Research Article

Evaluation of Post Emergence Herbicides for Controlling Grassy Weeds in Cotton

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Abstract

A field experiment was conducted during two consecutive years of *Kharif* 2018 and 2019 at Agricultural Research Sub Station, Aklera on "Evaluation of post emergence herbicides for controlling grassy weeds in cotton". The experiment was laid-out in randomized block design with three replications, having seven treatments. Results revealed that the application of post emergence herbicide clethodim 12% EC @ 144 g a. i. ha^{-1} at 2-3 leaf stage was effective in controlling grassy weeds in cotton resulting in to increased seed cotton yield (1966 kg ha^{-1}) over control. Application of clethodim 12% EC @ 144 g a. i. ha^{-1} at 2-3 leaf stage was recorded lowest weed population (5.00 and 13.84 m^{-2}), lowest weed dry matter accumulation (1.76 and 20.54 g m^{-2}) and higher weed control efficiency (97.55 and 80.73 per cent) at 15 & 45 days after application of treatments in the pooled analysis.

Keywords: Cotton, Clethodim, Weed Control Efficiency and seed cotton yield.

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Introduction

Cotton (Gossypium spp L.) is well-known as "King of Fibres" and "White Gold" due to higher economic value among all cash crops and favored fibre even for fashion fabrics. It plays a significant role in agriculture & industrial progress, employment generation and economic growth of India and contributing nearly 75 per cent of total raw material requirements of textile industry in India. Cotton is supporting the livelihood of about 7.7 million farmers, in India. Globally in 2019-20 cotton area, production and productivity were 34.50 million hectares (85.50 million acres), 121.50 million bales and 791 Kg ha^{-1}, which were nearly 4 and 6 percent greater than that of 2018-19 respectively. According to the Cotton and Wool Outlook, India is the largest cotton producer in the world with 28.50 million bales compared to 26.50 million bales in previous year followed by China (27.25 million bales), United States (20.02 million bales), Brazil (12.00 million bales) and Pakistan (8.00 million bales). It occupies an area of 12.25 million ha of which 11.6 million ha (94 per cent) is genetically modified cotton (Bt cotton) [3]. India is the second largest exporter of cotton [4]. In the last seven decades that cotton has been grown, production and productivity have steadily increased. However, in the last few years it seems to have reached a plateau.

Indian Scenario as on 26th September, 2019, area under cotton during 2019-20 was 127.67 lakh ha as against 121.05 lakh ha in 2018-19 *i.e.*, 5.46 percent more than the previous year. Among the states, Maharashtra was reported as leading in cotton acreage (44.05 lakh ha) followed by Gujarat (26.66 lakh ha), Telangana (18.59 lakh ha), Haryana (7.01 lakh ha) and Rajasthan (6.44 lakh ha).Cotton is a long duration crop and throughout the growth cycle it is open to weeds and the competition therein. In cotton, the critical period of weed control is the first 15 to 60 days. Maximum seed cotton yield can be derived when there is at least 95 per cent weed control. Yield in cotton is dependent on the climatic conditions, rainfall pattern, weed competition and incidence of pests and diseases. Weeds are a potential problem in cotton cultivation and reduce yield by 50 to 85 per cent depending upon the nature and intensity.

Material and Methods

A field experiment was conducted during two consecutive years of *kharif* 2018 and 2019 at ARSS, Aklera to evaluate post emergence herbicides for controlling grassy weeds in cotton. The experimental field was well prepared by two ploughing followed by harrowing & cultivator and one planking for uniform leveling were performed for sowing of cotton. The experiment was laid out in randomized block design with three replications having seven treatments i.e.T1:Clethodim 12% EC@ 96 g a.i. ha^{-1},T2: Clethodim 12% EC @ 120 g a.i. ha^{-1}, T3:Clethodim 12% EC @ 144 g a.i. ha^{-1}, T4:Fenoxaprop-p-ethyl 9.3% EC @ 67.5 g a.i. ha^{-1}, T5:Quizalofop-ethyl 5% EC @ 50 g a.i. ha^{-1}, T6:Control

(hand weeding at 20,40 and 60 days after crop sowing), T7:Untreated Control (weedy check). The soils of experimental sites were (black cotton soil) clay loam texture and alkaline in reaction (pH 7.8). The soil was medium in available nitrogen (286.40 kg/ha) and phosphorus (22.60 kg/ha) and high in available potassium (285.3 kg/ha).

Figure 1 Sowing work of cotton crop at experiment site site

1

Figure 2 General view of cotton crop at experiment site

Results

Weed density

The observations (**Table 1**) made after application of treatments revealed that grassy weed density in all the herbicide treatments was significantly low as compared to weedy check control at 15 and 45 days after application of treatments. Hand weeding control and application of Clethodim 12% EC @ 144 g a.i. ha^{-1} significantly more effective than other treatments with low weed density at each observation time. Other treatments Clethodim 12% EC @ 120 g a.i. ha^{-1}, Clethodim 12% EC@ 96 g a.i. ha^{-1}, Fenoxaprop-p-ethyl 9.3% EC @ 67.5 g a.i. ha^{-1}, Quizalofop-ethyl 5% EC @ 50 g a.i. ha^{-1}, were next in order of effectiveness against grassy weeds. These results are having propinquity with Jain et al, 1981 [6], Sharma (2008) [8] and Ayyadurai and Poonguzhalan (2011) [1].

Weed dry weight

The dry weight of grassy weeds in each treatment was found more or less in accordance to respective weed density (**Table 2**). The trend of effectiveness of all the treatments based on weed dry weight was almost similar to that observed based on weed density. It means that the growth and development of grassy weeds were effectively checked by herbicide treatments. The hand weeding control treatment and Clethodim 12% EC @ @ 144 g a.i. ha^{-1} was significantly more effective than other treatments at most of the observation times with low weed dry weight. The weed dry weight in other treatments Clethodim 12% EC @ 120 g a.i. ha^{-1}, Clethodim 12% EC@ 96 g a.i. ha^{-1}, Fenoxaprop-p-ethyl 9.3% EC @ 67.5 g a.i. ha^{-1}, Quizalofop-ethyl 5% EC @ 50 g a.i. ha^{-1}, were comparatively higher to check the grassy weed growth as compared to weedy check control. These results are in close proximity with those Gnanavel, and Babu, (2008) [5] and Choudhary and Gaur (2015) [3].

Table 1 Grassy weed density 15 & 45 days after application of treatments

Treatment	Number of grassy weeds m^{-2}					
	15 DAT			45 DAT		
	2018	2019	Pooled	2018	2019	Pooled
Clethodim 12% EC @ 96 g a.i. ha^{-1}	12.67 (3.62)	15.67 (4.02)	14.17 (3.82)	30.00 (5.52)	33.00 (5.79)	31.50 (5.65)
Clethodim 12% EC@ 120 g a.i. ha^{-1}	4.33 (2.18)	4.67 (2.22)	04.50 (4.40)	18.33 (4.33)	20.00 (4.52)	19.16 (4.43)
Clethodim 12% EC@ 144 g a.i. ha^{-1}	2.67 (1.74)	2.33 (1.64)	05.00 (3.38)	13.00 (3.63)	14.67 (3.89)	13.84 (3.76)
Fenoxaprop-p-ethyl 9.3% EC@ 67.5 g a.i. ha^{-1}	18.00 (4.30)	26.00 (5.15)	22.00 (9.45)	33.67 (5.84)	41.00 (6.44)	37.34 (6.14)
Quizalofop-ethyl 5% EC@ 50 g a.i. ha^{-1}	14.00 (3.81)	28.00 (5.32)	21.00 (4.40)	35.00 (5.96)	43.67 (6.64)	39.34 (6.30)
Control (hand weeding at 20,40 and 60 DAS)	8.00 (2.91)	8.00 (2.86)	04.00 (5.77)	10.67 (3.34)	12.67 (3.62)	11.67 (3.48)
Control (weedy check)	59.00 (7.71)	70.67 (8.43)	64.83 (8.07)	95.33 (9.78)	90.33 (9.52)	87.83 (9.65)
S Em ±	0.14	0.24	0.38	0.20	0.19	0.20
CD (P=0.05)	0.43	0.72	0.57	0.63	0.59	0.61

Table 2 Grassy weed dry weight at 15 & 45 days after application of treatments

Treatment	Grassy weed dry weight in g per m^{-2}					
	15 DAT			45 DAT		
	2018	2019	Pooled	2018	2019	Pooled
Clethodim 12% EC @ 96 g a.i. ha^{-1}	10.87 (3.37)	10.80 (3.36)	10.84 (3.37)	27.80 (5.32)	28.67 (5.40)	28.24 (5.36)
Clethodim 12% EC@ 120 g a.i. ha^{-1}	2.47 (1.70)	3.30 (1.92)	2.89 (3.32)	20.60 (4.59)	23.83 (4.93)	22.22 (4.76)
Clethodim 12% EC@ 144 g a.i. ha^{-1}	1.30 (1.29)	2.23 (1.64)	1.76 (1.47)	19.00 (4.41)	22.07 (4.74)	20.54 (4.58)
Fenoxaprop-p-ethyl 9.3% EC@ 67.5 g a.i. ha^{-1}	11.53 (3.47)	11.70 (3.49)	11.62 (3.48)	26.53 (5.20)	29.80 (5.50)	28.17 (5.35)
Quizalofop-ethyl 5% EC@ 50 g a.i. ha^{-1}	12.77 (3.64)	12.03 (3.54)	12.40 (3.59)	28.80 (5.41)	31.23 (5.63)	30.02 (5.52)
Control (hand weeding at 20, 40 and 60 DAS)	4.57 (2.25)	4.93 (2.30)	4.75 (3.28)	17.77 (4.27)	21.07 (4.64)	19.42 (5.46)
Control (weedy check)	51.20 (7.19)	66.20 (8.16)	58.70 (7.67)	97.90 (9.92)	115.37 (10.76)	107.64 (10.34)
S Em ±	0.15	0.18	0.17	0.10	0.12	0.11
CD (P=0.05)	0.47	0.54	0.51	0.31	0.37	0.34

Weed control efficiency

The per cent weed control efficiency over weedy check control was calculated based on grassy weed dry weight recorded at 15 and 45 days after application of treatments during two seasons (**Table 3**). The weed control efficiency calculated was highest in the treatment of handweeding control followed by Clethodim 12% EC @ 144 g a.i. ha^{-1} and Clethodim 12% EC @ 120 g a.i. ha^{-1} for each observation time. The weed control efficiency in other treatments was comparatively low. On overall comparison all the treatments effectively controlled grassy weeds as compared to weedy check control during the experimental period. These results are in contiguity with those of Sharma 2008 [8] and Chauhan, and Yadav, 2013 [2].

Cotton yield and yield attributes

The bolls $plant^{-1}$ and seed cotton yield was recorded at harvest during each season and the results have been presented in **Table 4** for both the seasons. The results revealed that all the treatments were effective to increase the

bolls per plant as compared to weedy check control. However, the bolls were significantly more in the treatments of hand weeding control and Clethodim 12% EC @ 144 g a.i. ha^{-1} (28.46).

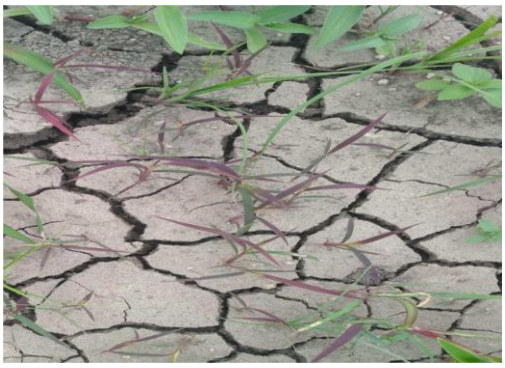

Figure 3 Grassy weeds control after application of Clethodim 12% EC @ 144 g a.i. ha^{-1}

Table 03 Weed control efficiency 15 & 45 days after application of treatments

Treatment	Per cent weed control efficiency					
	15 DAT			45 DAT		
	2018	2019	Pooled	2018	2019	Pooled
Clethodim 12% EC @ 96 g a.i. ha^{-1}	78.77	83.69	81.23	71.60	75.15	73.38
Clethodim 12% EC@ 120 g a.i. ha^{-1}	95.18	95.02	95.10	78.96	79.34	79.15
Clethodim 12% EC@ 144 g a.i. ha^{-1}	97.46	97.63	97.55	80.59	80.87	80.73
Fenoxaprop-p-ethyl 9.3% EC@ 67.5 g a.i. ha^{-1}	77.48	82.33	79.90	72.90	74.17	73.54
Quizalofop-ethyl 5% EC@ 50 g a.i. ha^{-1}	75.06	81.83	78.45	70.58	72.93	71.76
Control (hand weeding at 20, 40 and 60 DAS)	91.07	92.55	91.81	81.85	81.74	81.79
Control (weedy check)	0.00	0.00	0.00	0.00	0.00	0.00
S Em ±	1.26	1.18	1.22	1.46	1.33	1.38
CD (P=0.05)	3.48	3.25	3.37	3.64	3.56	3.60

Table 4 Impact of treatments on cotton yield and yield attributes

Treatment	Bolls plant^{-1}			Seed cotton yield q ha^{-1}		
	2018	2019	Pooled	2018	2019	Pooled
Clethodim 12% EC @ 96 g a.i. ha^{-1}	22.14	19.03	20.59	17.18 (4.14)	15.94 (3.99)	16.56 (4.07)
Clethodim 12% EC@ 120 g a.i. ha^{-1}	27.56	25.46	26.51	19.47 (4.41)	18.60 (4.31)	19.04 (4.36)
Clethodim 12% EC@ 144 g a.i. ha^{-1}	30.53	26.38	28.46	20.46 (4.52)	18.86 (4.34)	19.66 (4.34)
Fenoxaprop-p-ethyl 9.3% EC@ 67.5 g a.i. ha^{-1}	21.32	18.79	20.06	16.77 (4.09)	15.65 (3.95)	18.86 (4.43)
Quizalofop-ethyl 5% EC@ 50 g a.i. ha^{-1}	21.75	18.92	20.34	16.70 (4.08)	15.87 (3.98)	16.29 (4.03)
Control (hand weeding at 20,40 and 60 DAS)	30.91	27.28	29.10	20.90 (4.57)	19.15 (4.37)	20.03 (4.47)
Control (weedy check)	14.84	12.86	13.85	11.79 (3.42)	10.88 (3.29)	11.34 (4.36)
S Em ±	0.62	0.54	0.58	0.13	0.11	0.12
CD (P=0.05)	2.03	1.93	1.98	0.39	0.34	0.37

The cotton yield was recorded highest in the hand weeding control (20.03 q ha^{-1})which was followed by Clethodim 12% EC @ 144 g a.i. ha^{-1}(19.66 q ha^{-1}). Next best treatments were Clethodim 12% EC @ 120 g a.i. ha^{-1} (19.04), Clethodim 12% EC@ 96 g a.i. ha^{-1} (16.56 q ha^{-1}), Fenoxaprop-p-ethyl 9.3% EC @ 67.5 g a.i. ha^{-1} (18.86 q ha^{-1}), Quizalofop-ethyl 5% EC @ 50 g a.i. ha^{-1} (16.29 q ha^{-1}). The yieldin weedy check control was lowest (11.34 q

ha^{-1}). Similar results found with those of Sharma 2008 [8], Ayyadurai and Poonguzhalan 2011 and Rajeswari, and Charyulu, 1996 [7].

Conclusion

Based on the two years study results, it could be concluded that Clethodim 12% (w/v) EC @ 144 g a.i. ha^{-1} applied as post emergence (2 – 3 leaf stage of weeds) was effective for the control of grassy weeds in cotton crop with higher weed control efficiency (97.55 and 80.73) at 15 & 45 days after treatment which eventually resulted, significantly higher bolls plant-1 (28.46), seed cotton yield (19.66 q ha^{-1}) as compared to other treatments.

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Publication History

Received	20.03.2023
Revised	03.05.2023
Accepted	04.05.2023
Online	31.05.2023