Productivity of Dry direct seeded rice as influenced by herbicide combinations

Abstract

A field experiment was conducted during Kharif, 2022, Institute of Rice Research, Rajendranagar, Hyderabad in Telangana state. Fourteen weed management practices were evaluated in a randomized complete block design, replicated thrice. Weed management in Dry DSR can be done by adopting mechanical/ Hand weeding at 20, 40, 60 DAS under labour available conditions. Under labour scarcity conditions PE application of Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix) followed by Metsulfuron Methyl 10% + Chlorimuron ethyl 10% WP 4 g/ha + Cyhalofop Butyl 10% EC 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS is the best option. Other suitable Pre emergence herbicides that can be used are Pyrazosulfuron ethyl 10% WP 20 g/ha, Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix) and Pendimethalin 38.7 % CS 677.25 g/ha. Post emergence application of Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix) and Penoxsulam 1.02 % + Cyhalofop-butyl 5.1% OD 135 g/ha (Ready mix) at 2-4 weed leaf stage.

Key words: Grain yield, Herbicide combinations, Productivity, dry direct seeded rice, Weed density

Introduction

Rice (*Oryza sativa* L.) is one of the most important food crops in the world, forms the staple diet of billions of people and provides 70% direct employment to the rural India. Rice production symbolizes the single largest land use for food production on earth and worldwide, rice is grown on 164 M ha with an annual production of about 750Mt of paddy (FAO, 2019). To meet the global rice demand, it is estimated that about 114Mt of additional milled rice needs to be produced by 2035 (Singh *et al*.,2015) and therefore, meeting ever increasing rice demand in a sustainable way with shrinking natural resources is a great challenge.

India is the second largest producer of Rice after China. The area production and productivity of Rice in India are 44.79 million hectares, 112.41 million tones, 2578 kg/ha respectively. In India, major rice growing states are West Bengal, Punjab, Uttar Pradesh, Tamil Nadu, Andhra Pradesh, Telangana, Bihar, Odisha etc. The area and production of Rice in Telangana is 2 million hectares and 6.6 million tons respectively.

In the traditional method of establishment of rice, both puddling and transplanting operations requires a large amount of labour (Chauhan and Yadav,2013). The increasing demand for labour in non agricultural sectors and increasing labour costs resulting from the migration of rural labour to the cities, creates labour shortage at the critical time of transplanting (Chauhan, 2012). Late commencement of monsoon showers and drudgery involved in puddling and manual transplanting delay rice transplanting (Farooq *et al*., 2006). There is a need to look for direct seeding of rice that not only cope up with existing limitations but also are affordable and economically viable and secure future food demand.

Most significant biological constraint in DSR is weed infestation, which is very severe when compared to transplanted rice. The simultaneous emergence of crop and weed also poses a severe loss and weed control becomes a cumbersome procedure. In dry seeded rice, the critical period of weed competition has been reported to be 15-60 days after

seeding (Chauhan and Mahajan, 2014) and if weeds are controlled by any means during this period, minimal yield losses can be observed. Weed management using herbicides has become an integral part of modern agriculture. Herbicides have greater flexibility of operation and are often cost effective compared to any other method of weed management. A number of herbicides at low doses are giving effective weed control. The present investigation was carried out to find out the best possible pre and post emergence herbicides for weed management in Dry direct seeded rice.

Material Methods

The investigation was carried out during *kharif* 2022 at Institute of Rice Research, Professor Jayashankar State Agricultural university, Rajendranagar, Hyderabad, situated at an altitude of 542.3 m above MSL at 17^{o}19' N latitude and 78^{o}23' E longitude. It is in the Southern Telangana agro-climatic zone of Telangana state. According to Troll's climatic classification, it falls under semi-arid tropics (SAT). During the cropping period rainfall of 861.1 mm was received. RNR 29325(Rajendranagar 5) is short duration rice variety matures in 125 days. It has long slender grains and moderate resistance to BPH and leaf blast.Experiment consist of 14 treatments consisting of pre emergence application of Pendimethalin 38.7 % CS 677.25 g/ha, Pyrazosulfuron ethyl 10% WP 20 g/ha and Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix) followed bypost emergence application of Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix), Penoxsulam 1.02 % + Cyhalofop-butyl 5.1% OD 135 g/ha (Ready mix), Metsulfuron Methyl 10% + Chlorimuron ethyl 10% WP 4 g/ha + Cyhalofop Butyl 10% EC 75g/ha (Tank mix) and Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix), followed by mechanical weeding at 40-45 DAS in herbicide treated plots, weed free treatment i.e., hand weeding twice at 25 and 45 DAT and weedy check in RBD replicated thrice.

Weed density (No. m^{-2})

Weed density was taken at 20, 40 and60 DAS in randomly selected quadrat (0.5 x 0.5 m^{2}) in each plot. At every sampling, three categories of weeds viz., grasses, sedges and broad leaved weeds were separated and expressed as number m^{-2}. The sampling was done outside the net plot but within the gross plot.

Results and discussion

Effect on weed density

Grass weed density (No.m^{-2}) at 20 DAS

At 20 DAS (Table1) the significantly lower grass weed density was observed with T_{13}: Mechanical/ hand weeding at 20, 40, 60 DAS (2.8), it was statistically on par with T_{9}- pendimethalin 38.4% + pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by triafamone 20% + ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (3.1), T_{1}- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (3.2) it was inturn on par with T_{3}- 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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (3.5), T_{6}- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop -butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(3.6) and was further followed by the

treatment T_8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45 DAS (3.7), T_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45 DAS(3.8), T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (4.0) and it was inturn on par with T_2- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(4.2), T_7 - 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 followed by mechanical weeding at 40 -45 DAS(4.2) T_{11} - 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS (4.2), T_4- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (4.4) it was followed by T_5 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (5.1) and significantly highest grass weed density was recorded with T_{14}- Unweeded control (5.4).(Table1)

Sedges weed density (No.m^{-2}) at 20 DAS

At 20 DAT (table 1), the lower sedge weed density was observed with T9- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (1.4), it was on par with 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS(1.7), it was inturn on par with T1- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS(1.8) and it was inturn on par with 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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (2.0), T6- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop -butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(2.0), 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 followed by mechanical weeding at 40 -45 DAS(2.0), T8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45 DAS (2.1), T_{14}- Unweeded control (2.1).Further followed byT_2- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(2.2),T_4-

Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (2.2), T5- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (2.2), T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (2.2), T_{13}: Mechanical/ Hand weeding at 20, 40, 60 DAS (2.3) and significantly higher sedge weed density recorded withT_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45 DAS(2.6). (Table1)

Broad leaved weed density (No.m^{-2}) at 20 DAS

At 20 DAS (Table 1), the lower broad leaved weed density was observed with T_{11} - 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS(2.0) it was statistically on par with T_{13}- Mechanical/ Hand weeding at 20, 40, 60 DAS (2.6), it was inturn on par with all the treatments in the order of T9- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (2.8),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 followed by mechanical weeding at 40 -45 DAS(2.8),T1- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS(3.0),T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (3.0),T6- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop -butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(3.2), T_2- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(3.5),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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (3.5), T_4- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (3.5),T5- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (3.8), T8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45 DAS (3.8),T_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45

DAS(3.9) except T14- Unweeded control (5.8) which recorded significantly highest broad leaved weed density. (Table1)

Grass weed density(No.m^{-2}) at 40 DAS

At 40 DAS (Table 2), significantly lower grass weed density was observed with T_{13}- Mechanical/ Hand weeding at 20, 40, 60 DAS (4.2) and was at par withT1- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS(1.4), it was followed by T9- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (2.0), T_{11} - 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS(2.0) it was statistically on par with 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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (2.2), T5- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (2.2),T_4- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (2.3) and 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 followed by mechanical weeding at 40 -45 DAS(2.1) it was further followed byT_2- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(2.4) and was on par withT6- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop -butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(2.5), T8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45 DAS (2.4), T_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45 DAS(2.4), and T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (2.6). The significantly highest grass weed density was observed with T14- Unweeded control (5.5).

Sedge weed density(No.m^{-2}) at 40 DAS

At 40 DAS (Table 2), significantly lower sedge weed density was with T_{13}- Mechanical/ Hand weeding at 20, 40, 60 DAS (1.9) it was statistically on par with T_{11} - 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS(2.1),T5- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron

l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (2.2), 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 followed by mechanical weeding at 40 -45 DAS(2.2), T9- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (2.3), 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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (2.4), T_2- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(2.4) and T6- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop -butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(2.4) it was followed byT_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45 DAS(2.6), T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (2.7), T_4- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (2.8), T1- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS(3.0), T8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45 DAS (3.2), The significantly highest sedge weed density was observed with T14- Unweeded control (6.0).

Broad leaved weed density(No.m^{-2}) at 40 DAS

At 40 DAS (Table 2), significantly lower density of broad leaved weed density was observed with T_{13}- Mechanical/ Hand weeding at 20, 40, 60 DAS (1.7) it was statistically on par with T_{11} - 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS(1.7) it was inturn on par with T5- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (2.0), T6- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop -butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(2.0), T_2- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(2.1), 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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (2.3) and T_4- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (2.4), T9-

Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (2.3), T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (2.3) and T_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45 DAS(2.3), it was followed byT1- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS(2.6), 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 followed by mechanical weeding at 40 -45 DAS(2.7) andT8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45 DAS (3.0), Significantly highest sedge weed density was observed with T14- Unweeded control (7.3).

Grass weed density(No.m^{-2}) at 60 DAS

At 60 DAS (Table 3), significantly lower grass weed density was observed with T_{11} - 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS(1.6), it was due to effective reduction in weed density by pendimethalin + Pyrazosulfuron ethyl during initial period and by POE and mechanical weeding at later periods(Pavithra *et al* ., 2021). it was statistically on par with T_{13}- Mechanical/ Hand weeding at 20, 40, 60 DAS (1.7), T9- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (1.7),T_9- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAST$_2$- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(2.1) and T5- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (2.1) it was followed by T6- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop -butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(2.9) it was statistically on par with 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 followed by mechanical weeding at 40 -45 DAS(3.0), 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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (3.0)andT_4- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (3.6), further followed by T_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC

900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45 DAS(3.9),T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (4.3) andT1- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS(4.4) which was inturn on par withT8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45 DAS (5.0). Significantly highest grass weed density was observed with T14- Unweeded control (6.8).

Sedge weed density(No.m^{-2}) at 60 DAS

At 60 DAS (Table 3), significantly lower sedge weed density was observed with T_{11} - 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS(1.6) and T_{13}- Mechanical/ Hand weeding at 20, 40, 60 DAS (1.6) it was statistically on par with T_2- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(1.7), T9- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (1.8), T5- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (2.0) and 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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (2.1) it was followed byT6- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop - butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(2.5), 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 followed by mechanical weeding at 40 -45 DAS(2.7)andT_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45 DAS(2.8)further followed by T_4- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (3.3) andT1- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS(3.6) it was followed by T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (4.3)and followed by T8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45

DAS (5.1). the significantly highest total sedge weed density was observed with T14- Unweeded control (8.8).

Broad leaved weed density(No.m^{-2}) at 60 DAS

At 60 DAS (Table 3) the significantly lower broad leaved weed density was observed with T_{11} - 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS(1.7) it was statistically on par with T_{13}- Mechanical/ Hand weeding at 20, 40, 60 DAS (1.8), T9- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (1.8) and T5- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (2.0) and was followed by T_2- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(3.0), 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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (3.6), T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (3.6) it was inturn on par with T_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45 DAS(3.9),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 followed by mechanical weeding at 40 -45 DAS(3.9), T6- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop -butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(4.0) ,T_4- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (4.9) which was inturn on par with T1- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS(5.0) and was followed by T8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45 DAS (6.2) and T14- Unweeded control (6.3).

Table 1: Weed density (No/m2) at 20 DAS as influenced by different weed management practices in Dry direct seeded rice during kharif, 2022

Treatments	Weed density (No/m^2) 20 DAS		
	Grass	Sedge	BLW
T1:Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha	3.2 (9.0)	1.8 (2.3)	3.0 (8.0)

(Ready mix)PoE followed by mechanical weeding at 40-45 DAS			
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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS	4.2 16.3	2.2 (3.7)	3.5 (11.0)
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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	3.5 (11.3)	2.0 (3.0)	3.5 (11.0)
T4:Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	4.4 (18.0)	2.2 (4.0)	3.5 (11.3)
T5:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	5.1 (25.3)	2.2 (4.0)	3.8 (13.3)
T6:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop-butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40-45 DAS	3.6 (11.7)	2.0 (3.0)	3.2 (9.0)
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 followed by mechanical weeding at 40-45 DAS	4.2 (16.3)	2.0 (3.0)	2.8 (6.7)
T8:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	3.7 (13.0)	2.1 (3.3)	3.8 (13.7)
T9:Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	3.1 (8.7)	1.4 (1.0)	2.8 (7.0)
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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	4.0 (15.0)	2.2 (4.0)	3.0 (8.0)
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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS	4.2 (17.0)	1.7 (2.0)	2.0 (3.0)
T12:Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	3.8 (13.3)	2.6 (5.7)	3.9 (14.0)
T13:Mechanical/ Hand weeding at 20, 40, 60 DAS	2.8 (6.7)	2.3 (4.3)	2.6 (5.7)

T14:Unweeded control	5.4 (28.3)	2.1 (2.3)	5.8 (33.0)
S. Em±	0.15	0.11	0.78
CD (P=0.05)	0.4	0.3	2.3

Original data in parentheses was subjected to square root transformation

Table 2: Weed density (No/m2) at 40 DAS as influenced by different weed management practices in Dry direct seeded rice during kharif, 2022

Treatments	Weed density (No/m^2) 40 DAS		
	Grass	Sedge	BLW
T1:Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	2.7 (6.3)	3.0 (8.3)	2.6 (5.7)
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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS	2.4 (4.7)	2.4 (4.7)	2.1 (3.7)
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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	2.2 (4.0)	2.4 (4.7)	2.3 (4.3)
T4:Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	2.3 (4.3)	2.8 (6.7)	2.4 (5.0)
T5:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	2.2 (4.0)	2.2 (3.7)	2.0 (3.0)
T6:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop-butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40-45 DAS	2.5 (5.3)	2.4 (4.7)	2.0 (3.0)
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 followed by mechanical weeding at 40-45 DAS	2.1 (3.7)	2.2 (3.7)	2.7 (6.3)
T8:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	2.4 (5.0)	3.2 (9.0)	3.0 (8.0)
T9:Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	2.0 (3.3)	2.3 (4.3)	2.3 (4.7)
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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	2.6 (6.0)	2.7 (6.3)	2.3 (4.3)

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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS	2.0 (3.0)	2.1 (3.7)	1.7 (2.0)
T12:Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	2.4 (5.0)	2.6 (5.7)	2.3 (4.3)
T13:Mechanical/ Hand weeding at 20, 40, 60 DAS	1.4 (1.0)	1.9 (2.7)	1.7 (2.0)
T14:Unweeded control	5.5 (29.0)	6.0 (35.7)	7.3 (51.7)
S. Em+	0.1	0.2	0.23
CD (P=0.05)	0.3	0.6	0.7

Original data in parentheses was subjected to square root transformation

Table 3: Weed density (No/m2) at 60 DAS as influenced by different weed management practices in Dry direct seeded rice during kharif, 2022

Treatments	**Weed density (No/m^2) 60 DAS**		
	Grass	Sedge	BLW
T1:Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	4.4 (18.7)	3.6 (12.0)	5.0 (24.3)
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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS	2.1 (3.7)	1.7 (2.0)	3.0 (8.3)
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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	3.0 (8.0)	2.1 (3.7)	3.6 (12.0)
T4:Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	3.6 (12.3)	3.3 (10.3)	4.9 (23.0)
T5:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	2.1 (3.3)	2.0 (3.0)	2.0 (3.0)
T6:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop-butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40-45 DAS	2.9 (7.7)	2.5 (5.7)	4.0 (15.3)
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 followed by mechanical weeding at 40-45 DAS	3.0 (8.3)	2.7 (6.7)	3.9 (14.7)
T8:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40-45	5.0 (24.0)	5.1 (25.3)	6.2 (37.0)

DAS			
T9:Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	1.7 (2.0)	1.8 (2.3)	1.8 (2.3)
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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	4.3 (17.7)	4.3 (17.7)	3.6 (12.0)
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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS	1.6 (1.7)	1.6 (1.7)	1.7 (2.0)
T12:Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	3.9 (14.3)	2.8 (7.0)	3.9 (14.7)
T13:Mechanical/ Hand weeding at 20, 40, 60 DAS	1.7 (2.0)	1.6 (1.7)	1.8 (2.3)
T14:Unweeded control	6.2 (37.7)	8.8 (76.0)	6.3 (38.7)
S. Em+	0.24	0.2	0.28
CD (P=0.05)	0.70	0.6	0.8

Original data in parentheses was subjected to square root transformation

Plant height (cm) at harvest

Data pertaining to plant height (Table 4) under different weed management practices was analysed statistically and presented in table 3. There was no significance difference in plant height was observed with different weed management practices.

Tillers /m2 at harvest

Significantly higher number of tillers (Table 4) at harvest was observed with T_{13}- Mechanical/ Hand weeding at 20, 40, 60 DAS (364) it was statistically on par with T_{11} - 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS(92.5), T5- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (332),T9- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (329) it was followed by T_2- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(325), 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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (317), T6- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop -butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(308), T8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45 DAS (305),T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (302),T_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45 DAS(298), T_4- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (298) it was followed by 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 followed by mechanical weeding at 40 -45 DAS(274) it is inturn on par with T1- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS(255). Significantly lower number of tillers/m2 was recorded with T14- Unweeded control (233).

Panicles /m2 at harvest

Significantly highest number of panicles/ m2 at harvest (Table 4) were observed with T_{13}- Mechanical/ Hand weeding at 20, 40, 60 DAS (327) it was statistically on par with T_{11} - 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS(319), T5- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (314),T9- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (307), T_2- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(300) and 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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (293), it was followed by T6- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop -butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(279),T8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45 DAS (305)T_4- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (273), T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding

at 40-45 DAS (272), T_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45 DAS(264), 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 followed by mechanical weeding at 40-45 DAS(250) it was inturn on par with T1- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS(247), significantly lowest number of panicles/m2 recorded in T14- Unweeded control (209).

Grain yield

The significantly higher grain yield was observed (Table 4) with T_{13}- Mechanical/ Hand weeding at 20, 40, 60 DAS (3959) it was statistically on par with T_{11} - 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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS(3795), T5- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (3609),T9- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40 -45 DAS (3570), T_2- 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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS(3568) and 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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (3502), This was mainly due to killing of germinating weed seeds as well as removal of established weeds, During the critical period of crop weed competition, weed density continuously remained increasing and crop growth affected due to competition from weeds for the natural resources (Spandana et al., 2017),it was followed byT6- Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop -butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40 -45 DAS(3463), 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 followed by mechanical weeding at 40-45 DAS(3400), T_{12}- Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40- 45 DAS(3355),T_4- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS (3285), T_{10} - 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 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS (3167), T1- Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS(3114),T8 - Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40 -45 DAS (3068). Significantly lower grain yield was observed with T14- Unweeded control (1419).

Table4: Growth and yield attributes influenced by different weed management practices in Dry direct seeded rice during kharif, 2022

Treatments	Plant height (cm) at harvest	Tillers/m2 at harvest	Panicles/m2 at harvest	Grain Yield (kg/ha)

T1:Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	79.9	255	247	3114
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 at 2-4 leaf stage of the weed followed by mechanical weeding at 40-45 DAS	79.5	325	300	3568
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 75g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	80.8	317	293	3502
T4:Pendimethalin 38.7 % CS 677.25 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25 g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	76.4	298	273	3285
T5:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	75.7	332	314	3609
T6:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Penoxsulam 1.02 % + Cyhalofop-butyl 5.1% OD 135 h/ha (Ready mix) PoE followed by mechanical weeding at 40-45 DAS	79.0	308	279	3463
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 followed by mechanical weeding at 40-45 DAS	74.3	274	250	3400
T8:Pyrazosulfuron ethyl 10% WP 20 g/ha PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	79.9	305	275	3068
T9:Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS	77.7	329	307	3570
T10:Pendimethalin 38.4% + Pyrazosulfuron	82.0	302	272	3167

ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)PE followed by Penoxsulam 1.02 % + Cyhalofop-butyl 5.1% OD 135 h/ha (Ready mix)PoE followed by mechanical weeding at 40-45 DAS				
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 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS	77.6	355	319	3795
T12:Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha(Ready mix) PE followed by Bispyribac Sodium 10% SC 25 g/ha + Penoxsulam 2.67 % OD 25g/ha (Tank mix) PoE followed by mechanical weeding at 40-45 DAS	77.5	298	264	3355
T13:Mechanical/ Hand weeding at 20, 40, 60 DAS	76.6	364	327	3959
T14:Unweeded control	75.6	233	209	1419
S. Em+	1.98	13.0	15.2	164.1
CD (P=0.05)	NS	38.0	44	480

Conclusion

Weed management in Dry DSR can be done by adopting mechanical/ Hand weeding at 20, 40, 60 DAS under labour available conditions. Under labour scarcity conditions PE application of Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix)followed by Metsulfuron Methyl 10% + Chlorimuron ethyl 10% WP 4 g/ha + Cyhalofop Butyl 10% EC 75g/ha (Tank mix)PoE weed followed by mechanical weeding at 40-45 DAS is the best option. Other suitable Pre emergence herbicides that can be used are Pyrazosulfuron ethyl 10% WP 20 g/ha, Pendimethalin 38.4% + Pyrazosulfuron ethyl 0.85% ZC 900 + 20 g/ha (Ready mix) and Pendimethalin 38.7 % CS 677.25 g/ha. Post emergence application of Triafamone 20% + Ethoxysulfuron l0% WG 44+22.5 g/ha (Ready mix) and Penoxsulam 1.02 % + Cyhalofop-butyl 5.1% OD 135 g/ha (Ready mix) at 2-4 weed leaf stage.

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