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Herbicide options for weed management in dry direct-seeded rice

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ABSTRACT

A field study was conducted during the kharif seasons of 2021 and 2022 to evaluate the efficacy of different pre and post emergence herbicides in dry direct seeded rice (DDSR) at the Agricultural Research Station, Kunaram, Telangana state, India. This study highlights the importance of effective weed management strategies in dry direct-seeded rice (DDSR), particularly under the conditions of Telangana, India.Fourteen different treatments were tested, including both pre-emergence (PE) and post-emergence (PoE) herbicides, along with manual weeding and an untreated control. Pre-emergence herbicides included pendimethalin 38.7% CS, pyrazosulfuron-ethyl 10% WP, and a ready-mix of pendimethalin 38.4% + pyrazosulfuron-ethyl 0.85% ZC (Ready mix). Post-emergence herbicides included triafamone 20% + ethoxysulfuron 10% WG (Ready mix), penoxsulam + cyhalofop-butyl 5.1% OD (Ready mix), and metsulfuron-methyl 10% + chlorimuron-ethyl 10% WP (Ready mix). The pooled data analysis revealed that the application of pendimethalin 38.7% CS as a pre-emergence (PE) herbicide, followed by penoxsulam 1.02% + cyhalofop-butyl 5.1% OD (ready mix) as a post-emergence (PoE) herbicide, was the most effective treatment against grasses, sedges, and broadleaved weeds. The weed control efficiency at 15, 30, and 60 DAS was higher (55.79%, 79.52%, and 83.92%, respectively) with the application of pendimethalin 38.7% CS (PE) followed by penoxsulam 1.02% + cyhalofop-butyl 5.1% OD (ready mix) PoE compared to other chemical herbicides and the untreated control. Similarly, higher rice grain and straw yields, along with maximum net returns, were observed with these combinations. Therefore, it was concluded that the pre-emergence application of pendimethalin 38.7% CS, followed by the post-emergence application of penoxsulam 1.02% + cyhalofop-butyl 5.1% OD (ready mix) or triafamone 20% + ethoxysulfuron 10% WG (ready mix), appeared to be a viable strategy for weed control in dry direct-seeded rice, ensuring higher economic returns.

Keywords: *Ethoxysulfuron, DDSR, Direct seeded rice, Pendimethalin, PE, Penoxsulam, PoE, Pyrazosulfuron-ethyl, Triafamone, Weed*

INTRODUCTION

Rice (Oryza sativa L.) is the staple food in most Indian states and plays a major role in Indian economy by contributing 45 percent of the total food grain production. In India, rice is grown in an area of 45.12 million hectares annually with a production of 123.8 million tonnes and an average productivity of 2.7 tha^{-1} (Anonymous, 2023). In Telangana rice is grown in 4.25 m ha with annual production of 16.0 mt and the productivity is about 3541 kg ha^{-1} [1].

Dry direct-seeded rice (DDSR) is an impending version of upland rice cultivation increasingly adopted to conserve water, labor, and energy compared to puddled transplanted rice (PTR). In DDSR, rice crop is established by sowing the seeds directly in the non-puddled and non-saturated soil [9]. This method can be applied in both upland rice and aerobic rice [7]. The advantages offered by DDSR, namely rapid planting, easy mechanization, less labor and water requirement, and early maturity with fewer environmental footprints have brought almost 22% of the total rice area in Asia under DSR [5]. However, weed management poses a significant challenge in DDSR compared to PTR.

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In PTR systems, standing water suppresses weed growth, and transplanted rice seedlings have a competitive edge over weeds. In contrast, in DDSR, weeds germinate and grow simultaneously with crop seedlings in moist soil, leading to intense competition for resources. This competition can cause yield losses of 50% to 90% if weeds are not effectively controlled [13&14]. Moreover, the adoption of DDSR often leads to a shift in weed flora composition, favoring more difficult-to-control species..

Herbicides, both pre-emergence (PE) and post-emergence (PoE), provide selective, timely, effective, and cost-efficient weed control compared to manual weeding, giving crops a competitive advantage over weeds. However, managing the diverse and complex weed flora in DSR is challenging with the application of a single pre- or post-emergence herbicide [10]. Additionally, the application of PE herbicides can sometimes be hindered by inconsistent soil moisture and unpredictable weather conditions.The continuous use of a single herbicide or those with a similar mode of action can lead to the emergence of herbicide-resistant weeds, which are increasingly difficult to control. Currently available herbicides for rice have a limited spectrum of activity, and their effectiveness diminishes when used in isolation.To address these challenges, the combined PoE application of two or more herbicides with different modes of action can offer broad-spectrum weed control, enhance efficacy, and delay the onset of herbicide resistance. With this in mind, the present study evaluated the bio-efficacy of various pre- and post-emergence herbicides for effective weed management in dry DSR.

MATERIAL AND METHODS

A field experiment was conducted during *kharif* seasons of 2021 and 2022 at Agriculture Research Station, Kunaram, Telangana State, India situated at an altitude of 231 AMSL at 18.5272°' N latitude and 79.4943° f' E longitude. The soil of the experiment cite was clay in texture and slightly saline in reaction. It had normal electrical conductivity (0.32 dS m^{-1}) and neutral in reaction (pH 7.20). The organic carbon content was low (0.28–0.38%) while low in available nitrogen (185 kg ha^{-1}), phosphorus (10.79 kg ha^{-1}) and potash content (211 kg ha^{-1}). The experiment was laid out in randomized block design with three replications.

A total of fourteen treatments were evaluated,T1: Pendimethalin 38.7% CS 677.25 g/ha (PE) followed by triafamone 20% + ethoxysulfuron 10% WG 44+22.5 g/ha (Ready mix) (PoE),T2: Pendimethalin 38.7% CS 677.25 g/ha (PE) followed by penoxsulam 1.02% + cyhalofop-butyl 5.1% OD 135 g/ha (Ready mix) (PoE),T3: Pendimethalin 38.7% CS 677.25 g/ha (PE) followed by metsulfuron methyl 10% + chlorimuron ethyl 10% WP 4 g/ha + cyhalofop-butyl 10% EC 75 g/ha (Tank mix) (PoE),T4: Pendimethalin 38.7% CS 677.25 g/ha (PE) followed by mechanical weeding at 20-25 DAS and 40-45 DAS,T5: Pyrazosulfuron-ethyl 10% WP 20 g/ha (PE) followed by triafamone 20% + ethoxysulfuron 10% WG 44+22.5 g/ha (Ready mix) (PoE),T6: Pyrazosulfuron-ethyl 10% WP 20 g/ha (PE) followed by penoxsulam 1.02% + cyhalofop-butyl 5.1% OD 135 g/ha (Ready mix) (PoE),T7: Pyrazosulfuron-ethyl 10% WP 20 g/ha (PE) followed by metsulfuron methyl 10% + chlorimuron ethyl 10% WP 4 g/ha + cyhalofop-butyl 10% EC 75 g/ha (Tank mix) (PoE),T8: Pyrazosulfuron-ethyl 10% WP 20 g/ha (PE) followed by mechanical weeding at 20-25 DAS and 40-45 DAS,T9: Pendimethalin 38.4% + pyrazosulfuron-ethyl 0.85% ZC 900 + 20 g/ha (Ready mix) (PE) followed by triafamone 20% + ethoxysulfuron 10% WG 44+22.5 g/ha (Ready mix) (PoE),T10: Pendimethalin 38.4% + pyrazosulfuron-ethyl 0.85% ZC 900 + 20 g/ha (Ready mix) (PE) followed by penoxsulam 1.02% + cyhalofop-butyl 5.1% OD 135 g/ha (Ready mix) (PoE),T11: Pendimethalin 38.4% + pyrazosulfuron-ethyl 0.85% ZC 900 + 20 g/ha (Ready mix) (PE) followed by metsulfuron methyl 10% + chlorimuron ethyl 10% WP 4 g/ha + cyhalofop-butyl 10% EC 75 g/ha (Tank mix) (PoE),T12: Pendimethalin 38.4% + pyrazosulfuron-ethyl 0.85% ZC 900 + 20 g/ha (Ready mix) (PE) followed by mechanical weeding at 20-25 DAS and 40-45 DAS,T13: T2 + need-based manual weeding (100% weed-free),T14: Unweeded control.These treatments were evaluated for their efficacy in weed management

The net plot size was 7 x 4.5 m. The paddy variety KNM 1638 was soaked in water for 6 hrs prior to sowing the rice crop was sown in the first week of July with seed cum fertilizer drill, using a seed rate of 50 kg/ha and maintaining 25 cm distance between crop rows. N-P-K fertilizer was used @ 120-60-40 kg ha^{-1}, respectively. 1/3 of the recommended dose of nitrogen (40 kg ha^{-1}), full dose of phosphorus (60 kg ha^{-1}) and half dose of potash (20 kg ha^{-1}) were applied at after main field preparation and the remaining nitrogen was top-dressed in two equal splits dose, at active tillering (40 kg ha^{-1})and at panicle initiation stage (40 kg ha^{-1}). The remaining half of the potassium (20 kg ha^{-1}) was applied at the panicle initiation stage. Herbicides were applied using a knapsack sprayer fitted with a flat-fan nozzle with a spray volume of 440 lha^{-1}.

The pooled analysis of data on weed dynamics (density, dry biomass) was recorded at 15, 30 DAS and at 60 DAS from two randomly selected quadrates (1 x 1 m) from each experimental unit. Weeds were clipped from the ground surface and dried in an oven at 65 ºC for 48 h for determining dry weed biomass. Data on rice yield attributes were recorded from 10 randomly selected plants taken from each net plot and computed their average. A random sample of grain was taken from the produce of each plot, 1000 grains were counted manually and weighed on an electric balance. Treatment-wise economics were calculated by considering prevailing market price as, labour: ` Rs. 400/ day, hand weeding: ` Rs.4000/ha, Pendimethalin Rs.500/l, pyrazosulfuron-ethyl 10% WP Rs.250/80g and pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZCRs.800/1l (Ready mix) as pre-emergence (PE); triafamone 20% + ethoxysulfuron 10% WG (Ready mix)Rs.1100/60g, penoxsulam + cyhalofop-butyl 5.1% OD (Ready mix)Rs.1000/0.5l and Metsulfuron Methyl 10% + Chlorimuron ethyl 10% WP (Ready mix)Rs.125/8g, nitrogen (Urea): `Rs.7/kg, phosphorus (SSP): ` Rs.30/kg, rice seeds: ` Rs.44/ kg and rice straw: ` Rs.4/kg. Standard statistical methods were followed for analysing the experimental data (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Effect on weeds Weed flora

The major weed flora observed in the experimental field consisted of five grass species, six broad-leaved weeds and three sedges. The grassy weeds were *Cynodondactylon, Echinochloacolona, Echinochloa crus-galli, Echinocloaglabrescens, Paspalum distichum. Cyperus rotundus,Fimbristylis dichotoma* and *Scirpus juncoides* were the sedges and *Aechynomene indica, Alternathera sessilis, Eclipta zippeliana, Ludwigia hyssopifolia, Merremiae marginata* and *Portulaca oleracea* were the broad-leaved weeds.

Weed density and dry weight

Among the herbicidal treatments, the data on weed density at 20 days after sowing indicated that weed population in pre-emergence herbicide treated plots either with pendimethalin 38.7 % CS, pyrazosulfuron-ethyl 10% WP or their combination was significantly lower as compared to other treatments (Fig.1). This suggests that the pre-emergence application of herbicides effectively reduced the total weed population during initial stages of crop growth. These results are consistent with the findings of Kaur and Singh (2023), which showed that pendimethalin effectively controlled grasses and broad-leaved weeds, while pyrazosulfuron controlled sedges. Pendimethalin, belonging to the dinitroaniline family, inhibits microtubulin synthesis, which is essential for the formation of cell wall microfibrils. This prevents cell enlargement and chromosome movement during mitosis in germinating seeds and young weed shoots [2].

Similarly, at 30 DAS, the results indicated that among herbicide treatments, the application of pendimethalin 38.7 % CS (PE) followed by triafamone20% + ethoxysulfuronl0% WG (Ready mix) PoE and pendimethalin 38.7 % CS (PE) followed by penoxsulam 1.02 % + cyhalofop-butyl 5.1% OD (Ready mix) (PoE), resulted in lower total weed densities (4.79 and 5.17, respectively) compared to all other treatments (Fig. 1). Triafamone + ethoxysulfuron and penoxsulam demonstrated superior efficacy in controlling most weed species. Both herbicides are acetolactate synthase (ALS) inhibitors, which work by halting the flow of assimilates to the sink, thereby inhibiting weed growth [3].

However, at 60 DAS, among herbicide treatments, the lowest weed population (4.44) was recorded with pendimethalin 38.7 % CS (PE) followed by penoxsulam1.02 % + cyhalofop-butyl 5.1% OD (Ready mix) (PoE). The highest number of weeds was observed in the unweeded check. These results are consistent with those reported by [15&11]

Pendimethalin 38.7 % CS PE followed by penoxsulam1.02 % + cyhalofop-butyl 5.1% OD (Ready mix) (PoE) at 30 DAS, pendimethalin 38.7 % CS PE followed by metsulfuron methyl 10% + chlorimuron ethyl 10% WP + cyhalofop butyl 10% EC (Tank mix) (PoE) at 30 DAS and pyrazosulfuronethyl 10% WP (PE) followed by triafamone20% + ethoxysulfuronl0% WG (Ready mix) (PoE) at 30 DAS were found to be equally effective and recorded significantly lower dry weight of weeds at 60 DAS (Fig. 2). Significantly, the highest dry weight of weeds was recorded in unweeded check at 30 DAS and at 60 DAS.

Weed control efficiency and weed index

Among various weed management treatments, significantly higher weed control efficiency at 15, 30, 60 DAS i.e.55.79 %, 79.52 % and 83.92 %, respectively was observed with the application of pendimethalin 38.7 % CS (PE) followed by penoxsulam1.02 % + cyhalofop-butyl 5.1% OD (Ready mix) (PoE) as compared to other chemical herbicides and untreated control. A similar trend was also reported by [15].

Lower weed index was observed under pyrazosulfuron ethyl 10% WP (PE) followed by triafamone 20% + ethoxysulfuron l0% WG (Ready mix), pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC (Ready mix) (PE) followed by triafamone20% + ethoxysulfuron l0% WG (Ready mix) and pendimethalin 38.7 % CS (PE) followed by penoxsulam1.02 % + cyhalofop-butyl 5.1% OD (Ready mix) (PoE), all of which were most effective in controlling the weeds. However, the highest weed index and the lowest weed control efficiency were observed under the unweeded check.

Crop study

Yield and yield attributes:

Pendimethalin 38.7 % CS (PE) followed by triafamone20% + ethoxysulfuronl0% WG (Ready mix) (PoE) were found to be equally effective and recorded higher number of panicles/m^2(327) and filled grains/panicle (290) at harvest (Fig. 3). In contrast, the lowest values for all yield attributes were observed in the unweeded check at harvest.

Significantly higher grain yields (4888, 4796 and4763 kg/ha, respectively) and straw yields (4144 ,4101 and 3990 kg/ha, respectively) were recorded in plots treated with pyrazosulfuron ethyl 10% WP (PE) or pendimethalin 38.4% + pyrazosulfuronethyl 0.85% ZC (Ready mix) (PE) followed by triafamone 20% + ethoxysulfuron 10% WG (Ready mix) and pendimethalin 38.7 % CS (677.25 g/ha) (PE) followed by penoxsulam1.02 % + cyhalofop-butyl 5.1% OD (135 g/ha) (Ready mix) (PoE) (Fig. 3). The increase in grain yield under these treatments was attributed to the suppression of weed population and growth during the crop growth period, which reduced weed competition and provided a better environment for the proper development of yield attributes, such as the number of panicles/m^2 and the number of grains/panicle. This ultimately enhanced the grain yield of rice. The results also revealed that effective weed control during the early stages of crop growth is essential for achieving higher grain yield in *kharif* dry direct-seeded rice crops. The findings of the present investigation are in agreement with those reported by [16&4]

Economics

Among the herbicidal treatments the treatment pyrazosulfuron ethyl 10% WP 20 g/ha (PE) followed by triafamone 20% + ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix) (PoE) secured maximum net returns of Rs. 65,594 /ha with the highest B: C ratio of 2.59. This was followed by pendimethalin 38.7 % CS (677.25 g/ha) (PE) followed by penoxsulam 1.02 % + cyhalofop-butyl 5.1% OD 135 g/ha (Ready mix) (PoE) with net returns of ` Rs. 62,090/ha and B: C ratio of 2.48(Fig. 3). The unweeded check recorded a net profit of Rs.28,731/ha with the lowest B:C ratio of 1.8.

Table 1: Weed density (No. /m^2) as influenced by weed management treatments in dry DSR rice at 15, 30 and 60 DAS. ((Pooled data of 2 years).).

Tr. No	15 DAS				30 DAS				60 DAS			
	Grasses	Sedges	Broad leaved	Total	Grasses	Sedges	Broad leaved	Total	Grasses	Sedges	Broad leaved	Total
T1	5.18 (28)	1.26 (2)	2.73 (6)	5.91 (35)	3.34 (11)	1.55 (3)	3.05 (9)	4.79 (23)	5.37 (32)	1.11 (1)	2.74 (8)	6.40 (41)
T_2	3.98 (16)	1.79 (4)	2.89 (8)	5.24 (27)	3.51 (14)	1.48 (2)	3.08 (10)	5.17 (26)	3.56 (13)	1.05 (1)	2.43 (6)	4.44 (20)
T_3	3.71 (14)	1.45 (2)	3.39 (8)	4.80 (23)	3.84 (16)	1.08 (1)	2.68 (8)	5.03 (25)	3.69 (14)	1.22 (1)	2.90 (10)	5.09 (26)
T_4	4.61 (21)	2.14 (4)	5.54 (10)	5.93 (35)	4.44 (20)	2.12 (5)	3.45 (12)	6.06 (37)	6.29 (42)	1.60 (3)	4.09 (16)	7.79 (60)
T_5	4.88 (25)	1.56 (3)	3.18 (12)	6.34 (40)	3.69 (14)	1.74 (3)	3.29 (12)	5.44 (29)	5.00 (26)	1.07 (1)	2.12 (5)	5.64 (32)
T_6	4.43 (20)	2.03 (5)	4.12 (9)	5.88 (34)	3.75 (16)	1.78 (3)	2.43 (7)	5.17 (26)	5.33 (33)	1.33 (2)	3.22 (11)	6.76 (46)
T_7	4.43 (19)	2.03 (2)	2.68 (7)	5.35 (28)	4.08 (18)	1.72 (4)	3.15 (11)	5.72 (32)	4.70 (23)	1.61 (3)	1.83 (4)	5.40 (29)
T_8	3.94 (16)	1.99 (3)	4.86 (10)	5.37 (28)	4.73 (23)	1.64 (3)	3.36 (11)	6.11 (37)	6.67 (49)	1.31 (2)	3.71 (13)	8.03 (64)
T_9	4.30 (21)	1.17 (2)	3.91 (9)	5.69 (32)	4.37 (20)	2.03 (4)	3.79 (16)	6.36 (40)	4.30 (20)	0.85 (0)	3.39 (12)	5.74 (32)
T_{10}	4.31 (19)	1.30 (1)	3.10 (7)	5.21 (27)	3.54 (13)	2.17 (5)	2.65 (7)	5.04 (25)	4.84 (24)	1.67 (3)	3.26 (12)	6.24 (39)

T_{11}	4.14 (18)	1.97 (3)	2.67 (6)	5.21 (27)	3.97 (17)	2.10 (5)	2.86 (12)	5.85 (34)	4.11 (17)	1.51 (2)	2.29 (6)	5.10 (26)
T_{12}	4.25 (19)	1.70 (2)	4.97 (13)	5.81 (34)	4.01 (17)	2.03 (5)	2.69 (9)	5.59 (31)	5.35 (30)	2.05 (5)	3.74 (15)	7.08 (50)
T_{13}	4.86 (24)	2.33 (8)	4.97 (12)	6.62 (43)	5.45 (37)	2.59 (8)	4.17 (18)	7.96 (63)	5.56 (36)	1.11 (1)	3.91 (17)	7.32 (53)
T_{14}	6.75 (47)	4.69 (10)	17.08 (28)	9.21 (84)	10.75 (118)	3.48 (13)	6.19 (41)	13.10 (172)	7.13 (57)	1.86 (6)	6.35 (46)	10.42 (109)
S.Em$\pm$	0.26	0.49	3.01	0.28	0.35	0.27	0.34	0.34	0.29	0.33	0.35	0.31
CD (p=0.05)	0.80	1.50	9.14	0.87	1.06	0.82	1.05	1.05	0.88	1.02	1.06	0.96

***Note:** Figures in parenthesis indicate original values, @ = (√x+(0.5) transformed values; NS -Non-Significant; DAS- Days after sowing*

Table 2: Weed biomass (g/m^2) and weed control efficiency (%) as influenced by weed management treatments in dry DSR rice at 20, 40 and 60 DAS. ((Pooled data of 2 years).).

Tr. No	15 DAS					30 DAS					60 DAS				
	Grasses	**Sedges**	**BLW**	**Total**	**WCE (%)**	**Grasses**	**Sedges**	**BLW**	**Total**	**WCE (%)**	**Grasses**	**Sedges**	**BLW**	**Total**	**WCE (%)**
T1	4.61 (21)	1.96 (3)	4.07 (16)	3.7 (14)	36.72	5.75 (33)	1.97 (3)	4.04 (16)	4.22 (17)	58.94	6.80 (46)	1.97 (3)	4.32 (18)	4.79 (22)	53.42
T_2	3.65 (13)	1.95 (4)	3.35 (11)	3.12 (9)	55.79	2.90 (8)	2.17 (4)	4.22 (17)	3.21 (10)	79.52	3.29 (10)	0.84(0)	3.59 (13)	2.86 (8)	83.97
T_3	3.45 (11)	1.89 (4)	3.02 (9)	2.91 (8)	61.74	3.91 (15)	1.90 (3)	3.25 (10)	3.14 (9)	80.48	3.72 (13)	0.90 (0)	5.95 (35)	4.09 (16)	66.20
T_4	4.11 (17)	2.20 (4)	3.46 (12)	3.37 (11)	48.30	6.32 (39)	2.62 (6)	3.82 (14)	4.53 (20)	58.34	5.23 (27)	3.36(12)	6.44 (41)	5.20 (27)	44.59
T_5	3.08 (9)	2.26 (5)	3.32 (11)	2.96 (8)	60.39	4.12 (16)	2.92 (8)	3.34 (11)	3.50 (12)	75.55	5.62 (31)	0.82(0)	4.47 (20)	4.18 (17)	64.63
T_6	4.39 (19)	1.85 (4)	2.97(8)	3.28 (10)	50.91	6.16 (38)	2.71 (7)	3.2 4(10)	4.32 (18)	62.15	7.00 (48)	2.73(7)	4.89 (24)	5.18 (26)	45.14
T_7	3.97 (15)	1.73 (3)	3.06 (9)	3.09 (9)	56.39	5.79 (33)	3.40 (11)	4.31 (18)	4.61 (21)	56.65	5.42 (29)	1.86(3)	3.54 (12)	3.90 (15)	69.40
T_8	3.79 (14)	2.20 (5)	3.20 (10)	3.16 (9)	54.79	6.55 (43)	2.76 (7)	5.43 (29)	5.18 (26)	45.19	5.26 (27)	1.14 (1)	4.81 (23)	4.18 (17)	64.65
T_9	5.18 (27)	1.72 (3)	4.01 (16)	3.95 (15)	27.99	5.77 (33)	2.50 (6)	3.99 (15)	4.32 (18)	62.15	6.54 (42)	0.99(1)	5.39 (29)	4.93 (24)	50.31
T_{10}	4.52 (20)	1.68 (3)	2.64 (7)	3.20 (10)	53.47	5.96 (35)	3.19 (10)	3.22 (10)	4.34 (18)	61.82	5.45 (29)	2.37 (5)	6.41 (41)	5.05 (25)	47.72
T_{11}	3.93 (15)	1.00 (1)	3.97 (15)	3.29 (10)	50.55	5.11 (26)	2.88 (8)	4.63 (21)	4.32 (18)	62.13	4.44 (19)	0.88 (0)	3.85 (14)	3.44 (11)	76.38
T_{12}	4.65 (21)	2.76 (7)	3.71 (13)	3.80 (14)	33.44	5.11 (26)	3.19 (10)	3.50 (12)	4.02 (16)	67.27	6.62 (43)	2.87 (8)	6.30 (39)	5.53 (30)	37.27
T_{13}	4.63 (21)	1.82 (3)	4.01 (16)	3.71 (13)		7.46 (12)	4.39 (6)	5.86 (11)	3.19 (10)		7.32 (53)	1.00 (1)	6.80 (3)	4.39 (19)	
T_{14}	5.93 (35)	3.33 (11)	4.34 (19)	4.66 (21)		6.32 (50)	5.66 (32)	6.71 (45)	6.52 (42)		7.10 (50)	4.02 (16)	8.91 (79)	6.96 (48)	
SEm	0.28	0.41	0.25	0.16		0.19	0.23	0.06	0.09		0.17	0.23	0.21	0.14	
CD	0.85	1.24	0.76	0.49		0.58	0.71	0.19	0.29		0.53	0.69	0.64	0.42	

Note: Figures in parenthesis indicate original values, @ = (√x+(0.5) transformed values; NS -Non-Significant; DAS- Days after sowing

Table 3.: Yield and yield attributes as influenced by weed management treatments in dry DSR rice (Pooled data of 2 years).

Tr. No	Weed index (%)	No. of panicles/m2	No. of filled grains/ panicle	Grain yield (kg/ha)	Straw yield (kg/ha)	Test weight (g)	Net returns	BC ratio
T1	21.90	327	290	4083	3399	15.09	47014	2.116
T_2	8.87	320	253	4763	3990	15.01	62090	2.482
T_3	13.87	297	238	4502	3806	15.48	57818	2.429
T_4	16.91	274	230	4343	3913	15.56	52666	2.250
T_5	6.48	308	256	4888	4144	15.03	65594	2.596
T_6	28.40	300	256	3742	3433	15.75	40377	1.977
T_7	18.57	328	260	4256	3635	15.02	52022	2.272
T_8	19.57	317	272	4204	3748	15.03	50206	2.208
T_9	8.25	277	269	4796	4101	15.59	61711	2.436
T_{10}	23.70	290	252	3988	3608	15.20	43872	2.016
T_{11}	12.52	314	255	4573	4068	15.29	58068	2.390
T_{12}	10.07	299	254	4701	4444	15.78	59181	2.362
T_{13}		338	276	5227	4461	15.77	69763	2.573
T_{14}		270	257	2875	2851	15.24	28731	1.844
S.Em$\pm$		10.30	5.37	99.0	94.0	0.076		
CD (p=0.05)		31.26	16.30	299.0	286.0	0.230		

Note: Figures in parenthesis indicate original values, @ = ($\sqrt{x+0.5}$) transformed values; NS -Non-Significant; DAS- Days after sowing

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