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Studies on use of post emergent herbicides on weed dynamics, weed control efficiency, yield and economics of *Bt* cotton

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Abstract
A field experiment was conducted at the Main Agricultural Research Station, University of Agricultural Sciences, Raichur, Karnataka, during *kharif* 2025 to evaluate the efficacy of different weed-management practices on weed control, seed-cotton yield and economics in *Bt* cotton. The experiment was laid out in Randomized Complete Block Design (RCBD) with ten treatments and three replications. The results revealed that among the herbicides, application of pyrithiobac sodium 10 % + clethodim 10.25 % SE at 283 g *a.i.* ha^{-1} at the 3-4 leaf stage as a post-emergence treatment, followed by intercultivation at 45 days after sowing (DAS), recorded significantly lower total weed density (2.35, 1.96, 2.68 and 3.76 at 15, 30, 45 and 60 DAS respectively), lower weed dry matter (2.14, 1.90, 3.20 and 5.28 g m^{-2} at 15, 30, 45 and 60 DAS respectively) and higher total weed control efficiency (90.97, 94.40, 93.33 and 86.90 per cent at 15, 30, 45 and 60 days after herbicide application, respectively) and a lower weed index (9.92 %). However, this treatment was statistically at par with application of the same herbicide combination at 243 g *a.i.* ha^{-1} at the 3-4 leaf stage, followed by intercultivation at 45 DAS. The application of pyrithiobac sodium 10 % + clethodim 10.25 % SE at 283 g *a.i.* ha^{-1} also recorded higher seed cotton yield (2680 kg ha^{-1}), gross returns (₹ 2,00,975 ha^{-1}), net returns (₹ 1,23,580 ha^{-1}) and benefit cost ratio (2.60). From the present investigation, it can be concluded that application of pyrithiobac sodium 10 % + clethodim 10.25 % SE at 243 g *a.i.* ha^{-1} at the 3-4 leaf stage, followed by intercultivation at 45 DAS, was the most economically favourable herbicidal treatment for effective weed management and improved seed-cotton productivity in *Bt* cotton.

Keywords: Bt cotton, clethodim, pyrithiobac sodium, post-emergence herbicide, weed control efficiency, weed index, seed cotton yield

Introduction
Cotton (Gossypium spp.) is one of the most important commercial fibre crops in the world and is widely known as “White Gold” because of its significant economic value. It belongs to the family Malvaceae and is primarily cultivated for its natural fibre, which is used in the textile and clothing industries. Cotton is an important cash crop in India, providing livelihood and employment opportunities to millions of farmers, agricultural labourers, traders and workers in textile industries. Cotton fibre is used for manufacturing clothes, yarn, fabrics, bed sheets, towels and various industrial products. Cotton seeds are also economically important, as they are processed to obtain cottonseed oil, which is used for edible and industrial purposes. Cotton stalks can be used as fuel and for other industrial purposes. In India, cotton plays a vital role in the agricultural economy by contributing to farmers’ income, agricultural exports and the development of the textile industry. India is one of the major cotton-producing countries in the world, and cotton is cultivated under diverse agro-climatic conditions.

During 2025-26, cotton occupied 114.82 lakh hectares with a production of 290.91 lakh bales and productivity of 431 kg ha^{-1}. In Karnataka, it occupied 6.80 lakh hectares with a production of 2.27 million bales and productivity of 570 kg ha^{-1} during 2024-25 (Anon. 2026a, Anon. 2026b and Anon. 2025) [1, 2, 3].

Cotton productivity is constrained by several biotic and abiotic factors, among which weed infestation is a major constraint. The slow initial growth and wider row spacing of cotton favour weed emergence and establishment, resulting in competition for nutrients, moisture, light and space. The intensity of crop–weed competition depends on weed density, species composition, time of emergence and duration of interference (Prabhu *et al*., 2012, Papamichail *et al*., 2002, Knezevic *et al*., 2002 and Iqbal *et al*., 2019) [8, 11, 17, 18]. Early-season weed competition can substantially reduce crop growth and seed cotton yield, while late-season weeds may interfere with harvesting and affect produce quality. Their occurrence and dominance vary with soil, rainfall, cropping system and management practices (Kamble *et al*., 2017 and Veeraputhiran, 2023) [10, 23], making management of diverse weed flora difficult through a single method or herbicide. Cotton weeds are traditionally managed through preventive, cultural, mechanical and manual methods. Although hand weeding and intercultivation are effective, they are labour-intensive, costly and often difficult to perform timely under labour scarcity and rainy conditions. Mechanical operations at later crop stages may also be restricted due to crop growth and

the risk of crop damage. Hence, chemical weed management, particularly post-emergence herbicides, has gained importance for timely suppression of emerged weeds and reduction of crop-weed competition (Nadanassababady *et al*., 2000 [15] and Panchal *et al*., 2024) [15, 16]. Therefore, the present study was undertaken to evaluate the influence of post emergent herbicides on weed dynamics, weed control efficiency, seed cotton yield and economics of *Bt*

Cotton Materials and Methods

The experiment was conducted during *kharif* season of 2025 at Main Agricultural Research Station (MARS), University of Agricultural Sciences (UAS), Raichur, which is situated at a latitude of 16º 12′ N, longitude of 77º 20′ E and at an elevation of 407 metres above the mean sea level and falls under the North-Eastern Dry Zone of Karnataka (Zone-2). The soil of the experimental site was deep black soil with a pH 8.10 and electrical conductivity of 0.35 dS m^{-1}, 0.70 per cent organic carbon, 225 kg ha^{-1} available nitrogen, 23 kg ha^{-1} available phosphorus (P_2O_5) and 410 kg ha^{-1} available potassium (K_2O).

The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications and ten treatments comprising pyrithiobac sodium 10 % + clethodim 10.25 % SE @ 160 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS (T_1), pyrithiobac sodium 10 % + clethodim 10.25 % SE @ 202.50 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS (T_2), pyrithiobac sodium 10 % + clethodim 10.25 % SE @ 243 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS (T_3), pyrithiobac sodium 10 % + clethodim 10.25 % SE @ 283 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS (T_4), clethodim 25 % EC @ 180 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS (T_5), pyrithiobac sodium 10 % EC @ 75 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS (T_6), pyrithiobac sodium 6 % + quizalofop ethyl 4 % MEC @ 112.5 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS (T_7), weed-free check with hand weeding at 20, 40 and 60 DAS + IC at 25, 45 and 65 DAS (T_8), weedy check (T_9) and farmer's practice with hand weeding at 25 and 55 DAS + IC at 30 and 60 DAS (T_{10}).

The *Bt* cotton hybrid SWCH 4749 BG II (US 7067) was used for the experiment. The hybrid is a high-yielding *Bt* cotton hybrid possessing *Cry1Ac* and *Cry2Ab* genes for resistance against bollworms. The crop was sown on 3rd July 2025 at a spacing of 90 cm × 60 cm. The post-emergent herbicides were applied as per the treatment details using a hand-operated knapsack sprayer fitted with a suitable nozzle at a spray volume of 500 L ha^{-1} followed by intercultivation operation. The fertilizers (RDF) 180-90- 90 kg NPK ha^{-1} was applied as per the recommended dosage.

Weed density was recorded at 15, 30, 45 and 60 days after herbicide application by placing a 0.5 m^{-2} quadrat at random in each plot and the observations were expressed as number of weeds m^{-2}. The weed density and weed dry matter data were subjected to square-root transformation using $(x + 0.5)^{1/2}$ before statistical analysis. Weed control efficiency (WCE) denotes the magnitude of reduction in weed biomass due to the weed management treatments. The weed control efficiency was calculated by using the formula given by Mani *et al.* (1976) [14]. Weed control efficiency was calculated at 15, 30, 45, 60 days after herbicide application (DAHA) and at harvest.

$$WCE\ (\%) = \frac{W_c - W_t}{W_c} \times 100$$

Where,

W_c = Dry weight of weeds in weedy check (g m^{-2})

W_t = Dry weight of weeds in respective treatment plot (g m^{-2})

The total seed cotton picked from the net plot of each treatment in different pickings were used and worked out the seed cotton yield ha^{-1}. Weed index (WI) is the reduction in crop yield due to the presence of weeds in comparison with weed free check and expressed as percentage. In other words, weed index expresses the competition offered by weeds, measured by per cent reduction in yield owing to their presence in the field. Weed index was calculated by using the formula given by Gill and Vijayakumar (1969) [6].

$$WI\ (\%) = \frac{X - Y}{X} \times 100$$

Where,

X- Seed cotton yield in weed free check plot

Y- Seed cotton yield in treated plot.

The economics of different weed-management treatments was calculated based on the prevailing prices of inputs at the time of their use. The data were statistically analysed using Fisher's method of analysis of variance and the significance of treatment effects was tested at the 5 per cent probability level ($P = 0.05$), as described by Bartlett (1947) [4].

Results and discussion

Weed flora

The major grassy weeds observed in the experimental field were *Cynodon dactylon, Agropyron repens, Digitaria ciliaris, Dinebra retroflexa* and *Brachiaria euciformis*. The commonly occurring broad-leaved weeds were *Amaranthus spinosus, Aristolochia bracteata* Retz., *Calotropis gigantea, Commelina benghalensis, Corchorus trilocularis, Euphorbia geniculata, Euphorbia hirta, Cassia occidentalis, Cleome viscosa, Digera arvensis* Forsk., *Parthenium hysterophorus, Phyllanthus niruri, Physalis minima, Portulaca oleracea, Sida acuta, Tridax procumbens, Xanthium strumarium, Abutilon indicum, Acalypha indica, Acanthospermum hispidum, Cyanotis cucullata* and *Lagascea mollis*. etc.

Total weeds density (No. m^{-2}) and Total weed dry matter (g m^{-2})

The weed density and weed dry matter were significantly reduced by the application of herbicides compared with the weedy check (Tables 1). Among the weed management practices, At 15, 30, 45 and 60 DAA, the weed-free check (T_8), comprising three hand weedings at 20, 40 and 60 DAS along with three intercultivations at 25, 45 and 65 DAS, recorded significantly lower total weed density and total weed dry matter (0.71 m^{-2} and 0.71 g m^{-2}, respectively, at all the stages) and was statistically on par with farmer's practice (T_{10}) at 15 and 45 DAA. Among the herbicidal

treatments, application of pyrithiobac sodium 10 % + clethodim 10.25 % SE @ 283 g *a.i.* ha^{-1} at the 3-4 leaf stage (PoE), followed by intercultivation at 45 DAS (T_4), recorded significantly lower total weed density (2.35, 1.96, 2.68 and 3.76 m^{-2}) and total weed dry matter (2.14, 1.90, 3.20 and 5.28 g m^{-2}) at 15, 30, 45 and 60 DAA, respectively. This treatment was found to be statistically on par with application of pyrithiobac sodium 10 % + clethodim 10.25 % SE @ 243 g *a.i.* ha^{-1} (T_3), which recorded total weed density (2.55, 2.20, 2.86 and 4.17 weeds m^{-2}) and total weed dry matter (2.31, 2.02, 3.41 and 5.87 g m^{-2}), and application of pyrithiobac sodium 6 % + quizalofop ethyl 4 % MEC @ 112.5 g *a.i.* ha^{-1} (T_7), which recorded total weed density (2.80, 2.42, 3.14 and 4.59 weeds m^{-2}) and total weed dry matter (2.54, 2.13, 3.88 and 6.48 g m^{-2}) at 15, 30, 45 and 60 DAA, respectively. However, significantly higher total weed density (7.40, 8.36, 9.62 and 10.46 weeds m^{-2}) and total weed dry matter (6.90, 7.80, 12.08 and 15.01 g m^{-2}) were recorded in the weedy check (T_9) at 15, 30, 45 and 60 DAA, respectively.

The lower total weed density and dry matter under effective herbicidal treatments could be attributed to the complementary activity of pyrithiobac sodium and clethodim against broad-leaved and grassy weeds, respectively. Pyrithiobac sodium inhibits acetolactate synthase (ALS), restricting branched-chain amino acid synthesis and weed growth, while clethodim inhibits acetyl-CoA carboxylase (ACCase) disrupting fatty-acid synthesis in susceptible grasses. The combined activity reduced weed survival and biomass accumulation with higher dose providing more sustained suppression. Intercultivation at 45 DAS further removed surviving and newly emerged weeds, contributing to lower density and dry matter at later stages. Similar reductions in total weed density and dry matter were reported by Prabhu *et al.* (2012) [18], Veeraputhiran and Srinivasan (2015) [22] and Singh *et al.* (2016) [20].

Total weed control efficiency (%)

The total weed control efficiency was significantly influenced by different weed management practices at 15, 30, 45 and 60 DAA (Table 2). Among all the herbicidal treatments, application of pyrithiobac sodium 10 % + clethodim 10.25 % SE @ 283 g *a.i.* ha^{-1} at the 3-4 leaf stage of weeds as PoE *fb* IC at 45 DAS (T_4) recorded higher total weed control efficiency (90.97, 94.40, 93.33 and 86.90 % at 15, 30, 45 and 60 DAA, respectively), followed by application of the same herbicide combination @ 243 g *a.i.* ha^{-1} at the 3-4 leaf stage of weeds as PoE *fb* IC at 45 DAS (T_3) (89.86, 93.94, 92.11 and 82.64 %, respectively) and pyrithiobac sodium 6 % + quizalofop ethyl 4 % MEC @ 112.5 g *a.i.* ha^{-1} at the 3-4 leaf stage of weeds as PoE *fb* IC at 45 DAS (T_7) (87.22, 93.03, 89.03 and 79.61 %, respectively). However, among all the treatments, the weed-free check (T_8) recorded 100.00 per cent total weed control efficiency at all observation stages, followed by farmer's practice (T_{10}), which recorded 100.00, 91.36, 100.00 and 89.34 per cent at 15, 30, 45 and 60 DAA, respectively, whereas 0.00 per cent total weed control efficiency was recorded in the weedy check (T_9) throughout the observation period.

Total weed-control efficiency was closely associated with reduced weed dry matter. Higher efficiency under T_4, T_3 and T_7 during the initial observations was attributed to effective suppression of mixed weed flora, while intercultivation at 45 DAS further reduced surviving and newly emerged weeds. The decline in efficiency at 60 DAA under several herbicidal treatments corresponded with renewed weed emergence and increased biomass as residual herbicidal activity diminished. These results were in conformity with findings of Kumar *et al.* (2016) [9], Singh and Rathore (2015) [19] and Chetan (2013) [5].

Weed index (%)

Weed index varied considerably among the treatments and results presented in table 2. The weed-free check (T_8) recorded 0.00 per cent weed index, indicating maximum yield potential under complete weed-free conditions. Among the herbicidal treatments, application of pyrithiobac sodium 10 % + clethodim 10.25 % SE @ 283 g *a.i.* ha^{-1} (T_4) recorded lower weed index (9.92 %), followed by the same combination @ 243 g *a.i.* ha^{-1} (T_3) (11.60 %) and pyrithiobac sodium 6 % + quizalofop ethyl 4 % MEC @ 112.5 g *a.i.* ha^{-1} (T_7) (14.89 %). Farmer's practice (T_{10}) recorded a lower weed index of 7.56 per cent. The untreated control recorded significantly higher weed index (57.55 %) due to unrestricted weed competition throughout the crop growth period. The lower weed index under effective weed-management treatments reflected reduced yield loss associated with better suppression of weed density and dry matter. These results were in conformity with findings of Kamble *et al.* (2017) [10].

Seed cotton yield (kg ha^{-1})

Seed cotton yield varied significantly among the weed-management practices. The weed-free check (T_8) recorded higher seed cotton yield (2975 kg ha^{-1}) followed by farmer's practice (T_{10}) with 2750 kg ha^{-1}. Among the herbicidal treatments, application of pyrithiobac sodium 10 % + clethodim 10.25 % SE @ 283 g *a.i.* ha^{-1} (T_4) recorded higher seed cotton yield (2680 kg ha^{-1}) followed by the same combination @ 243 g *a.i.* ha^{-1} (T_3) (2630 kg ha^{-1}) and pyrithiobac sodium 6 % + quizalofop ethyl 4 % MEC @ 112.5 g *a.i.* ha^{-1} (T_7) (2532 kg ha^{-1}). The comparatively lower yield under T_1, T_2, T_5 and T_6 corresponded with their relatively greater weed density and dry matter. The untreated control recorded significantly lower seed cotton yield (1263 kg ha^{-1}). The higher seed cotton yield under the effective herbicidal treatments could be attributed to their greater weed-control efficiency and lower weed index. Effective weed suppression reduced competition for nutrients, moisture, light and growing space, thereby improving crop growth, reproductive development and assimilates partitioning towards seed cotton production. The resulting yield enhancement under these treatments was consistent with the findings of Tariq *et al.* (2020) [21], Madhavi, M. and Ramprakash (2015) [13].

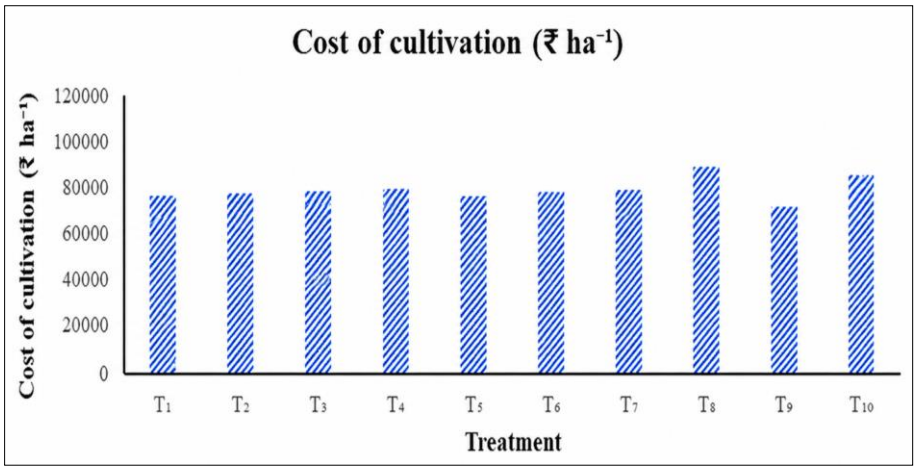
Economics of weed management

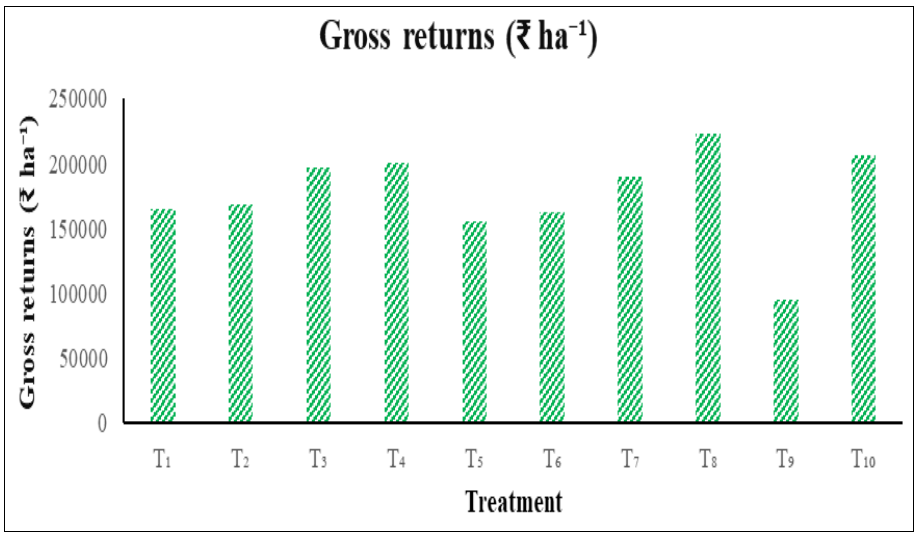
The economics of the different weed management practices (cost of cultivation, gross returns, net returns and benefit-cost ratio) are presented in fig. 3. The cost of cultivation was

higher in the weed-free check (₹ 88,050 ha^{-1}), followed by farmer's practice (₹ 84,000 ha^{-1}), because of the labour required for repeated hand weeding and intercultivation. It was considerably lower and nearly the same in the herbicidal treatments T_3, T_4 and T_7 (₹ 76,900, ₹ 77,395 and ₹ 77,400 ha^{-1}, respectively), and lower in the weedy check (T_4) (₹ 71,550 ha^{-1}). Gross returns, net returns and B:C ratio differed significantly among the weed management practices. The weed-free check (T_8) recorded the higher gross returns (₹ 2,23,150 ha^{-1}), net returns (₹ 1,35,100 ha^{-1}) and B:C ratio (2.53), and which was on par with farmer's practice (T_{10}) ₹ 2,06,250 ha^{-1}, ₹ 1,23,700 ha^{-1} and 2.50, respectively. Among the herbicidal treatments, pyrithiobac sodium 10 % + clethodim 10.25 % SE @ 283 g *a.i.* ha^{-1} (T_4) recorded the higher gross returns (₹ 2,00,975 ha^{-1}), net returns (₹ 1,23,580 ha^{-1}) and B:C ratio (2.60). Its net returns and B:C ratio were on par with T_8 and T_{10}, although its gross returns were significantly lower than those of T_8. T_4 but was on par with the same combination @ 243 g *a.i.* ha^{-1} (T_4), which recorded ₹ 1,97,225 ha^{-1}, ₹ 1,20,325 ha^{-1} and 2.56, and with pyrithiobac sodium 6 % + quizalofop ethyl 4 % MEC @ 112.5 g *a.i.* ha^{-1} (T_7), which recorded ₹ 1,89,875 ha^{-1}, ₹ 1,12,475 ha^{-1} and 2.45. The weedy check (T_9) recorded the lower gross returns (₹ 94,700 ha^{-1}), net returns (₹ 23,150 ha^{-1}) and B:C ratio (1.32), which were significantly lower than in all the other treatments. Higher gross returns, net returns and B:C ratio were obtained with effective weed management practices because better weed suppression created favourable conditions for crop growth, resulting in higher seed cotton yield. Treatments with repeated hand weeding incurred higher cultivation costs, which reduced their net returns and B:C ratio relative to their gross returns. Post-emergence herbicide treatments achieved comparable net returns at a lower cost. Poor weed control gave the lower returns despite the lower cost of cultivation, as seed cotton yield was drastically reduced. Similar results were reported by Veeraputhiran and Srinivasan (2015) [22], Hiremath *et al.* (2013) [7] and Panchal *et al.* (2024) [16].

Conclusion

Application of pyrithiobac sodium 10 % + clethodim 10.25 % SE at 283 g *a.i.* ha^{-1} as post-emergence treatment at the 3-4 leaf stage, followed by intercultivation at 45 days after sowing, effectively reduced total weed density and weed dry matter and improved weed control efficiency, resulted in a lower weed index and recorded higher seed-cotton yield, gross returns, net returns and benefit-cost ratio among the weedicide treatments. This treatment was statistically at par with application of the same herbicide combination at 243 g *a.i.* ha^{-1} in terms of weed suppression, seed-cotton yield and economic performance. Therefore, application of pyrithiobac sodium 10 % + clethodim 10.25 % SE at 243 g *a.i.* ha^{-1}, followed by intercultivation at 45 days after sowing, proved to be an effective and economically viable weed-management practice for improving seed-cotton productivity.





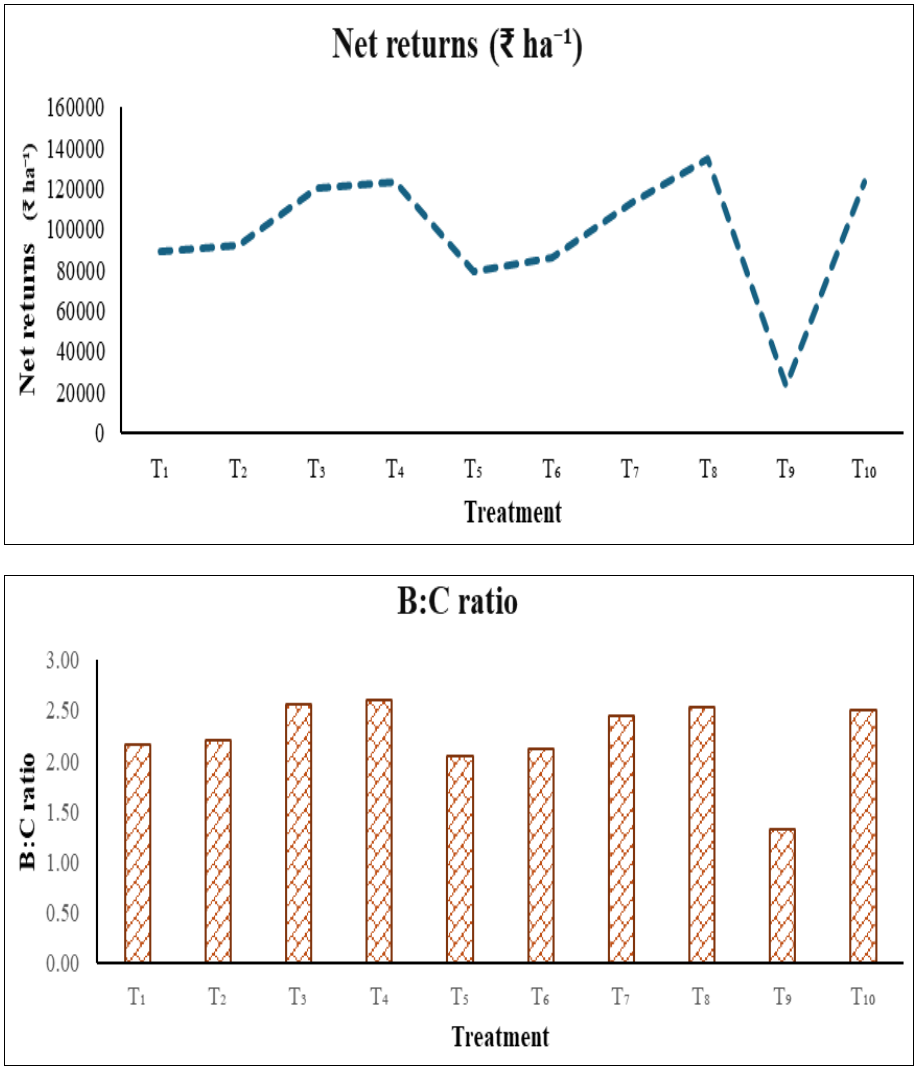


Fig 1: Cost of cultivation, Goss returns, net returns and benefit cost ratio of *Bt* cotton as influenced by weed management practices

Table 1: Total weed density and Total dry matter of weeds at different growth stages of *Bt* cotton as influenced by weed management practices

Tr No	Treatment	Total weed density (No. m^{-2})				Total weed dry matter (g m^{-2})			
		15 DAA	30 DAA	45 DAA	60 DAA	15 DAA	30 DAA	45 DAA	60 DAA
T_1	Pyrithiobac sodium 10 % + Clethodim 10.25 % SE @ 160 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	4.45 (19.33)	4.06 (16.00)	5.05 (25.00)	5.97 (35.33)	4.09 (16.24)	3.59 (12.39)	6.22 (38.23)	8.44 (70.72)
T_2	Pyrithiobac sodium 10 % + Clethodim 10.25 % SE @ 202.50 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	4.18 (17.00)	3.94 (15.00)	4.60 (20.67)	5.81 (33.33)	3.86 (14.37)	3.49 (11.66)	5.72 (32.22)	8.19 (66.60)
T_3	Pyrithiobac sodium 10 % + Clethodim 10.25 % SE @ 243 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	2.55 (6.00)	2.20 (4.33)	2.86 (7.67)	4.17 (17.00)	2.31 (4.86)	2.02 (3.60)	3.41 (11.16)	5.87 (34.00)
T_4	Pyrithiobac sodium 10 % + Clethodim 10.25 % SE @ 283 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	2.35 (5.00)	1.96 (3.33)	2.68 (6.67)	3.76 (13.67)	2.14 (4.10)	1.90 (3.13)	3.20 (9.75)	5.28 (27.33)
T_5	Clethodim 25% EC @ 180 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	4.92 (23.67)	4.56 (20.33)	5.28 (27.33)	6.59 (43.00)	4.55 (20.18)	4.05 (15.87)	6.80 (45.72)	9.30 (85.99)
T_6	Pyrithiobac sodium 10 % EC @ 75 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	4.71 (21.67)	4.34 (18.33)	5.05 (25.00)	6.12 (37.00)	4.36 (18.53)	3.86 (14.37)	6.52 (41.97)	8.63 (74.04)
T_7	Pyrithiobac sodium 6 % + Quizalofop ethyl 4 % MEC @ 112.5 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	2.80 (7.33)	2.42 (5.33)	3.14 (9.33)	4.59 (20.67)	2.54 (5.93)	2.13 (4.04)	3.88 (14.53)	6.48 (41.48)
T_8	Weed free check (Hand weedings at 20, 40 and 60 DAS + IC at 25, 45 and 65 DAS)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)	0.71 (0.00)
T_9	Weedy check	7.40 (54.33)	8.36 (69.33)	9.62 (92.00)	10.46 (111.00)	6.90 (47.11)	7.80 (60.35)	12.08 (145.31)	15.01 (224.82)
T_{10}	Farmer's practice (Hand weedings at 25 and 55 DAS + IC at 30 and 60 DAS)	0.71 (0.00)	2.68 (6.67)	0.71 (0.00)	3.40 (11.67)	0.71 (0.00)	2.30 (4.79)	0.71 (0.00)	4.90 (23.48)

	S. Em.±	0.42	0.27	0.34	0.40	0.30	0.25	0.43	0.59
	C. D. at 5 %	1.25	0.79	1.00	1.20	0.89	0.74	1.26	1.77

Note- *Figures in the paranthesis indicates original value
Data subjected to square root transformation using $(x+0.5)^{1/2}$, where x is weed density
EC: Emulsifiable concentrate SE: Suspo-emulsion IC: Intercultivation DAA: Days after application
MEC: Microemulsion concentrate POE: Post emergence DAS: Days after sowing *a.i.*: active ingredient

Table 14: Total weed control efficiency, weed index and seed cotton yield of *Bt* cotton as influenced by weed management practices

Tr No	Treatment	Total weed control efficiency (%)				Weed index (%)	Seed cotton yield (kg ha^{-1})
		15 DAA	30 DAA	45 DAA	60 DAA		
T_1	Pyrithiobac sodium 10 % + Clethodim 10.25 % SE @ 160 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	62.17	77.37	71.25	65.27	26.15	2197
T_2	Pyrithiobac sodium 10 % + Clethodim 10.25 % SE @ 202.50 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	69.01	80.18	77.76	66.38	24.54	2245
T_3	Pyrithiobac sodium 10 % + Clethodim 10.25 % SE @ 243 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	89.86	93.94	92.11	82.64	11.60	2630
T_4	Pyrithiobac sodium 10 % + Clethodim 10.25 % SE @ 283 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	90.97	94.40	93.33	86.90	9.92	2680
T_5	Clethodim 25% EC @ 180 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	55.07	73.20	68.38	59.05	30.52	2067
T_6	Pyrithiobac sodium 10 % EC @ 75 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	61.15	75.25	70.64	64.56	27.06	2170
T_7	Pyrithiobac sodium 6 % + Quizalofop ethyl 4 % MEC @ 112.5 g *a.i.* ha^{-1} at 3-4 leaf stage (PoE) *fb* IC at 45 DAS	87.22	93.03	89.03	79.61	14.89	2532
T_8	Weed free check (Hand weedings at 20, 40 and 60 DAS + IC at 25, 45 and 65 DAS)	100.00	100.00	100.00	100.00	0.00	2975
T_9	Weedy check	0.00	0.00	0.00	0.00	57.55	1263
T_{10}	Farmer's practice (Hand weedings at 25 and 55 DAS + IC at 30 and 60 DAS)	100.00	91.36	100.00	89.34	7.56	2750
	S. Em.±	-	-	-	-	-	95
	C. D. at 5 %	-	-	-	-	-	281

Note- EC: Emulsifiable concentrate SE: Suspo-emulsion IC: Intercultivation DAA: Days after application
MEC: Microemulsion concentrate POE: Post emergence DAS: Days after sowing *a.i.*: active ingredient

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