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Impact of Integrated Weed Management Practices on Yield and Economics of Semidry Rice

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Authors' contributions

This work was carried out in collaboration among all authors. Authors TRP and MG done conceptualization and designing of the research work. Author VS performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors TRP, MG and AS managed the analyses of the data and interpretation. Author VS managed execution of lab experiments, data collection and the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted during *Kharif,* 2019 at Agricultural Research Station, Rajendranagar, Hyderabad to study the effect of integrated weed management practices on weed density, weed dry weight, yield and economics of semidry rice. Among all the treatments pyrazosulfuron ethyl @ 20 g a.i ha^{-1} *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} *fb* mechanical weeding at 50 DAS recorded significantly lower weed density, weed dry weight with highest weed control efficiency. Grain yield and B:C ratio were also recorded highest from the same treatment in semidry rice system of cultivation. This treatment was statistically comparable with hand weeding plot.

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1. INTRODUCTION

Rice (*Oryza sativa* L.) is the major food crop of the World. It has been cultivated in 114 countries across the world. India is the second largest rice producing country in the world with an area of 43.79 M ha, having production and productivity of 112.91 M t and 2578 kg ha^{-1} respectively [1]. In India, rice is being cultivated by three principal systems *viz.,* transplanting, dry seeding and wet seeding. Irrigated rice is spreading over 26.51 M ha (60.06%) of total area [1]. It requires about 150 ha-cm of water and engagement of labor for transplanting and weeding [2]. To reduce the share of water in rice cultivation, it is imperative to develop new ways of growing rice that uses less water, while maintaining high yields.

Semidry system of rice cultivation (Dry direct seeded irrigated) is a system associated with upland condition in the early and low land situation at later stages of crop growth. In semidry system, rice is treated as rainfed for about 40-45 days, and when sufficient water is available, it is converted into wet crop [3]. It eliminates the nursery raising, puddling and transplanting operations reducing 25% of total human labour involved in rice cultivation [4]. In dry seeded rice ecosystem, weeds and crop emerge simultaneously during the initial 4-6 weeks as it provides congenial conditions for weed growth due to absence of stagnant water [5]. The extent of yield reduction of rice due to weeds has been estimated up to 95% [6] and 46.0 to 63.1% [7]. Hand weeding though efficient is expensive and often limited by scarcity of labor in time. This is more pertinent at command areas where glut of demand rises soon after release of project water for transplantation. On the other hand, herbicides offer economic and efficient weed control if applied at proper dose and stage. However, use of same herbicide or herbicides having the same mode of action repeatedly may lead to the weed resistance problem and also weed shifts [8]. Integrated weed management practices like cultural, mechanical, herbicides and biological control seems to be the best strategy as weeds are subjected to multiple attacks. Keeping in view a field experiment was conducted to study the effect of integrated weed management practices in semidry rice.

2. MATERIALS AND METHODS

A field experiment was carried out during *Kharif,* 2019 at Agricultural Research Station, Rajendranagar, Hyderabad, situated at an altitude of 542.3 m above mean sea level at 17°19 'N latitude and 78°23' E longitude. The soil of experimental site was loamy sand with soil pH of 8.04, and medium in organic carbon (0.53%), low in available N (204.47 kg ha^{-1}), P (21.26 kg ha^{-1}) and high in available K (475.78 kg ha^{-1}). The experiment comprised of three pre emergence herbicides pendimethalin (30% EC) @ 1 kg a.i ha^{-1}, oxyfluorfen (23.5% EC) @ 200 g a.i ha^{-1} and pyrazosulfuron ethyl (10% WP) @ 20 g a.i ha^{-1} which were followed by three different post emergence herbicides viz., bispyribac-sodium (10% SC) @ 25 g a.i ha^{-1}, penoxsulam (1.02%) + cyhalofop-p-butyl (5.1%) OD (25+127 g a.i ha^{-1}) and chlorimuron ethyl + metsulfuron methyl (20% WP) @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl (9.3% EC) @ 60 g a.i ha^{-1}. All these treatment combinations (sequential application of pre and post emergence herbicides) were integrated with mechanical weeding at 50 DAS, hand weeding treatment at 20, 40, and 60 DAS and unweeded control. These treatments were replicated thrice in a randomized block design. A short duration rice variety KNM-118 (Kunaram Sannalu) was sown as dry seeds in solid rows at 30 cm spacing. A seed rate of 50 kg ha^{-1} was used. Recommended dose of 120:60:40 kg ha^{-1} of N, P and K were applied uniformly. The entire P_2O_5 and K_2O were applied as basal. The nitrogen was applied in three splits equally at sowing, active tillering and panicle initiation stage. All the herbicides were applied using knapsack sprayer fitted with flat fan nozzle at spray volume of 500 l ha^{-1}. The data on weed density and weed dry weight were recorded with the help of quadrant (0.5 m × 0.5 m). The weed was showing wide variation and having the value zero, were subjected to the square root transformation of $\sqrt{x+1}$ to make the analysis of variance valid. All the data obtained in the study were statistically analyzed using F-test as suggested by Gomez and Gomez [9]. Critical difference values at P=0.05 were used to determine the significance of differences between means.

3. RESULTS AND DISCUSSION

3.1 Weed Flora

Weed flora observed in the experimental plot were *Trianthema portulacastram, Parthenium hysterophorus, Alternanthera sessilis, Digera arvensis, Corchorus capsularis,* among broad leaved weeds. *Echinocloa colona* was the dominant weed among grasses and *Cyperus rotundus* was the major sedge. The broad leaved weeds were dominant weeds compared to grasses and sedges. Similar findings showing the predominance of broad leaved weeds was reported by Yogananda et al. [10] in dry direct seeded rice.

3.2 Weed Density and dry Weight

All the weed control treatments found effective in reducing total weed density and dry matter as compared to unweeded control. Significantly lowest weed density and dry matter were recorded in hand weeding treatment (at 20, 40 and 60 DAS) and was found to be on par with pyrazosulfuron ethyl @ 20 g a.i ha^{-1} PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} PoE. It was on par with oxyfluorfen @ 200 g a.i ha^{-1} PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} PoE and oxyfluorfen @ 200 g a.i ha^{-1} PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} PoE. Mechanical weeding recorded higher weed density and dry matter among weed control treatments. Inaccessibility of the power weeder in the narrow intra row area could not remove weeds resulted in more weed density as reported by Reshma [11]. Unweeded control recorded highest weed density and dry matter. Uncontrolled weed growth throughout the crop growth period might have contributed for higher dry matter production as reported by Kashid [12] and Yogananda et al. [10].

3.3 Weed Control Efficiency

The weed control efficiency was found highest in hand weeding treatment. Among the herbicidal treatments highest weed control efficiency was recorded in pyrazosulfuron ethyl @ 20 g a.i ha^{-1} PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} PoE. It was found on par with oxyfluorfen @ 200 g a.i ha^{-1} PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} PoE and oxyfluorfen @ 200 g a.i ha^{-1} PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} PoE.

3.4 Phytotoxicity

Application of pre-emergence herbicide oxyfluorfen @ 200 g a.i ha^{-1} has shown phytotoxicity symptoms on the semidry crop in early stages (15 to 20 days after spraying). The plant has shown symptoms of chlorosis and yellowing of the leaves. As crop growth progressed the phytotoxicity symptoms disappeared. Similar findings were reported by Ramachandiran and Balasubramanian [13] and Reshma [11].

3.5 Yield

Significantly higher grain yield was recorded in hand weeding treatment at 20, 40 and 60 DAS (4048 kg ha^{-1}). It was on par with the grain yield obtained in pyrazosulfuron ethyl @ 20 g a.i ha^{-1} PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} PoE (3823 kg ha^{-1}). Grain yield recorded from oxyfluorfen @ 200 g a.i ha^{-1} PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} PoE (3592 kg ha^{-1}) and oxyfluorfen @ 200 g a.i ha^{-1} PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} PoE (3556 kg ha^{-1}) was higher than the other treatments. These herbicides combinations have effectively controlled grassy and broad leaved weeds at all critical stages of crop growth. Eventually, less competition from weeds might have enabled the crop plants to utilize sufficient light, water, nutrients and space throughout the crop growth period to produce more yield attributes and grain yield duly synthesizing and translocating more photosynthates from source to sink. These results are in agreement with Kashid et al. [12].

3.6 Economics

Among different weed management practices, highest net returns (Rs 48956) and B:C ratio (2.41) was recorded in pyrazosulfuron ethyl @ 20 g a.i ha^{-1} PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} PoE. While lowest net returns (Rs 3692) and B:C ratio (1.11) were recorded in unweeded control. Highest grain yield and reduced labour costs attributed to the increased net returns in this treatment.

Table 1. Effect of integrated weed management practices on total density of weeds (no. m^{-2}) in semidry rice

T. No	Tretaments	20 DAS	40 DAS	60 DAS	Harvest
T_1	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	6.56 (42.33)	7.23 (52.20)	6.05 (35.67)	9.43 (88.00)
T_2	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	6.73 (44.33)	9.69 (93.00)	6.70 (44.00)	9.46 (88.67)
T_3	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	6.48 (41.00)	7.17 (51.00)	5.91 (34.00)	8.51 (73.00)
T_4	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	3.22 (9.67)	5.34 (27.53)	4.68 (21.00)	8.18 (66.33)
T_5	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	3.36 (10.33)	9.09 (82.17)	6.15 (37.00)	8.83 (77.33)
T_6	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	3.51 (11.33)	5.06 (24.70)	4.51 (19.33)	8.40 (69.67)
T_7	Pyrazosulfuron ethyl @ 20 g a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS	5.41 (28.67)	6.83 (46.03)	5.51 (29.33)	8.31 (68.33)
T_8	Pyrazosulfuron ethyl @ 20g a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	5.47 (29.33)	9.03 (80.60)	6.07 (36.00)	9.38 (87.33)
T_9	Pyrazosulfuron ethyl @ 20 g a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	5.13 (25.33)	4.84 (22.43)	4.16 (16.33)	7.91 (62.33)
T_{10}	Mechanical weeding at 20, 40, and 60 DAS.	8.48 (71.33)	9.62 (91.90)	8.30 (68.67)	10.05 (100.33)
T_{11}	Hand weeding at 20, 40, and 60 DAS.	8.28 (67.67)	4.15 (16.40)	3.69 (12.67)	5.70 (31.67)
T_{12}	Unweeded control.	9.50 (89.33)	12.39 (152.87)	13.86 (192.67)	17.26 (298.00)
	SE(m) ±	0.37	0.46	0.36	0.60
	CD (p=0.05)	**1.09**	**1.35**	**1.04**	**1.75**
	CV %	10.7	10.6	10.2	11.0

Figures in parenthesis are means of original value that is transformed by √(X+1) and given outside parenthesis

Table 2. Effect of integrated weed management practices on total dry matter of weeds (no. m^{-2}) in semidry rice

T. No	Tretaments	20 DAS	40 DAS	60 DAS	Harvest
T_1	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	2.31 (4.34)	4.77 (21.80)	4.47 (18.99)	9.51 (90.53)
T_2	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	2.27 (4.19)	6.18 (37.19)	5.31 (27.66)	9.82 (95.47)
T_3	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	2.22 (4.01)	4.41 (18.50)	3.85 (13.92)	8.84 (78.03)
T_4	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	1.49 (1.23)	3.55 (11.60)	3.62 (12.17)	8.80 (77.01)
T_5	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	1.44 (1.12)	5.92 (34.11)	4.80 (22.27)	9.24 (84.66)
T_6	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	1.52 (1.33)	3.28 (9.78)	3.32 (10.01)	8.97 (79.83)
T_7	Pyrazosulfuron ethyl @ 20 g a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS	1.80 (2.29)	4.15 (16.30)	3.91 (14.43)	8.90 (78.40)
T_8	Pyrazosulfuron ethyl @ 20g a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	1.77 (2.15)	5.50 (30.01)	4.79 (21.99)	9.97 (98.73)
T_9	Pyrazosulfuron ethyl @ 20 g a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	1.83 (2.39)	3.11 (8.70)	2.97 (7.83)	8.43 (70.96)
T_{10}	Mechanical weeding at 20, 40, and 60 DAS.	3.25 (9.71)	7.92 (62.01)	9.19 (83.96)	11.42 (130.10)
T_{11}	Hand weeding at 20, 40, and 60 DAS.	3.28 (9.84)	2.69 (6.27)	2.12 (3.57)	5.77 (32.37)
T_{12}	Unweeded control.	3.58 (11.86)	9.89 (98.03)	14.16 (199.77)	19.99 (359.91)
	SE(m) ±	0.13	0.33	0.32	0.53
	CD (p=0.05)	**0.37**	**0.97**	**0.86**	**1.56**
	CV %	10.6	11.2	10.4	10.2

Figures in parenthesis are means of original value that is transformed by √(X+1) and given outside parenthesis

Table 3. Effect of integrated weed management practices on weed control efficiency (%) in semidry rice

T. No	Tretaments	20 DAS	40 DAS	60 DAS	Harvest
T_1	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	63.41	77.76	90.49	76.91
T_2	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	64.64	62.06	86.16	75.50
T_3	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	66.22	81.13	93.03	80.48
T_4	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	89.66	88.17	93.91	80.77
T_5	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	90.56	65.20	88.85	78.59
T_6	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	88.81	90.02	94.99	79.97
T_7	Pyrazosulfuron ethyl @ 20 g a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS	80.66	83.37	92.78	80.38
T_8	Pyrazosulfuron ethyl @ 20g a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	81.84	69.38	88.99	74.57
T_9	Pyrazosulfuron ethyl @ 20 g a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	79.82	91.13	96.08	82.50
T_{10}	Mechanical weeding at 20, 40, and 60 DAS.	18.13	36.75	57.97	65.62
T_{11}	Hand weeding at 20, 40, and 60 DAS.	17.00	93.61	98.21	93.52
T_{12}	Unweeded control.	0.00	0.00	0.00	0.00

Table 4. Effect of integrated weed management practices on grain yield (kg ha^{-1}) and economics of semidry rice

T. No	Tretaments	Grain yield (kg ha^{-1})	Gross Returns (Rs.)	Net returns (Rs.)	B:C ratio
T_1	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	3131	69278	34263	1.98
T_2	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	2737	60202	23500	1.64
T_3	Pendimethalin @ 1 kg a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	3146	69887	34335	1.97
T_4	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	3556	77893	43190	2.24
T_5	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	2853	62732	26342	1.72
T_6	Oxyfluorfen @ 200 g a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	3592	78679	43439	2.23
T_7	Pyrazosulfuron ethyl @ 20 g a.i ha^{-1} as PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS	3255	72041	37778	2.10
T_8	Pyrazosulfuron ethyl @ 20g a.i ha^{-1} as PE *fb* penoxsulam + cyhalofop-p-butyl (25+127 g a.i ha^{-1}) as PoE at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	2969	65713	29763	1.83
T_9	Pyrazosulfuron ethyl @ 20 g a.i ha^{-1} as PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} at 2-4 leaf stage of weeds *fb* MW at 50 DAS.	3823	83765	48965	2.41
T_{10}	Mechanical weeding at 20, 40, and 60 DAS.	2591	57187	19817	1.53
T_{11}	Hand weeding at 20, 40, and 60 DAS.	4048	88139	43269	1.96
T_{12}	Unweeded control.	1648	36562	3692	1.11
	SE(m) ±	172.48			
	CD (p=0.05)	**505.80**			
	CV %	9.6			

Synthesizing and translocating more photosynthates from source to sink. These results are in agreement with Kashid et al. [12]

4. CONCULUSION

It was concluded that application of pyrazosulfuron ethyl @ 20 g a.i ha^{-1} PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl PoE @ 60 g a.i ha^{-1} *fb* mechanical weeding at 50 DAS or oxyfluorfen @ 200 g a.i ha^{-1} PE *fb* chlorimuron ethyl + metsulfuron methyl @ 4 g a.i ha^{-1} + fenoxaprop-p-ethyl @ 60 g a.i ha^{-1} PoE *fb* mechanical weeding at 50 DAS and oxyfluorfen @ 200 g a.i ha^{-1} PE *fb* bispyribac-sodium @ 25 g a.i ha^{-1} PoE *fb* mechanical weeding at 50 DAS found most effective and economical in controlling weeds under semidry rice system of cultivation.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Directorate of Economics and Statistics (DES). Agricultural statistics at a glance. 2017-18 report.
2. Mahajan G, Chauhan BS. Performance of dry direct seeded rice in response to genotype and seeding rate. Agronomy Journal. 2016;108:257-265.
3. Chatterjee BN, Maiti S. Principles and practices of rice growing. Oxford and IBH Publishing Company, New Delhi. 1985; 314.
4. Dhanapal GN, Sanjay MT, Nagarjun P, Sandeep A. Integrated weed management for control of complex weed flora in direct seeded upland rice under Southern transition zone of Karnataka. Indian Journal of Weed Science. 2018;50(1):33-36.
5. Hemalatha K, Ramana AV, Bisen N, Rani M. Effect of weed management practices on yield and economics of semidry rice. Journal of Pure and Applied Microbiology. 2017;11(2): 1027-1032.
6. Naresh RK, Gupta RK, Singh RV, Singh D, Singh B, Singh VK, Jain N, Bhatia A. Direct seeded rice: Potential, performance and problems- A review. Current Advances in Agricultural Science. 2011;3 (2):105-110.
7. Choudhary VK, Anil D. Herbicide weed management effect on weed dynamics, crop growth and yield in direct-seeded rice. Indian Journal of Weed Science. 2018; 50(1):6-12.
8. Yakadri M, Madhavi M, Ramprakash T, Leela Rani. Herbicide combinations for control of complex weed flora in transplanted rice. Indian Journal of Weed Science. 2016;48(2):155-157.
9. Gomez KA, Gomez AA. Statistical procedure for agricultural research. 2nd Edition. John Willey and Sons, New York. 1984;680.
10. Yogananda SB, Thimmegowda P, Shruthi GK. Sequential application of pre- and post-emergence herbicides for control of complex weed flora in dry direct-seeded rice under Cauvery command area of Karnataka. Indian Journal of Weed Science. 2019;51(2):111-115.
11. Reshma RS. Efficacy and economics of weed management strategies in aerobic rice (*Oryza sativa* L.). MSc (Ag) thesis. Kerala Agricultural University, Thrissur, India; 2014.
12. Kashid NV, Jadhav VT, Patil YJ. Herbicides for weed management in dry direct-seeded rice. Indian Journal of Weed Science. 2019;51(1):72-74.
13. Ramachandrian K, Balasubramanian R. Efficacy of herbicides for weed control in aerobic rice. Indian Journal of Weed Science. 2012;44(2):118-121.

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