

Impact of defoliants on yield, fibre quality and economics in cotton

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Abstract: A field experiment was conducted to study the effect of chemical defoliation on growth parameters, seed cotton yield and fibre quality of cotton under high density planting during *kharif*, 2023. Defoliation with Etherel @ 3000 ppm + Sodium chlorate @ 0.9% at 50 boll opening percentage resulted in higher number of bolls per square mt. and boll weight (gm.) and seed cotton yield (1375.67 kg ha⁻¹). Etherel @ 3000 ppm + Sodium chlorate @ 0.9% at 50 boll opening percentage recorded significantly higher leaf defoliation (98.33%) after 10 days after spray and was superior over other defoliants tried. In all the treatments net returns (₹/ha) was maximum in T₁₀-T₃+Diuron@400 ppm (₹ 89492) which is as par with T₃-Thidiazuron @500 ppm (₹ 86498).

Key words: Boll opening percentage, Defoliants, Etherel, etc, Seed cotton yield

Introduction

Cotton is major cash crop of *kharif* season in India. One of the constraints that limit realization of potential yield of cotton is poor and uneven opening of mature bolls. Excessive vegetative growth attained by cotton and thick crop canopy due to liberal use of nutrients hinders the opening of mature bolls, delays crop maturity and prolongs picking duration. Shedding of leaves with defoliants, terminate cotton development in preparation for harvest and expose the bolls to better circulation of air which in turn favours quick boll opening and early picking. Defoliants normally produce ethylene, which is a ripening hormone and causes leaf drop and allow the bolls to crack open and fluff out. Secondly, it leads to clean and efficient picking as it avoids staining of leaves with pigments and increase the quality of fibre. The present investigation was, therefore, undertaken to study the effect of chemical defoliation on growth parameters, seed cotton yield and fibre quality of cotton.

Material and methods

The experiment was carried out at Agricultural Research Station Hebballi Farm, Dharwad during *kharif* 2023. The soil of experimental field was deep cotton soil with O.C.(g.kg⁻¹): 0.54%. The experiment was laid out in randomized block design replicated thrice with ten treatments consisting of T1. Control, T2. Ethrel @ 3000 ppm, T3. Thidiazuron @ 500 ppm, T4. Sodium chlorate @ 0.9%, T5. CICR Defoliant, T6. Hydrogen cyanamide @ 5000 ppm, T7. T2+5% of urea, T8. T2+Diuron @ 400 ppm, T9. T2+Sodium chlorate @ 0.9% and T10. T3+Diuron @ 400. The chemical defoliants were applied as a foliar spray as per treatments when cotton crop attained 50 BOP and control treatment was sprayed with water only. The Cotton variety RCH-659 was sown at high density *i.e.*, at inter-row spacing of 90 cm and intra-row spacing of 30 cm on 17 July 2023. Recommended cultural practices and plant protection measures were followed throughout the crop growing season. Data on

growth parameters and yield attributes were recorded from five tagged plants per plot and calculated in kg ha.

Results and discussion

Growth Parameters: The effect of different defoliants on growth parameters in cotton genotype to facilitate mechanical picking is recorded in table no.1. and the plant height (cm) at harvest recorded maximum in T₃- Thidiazuron @ 500 ppm (106.40 cm) and lowest plant height is recorded in T₁₀-T₃+Diuron @400 ppm (91.60). This reduction in plant height might be due to complete shedding of leaves which in turn reduced assimilation of photosynthates. These results were in conformity with the findings of Karademir *et al.* (2007) and Meena *et al.* (2016). Similar results recorded by Mrunalini, (2019) that Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml ha⁻¹ (T2), there was reduction in plant height (103.5 cm).

The no of sympodia at harvest was maximum in T₆-Hydrogen cyanamide @ 5000 pm (20.60) and lowest was recorded in T₉-T₂+ Sodium chlorate @ 0.9% and T₁₀-T₃+Diuron @ 400 ppm (17.13). No. of monopodia at harvest was maximum in T₉. T₂+Sodium chlorate @ 0.9% (1.60) and lowest data was recorded in T₃-Thidiazuron @ 500ppm (1.00). The percent defoliants effect after 5 days and 10 days recorded maximum T₉-T₂+Sodium chlorate @ 0.9% (84.67 and 98.33), respectively.

Yield attributing characters: The seed cotton yield (kg/ha) was recorded maximum (Table no.2) in treatment T₉-T₂+Sodium chlorate @ 0.9% (1375.67 kg/ha) and lowest seed cotton yield (kg/ha) was recorded in T₆-Hydrogen cyanamide @ 5000 pm (806.81 kg/ha). However considerable increase in yield was recorded in T₂. Ethrel @ 3000 ppm (1249.79 kg/ha.) followed by T₁₀-T₃+Diuron @ 400 PPM (1209.37 kg/ha.). Similar results recorded by Mrunalini, (2019) and reported that Etherel and Dropp Ultra can be attributed to their favourable effect on yield determining parameters like number of picked bolls per plant,

Table 1. Effect of different defoliants on growth characters in cotton genotype to facilitate mechanical picking

Treatments	Plant height (cm) at harvest	No of Sympo dia at harvest	No of mono-podia at harvest	Final plant population (no. /net plot)	Per cent defoliation 5 days after spray	10 days after spray
T ₁ . Control	93.47	19.73	1.30	84.00	5.00	7.33
T ₂ . Ethrel @3000 ppm	94.87	17.80	1.35	83.33	68.33	90.33
T ₃ . Thidiazuron @500 ppm	106.40	19.13	1.00	84.00	63.33	90.00
T ₄ . Sodium chlorate @0.9 %	98.93	18.00	1.25	83.00	76.33	94.67
T ₅ . CICR Defoliant	101.27	20.53	1.10	84.00	60.33	90.33
T ₆ . Hydrogen cyanamide @5000 ppm	100.40	20.60	1.11	83.67	70.33	93.00
T ₇ . T2+5% Urea	96.47	18.13	1.23	83.33	67.33	95.33
T ₈ . T2+Diuron@400 ppm	97.60	18.87	1.09	84.00	71.67	94.33
T ₉ . T2+Sodium chlorate @0.9 %	94.93	17.13	1.60	83.00	84.67	98.33
T ₁₀ . T3+Diuron @400PPM	91.60	17.13	1.50	84.00	81.33	96.00
Mean	97.59	18.71	1.25	83.63	64.87	84.97
S.Ed	5.00	0.96	0.88	0.43	2.95	1.60
C.D. (5%)	10.52	2.01	0.18	0.90	6.20	3.38
CV	6.28	6.28	8.15	0.63	5.57	2.32

boll opening percentage and synchronized boll opening which was due to increased ethylene production within a boll to hasten opening and speed up drying of fully opened bolls. These results were in conformity with Wankhade and Bathkal (1994) and Buttar and Singh (2013).

The boll weight (gm) and no of bolls per sq. meters was recorded maximum in T₉-T₂+Sodium chlorate @ 0.9% (48.23 and 74.00) respectively and lowest boll weight (gm) was recorded in T₃-Thidiazuron @ 500 ppm. (24.57). and lowest no of bolls per sq meters recorded in T₈-T₂+Diuron @400 ppm (52.79).

Economics: The net returns (₹/ha) was maximum in T₁₀-T₃+Diuron @ 400 ppm (₹ 89492) which is as par with T₃-Thidiazuron @ 500 ppm (₹ 86498). Lowest net returns (₹/ha) was recorded in T₆-Hydrogen cyanamide @ 5000 ppm (₹ 62491). The B:C ratio recorded maximum is T₄-Sodium chlorate @ 0.9% (2.25) which is as par with T₇-T₂+5% of urea, T₅-Thidiazuron @ 500 ppm.

Fibre Quality Parameters: The table no 3. indicates the data on application of defoliants on cotton quality parameters that the seed index recorded highest in treatment T₄. Sodium chlorate

@ 0.9% (10.53) and lowest data recorded in T₁₀.T3+Diuron @ 400 PPM (9.07). T₂. Ethrel @3000 ppm recorded maximum lint index (6.64) and lowest was recorded in T₁₀.T3+Diuron @ 400 PPM (5.23). The upper half mean leangth (mm) was recorded maximum in T₁. Control (29.90mm) which is on par with T₄. Sodium chlorate @ 0.9% (29.80 mm), T₇.T2+5% Urea (29.30 mm) and T₁₀.T3+Diuron @400 PPM (29.20mm) respectively. Where as lowest upper half mean leangth (mm) was recorded maximum in T₆.Hydrogen cyanamide @5000 ppm (27.90mm). Uniformity index was almost ranging from 81.00 to 83.00 which is on par with each other in all the treatments.

Micronaire (10⁻⁶g/in) was maximum in T₂.Ethrel @3000 ppm (3.70 10⁻⁶g/in) and lowest micronaire (10⁻⁶g/in) recorded in T₁₀.T3+Diuron @ 400 PPM (2.90 10⁻⁶g/in). Tenacity 3.2 mm (g/tex) and elongation % was recorded maximum in T₁.Control (30.20 and 4.70%) respectively and lowest tenacity 3.2 mm (g/tex) and elongation% was recorded in T₆.Hydrogen cyanamide @ 5000 ppm (26.60 and 4.00 %). Earliness index was recorded maximum in T₆. Hydrogen cyanamide @5000 ppm (56.70) and lowest value recorded in T₉. T2+Sodium chlorate @ 0.9% (50.10).

Table 2. Effect of different defoliants on yield characters and economics in cotton genotype to facilitate mechanical picking

Treatments	Seed cotton yield (kg/ha.)	Boll weight (gm.)	No. of bolls per Sq.meter	Cost of ₹/ha.)	Gross Return ₹/ha.)	Net Return ₹/ha.)	B:C Ratio
T ₁ . Control	1056.89	39.50	58.71	65259	138750	73491	2.13
T ₂ . Ethrel @3000 ppm	1249.79	43.90	66.35	65105	144586	79481	2.22
T ₃ . Thidiazuron @500 ppm	972.38	24.57	54.51	74177	160675	86498	2.17
T ₄ . Sodium chlorate @0.9 %	1029.33	41.77	62.90	66120	148854	82734	2.25
T ₅ . CICR Defoliant	831.43	36.80	54.76	72273	150684	78411	2.08
T ₆ . Hydrogen cyanamide@5000 ppm	806.81	35.00	59.20	64361	126852	62491	1.97
T ₇ . T2+5% Urea	1011.54	41.50	68.33	65431	145924	80493	2.23
T ₈ . T2+Diuron@ 400 ppm	929.53	35.43	52.79	65000	134492	69492	2.07
T ₉ . T2+Sodium chlorate@0.9 %	1375.67	48.23	74.00	69891	150689	80798	2.16
T ₁₀ . T3+Diuro@400 PPM	1209.37	41.60	70.36	72894	162386	89492	2.23
Mean	1047.27	38.83	62.19	68051	146389	78338	2.15
S.Ed	18.27	2.03	3.22	5835	6295	6760	0.09
C.D. (5%)	38.38	4.26	6.77	12259	13225	14202	0.19
CV 2.13	6.40	6.35	10.5	5.26	10.56	5.25	

Impact of defoliants on yield, fibre quality

Table 3. Effect of different defoliants on Earliness index and Quality parameters in cotton

Treatments	Seed Index	Lint Index	UHML (mm)	Uniformity index	Mic (10 ⁻⁶ g/in)	Tenacity 3.2mm	Elongation (g/tex)%	Earliness index
T ₁ . Control	9.51	5.86	29.90	83.00	3.20	30.20	4.70	53.20
T ₂ . Ethrel @3000 ppm	10.17	6.64	28.80	82.00	3.70	28.40	4.10	52.00
T ₃ . Thidiazuron @500 ppm	10.27	5.96	28.30	82.00	3.10	27.60	4.00	54.80
T ₄ . Sodium chlorate @0.9 %	10.53	6.53	29.80	83.00	3.20	29.60	4.30	53.70
T ₅ . CICR Defoliant	10.13	6.19	28.40	82.00	3.60	27.40	4.00	55.90
T ₆ . Hydrogen cyanamide @5000 ppm	10.09	5.89	27.90	81.00	3.30	26.60	4.00	56.70
T ₇ . T2+5% Urea	10.27	5.98	29.30	83.00	3.40	28.20	4.10	54.10
T ₈ . T2+Diuron@ 400 ppm	10.17	6.23	28.90	82.00	3.40	28.10	4.10	55.20
T ₉ . T2+Sodium chlorate@0.9 %	9.67	5.82	28.40	82.00	3.10	27.60	4.20	50.10
T ₁₀ . T3+Diuron @400 PPM	9.07	5.23	29.20	83.00	2.90	28.20	4.00	52.60
Mean	10.14	6.15	28.91	82.29	3.36	28.29	4.17	53.83
S.Ed	0.15	0.02	1.98	5.64	0.22	1.94	0.29	3.68
C.D (5%)	0.31	0.03	4.16	11.84	0.47	4.06	0.6	7.74
C.V	1.84	0.32	8.4	8.39	8.39	5.57	8.41	8.38

Earliness: Application of defoliants *i.e.*, T₉-T2+Sodium chlorate @ 0.9%+ and T₂.Ethrel @ 3000 ppm at 50% boll opening had reduced the crop duration and application of dessicants resulted in reduction of crop duration by 6 and 5 days respectively when compared to T₆. Hydrogen cyanamide @ 5000 ppm (Table 3). By using defoliants in cotton early vacation of the field is possible which facilitates timely sowing of succeeding *rabi* crops. These results were in conformity with Ramesh babu *et al.* (1995) and Buttar and Singh (2013).

Conclusion

The percent defoliants effect after 5 days and 10 days recorded maximum with T₉-Ethrel @3000 ppm+Sodium chlorate @ 0.9% (84.67 and 98.33), respectively under high density planting. Cotton variety RCH-659 with application of Ethrel @3000 ppm+ Sodium chlorate@ 0.9% produced higher seed cotton yield of 1375.67 kg ha⁻¹. Higher net returns (₹ 89492 ha⁻¹) and B:C ratio (2.23) were obtained with T₁₀.T₃ +Diuron @ 400 PPM.

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