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MANAGEMENT ROTTBOELLIA COCHINCHINENSIS-INVASIVE WEED AND OTHER WEEDS IN CORN (ZEA MAYS) BY DIFFERENT TIME OF HERBICIDES APPLICATION IN CORN GROWING DISTRICTS OF KARNATAKA, INDIA

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ABSTRACT:
The species Rottboellia cochinchinensis L. (Itchgrass) has become a most important invasive weed in corn cultivating areas of India and world requiring urgent management strategies to enhance its control. This study aims to evaluate the effectiveness of the different herbicide, combinations and sequence of herbicides. Pendimethalin, Pyroxsulfone, flumioxazine and diclosulum. The experiment was conducted during 2024–25 and 2025–26 along with large plot adaptive trials simultaneously in farmers field. With the objective to evaluate the efficacy of sequential application of pendimethalin as pre-plant incorporation, pre-emergent and post emergent. Their isolated application and tank mix application of pendimethalin, pyroxsulfone, diclosulum and tembotrione as per the treatments. The application of pendimethalin at various dosage in different applications as PPI + PE controlled 100 percent of the R. cochinchinensis species and prevented the germination of new flushes of R. cochinchinensis till 90 days of sowing.Regarding tank mix application, Flumioxazine + Diclosulum (PE)-TM @ 125+22 g a.i./ha, Flumioxazin + Pyroxasulfone (PE)-TM@ 125+127 g a.i./ha was effective in controlling all the weed till 30 to 45 days after application. In the sequential application of herbicide Pyroxasulfone PE fb Tembotrione PoE @ 127 fb120 g a.i/ha was effective in controlling all the weeds up to 25-30 days, while Post emergent application of tembotrione was ineffective in controlling the regrowth or new emergence of R. cochinchinensis. Thus, application of pendimethalin at various dose at different time of application was the best option to control R. cochinchinensis. Consisting of an important management tool to control the Itchgrass.

KEYWORDS: Rottboellia cochinchinensis, maize, pendimethalin, herbicide sequence, weed density, invasive weed management

INTRODUCTION

Corn is India's third-most important cereal food crop in India with production of area 108.87 lakh hectares (approx. 10.89 million ha) a production of 356.73 lakh tonnes. Primarily production is concentrated in states like Karnataka, Madhya Pradesh, Maharashtra, Telangana, and Andhra Pradesh, though overall productivity (around 3-3.5 tonnes ha-1) lags the global average.

Karnataka, a major agricultural state in Southern India, Over the past few decades, corn (Zea mays L.) has emerged as a key cereal crop, placing Karnataka among the top corn producing states in the country contribute significantly to corn production. Farmers cultivate corn under both rainfed and irrigated conditions. Karnataka is the major corn growing state in India with an area of 9.7 lakh hectares (approx. 1.3 m ha in some reports in 2023-24) with production 3.1 t/ha. Karnataka still has the potential to increase the productivity of corn with improved agronomic practices focusing majority on the improper weed management. A number of weed species compete with corn plant and have been observed to reduce yield as much as 65% with delay in weed control. Weeds in corn during the critical period of weed depending on the intensity and persistence of weed density in standing crop can reduce the yield up to 80 percent. Among all these weeds, Rottboellia cochinchinensis popularly called as itch grass is most commonly associated problematic aggressive invasive weed species (Murali, et al., 2025).

Itch grass belongs to the Poaceae family is an annual C4 grass or perennial depending on environmental conditions and reproduced by seeds. R. cochinchinensis is associated with its manual removal which is very difficult and feared by the labours, because of the presence of rigid trichome (Fiber glass like needles in the area of the leaf sheet) when come in contact with skin, penetrate as glass needles, break ups and cause irritation, painful infection and inflammation. Farmers consider this is dangerous for flocks because of the stiff hairs, may lacerate the animal's mouth and intestine. Elsewhere, its wide distribution and infestations result in up to 80 percent crop loss or even abandonment of corn lands before harvesting of the yield. A pragmatic weed management package is necessary for control of Rottboellia cochinchinens is corn, this pragmatic approach would involve a judicious use of weed control measures according to resource availability and climate condition. Chemical weed control is the most efficient and economical option for weed control as manual removal is completely impossible due to trichomes. The repeated use of herbicides with the same mode of action has accelerated the evolution of herbicide resistance in weeds, necessitating the adoption of best management practices such as herbicide mixtures, sequences, and integration of pre- and post-emergence applications (Norsworthy et al., 2012).

The judicious selection of herbicide type, chemical combination, time of application and method of application may improve weed control. The use of herbicides with multiple modes of action in combinations can enhance weed control efficacy and reduce the risk of herbicide resistance evolution in weeds (Yu and Powles, 2014). However, research on the use of pre-emergence, tank mix and sequential use of different herbicide combinations remains limited in field of itchgrass control. (Beckie and Reboud, 2009).

Mahajan et al. 2013 reported that the subsequent application of pre and post emergence herbicides provides excellent weed control when compare with their single application. No such study has been conducted to evaluate the suppressive potential of sequential application of different herbicide with a focus on Rottboellia cochinchinensis in India. It was hypothesized that potential pre-emergent herbicides may provide better control of Rottboellia cochinchinensis followed by combination of different pre-emergent herbicides, as no herbicide recommended for corn controls the itch grass.

The sustainability of corn crop has been repeatedly questioned over the last four to five years. After exploratory survey conducted by ICAR-AICRP on weed management, Bengaluru concluded that infestation of Rottboellia cochinchinensis in corn and decline in corn productivity were the two most important constraints for the declining total factor in productivity of corn.

HPPD, Atrazine herbicides (Atrazine, Tembotrion, Topramezone, Topramezone + Atrazine, Mesotrione + Atrazine) were recommended herbicides for corn. Use of these herbicides has not controlled the invasive weed Rottboellia cochinchinensis, which consistently controlled other grass, broad leaf weeds effectively. Topramezone + Atrazine applied only at 2–3 leaf stage of weed resulted in control of all weeds including Rottboellia cochinchinensis. However, regeneration was noted & percent control is lost.

Use of above herbicides continuously for 2–3 years resulted in the control of all the weeds and evolution of resistance to Rottboellia cochinchinensis in corn growing area. This caused the most serious case of herbicide resistance in Karnataka, resulting heavy weed infestation of Rottboellia cochinchinensis at times abandoned of land.

Due to large scale failure of use of HPPD, Atrazine herbicides. Different herbicides in various doses at different time of application were applied. the treatment details include T1- SSB fb Pendimethalin (PE) @670g a.i/ha, T2- Pendimethalin (PPI) fb Pendimethalin (PE) @ 670 fb 580g a.i./ha,T3- Pendimethalin (PPI)@ 670 g a.i./ha, T4- Pendimethalin (PE)@ 670 g a.i./ha, T5- Pendimethalin + Pyxoxasulfone (TM -PE) @ 580+127 g a.i./ha, T6- Flumioxazine + Diclosulum (PE)-TM @125+22 g a.i./ha, T7- Flumioxazine + Pyroxasulfone (PE)-TM@ 125+127 g a.i./ha , T8- Pyroxasulfone PE fb Tembotrione POE @ 127 g a.i./ha fb 120 g a.i/ha T9- Farmers practice - 2 Hand weeding 20 & 40 DAS and T10-Weedy check were taken up. Hence, with this background to field trails was taken up in the maize infested farmers field to evaluate the herbicides for control of Rottboellia cochinchinensis. The use of the herbicides played a crucial role in restoring the productivity of corn in this part of state.

MATERIALS AND METHODS

Bio-efficacy of Pre-Plant incorporation (PPI), pre-emergent (PE), post emergent herbicide alone and herbicide association in combination against Rottboellia cochinchinensis in corn was evaluated. A field experiment was conducted on the farmers field during kharif season in 2024–25 and 2025–26 with the objective of to know the performance of herbicides against the Rottboellia cochinchinensis in real field situation at Davangere, Karnataka. Treatments in the study were Pendimethalin, it was applied on pre-plant incorporation (PPI) where the herbicide was sprayed just prior to sowing and properly mixed with soil or incorporated 5 cm deep by-passing cultivator/stir the soil in opposite directions. Pre-emergent herbicides were applied immediately after sowing in moist soil. Post emergent was applied at 25 days after sowing. Herbicides were applied with a flat-fan nozzle using spray volume 500 L/ha for PPI & PE and 375 L/ha for post emergent herbicide (POE)

Pendimethalin (PE) alone and combination of herbicides Pendimethalin + Pyxoxasulfone (TM -PE), Flumioxazine + Diclosulum (PE)-TM Flumioxazine + Pyroxasulfone (PE)-TM, Pyroxasulfone (PE) fb Tembotrione (POE), along farmers practice, where hand weeding was done at 20 & 40 DAS and weedy check. The experiment design was randomized complete block with three replications. The size of the field was 700 m2. Each plot size was 5.4 × 3.9 m². The corn variety NK 6514 was sown on 7th June 2024 and 10th June 2025 during 2024–25 and 2025–26 respectively. The seeding rate was 15 kg/ha at 60 cm row spacing and 30 cm between plant spacing. The crop was managed according to the standard agronomic practice of the state university. The experiment was repeated twice during kharif 2024–25 and 2025–26.

Observations on crop phytotoxicity (chlorosis, necrosis, stunting, epinasty, hypertrophy and wilting) on 0–10 scale (0–no phytotoxicity and 10–complete phytotoxicity) and weed control ratings on 0–10 scale (0–no control and 10–complete control of weed) were recorded at 0, 1, 3, 5, 7, 10, 15 and 20 days after spray for herbicide application (Table 1). The weed count and weed dry weight was recorded at 15, 30, 45, 60 and at harvest. Weed samples from two randomly selected spots for each plot were taken with the help of quadrant measuring 0.5 m × 0.5 m. The weeds were separated as Rottboellia cochinchinensis, other grasses and broadleaf weed and sedge from each sample. The samples were oven dried at 70°C until constant weight was obtained. Then dried weed samples were weighed and the weight taken was expressed in terms of g/m² before subjecting to statistical analysis.

The crop was harvested at full physiological maturity on 20th October 2024 and 29th October 2025. One border row on both side of the experimental plots were harvested first, then after the net area separately. The kernel weight was recorded at 14% moisture after threshing, cleaning and drying. Second yield was recorded from the harvested area 5.1 × 3.6m². in each plot. The kernel yield was expressed as quintal ha-1.

Statistical Analysis

Before statistical analysis the percent data of the weed control efficiency were subjected to square root transformation to improve the homogeneity of the variance. The data were subjected to the analysis of variance (ANOVA). The significant treatment effect was judged with the help of 'F' test at the 5% level of significance. Data was subjected to R software, python Tukey and HSD test. The data were analysed separately for each year and pooled analysis was done.

RESULT AND DISCUSSION

Effect of weed management practices on Rottboellia cochinchinensis in corn

The density and dry weight of Rottboellia cochinchinensis were significantly influenced by weed management practices, as evident from observations recorded over two seasons and their pooled analysis (Tables 2 to 4; Fig. 1 to 3). Despite minor seasonal variation, the relative performance of weed control treatments remained consistent. At 15 and 30 DAS, the use of pendimethalin applied as pre-plant incorporation or pre-emergence, either alone or following a stale seedbed technique, resulted in near-complete suppression of R. cochinchinensis. Under these treatments, pooled weed density and dry weight remained at the minimum observable level (≈0.71 plants m^{-2} and 0.71 g m^{-2}, respectively), indicating effective prevention of early weed emergence. In contrast, the farmers' practice of two hand weedings recorded a pooled weed density of about 7.2 plants m^{-2} at 15 DAS and 2.2 plants m^{-2} at 30 DAS, while the untreated control exhibited the highest early infestation, with weed density exceeding 7.2 plants m^{-2} and dry weight reaching about 3.4 g m^{-2}. These results confirm that R. cochinchinensis establishes rapidly in the absence of early chemical control, as also reported by Mahajan et al. (2014) and Chauhan and Johnson (2010).

As the crop progressed to 45 and 60 DAS, weed management practices involving pendimethalin-based programs, flumioxazin combined with Diclosulum or Pyroxasulfone and Pyroxasulfone followed by Tembotrione continued to maintain lower pooled weed density (≈0.7–1.3 plants m^{-2}) and dry weight (≈1.0–1.8 g m^{-2}). These values were statistically comparable with those recorded under the farmers' practice, indicating sustained suppression of R. cochinchinensis during the critical vegetative growth phase of corn. In contrast, the untreated plots showed a sharp increase in infestation, with pooled weed density rising to about 5.8 plants m^{-2} and dry weight exceeding 3.9 g m^{-2}, reflecting severe mid-season weed competition. Similar mid-season resurgence of grassy weeds under inadequate residual control has been reported earlier (Kumar et al., 2015; Rana et al., 2020). The association of herbicides, on tank mix Pendimethalin + Pyroxasulfone (TM -PE), Flumioxazine + Diclosulum (PE)-TM, Flumioxazin + Pyroxasulfone (PE)-TM controlled all the weeds effectively. Sequence of application of Pyroxasulfone (PE) controlled all the weeds including R. cochinchinensis till 30-35 days and application of Tembotrione Post emergent herbicide controlled all weeds, but was found ineffective in controlling newly emerging RC. Application of tank mix herbicide flumioxazin combined with Diclosulum or Pyroxasulfone was found toxic to crop, but found very effective in controlling all the weed flora.

At 90 DAS, pendimethalin applied as pre-plant incorporation followed by pendimethalin as pre-emergence recorded the lowest pooled weed density (1.85 plants m^{-2}) and weed dry weight (2.54 g m^{-2}) of Rottboellia cochinchinensis and was significantly superior to most other herbicidal treatments. The sustained effectiveness of this treatment can be attributed to early and uniform herbicide placement in the soil profile, which suppresses successive flushes of germinating weeds and reduces late-season establishment. Similar advantages of sequential pendimethalin application in controlling grassy weeds have been reported by Chauhan and Johnson (2010) and Mahajan et al. (2014). The farmers' practice of two hand weedings at 20 and 40 DAS also resulted in lower weed density (2.12 plants m^{-2}) and weed dry weight (2.37 g m^{-2}) and was statistically on par with the best herbicidal treatment. Effective physical removal of weeds during the critical period of crop weed competition has been shown to reduce later weed emergence and biomass accumulation, as reported by Rana et al. (2020).

Pendimethalin applied alone as pre-plant incorporation and pre-emergence recorded moderate weed density and weed dry weight ranging, indicating that these treatments were effective in controlling R. cochinchinensis at later stage of the crop compared to pyroxasulfone fb Tembotrione. Similarly, pendimethalin combined with pyroxasulfone, flumioxazine combined with diclosulam and pyroxasulfone recorded pooled weed density ranging from 2.60 to 3.02 plants m^{-2} and weed dry weight between 4.44 and 4.59 g m^{-2}. combinations of these herbicides provided effective suppression of R. cochinchinensis due to efficacy of herbicides which controlled the emergence of later weed flushes, particularly under favourable moisture conditions as per the study documented by Kumar et al. (2015).

In contrast, pyroxasulfone applied as pre-emergence followed by tembotrione as post-emergence recorded higher weed density (3.21 plants m^{-2}) and weed dry weight (6.75 g m^{-2}) at 90 DAS. This reduction in control can be attributed to the limited persistence of pyroxasulfone under field conditions, which allows late-emerging R. cochinchinensis plants to establish once herbicide activity declines. Declining residual activity of pre-emergence herbicides leading to late-season weed escapes has also been reported by Kaur et al. (2017). Application of tembotrione effectively controlled all the emerged weeds, but was less effective against subsequent flushes of R. cochinchinensis, which is known for prolonged emergence behaviour. Similar limitations of post-emergence herbicides against late-emerging grassy weeds have been reported by Jhala et al. (2018). The untreated control recorded the highest weed density (5.01 plants m^{-2}) and weed dry weight (9.93 g m^{-2}), confirming severe infestation and the strong competitive ability of Rottboellia cochinchinensis when no weed control measures are adopted. Unrestricted growth and continuous emergence of grassy weeds under weedy conditions have been widely documented in corn ecosystems (Kumar et al., 2015; Mahajan et al., 2014).

Effect of weed management practices on other grasses and broad-leaved weeds in corn

At 15 and 30 DAS, weed density and weed dry weight of other grasses and broad-leaved weeds were significantly influenced by different weed management practices (Tables 5 and 7; Figs. 4 and 6). Pendimethalin applied as pre-plant incorporation followed by pendimethalin as pre-emergence recorded significantly lower weed density and weed dry weight of both grasses and broad leaf weeds, indicating effective suppression of early weed emergence. Similar early-season control of mixed weed flora in corn with pendimethalin has been reported by Sharma et al. (2016) and Singh et al. (2018), who attributed the effect to inhibition of seedling emergence during the critical period of crop–weed competition. This was closely followed by pendimethalin (580 g a.i. ha^{-1}) combined with pyroxasulfone (127 g a.i. ha^{-1}) and flumioxazine (125 g a.i. ha^{-1}) combined with diclosulam (22 g a.i. ha^{-1}), which also maintained lower weed density (<1.5 plants m^{-2}) and weed dry weight (<1.0 g m^{-2}) at early stages. The effectiveness of these combinations may be attributed to their complementary modes of action, which suppressed both grassy and broad-leaved weeds during early growth stages. Comparable results under herbicide mixtures in corn have been documented by Knezevic et al. (2017). The farmers' practice of two hand weedings recorded higher weed density during early stages, indicating that manual weeding carried out later could not prevent initial weed emergence. The untreated control recorded the highest weed density and weed dry weight at 15 and 30 DAS, reflecting unchecked emergence of mixed weed flora.

As the crop advanced to 45 and 60 DAS, clear differences among weed management practices became evident (Tables 6 and 8; Figs. 5 and 7). Pendimethalin-based programs, pendimethalin combined with pyroxasulfone, and flumioxazine combined with diclosulam continued to maintain lower weed density (≤1.8 plants m^{-2}) and weed dry weight (≤2.6 g m^{-2}) of other grasses and broad-leaved weeds. These treatments were statistically comparable with the farmers' practice, indicating effective weed control during the active vegetative growth phase of corn. Sustained mid-season weed suppression under residual herbicide programs has also been reported by Ganie et al. (2019). However, pendimethalin applied alone and flumioxazine combined with pyroxasulfone showed a gradual increase in weed density and weed dry weight beyond 45 DAS, suggesting partial weed escape. This increase can be attributed to reduced herbicide persistence and staggered weed emergence, particularly of broad-leaved weeds with extended germination behaviour. Similar mid-season weed resurgence due to decline in herbicide activity has been reported by Dass et al. (2017).

Effect of weed management practices on kernel yield of corn

Kernel yield of corn was significantly influenced by different weed management practices during both the years as well as in the pooled analysis (Table 9). Among the treatments, pendimethalin applied as pre-plant incorporation followed by pendimethalin as pre-emergence recorded the highest pooled kernel yield (7731 kg ha^{-1}) and was found to be statistically on par with the farmers' practice of two hand weedings at 20 and 40 DAS (7790 kg ha^{-1}). The higher yield under these treatments can be attributed to effective suppression of weeds during the critical period of crop–weed competition, resulting in improved availability of nutrients, moisture, and light to the corn crop. This was followed by application of pendimethalin as pre-plant incorporation or pre-emergence, which recorded pooled kernel yields of 7404 and 7356 kg ha^{-1}, respectively. These treatments maintained effective weed control during early growth stages but showed slightly higher yields next to application of pendimethalin as PPI and pre-emergence compared to weedy check. Similar yield losses in corn due to uncontrolled weed growth have been widely reported in earlier studies (Dass et al., 2017; Swanton et al., 2015).

CONCLUSION:

The present study clearly demonstrated that weed management practices significantly influenced weed dynamics and kernel yield of corn. Among the evaluated strategies, pendimethalin applied as pre-plant incorporation followed by pre-emergence application proved to be the most effective, as it consistently recorded

lower weed density and weed dry weight of Rottboellia cochinchinensis as well as other grasses and broad-leaved weeds across growth stages of corn which was statistically comparable with the farmers' practice. Herbicide combinations involving pendimethalin with pyroxasulfone and flumioxazine with diclosulam provided effective weed control up to mid-season but due to crop toxicity the herbicide combination could not be recommended. The untreated control consistently recorded the highest weed pressure and the lowest kernel yield, emphasizing the severity of yield losses under unmanaged weed conditions.
The study suggests that sequential use of pre-plant incorporation and pre-emergence herbicide application of pendimethalin can be the most reliable and practical weed management strategy for corn to control R. cochinchinensis.

ACKNOWLEDGEMENT:
The authors are very grateful to the Department of Agriculture, Bangalore, Karnataka for extending financial support through RKVY project to carry out this research work in farmer's field.

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Table 1- Crop Toxicity Ratings as influenced by different herbicides in Maize crop

	Treatments	Dose ga.i/ha	Crop Toxicity Rating (DAHS)*										
			0	1	3	5	7	10	15	18	20	25	30
T1	SSB *fb* Pendimethalin (PE)	670	0	0	0	0	0	0	0	0	0	0	0
T2	Pendimethalin (PPI) *fb* Pendimethalin (PE)	670 *fb* 580	0	0	0	0	0	0	0	0	0	0	0
T3	Pendimethalin (PPI)	670	0	0	0	0	0	0	0	0	0	0	0

T4	Pendimethalin (PE)	670	0	0	0	0	0	0	0	0	0	0	0
T5	Pendimethalin + Pyxoxasulfone (TM -PE)	580+127	0	0	0	0	0	0	0	0	0	0	0
T6	Flumioxazine + Diclosulum (PE)-TM	125+ 22	0	0	0	0	1	3	5	7	7	0	0
T7	Flumioxazine + Pyroxasulfone (PE)-TM	125+127	0	0	0	0	1	3	5	7	7	0	0
T8	Pyroxasulfone PE *fb* *T*embotrione	127+120	0	0	0	0	0	0	0	0	0	0	0
T9	Farmers practice - 2 Hand weeding 20 & 40 DAS		0	0	0	0	0	0	0	0	0	0	0
T10	Unweeded check		0	0	0	0	0	0	0	0	0	0	0

*DAHS- Days after Herbicide spray 0-No injury, Normal; 1- Injury; 10 – complete destruction

Table 1a: Qualitative description of treatment effects on weeds and crop in the visual scoring scale of 0 to 10 (Rao, 1986)

Effect	Rating	Weed	Crop
None	0	No control	No injury, normal
Slight	1	Very poor control	Slight stunting, injury or discoloration
	2	Poor control	Some stand loss, stunting or discoloration
	3	Poor to deficient control	Injury more pronounced but not persistent
Moderate	4	Deficient control	Moderate injury, recovery possible
	5	Deficient to moderate control	Injury more persistent, recovery doubtful
	6	Moderate control	Near severe injury no recovery possible
Severe	7	Satisfactory control	Severe injury stand loss
	8	Good control	Almost destroyed a few plants surviving
	9	Good to excellent control	Very few plants alive
Complete	10	Complete control	Complete destruction

Table 2: Effect of different weed management practices on weed density and weed dry weight of Rottboellia cochinchinensis at 15 and 30

Treatments	**Weed Count (No. m^{-2})**						**Weed dry weight (g. m^{-2})**					
	15 DAS			**30 DAS**			**15 DAS**			**30 DAS**		
	Year 1	**Year 2**	**Pooled**	**Year 1**	**Year 2**	**Pooled**	**Year 1**	**Year 2**	**Pooled**	**Year 1**	**Year 2**	**Pooled**
T1	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}
T2	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}
T3	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}
T4	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}
T5	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}
T6	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}
T7	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}
T8	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.71^{a}
T9	7.37^{b}	7.05^{b}	7.21^{b}	2.41^{b}	1.94^{b}	2.17^{b}	3.42^{b}	3.15^{b}	3.28^{b}	1.15^{b}	0.74^{a}	0.94^{b}
T10	7.33^{b}	7.19^{b}	7.26^{b}	7.06^{c}	7.15^{c}	7.1^{c}	3.71^{c}	3.19^{b}	3.45^{c}	3.47^{c}	3.3^{b}	3.38^{c}
SEm±	**0.13**	**0.1**	**0.11**	**0.06**	**0.1**	**0.09**	**0.08**	**0.04**	**0.08**	**0.03**	**0.02**	**0.05**
C.V.	**10.68**	**8.67**	**9.18**	**7.2**	**11.57**	**10.24**	**10.72**	**5.83**	**11.02**	**4.33**	**3.3**	**8.15**

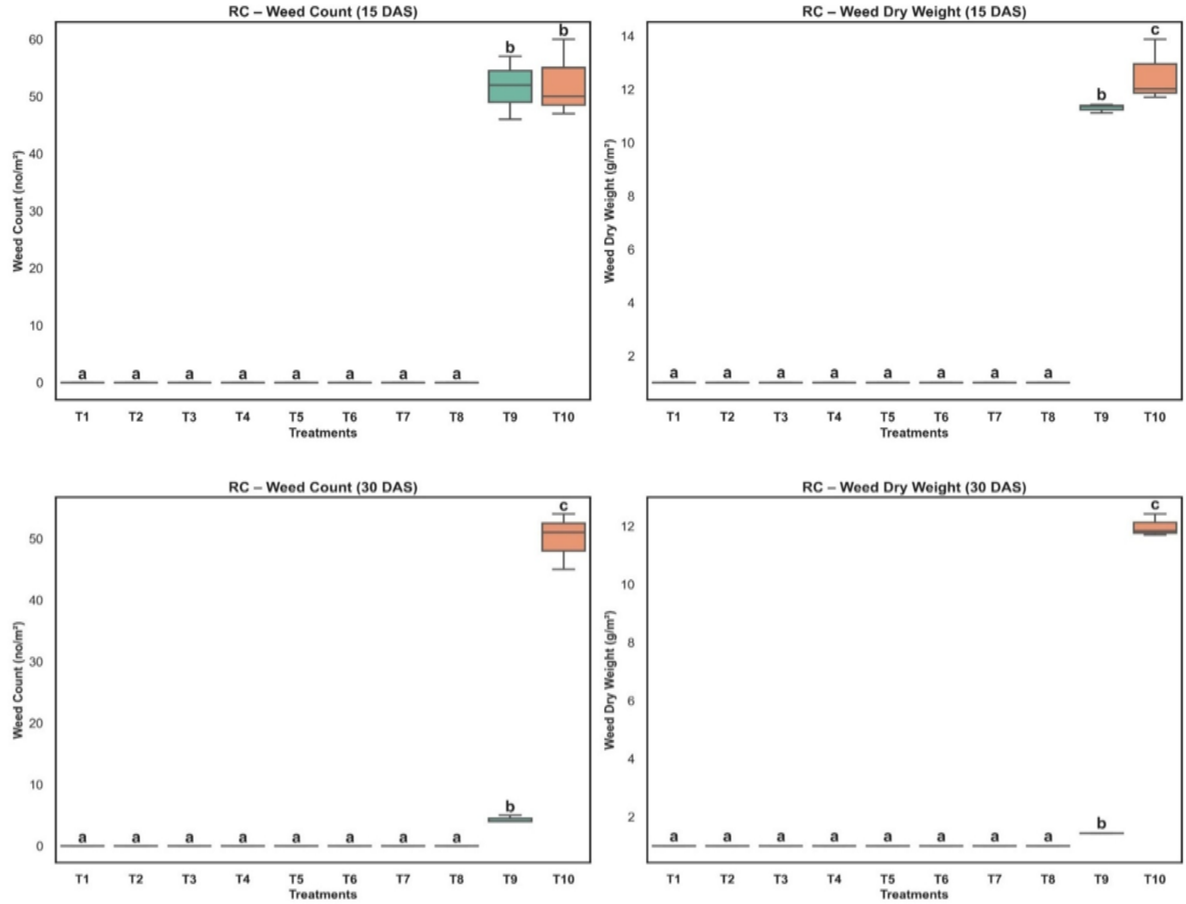


Fig.1: Effect of different weed management practices on weed density and weed dry weight of *Rottboellia cochinchinensis* at 15 and 30 DAS in corn crop

Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE) T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM

T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE) T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM

T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)

T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE) T9- Farmers practice - 2 Hand weeding 20 & 40 DAS

T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM T10-Untreated control (Weedy Check)

Table 3: Effect of different weed management practices on weed density and weed dry weight of *Rottboellia cochinchinensis* at 45 and 60

Treatments	Weed Count (No. m^{-2})						Weed dry weight (g. m^{-2})					
	45 DAS			60 DAS			45 DAS			60 DAS		
	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled
T1	1.47^{c}	1.00^{b}	1.24^{c}	2.12^{d}	1.94^{b}	2.03^{e}	1.16^{c}	1.01^{b}	1.08^{c}	2.24^{d}	2.16^{b}	2.20^{c}
T2	0.71^{a}	0.71^{a}	0.71^{a}	1.00^{a}	1.58^{a}	1.29^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.96^{a}	1.29^{a}	1.12^{a}
T3	1.29^{b}	1.00^{b}	1.15^{b}	1.76^{c}	1.94^{b}	1.85^{d}	1.06^{b}	0.92^{a}	0.99^{b}	2.09^{c}	1.44^{a}	1.76^{b}
T4	1.29^{b}	1.00^{b}	1.15^{b}	1.76^{c}	1.58^{a}	1.67^{c}	1.09^{c}	0.93^{a}	1.01^{c}	1.85^{b}	1.48^{a}	1.67^{b}
T5	1.76^{c}	1.29^{b}	1.53^{d}	2.12^{d}	1.94^{b}	2.03^{e}	1.41^{d}	1.16^{c}	1.29^{d}	2.40^{e}	2.20^{c}	2.30^{d}
T6	1.76^{c}	1.76^{c}	1.76^{e}	2.26^{d}	2.26^{c}	2.26^{g}	1.44^{d}	1.47^{d}	1.46^{e}	2.45^{e}	2.38^{c}	2.41^{d}
T7	1.94^{c}	1.76^{c}	1.85^{e}	2.26^{d}	2.12^{c}	2.19^{f}	1.41^{d}	1.5^{d}	1.45^{e}	2.57^{f}	2.45^{d}	2.51^{e}
T8	1.94^{c}	1.76^{c}	1.85^{e}	2.41^{e}	2.41^{d}	2.41^{h}	1.57^{e}	1.54^{e}	1.55^{e}	3.23^{g}	3.25^{e}	3.24^{f}
T9	0.71^{a}	0.71^{a}	0.71^{a}	1.29^{b}	1.58^{a}	1.44^{b}	0.71^{a}	0.71^{a}	0.71^{a}	0.82^{a}	1.25^{a}	1.04^{a}
T10	5.64^{d}	5.95^{d}	5.8^{f}	5.15^{f}	4.52^{e}	4.84^{i}	4.11^{f}	3.82^{f}	3.97^{f}	4.99^{h}	5.10^{f}	5.04^{g}
SEm±	**0.2**	**0.23**	**0.21**	**0.17**	**0.13**	**0.17**	**0.12**	**0.16**	**0.13**	**0.13**	**0.08**	**0.14**
C.V.	**18.51**	**23.93**	**20.37**	**13.43**	**10.12**	**13.38**	**14.36**	**20.19**	**16.25**	**9.41**	**6.02**	**10.26**

DAS in corn

Means followed by the same lowercase letter in the column do not differ for each other according to Tukey honest significant difference (Tukey HSD Test) at 5 % probability level

SSB: Stale Seedbed; PPI: Pre plant incorporation; **PE:** Pre-emergent; **PoE:** Post emergent (sprayed 20-25 DAS).

Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM
T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)
T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)
T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)
T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T9- Farmers practice - 2 Hand weeding 20 & 40 DAS
T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T10-Untreated control (Weedy Check)

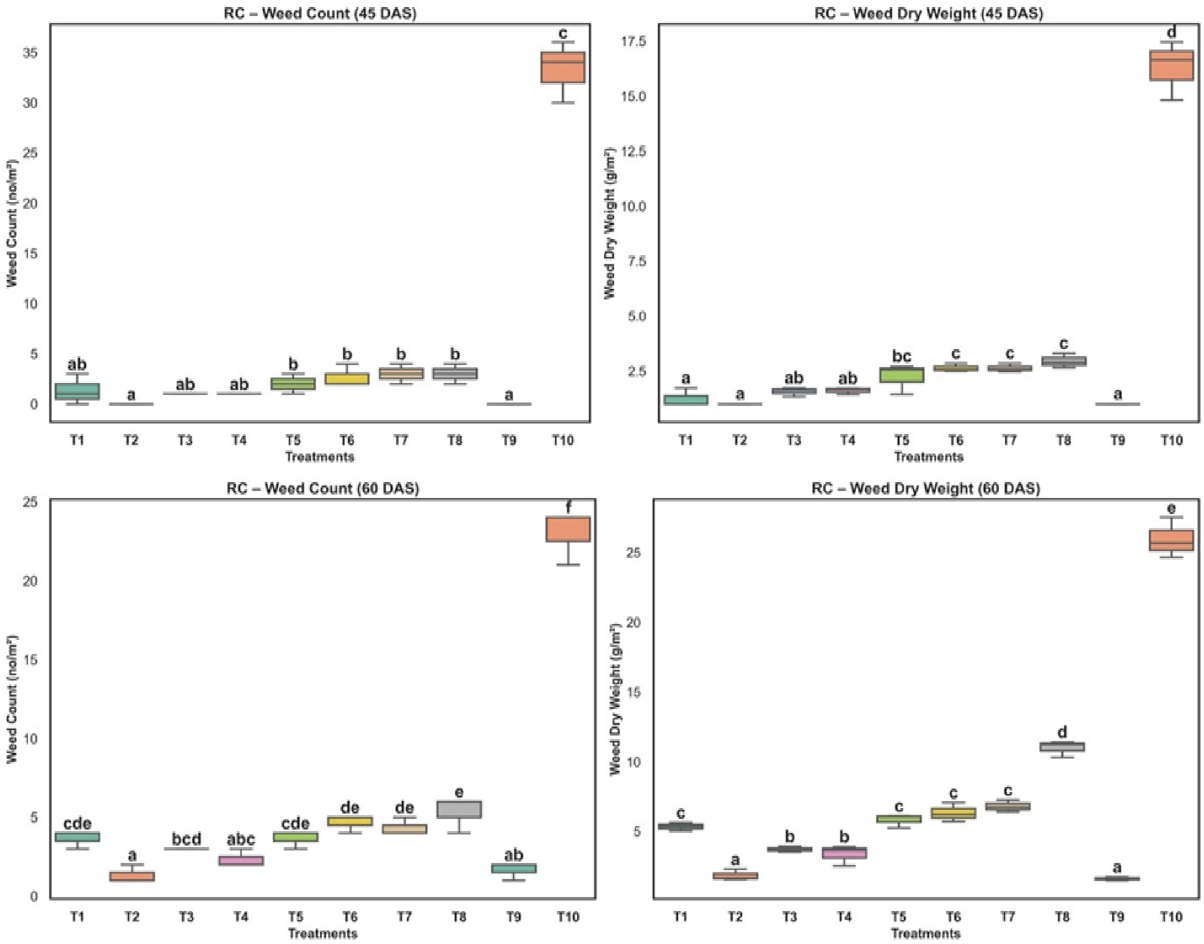


Fig.2: Effect of different weed management practices on weed density and weed dry weight of *Rottboellia cochinchinensis* at 45 and 60 DAS in corn crop

Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)

T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM

T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)

T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM

T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)

T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)

T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)

T9- Farmers practice - 2 Hand weeding 20 & 40 DAS

T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM

T10-Untreated control (Weedy Check)

Table 4: Effect of different weed management practices on weed density and weed dry weight of Rottboellia cochinchinensis at 90

Treatments	Weed Count (No. m^{-2})			Weed dry weight (g. m^{-2})		
	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled
T1	2.80^{d}	2.41^{c}	2.60^{c}	4.61^{b}	4.37^{c}	4.49^{d}
T2	1.94^{a}	1.76^{a}	1.85^{a}	2.74^{a}	2.34^{a}	2.54^{a}
T3	2.41^{c}	2.12^{b}	2.26^{b}	4.25^{b}	4.10^{b}	4.17^{b}
T4	2.41^{c}	2.12^{b}	2.26^{b}	4.30^{b}	4.33^{c}	4.32^{c}
T5	2.80^{d}	2.41^{c}	2.60^{c}	4.50^{b}	4.38^{d}	4.44^{c}
T6	2.90^{e}	2.67^{d}	2.79^{d}	4.57^{b}	4.45^{d}	4.51^{d}
T7	3.23^{f}	2.80^{e}	3.02^{e}	4.64^{b}	4.53^{d}	4.59^{d}
T8	3.63^{g}	2.80^{e}	3.21^{f}	7.08^{c}	6.41e	6.75^{e}
T9	2.12^{b}	2.12^{b}	2.12^{b}	2.44^{a}	2.30^{a}	2.37^{a}
T10	5.15^{h}	4.88^{f}	5.01^{g}	9.95^{d}	9.90^{f}	9.93^{f}
SEm±	**0.13**	**0.09**	**0.12**	**0.17**	**0.09**	**0.13**
C.V.	**7.47**	**6.17**	**7.54**	**5.85**	**3.22**	**4.85**

DAS in corn crop

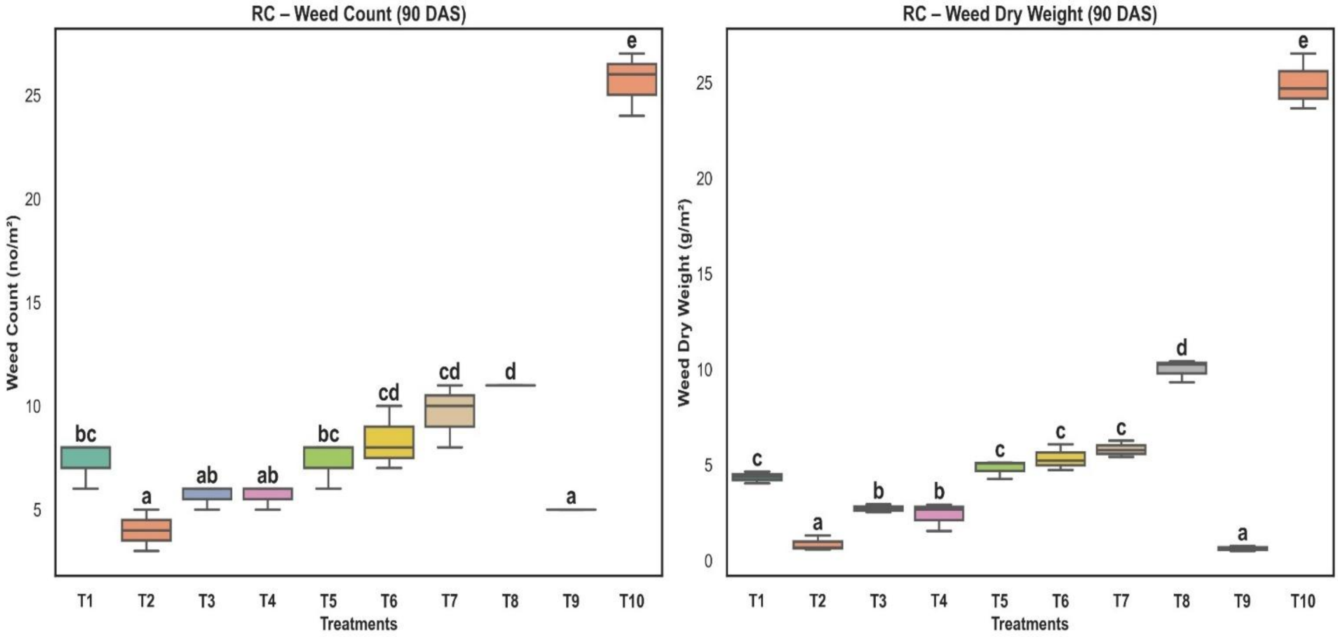
Means followed by the same lowercase letter in the column do not differ for each other according to Tukey honest significant difference (Tukey HSD Test) at 5 % probability level

SSB: Stale Seedbed; PPI: Pre plant incorporation; **PE:** Pre-emergent; **PoE:** Post emergent (sprayed 20-25 DAS).

Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM
T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)
T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)
T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)
T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T9- Farmers practice - 2 Hand weeding 20 & 40 DAS
T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T10-Untreated control (Weedy Check)

Fig.3: Effect of different weed management practices on weed density and weed dry weight of *Rottboellia*



***cochinchinensis* at 90 DAS in corn crop**

Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM
T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)
T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)
T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)
T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T9- Farmers practice - 2 Hand weeding 20 & 40 DAS
T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T10-Untreated control (Weedy Check)

Table 5: Effect of different weed management practices on weed density and weed dry weight of other grasses at 15 and 30 DAS in corn

Treatments	Weed Count (No. m^{-2})						Weed dry weight (g. m^{-2})					
	15 DAS			30 DAS			15 DAS			30 DAS		
	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled
T1	0.71^{a}	0.71^{a}	0.71^{a}	1.58^{b}	1.58^{b}	1.58^{b}	0.71^{a}	0.71^{a}	0.71^{a}	0.79^{a}	0.83^{a}	0.81^{b}
T2	0.71^{a}	0.71^{a}	0.71^{a}	1.29^{a}	1.29^{a}	1.29^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.78^{a}	0.77^{a}	0.77^{a}
T3	0.71^{a}	0.71^{a}	0.71^{a}	1.76^{b}	1.29^{a}	1.53^{b}	0.71^{a}	0.71^{a}	0.71^{a}	0.81^{a}	0.79^{a}	0.80^{b}
T4	0.71^{a}	0.71^{a}	0.71^{a}	1.76^{b}	1.29^{a}	1.53^{b}	0.71^{a}	0.71^{a}	0.71^{a}	0.82^{a}	0.80^{a}	0.81^{b}
T5	1.47^{b}	1.00^{b}	1.24^{b}	2.12^{c}	1.94^{b}	2.03^{d}	0.80^{a}	0.75^{b}	0.77^{a}	0.88^{a}	0.86^{b}	0.87^{b}
T6	1.47^{b}	1.00^{b}	1.24^{b}	1.94^{b}	1.58^{b}	1.76^{b}	0.81^{a}	0.75^{b}	0.78^{a}	0.97^{b}	0.81^{a}	0.89^{b}
T7	1.47^{b}	1.29^{c}	1.38^{b}	2.03^{c}	1.76^{b}	1.89^{c}	0.82^{a}	0.78^{b}	0.80^{a}	0.97^{b}	0.84^{a}	0.91^{b}
T8	1.47^{b}	1.29^{c}	1.38^{b}	2.80^{d}	2.12^{c}	2.46^{e}	0.79^{a}	0.79^{c}	0.79^{a}	1.21^{c}	0.90^{b}	1.05^{c}
T9	2.90^{c}	2.41^{d}	2.65^{c}	2.08^{c}	1.94^{b}	2.01^{d}	1.13^{b}	0.91^{d}	1.02^{b}	1.29^{d}	1.02^{c}	1.16^{d}
T10	3.54d	3.13^{e}	3.34^{d}	4.60^{e}	3.01^{d}	3.81^{f}	1.51^{c}	1.04^{e}	1.27^{c}	2.34^{e}	1.44^{d}	1.89^{e}
SEm±	**0.21**	**0.16**	**0.18**	**0.21**	**0.2**	**0.23**	**0.06**	**0.02**	**0.06**	**0.09**	**0.06**	**0.11**
C.V.	**24.03**	**21.86**	**22.45**	**16.67**	**19.07**	**20.42**	**11.7**	**4.83**	**13.1**	**14.06**	**10.57**	**19.05**

Means followed by the same lowercase letter in the column do not differ for each other according to Tukey honest significant difference (Tukey HSD Test) at 5 % probability level

SSB: Stale Seedbed; PPI: Pre plant incorporation; **PE:** Pre-emergent; **PoE:** Post emergent (sprayed 20-25 DAS).

Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM
T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)
T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)
T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)
T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T9- Farmers practice - 2 Hand weeding 20 & 40 DAS
T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T10-Untreated control (Weedy Check)

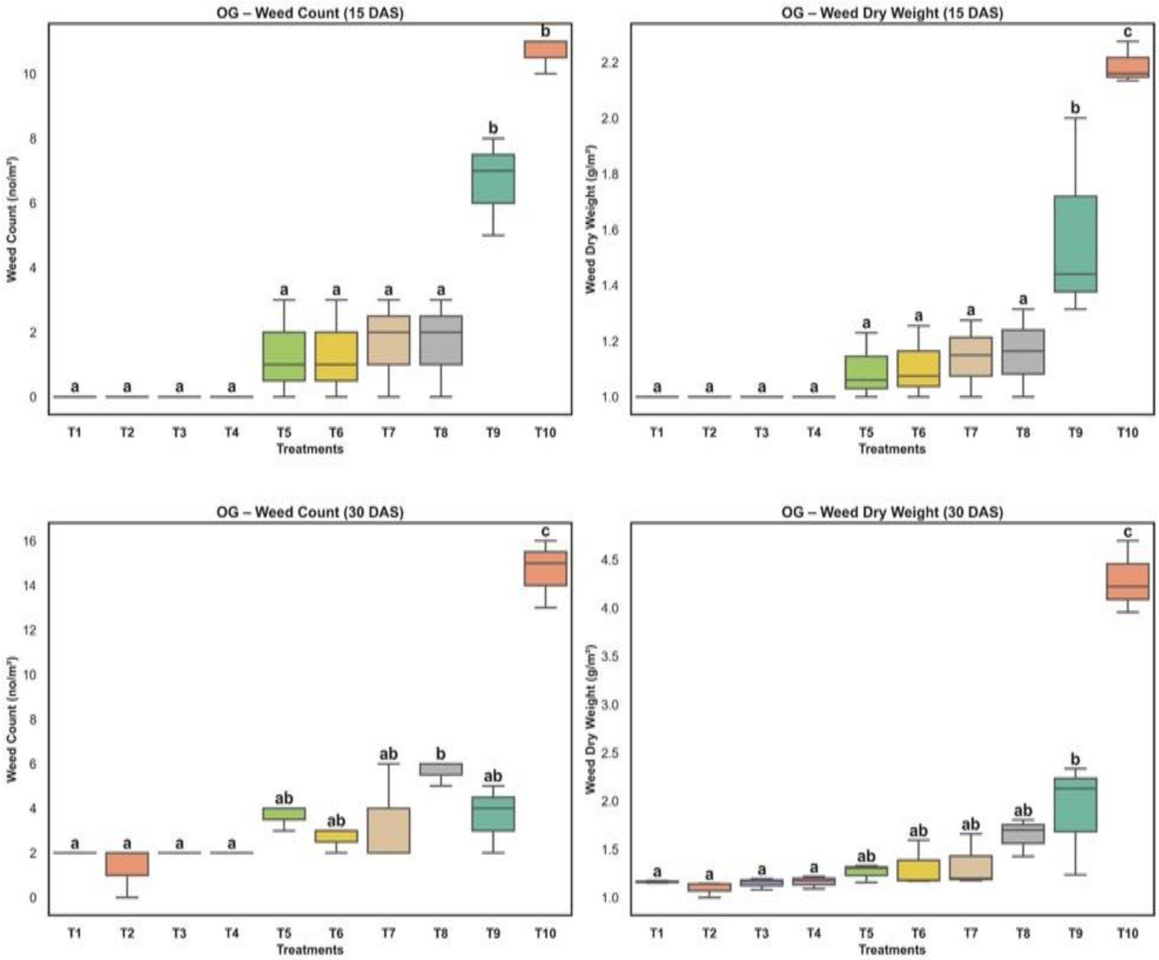


Fig.4: Effect of different weed management practices on weed density and weed dry weight of other grasses at 15 and 30 DAS in corn crop Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)

T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM

T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)

T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM

T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)

T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)

T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)

T9- Farmers practice - 2 Hand weeding 20 & 40 DAS

T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM

T10-Untreated control (Weedy Check)

Table 6: Effect of different weed management practices on weed density and weed dry weight of other grasses at 45 and 60 DAS in corn

Treatments	Weed Count (No. m^{-2})						Weed dry weight (g. m^{-2})					
	45 DAS			60 DAS			45 DAS			60 DAS		
	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled
T1	1.47^{b}	1.76^{d}	1.61^{b}	2.55^{c}	2.41^{b}	2.48^{c}	0.92^{a}	1.28^{b}	1.10^{d}	1.94^{d}	2.27^{e}	2.11^{d}
T2	1.29^{b}	1.00^{b}	1.15^{a}	1.58^{a}	1.58^{a}	1.58^{a}	0.87^{a}	0.79^{a}	0.83^{b}	1.32^{b}	1.30^{b}	1.31^{b}
T3	1.76^{c}	1.58^{c}	1.67^{b}	2.08^{b}	1.94^{a}	2.01^{b}	0.91^{a}	1.20^{b}	1.05^{c}	1.70c	1.99^{d}	1.84^{c}
T4	1.76^{c}	1.58^{c}	1.67^{b}	2.08^{b}	1.76^{a}	1.92^{b}	0.90^{a}	1.28^{b}	1.09^{d}	1.72^{c}	1.79^{c}	1.75^{c}
T5	2.53^{d}	2.53^{e}	2.53^{c}	3.09^{e}	2.64^{b}	2.87^{e}	1.19^{b}	1.73^{c}	1.46^{e}	2.18^{e}	2.35^{f}	2.27^{e}
T6	2.67^{d}	2.67^{e}	2.67^{c}	2.78^{d}	2.67^{b}	2.73^{d}	1.20^{b}	1.80^{c}	1.50^{e}	2.18^{e}	2.36^{f}	2.27^{e}
T7	2.80^{e}	2.80^{e}	2.80^{d}	2.92^{d}	2.90^{c}	2.91^{e}	1.22^{b}	1.80^{c}	1.51^{e}	2.52^{f}	2.51^{f}	2.51^{f}
T8	3.32^{f}	2.90^{e}	3.11^{e}	3.63^{f}	3.33^{d}	3.48^{f}	1.35^{b}	1.92^{c}	1.64^{e}	3.21^{g}	2.84^{g}	3.02^{g}
T9	1.00^{a}	0.71^{a}	0.86^{a}	1.58^{a}	1.58^{a}	1.58^{a}	0.71^{a}	0.71^{a}	0.71^{a}	0.80^{a}	0.77^{a}	0.78^{a}
T10	5.33^{g}	5.00^{f}	5.16^{f}	4.45^{g}	4.52^{e}	4.48^{g}	2.19^{c}	3.06^{d}	2.62^{f}	4.21^{h}	3.92^{h}	4.07^{h}
SEm$\pm$	0.2	0.19	0.19	0.15	0.15	0.15	0.07	0.11	0.12	0.11	0.11	0.12
C.V.	14.49	14.47	13.89	9.86	10.59	9.82	10.79	11.76	15.59	8.83	8.6	9.64

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM
T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)
T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)
T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)
T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T9- Farmers practice - 2 Hand weeding 20 & 40 DAS
T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T10-Untreated control (Weedy Check)

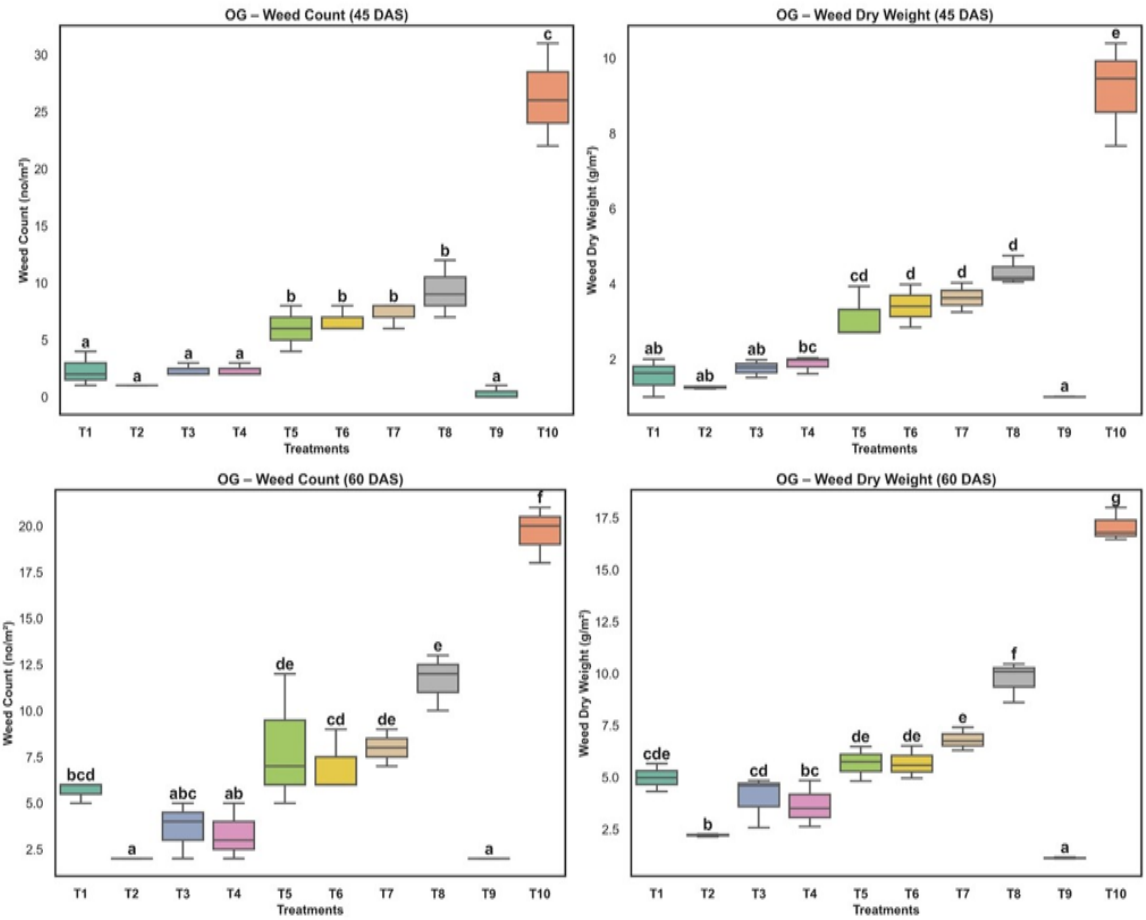


Fig.5: Effect of different weed management practices on weed density and weed dry weight of other grasses at 45 and 60 DAS in corn crop Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM
T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)
T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)
T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)
T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T9- Farmers practice - 2 Hand weeding 20 & 40 DAS
T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T10-Untreated control (Weedy Check)

Table 7: Effect of different weed management practices on weed density and weed dry weight of broad-leaved weeds at 15 and 30 DAS in corn crop

Treatments	Weed Count (No. m^{-2})						Weed dry weight (g. m^{-2})					
	15 DAS			30 DAS			15 DAS			30 DAS		
	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled
T1	1.00^{a}	1.00^{a}	1.00^{a}	1.76^{b}	1.76^{b}	1.76^{b}	0.73^{a}	0.74^{a}	0.73^{a}	0.80^{a}	0.79^{a}	0.80^{b}
T2	1.00^{a}	0.71^{a}	0.86^{a}	1.29^{a}	1.29^{a}	1.29^{a}	0.72^{a}	0.71^{a}	0.72^{a}	0.74^{a}	0.74^{a}	0.74^{a}
T3	1.29^{a}	1.00^{a}	1.15^{a}	1.94^{c}	1.94^{c}	1.94^{b}	0.74^{a}	0.74^{a}	0.74^{a}	0.80^{a}	0.81^{a}	0.81^{b}
T4	1.00^{a}	0.71^{a}	0.86^{a}	1.94^{c}	1.94^{c}	1.94^{b}	0.74^{a}	0.74^{a}	0.72^{a}	0.81^{a}	0.82^{a}	0.82^{b}
T5	1.18^{a}	1.00^{a}	1.09^{a}	2.26^{d}	2.12^{d}	2.19^{c}	0.74^{a}	0.74^{a}	0.74^{a}	0.84^{a}	0.83^{a}	0.84^{b}
T6	1.00^{a}	1.00^{a}	1.00^{a}	2.26^{d}	2.26^{e}	2.26^{c}	0.74^{a}	0.75^{a}	0.74^{a}	0.85^{a}	0.82^{a}	0.84^{b}
T7	1.00^{a}	1.29^{a}	1.15^{a}	2.67^{e}	2.55^{f}	2.61^{d}	0.73^{a}	0.76^{a}	0.74^{a}	0.88^{a}	0.86^{a}	0.87^{b}
T8	1.29^{a}	1.29^{a}	1.29^{a}	3.01^{f}	2.90^{g}	2.96^{e}	0.75^{a}	0.74^{a}	0.74^{a}	0.91^{a}	0.90^{a}	0.90^{c}
T9	3.62^{b}	2.41^{b}	3.01^{b}	1.94^{c}	1.94^{c}	1.94^{b}	1.11^{b}	0.87^{b}	0.99^{b}	0.80^{a}	0.81^{a}	0.80^{b}
T10	4.37^{b}	3.60^{c}	3.98^{c}	6.26^{g}	5.43^{h}	5.84^{f}	1.22^{c}	1.05^{c}	1.14^{c}	2.22^{b}	2.25^{b}	2.23^{d}
SEm±	**0.3**	**0.26**	**0.29**	**0.26**	**0.22**	**0.23**	**0.02**	**0.03**	**0.04**	**0.08**	**0.07**	**0.07**
C.V.	**31.2**	**31.78**	**32.17**	**17.53**	**15.77**	**16**	**5.05**	**7.38**	**8.24**	**14.04**	**12.92**	**12.11**

Means followed by the same lowercase letter in the column do not differ for each other according to Tukey honest significant difference (Tukey HSD Test) at 5 % probability level

SSB: Stale Seedbed; PPI: Pre plant incorporation; **PE:** Pre-emergent; **PoE:** Post emergent (sprayed 20-25 DAS).

Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM
T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)
T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)
T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)
T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T9- Farmers practice - 2 Hand weeding 20 & 40 DAS
T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T10-Untreated control (Weedy Check)

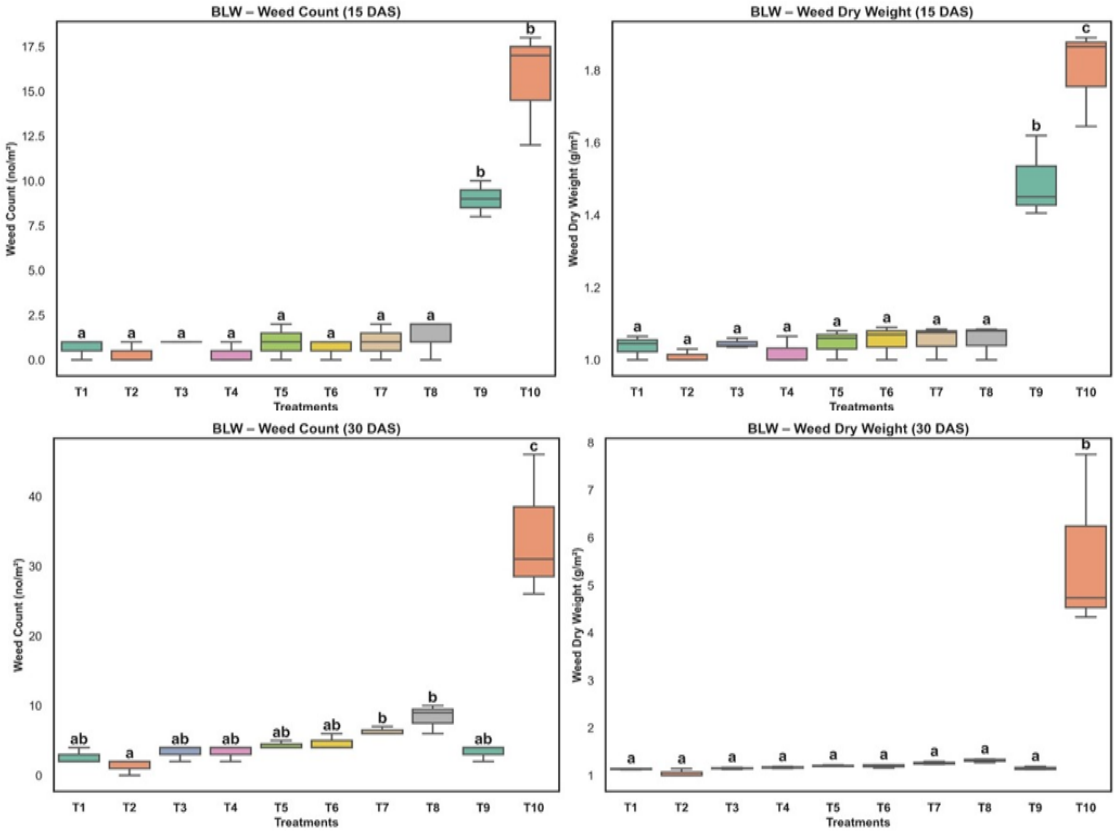


Fig.6: Effect of different weed management practices on weed density and weed dry weight of broad-leaved weeds at 15 and 30 DAS in corn

Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM
T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)
T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)
T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)
T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T9- Farmers practice - 2 Hand weeding 20 & 40 DAS
T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T10-Untreated control (Weedy Check)

Table 8: Effect of different weed management practices on weed density and weed dry weight of broad-leaved weeds at 45 and 60 DAS in corn crop

Treatments	Weed Count (No. m^{-2})						Weed dry weight (g. m^{-2})					
	45 DAS			60 DAS			45 DAS			60 DAS		
	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled	Year 1	Year 2	Pooled
T1	2.53^{b}	2.53^{c}	2.53^{c}	4.14^{d}	3.98^{c}	4.06^{c}	1.36^{c}	1.33^{c}	1.35^{c}	4.00^{d}	3.55^{e}	3.78^{e}
T2	2.21^{b}	1.29^{b}	1.75^{b}	2.78^{a}	2.67^{a}	2.73^{a}	1.02^{b}	0.91^{b}	0.97^{a}	2.72^{b}	2.39^{b}	2.56^{b}
T3	2.53^{b}	2.08^{c}	2.31^{c}	3.53^{b}	3.23^{b}	3.38^{b}	1.26^{c}	1.15^{c}	1.21^{b}	3.46^{c}	2.67^{c}	3.07^{c}
T4	2.53^{b}	2.08^{c}	2.31^{c}	3.81^{c}	3.34^{b}	3.58^{b}	1.31^{c}	1.17^{c}	1.24^{c}	3.76^{c}	2.86^{d}	3.31^{d}
T5	3.61^{c}	3.33^{d}	3.47^{d}	4.94^{g}	4.74^{d}	4.84^{e}	1.40^{c}	1.55^{d}	1.48^{d}	4.84^{f}	4.10^{g}	4.47^{g}
T6	3.70^{c}	3.44^{d}	3.57^{d}	4.30^{e}	4.67^{d}	4.48^{d}	1.72^{d}	1.65^{d}	1.69^{e}	3.98^{d}	3.99^{f}	3.98^{f}
T7	3.33^{c}	3.61^{e}	3.47^{d}	4.80^{g}	4.94^{d}	4.87^{e}	1.64^{d}	1.70^{d}	1.67^{e}	4.45^{e}	4.12^{g}	4.29^{f}
T8	4.30^{d}	4.06^{f}	4.18^{e}	5.87^{h}	5.81^{e}	5.84^{f}	1.86^{e}	1.98^{e}	1.92^{f}	5.55^{g}	4.53^{h}	5.04^{h}
T9	1.29^{a}	0.71^{a}	1.00^{a}	4.66^{f}	4.13^{c}	4.40^{d}	0.77^{a}	0.71^{a}	0.74^{a}	1.50a	1.50^{a}	1.50^{a}
T10	9.64^{e}	8.44^{g}	9.04^{f}	7.25^{i}	7.16^{f}	7.20^{g}	4.58^{f}	5.04^{f}	4.81^{g}	9.2^{h}	6.72^{i}	7.96^{i}
SEm±	**0.19**	**0.16**	**0.21**	**0.13**	**0.15**	**0.15**	**0.14**	**0.07**	**0.11**	**0.21**	**0.15**	**0.28**
C.V.	**9.26**	**9**	**10.73**	**4.77**	**5.62**	**5.66**	**14.43**	**6.73**	**11.57**	**8.25**	**7.04**	**12.09**

Means followed by the same lowercase letter in the column do not differ for each other according to Tukey honest significant difference (Tukey HSD Test) at 5 % probability level

SSB: Stale Seedbed; PPI: Pre plant incorporation; **PE:** Pre-emergent; **PoE:** Post emergent (sprayed 20-25 DAS).

Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM
T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)
T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)
T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)
T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T9- Farmers practice - 2 Hand weeding 20 & 40 DAS
T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T10-Untreated control (Weedy Check)

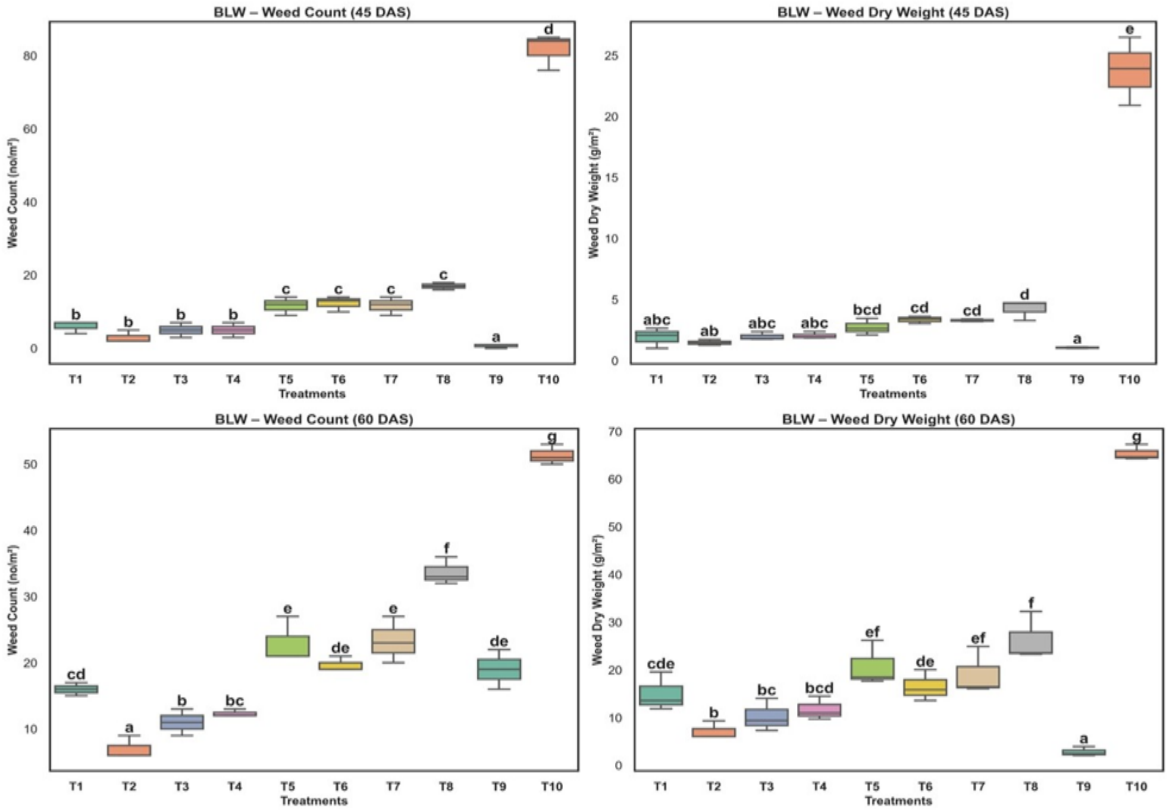


Fig.7: Effect of different weed management practices on weed density and weed dry weight of broad-leaved weeds at 45 and 60 DAS in corn

Treatment details

T1- SSB *fb* Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T6-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Diclosulum 84% WDG @ 22 g a.i. ha^{-1} (PE)-TM
T2- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI) *fb* Pendimethalin 38.7 EC @ 580 g a.i. ha^{-1} (PE)
T7-Flumioxazine 50% SC @ 125 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T3 - Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PPI)
T8 - Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) *fb* Tembotrione 42% SC @ 120 g a.i. ha^{-1} (PoE)
T4- Pendimethalin 38.7% EC @ 670 g a.i. ha^{-1} (PE)
T9- Farmers practice - 2 Hand weeding 20 & 40 DAS
T5- Pendimethalin 38.7% EC @ 580 g a.i. ha^{-1} + Pyroxasulfone 85% WG @ 127 g a.i. ha^{-1} (PE) -TM
T10-Untreated control (Weedy Check)

Table 9: Effect of different weed management practices on kernel yield of corn

Treatments	Kernel yield (Kg ha^{-1})		
	2024	**2025**	**Pooled**
T1	7018^{c}	7126^{c}	7072^{c}
T2	7724^{a}	7738^{a}	7731^{a}
T3	7362^{b}	7446^{b}	7404^{b}
T4	7314^{b}	7398^{b}	7356^{b}
T5	6964^{c}	7062^{c}	7013^{c}
T6	6542^{d}	6648^{d}	6595^{d}
T7	6431^{d}	6527^{d}	6479^{d}
T8	6896^{c}	6991^{c}	6943^{c}
T9	7786^{a}	7794^{a}	7790^{a}
T10	3824^{e}	3916^{e}	3870^{e}
SEm±	**5.02**	**3.75**	**3.94**