 (141.9)	12.33 (151.1)
T_5	T_1 fb Hand weeding at 50 DAS.	5.22 (26.5)	5.02 (24.3)	5.12 (25.4)	10.09 (101.0)	9.48 (89.0)	9.78 (95.0)
T_6	T_2 fb Hand weeding at 50 DAS.	5.02 (24.3)	4.88 (23.0)	4.95 (23.6)	10.04 (99.8)	9.40 (87.8)	9.72 (93.8)
T_7	T_3 fb Hand weeding at 50 DAS.	5.20 (26.2)	5.17 (25.8)	5.19 (26.0)	10.07 (100.6)	9.50 (89.5)	9.78 (95.0)
T_8	T_4 fb Hand weeding at 50 DAS.	6.13 (36.6)	5.26 (26.7)	5.69 (31.6)	10.15 (102.1)	9.51 (89.7)	9.83 (95.9)
T_9	Hand weeding at 20, 40, 60 DAS	4.94 (23.4)	4.72 (21.3)	4.83 (22.0)	7.79 (60.0)	7.46 (54.7)	7.63 (57.3)
T_{10}	Unweeded (control)	9.95 (98.0)	9.80 (95.2)	9.87 (96.6)	14.40 (208.6)	14.13 (199.1)	14.30 (203.8)
	Mean	7.14 (53.7)	6.94 (51.0)		11.32 (130.8)	10.78 (119.3)	
		SEm±	CD (0.05%)		SEm±	CD (0.05%)	
	F1	0.057	0.163		0.132	0.380	
	F2	0.127	0.365		0.297	0.851	
	F1×F2	0.180	NS		0.42	NS	

Note: Original values are given in parenthesis, which are transformed to $\sqrt{x} + 1$

Table 2: Weed dry weight (g m^{-2}) of aerobic rice at 20 and 40 DAS as influenced by weed management practices under different seeding methods.

T	Weed management practices	Seeding methods					
		20 DAS			40 DAS		
		S_1	S_2	Mean	S_1	S_2	Mean
T_1	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Metsulfuron methyl + Chlorimuron ethyl 4 g. ai ha^{-1} as PoE + Cyhalofop butyl 75 g. ai ha^{-1} as PoE at 15-20 DAS.	3.46 (11.0)	3.81 (13.6)	3.64 (12.33)	9.47 (88.7)	8.91 (78.4)	9.19 (83.6)
T_2	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Azimsulfuron 35g.ai ha^{-1} + Cyhalofop butyl 75 g. ai ha^{-1} as PoE 15-20 DAS.	3.38 (10.4)	3.70 (12.9)	3.54 (11.70)	9.39 (87.3)	8.81 (76.8)	9.10 (82.0)
T_3	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Pyrazosulfuron ethyl 20 g.ai ha^{-1} + Cyhalofop butyl 75 g. ai ha^{-1} as PoE at 15-20 DAS.	3.29 (10.6)	3.77 (13.2)	3.53 (11.95)	9.48 (89.0)	8.95 (79.2)	9.21 (84.1)
T_4	Bispyribac sodium 25 g ai ha^{-1} as early PoE fb 2-4-D 0.5 kg.ai ha^{-1} at 40 DAS.	3.40 (10.9)	3.84 (13.8)	3.62 (12.36)	9.43 (88.0)	8.93 (79.0)	9.18 (83.5)
T_5	T_1 fb Hand weeding at 50 DAS.	3.30 (10.0)	3.79 (13.4)	3.55 (11.71)	9.35 (86.5)	8.84 (77.3)	9.09 (81.9)
T_6	T_2 fb Hand weeding at 50 DAS.	3.22 (9.5)	3.67 (12.6)	3.44 (11.06)	9.30 (85.6)	8.79 (76.4)	9.05 (81.0)
T_7	T_3 fb Hand weeding at 50 DAS.	3.25 (9.9)	3.80 (13.5)	3.52 (11.73)	9.44 (88.2)	8.87 (77.8)	9.15 (83.0)
T_8	T_4 fb Hand weeding at 50 DAS.	3.49 (11.2)	3.87 (14.0)	3.68 (12.65)	9.39 (87.3)	8.88 (77.8)	9.13 (82.5)
T_9	Hand weeding at 20, 40, 60 DAS	(4.12) 16.0	4.52 (19.6)	4.32 (17.80)	7.76 (59.2)	7.59 (56.7)	7.67 (58.0)
T_{10}	Unweeded (control)	4.14 (16.4)	4.65 (20.8)	4.40 (18.63)	12.12 (146.0)	11.94 (141.8)	12.63 (143.9)
	Mean	(3.50) 11.62	3.94 (14.7)		9.57 (90.6)	9.11 (82.1)	
		SEm±	CD		SEm±	CD(0.05%)	
	F1	0.07	0.21		0.06	0.17	
	F2	0.16	0.48		0.13	0.38	
	F1×F2	0.23	NS		0.19	NS	

Note: Original values are given in parenthesis, which are transformed to $\sqrt{x} + 1$

Table 2a: Weed dry weight (g m^{-2}) of aerobic rice at 60 DAS and at harvest as influenced by weed management practices under different seeding methods.

T	Weed management practices	Seeding methods					
		60 DAS			Harvest		
		S_1	S_2	Mean	S_1	S_2	Mean
T_1	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Metsulfuron methyl + Chlorimuron ethyl 4 g. ai ha^{-1} as PoE + Cyhalofop butyl 75 g. ai ha^{-1} as PoE at 15-20 DAS.	11.74 (136.9)	11.61 (133.9)	11.67 (135.4)	13.61 (184.4)	13.27 (175.2)	13.44 (179.8)
T_2	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Azimsulfuron 35g.ai ha^{-1} + Cyhalofop butyl 75 g. ai ha^{-1} as PoE 15-20 DAS.	11.77 (137.6)	11.52 (131.9)	11.65 (134.7)	13.57 (183.3)	13.21 (173.7)	13.39 (178.5)
T_3	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Pyrazosulfuron ethyl 20 g.ai ha^{-1} + Cyhalofop butyl 75 g. ai ha^{-1} as PoE at 15-20 DAS.	11.78 (138.0)	11.60 (133.6)	11.69 (135.8)	13.63 (185.0)	13.26 (175.0)	13.45 (180.0)
T_4	Bispyribac sodium 25 g ai ha^{-1} as early PoE fb 2-4-D 0.5 kg.ai ha^{-1} at 40 DAS.	11.82 (139.0)	11.64 (134.6)	11.73 (136.8)	13.68 (186.2)	13.30 (176.1)	13.49 (181.1)
T_5	T_1 fb Hand weeding at 50 DAS.	3.78 (13.3)	3.32 (10.1)	3.55 (11.7)	12.54 (156.6)	12.19 (147.7)	12.37 (152.2)
T_6	T_2 fb Hand weeding at 50 DAS.	3.68 (12.5)	3.29 (9.8)	3.48 (11.2)	12.44 (154.0)	12.11 (145.8)	12.27 (149.9)
T_7	T_3 fb Hand weeding at 50 DAS.	3.80 (13.5)	3.30 (10.2)	3.55 (11.8)	12.67 (159.6)	12.23 (148.7)	12.45 (154.2)
T_8	T_4 fb Hand weeding at 50 DAS.	3.84 (13.8)	3.39 (10.5)	3.61 (12.1)	12.75 (161.6)	12.27 (149.8)	12.51 (155.7)
T_9	Hand weeding at 20, 40, 60 DAS	3.53 (11.5)	3.23) (9.5)	3.38 (10.5)	6.80 (45.7)	5.99 (35.5)	6.39 (40.6)
T_{10}	Unweeded (control)	15.5 (240.6)	15.4) (236.4)	15.47 (238.5)	16.17 (260.6)	15.89 (251.6)	16.03 (256.1)
	Mean	85.6	82.0		167.7	157.9	
		SEm±	CD (0.05%)		SEm±	CD	
	F1	0.65	1.88		0.07	0.216	
	F2	1.47	4.21		0.168	0.48	
	F1×F2	2.08	NS		0.238	NS	

Note: Original values are given in parenthesis, which are transformed to $\sqrt{x} + 1$

Table 3: Weed index, weed control efficiency (60 DAS) and grain yield of aerobic rice as influenced by weed management practices under different seeding methods.

T	weed management practices	Weed index (%)			WCE (%)	Grain yield (kg/ha)		
		S1	S2	Mean		S1	S2	Mean
T_1	Pretilachlor 0.75 kg ai ha^{-1} as PE fb (Metasulfuron methyl + Chlorimuron ethyl) 4 g. ai ha^{-1} as PoE + Cyhalofop butyl 75 g. ai ha^{-1} as PoE at 15-20 DAS.	21.1	26.7	23.9	43.2	2357	2978	2668
T_2	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Azimsulfuron 35 g.ai ha^{-1} + Cyhalofop butyl 75 g. ai/ha as PoE 15-20 DAS.	12.0	22.9	17.4	43.5	2630	3135	2883
T_3	Pretilachlor 0.75 kg ai ha^{-1} as PE fb Pyrazosulfuron 20 g.ai/ha + Cyhalofop butyl 75 g. ai ha^{-1} as PoE at 15-20 DAS.	22.0	20.2	21.1	43.0	2330	3245	2787
T_4	Bispyribac sodium 25 g ai ha^{-1} as early PoE fb 2-4-D 0.5 kg.ai ha^{-1} at 40 DAS.	25.8	26.7	26.3	42.6	2217	2978	2598
T_5	T_1 fb Hand weeding at 50 DAS.	11.1	10.4	10.7	95.0	2658	3643	3150
T_6	T_2 fb Hand weeding at 50 DAS.	9.6	8.1	8.9	95.3	2701	3735	3218
T_7	T_3 fb Hand weeding at 50 DAS.	14.8	10.9	12.8	94.9	2546	3622	3084
T_8	T_4 fb Hand weeding at 50 DAS.	14.5	15.1	14.8	94.8	2557	3449	3003
T_9	Hand weeding at 20, 40, 60 DAS	0.0	0.0	0.0	95.5	2989	4064	3526
T_{10}	Unweeded (control)	67.9	74.1	71.0	0	958	1051	1005
	Mean	19.88	21.51			2366	3161	
						SEm±	CD (0.05%)	
	F1					44.73	128.09	
	F2					100.0	286.4	
	F1×F2					141.4	405.0	

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