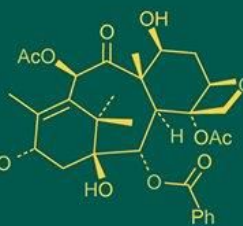


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Sequential application of different pre and post emergence herbicides for weed management in *Bt* cotton

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Abstract

Aim: To study the relative performance of sequential application of different pre and post emergence herbicides on weed flora & effect of herbicides on growth, yield and Economics of *Bt* cotton.

Design: The experiment was laid out in randomized block design with 8 treatment combination replicated thrice.

Site and duration of study: A field experiment was conducted at Cotton Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during the season *kharif* 2023-2024.

Results: All the pre-emergence and post emergence herbicides significantly influenced the weeds compared to weedy check. At 30 DAS 3 hoeing's and 3 hand weeding recorded lowest weed count, weed dry matter and highest weed control efficiency. The treatments T₁, T₂ and T₃ where pre-emergence herbicide diuron 80 wp was sprayed @ 1.5 kg ha⁻¹ significantly reduced the weed population and dry weight at 30 DAS as compared to treatments T₃, T₄ and T₆ where pyriithiobac sodium 3.15 w/w + pendimethalin 34% ready mix herbicide was used as pre-emergence spray. The diuron sprayed treatments were found significantly at par with each other. At 60 DAS more or less same trend was observed in respect of weed population and weed dry weight with lowest weed population in farmers practice and highest weed population and weed dry weight in weedy check treatments. However at 90 DAS and at harvest, T₅ treatment i.e. Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha⁻¹ (PE) *fb* pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) *fb* hand weeding at 50-55 DAS recorded minimum weed population, weed index and weed dry weight followed by T₂ i.e. Diuron 1.5 kg ha⁻¹ (PE) *fb* pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) *fb* hand weeding at 50-55 DAS which was found significantly at par with each other and significantly superior over other treatments except farmers practice where lowest population, weed dry weight, lowest weed index and highest weed control efficiency was recorded.

Keywords: *Bt*-cotton, diuron, glufosinate ammonium, herbicides, pyriithiobac + pendimethalin, pyriithiobac sodium + quizalofop ethyl, weed management

1. Introduction

Cotton crop is sensitive to weed competition during initial growth stages due to slow growth and wider spacing. Weeds compete for nutrients, water, light and thus reduce cotton yield substantially. Being heavily fertilized/manured and often irrigated are also among the factors responsible for heavy weed infestation. In case of heavy rains, providing timely weed control becomes difficult as soil becomes sticky and wet leading to poor workability while in dry soil, the surface becomes hard making inter-row cultivation difficult. Also, non-availability of human labour for weeding makes timely weed control tedious and uneconomic. So, the use of effective and broad-spectrum pre-emergence and post-emergence herbicides in cotton for weed management is considered necessary. Chemical weed control became more important and attractive to farmers. In the absence of interculture and with regular monsoon rains, weeds germinate in different spells and compete with crop plants and finally reduce the seed cotton yield. Hence, there is a need to go for application of pre-emergence herbicides to manage the weeds in the early stage of crop growth and some selective and non-selective post-emergence herbicides to manage the weeds to eliminate weed competition throughout the critical period and in later stages of crop growth for getting higher cotton yield.

2. Materials and Methods

The experiment was conducted at Research farm of Cotton Research Unit, Dr.PDKV, Akola. Eight treatments were tested in randomized block design replicated thrice. The

application of herbicide was done as per the treatments with manually operated knapsack sprayer attached with a flood jet nozzle. After calibrating the sprayer, water volume used was 700 lit. per ha. for PE and 500 lit. per ha. for PoE.

Treatment details

T ₁	Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> inter-cultivation at 30 and 45 DAS
T ₂	Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> hand weeding at 50-55 DAS
T ₃	Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> directed spray (inter-row) of glufosinate ammonium 13.5% SL 450 g ha ⁻¹ at 50-55 DAS
T ₄	Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha ⁻¹ (PE) <i>fb</i> inter-cultivation at 30 and 45 DAS
T ₅	Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> hand weeding at 50-55 DAS
T ₆	Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> directed spray (inter-row) of glufosinate ammonium 13.5% SL 450 g ha ⁻¹ at 50-55 DAS
T ₇	Farmer's practice (3 hoeing and 3 weeding)
T ₈	Weedy check

*Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% w/w ZC 649.25 g ha⁻¹ is a new pre emergence broad spectrum label claim herbicide in cotton.

Weed study: For weed population study and weed dry weight was recorded by using a quadrat of 1 m x 1 m from a random spot in the plot where weed infestation was

representative of the treatment. Then weeds were grouped as monocot species and dicot species. Weed control efficiency and weed index were computed as below-

$$\text{WCE (\%)} = \frac{\text{Dry matter of weeds in untreated plot} - \text{Dry matter of weeds in treated plot}}{\text{Dry matter of weeds in untreated}} \times 100$$

$$\text{WI (\%)} = \frac{\text{Yield from weed free plot} - \text{Yield from treated plot}}{\text{Yield from weed free plot}} \times 100$$

3. Results and Discussion

3.1 Weed studies

At all the growth stages of cotton T₇ (Farmers practice-3 hoeing + 3 Hand weeding) recorded lowest weed count and weed dry matter due to continuous intercultural and hand weeding operations in this treatment. At 30, 60, 90 DAS and at harvest, weedy check observed maximum weed population and weed dry weight due to uncontrolled growth of weeds in this treatment. Diuron 80% WP @ 1.5 kg ha⁻¹ as a pre-emergence spray was found very effective in controlling all the monocots and dicots weeds upto 60 DAS as compared to other pre-emergence ready mix herbicide Pyriithiobac Sodium 3.1% w/w + pendimethalin 34.0% w/w ZC 649.25 g ha⁻¹ as pre-emergence spray. Other post emergence herbicides viz. pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ and glufocinate ammonium non selective herbicides controlled the weeds in the later growth stages of cotton. Similar results of glufocinate ammonium were also reported by Young *et al.* (2001) [12] and Bharathi *et al.* (2011) [1]. However at 90 DAS and at harvest, T₅ treatment i.e. Pyriithiobac Sodium 3.1% w/w + pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha⁻¹ (PE) *fb* pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) *fb* hand weeding at 50-55 DAS recorded minimum weed population followed by T₂ i.e. Diuron 1.5 kg ha⁻¹ (PE) *fb* pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) *fb* hand weeding at 50-55 DAS which was found significantly at par with each other and significantly superior over other treatments except farmers practice where

lowest population was recorded. Hanumanth, (2017) [5] earlier reported that diuron (PE) followed by either mechanical weeding or post emergence application of pyriithiobac sodium + quizalofop ethyl was able to control weeds. Varsha *et al* (2018) [11] also reported that mechanical weeding thrice at 20, 40 and 60 DAS reduced the weed growth in both red and black soils. Among the herbicides, diuron at 1.0 kg per hectare *fb* pyriithiobac sodium + quizalofop ethyl in red soil and both diuron at 1.0 kg ha⁻¹ and 0.75 kg ha⁻¹ along with sequential application of herbicides reduced the weed count.

3.2 Weed control efficiency and weed control

At all the growth stages of cotton i.e. at 30, 60, 90 DAS and at harvest, the highest weed control efficiency of 97.69%, 94.84%, 94.21% and 91.41% was recorded under farmers practice i.e. T₇ (3 Hoieng +3 Hand Weeding) as indicated in Table 3. This may be due to better control of weeds due to cultural practice. The weed control treatments (T₁, T₂ and T₃) where diuron 80% wp was sprayed as a pre-emergence also showed maximum weed control efficiency at 30 and at 60 DAS and found statistically at par with each other. Similar results were reported by Tiwara and Brar (1990) [10] and Chethan (2013) [2]. At 90 DAS and at harvest T₅ and T₂ treatments showed highest weed control efficiency than other herbicide treatments. Sequential herbicide application combined with cultural practice performed better in controlling weeds and ultimately increased WCE. While lowest weed index was noticed in (T₅) i.e. Pyriithiobac Sodium 3.1% w/w + pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha⁻¹ (PE) *fb* pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) *fb* hand weeding at 50-55 DAS. This might be due to integrated weed management approach and effective weed control in treated plot which resulted increase in yield.

Highest weed index of 56.12 was recorded in weedy check treatments might be due to weed competition with crop and reduced the seed cotton yield. Similar results were also reported by Singh *et al.* (2016) [18] and Rathod *et al.* (2023) [6].

3.3 Growth and yield attributes of cotton

All the growth characters viz; plant height, number of leaves, number of sympodial branches and plant dry matter were noticed highest in farmers practice of 3 hoeing and 3 hand weedings. Cultural practice of 3H + 3HW was found comparable with T₅ treatments i.e. Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha⁻¹ (PE) fb pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) fb hand weeding at 50-55 DAS and T₂ i.e. Diuron 1.5 kg ha⁻¹ (PE) fb pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) fb hand weeding at 50-55 DAS and in respect of plant height and number of sympodial branches per plant. Similar results were also reported by Rathod *et al.* (2023) [6]. Weed control practices caused significant variation on seed cotton yield and number of picked bolls per plant. The highest seed cotton yield (2785 Kg ha⁻¹) was registered with 3H+3HW which was found at par with T₅ treatment (2625 Kg ha⁻¹) i.e. Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha⁻¹ (PE) fb pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) fb hand weeding at 50-55 DAS followed by T₂ treatment (2593 kg ha⁻¹) where diuron @ 1.5 kg ha⁻¹ as a pre-emergence fb pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) fb hand weeding at 50-55 DAS was done. In case of boll weight maximum weight was observed in farmers practice i.e. 4.72 g, however different herbicidal treatments recorded more or less similar values of boll weight and

found non-significant results. Lowest boll weight (4.28) was recorded in weedy check. Similar results were recorded by Rathod *et al.* (2023) [6] and Reddy *et al.* (2023) [7]. Deshpande *et al.* (2006) [3] also found same results that the highest seed-cotton yield was recorded by 3 hand-weedings + 3 hoeings.

3.5 Economics

Cost of cultivation varied under different weed control treatments. The minimum cost of cultivation (46056 ₹ ha⁻¹) was registered under weedy check plot. However, it was recorded maximum (75597 ₹ ha⁻¹) under farmers practice of 3H + 3HW followed by 63892 ₹ ha⁻¹ in T₂ treatment (Diuron 1.5 kg ha⁻¹ (PE) fb pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) fb hand weeding at 50-55 DAS). The cost of cultivation under different herbicide treatments varied from 46056 ₹ ha⁻¹ to 75597 ₹ ha⁻¹. Maximum GMR of 184389 ₹ ha⁻¹ was registered in 3H + 3HW as a cultural practice followed by 173753 ₹ ha⁻¹ in T₅ treatment (Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC649.25 g ha⁻¹ (PE) fb pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) fb hand weeding at 50-55 DAS) closely followed by 171635 ₹ ha⁻¹ in T₂ i.e. Diuron 1.5 kg ha⁻¹ (PE) fb pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) fb hand weeding at 50-55 DAS. However significantly highest NMR of 111180 ₹ ha⁻¹ was noticed in T₅ as against 108792 ₹ ha⁻¹ in T₇. Closely followed by T₂ treatment. Similar results are found by Sreena *et al.*, (2019) [9]. Also, the maximum B:C ratio was recorded in T₅ (2.78) followed by in T₂ (2.68) and least B:C ratio in weedy check treatment (1.76). The less B:C ratio in 3H+3HW was observed due to more labour charges needed for hoeing and hand weeding than the herbicide cost required.

Table 1: Total weed population m⁻² and dry matter produce as influenced by different weed management treatments

Treatments	Total weed count				Total weed Dry Matter (g)			
	30 DAS	60 DAS	90 DAS	Harvest	30 DAS	60 DAS	90 DAS	Harvest
T ₁ : Diuron 1.5 kg ha ⁻¹ (PE) fb inter-cultivation at 30 and 45 DAS	2.67 (6.67)	3.52 (12.00)	4.95 (24.00)	6.39 (40.37)	2.23 (4.49)	3.83 (14.16)	5.52 (30.04)	6.76 (45.32)
T ₂ : Diuron 1.5 kg ha ⁻¹ (PE) fb pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) fb hand weeding at 50-55 DAS	2.47 (5.67)	3.34 (10.67)	4.41 (19.00)	5.36 (28.30)	2.15 (4.13)	3.45 (11.46)	5.10 (25.62)	6.43 (40.85)
T ₃ : Diuron 1.5 kg ha ⁻¹ (PE) fb pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) fb directed spray (inter-row) of glufosinate ammonium 13.5% SL 450 g ha ⁻¹ at 50-55 DAS	2.60 (6.33)	3.08 (9.00)	4.87 (23.33)	5.40 (28.70)	2.11 (4.23)	3.82 (14.08)	5.44 (29.13)	6.45 (41.12)
T ₄ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC649.25 g ha ⁻¹ (PE) fb inter-cultivation at 30 and 45 DAS	5.55 (30.33)	5.15 (26.00)	5.61 (31.00)	6.83 (46.12)	4.62 (21.23)	5.14 (25.96)	6.68 (44.14)	7.39 (54.18)
T ₅ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha ⁻¹ (PE) fb pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) fb hand weeding at 50-55 DAS	5.60 (31.00)	4.10 (16.33)	4.38 (18.67)	5.07 (25.26)	4.75 (22.25)	3.37 (10.84)	5.07 (25.22)	6.32 (39.51)
T ₆ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC649.25 g ha ⁻¹ (PE) fb pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) fb directed spray (inter-row) of glufosinate ammonium 13.5% SL 450 g ha ⁻¹ at 50-55 DAS	5.70 (32.00)	4.78 (22.33)	5.43 (29.00)	6.75 (45.12)	4.03 (24.83)	4.50 (19.79)	5.89 (34.20)	6.94 (47.64)
T ₇ : Farmer's practice (3 hoeing and 3 weeding)	1.86 (3.00)	2.12 (4.00)	2.85 (7.67)	4.03 (15.81)	1.64 (2.23)	2.57 (6.18)	3.42 (11.21)	4.45 (19.30)
T ₈ : Weedy check	10.42 (108.0)	12.43 (154.0)	13.74 (188.3)	14.60 (212.80)	9.75 (96.63)	10.97 (119.84)	13.93 (193.58)	15.01 (224.72)
SE (m) ±	0.15	0.16	0.18	0.20	0.27	0.21	0.22	0.24
CD P= 0.05	0.45	0.48	0.56	0.60	0.82	0.63	0.66	0.72

Table 2: Weed control efficiency and Weed Index as influenced by different treatments

Treatments	Weed control efficiency (%)				Weed index (%)
	30 DAS	60 DAS	90 DAS	At Harvest	
T ₁ : Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> inter-cultivation at 30 and 45 DAS	95.35	88.18	84.48	79.83	15.98
T ₂ : Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> hand weeding at 50-55 DAS	95.73	90.44	86.77	81.82	6.89
T ₃ : Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> directed spray (inter-row) of glufosinate ammonium 13.5% SL 450 g ha ⁻¹ at 50-55 DAS	95.62	88.25	84.95	81.70	12.68
T ₄ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix)w/w g ha ⁻¹ ZC649.25 g ha ⁻¹ (PE) <i>fb</i> inter-cultivation at 30 and 45 DAS	78.03	78.34	77.20	75.89	18.71
T ₅ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> hand weeding at 50-55 DAS	76.97	90.95	86.97	82.42	5.75
T ₆ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix)w/w ZC649.25 g ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE,25-30 DAS) <i>fb</i> directed spray (inter-row) of glufosinate ammonium 13.5% SL 450 g ha ⁻¹ at 50-55 DAS	74.30	83.49	82.33	78.80	14.61
T ₇ : Farmer's practice (3 hoeing and 3 weeding)	97.69	94.84	94.21	91.41	-
T ₈ : Weedy check	-	-	-	-	56.12
SE (m) ±	-	-	-	-	-
CD P= 0.05	-	-	-	-	-

Table 3: Growth and yield attributes of cotton at harvest as influenced by different weed management treatments

Treatments	Plant height (cm)	No. of monopodia	No. of sympodia	Dry matter per plant (g)	No. of Bolls	Boll Weight
T ₁ : Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> inter-cultivation at 30 and 45 DAS	117.24	1.04	18.61	127.35	29.81	4.42
T ₂ :Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> hand weeding at 50-55 DAS	130.07	1.23	23.37	159.52	36.66	4.68
T ₃ : Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> directed spray (inter-row) of glufosinate ammonium 13.5% SL 450 g ha ⁻¹ at 50-55 DAS	126.98	1.21	20.19	136.64	32.20	4.55
T ₄ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix)w/w g ha ⁻¹ ZC649.25 g ha ⁻¹ (PE) <i>fb</i> inter-cultivation at 30 and 45 DAS	114.31	1.17	17.88	125.66	26.32	4.52
T ₅ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> hand weeding at 50-55 DAS	131.87	1.15	24.12	160.38	37.20	4.62
T ₆ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix)w/w ZC 649.25 g ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE,25-30 DAS) <i>fb</i> directed spray (inter-row) of glufosinate ammonium 13.5% SL 450 g ha ⁻¹ at 50-55 DAS	122.97	1.13	19.26	136.56	33.89	4.58
T ₇ : Farmer's practice (3 hoeing and 3 weeding)	137.17	1.29	24.86	168.53	39.90	4.72
T ₈ : Weedy check	100.46	1.02	12.13	102.53	14.67	4.28
SE (m) ±	3.39	0.08	0.76	2.88	1.51	0.14
CD P= 0.05	10.41	NS	2.34	8.85	4.63	NS

Table 4: Seed cotton yield, stalk yield (kg ha⁻¹), Biological Yield (kg ha⁻¹), Harvest Index (%) and as influenced by different treatments

Treatments	Yield studies				Economics			
	SCY (kg ha ⁻¹)	Stalk yield	Biological Yield	Harvest index %	COC (₹ ha ⁻¹)	GMR (₹ ha ⁻¹)	NMR (₹ ha ⁻¹)	B:C ratio
T ₁ : Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> inter-cultivation at 30 and 45 DAS	2340	3148	5488	42.63	58680	154908	96228	2.64
T ₂ :Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> hand weeding at 50-55 DAS	2593	3483	6075	42.67	63892	171635	104743	2.68
T ₃ : Diuron 1.5 kg ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> directed spray (inter-row) of glufosinate ammonium 13.5% SL 450 g ha ⁻¹ at 50-55 DAS	2432	3264	5696	42.69	61065	160976	99911	2.63
T ₄ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix)w/w g ha ⁻¹ ZC649.25 g ha ⁻¹ (PE) <i>fb</i> inter-cultivation at 30 and 45 DAS	2264	3053	5317	42.58	57848	149877	92029	2.59
T ₅ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE, 25-30 DAS) <i>fb</i> hand weeding at 50-55 DAS	2625	3325	5950	44.11	62573	173753	111180	2.78
T ₆ : Pyriithiobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix)w/w ZC 649.25 g ha ⁻¹ (PE) <i>fb</i> pyriithiobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha ⁻¹ (PoE,25-30 DAS) <i>fb</i> directed spray (inter-row) of glufosinate ammonium 13.5% SL 450 g ha ⁻¹ at 50-55 DAS	2378	3196	5574	42.66	60344	157407	97063	2.60
T ₇ : Farmer's practice (3 hoeing and 3 weeding)	2785	3508	6294	44.24	75597	184389	108792	2.44
T ₈ : Weedy check	1222	1989	3212	38.04	46056	80918	34862	1.76
SE (m) ±	63	73	135	--	-	4155	4155	-
CD P= 0.05	193	224	415	--	-	12750	12750	-

4. Conclusions

1. In cotton, for effective weed management 3 Hoeing and 3 hand weeding proved better in controlling weeds, lesser weed dry matter accumulation, higher weed control efficiency, minimum weed index and higher seed cotton yield highest gross monetary returns among all the weed management practices.
2. Among the herbicides, sequential application of either Diuron 1.5 kg ha⁻¹ (PE) or Pyriithobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha⁻¹ (PE) *fb* pyriithobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) *fb* hand weeding at 50-55 DAS was found comaprable in controlling weeds, maximum weed control efficiency, lowest weed index and comparable yield as obtained in cultural practice of 3H+3HW.
3. Sequential application of pyriithobac Sodium 3.1% w/w + Pendimethalin 34.0% (Ready mix) w/w ZC 649.25 g ha⁻¹ (PE) *fb* pyriithobac sodium 6% EC + quizalofop ethyl 4% EC w/w MEC 125 g ha⁻¹ (PoE, 25-30 DAS) *fb* hand weeding at 50-55 DAS found most renumerative integrated approach for managing the weeds in cotton.
4. Therefore, under scanty of labour it is advisable to follow the sequential application of pre and post emergence selective herbicides in combination with hand weeding in later growth stages of cotton for effective and economical weed management.

5. References

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