



## Impact of defoliant on yield, fibre quality and economics in Bt Cotton

SR Kareekatti<sup>1</sup>, UK Shanwad<sup>2</sup>, Akber SM D<sup>3</sup>, Poornima Matti<sup>4</sup>, VR Kulkarni<sup>5</sup>, Rajesh Patil<sup>6</sup>

<sup>1</sup> Scientist, Department of Crop Physiology, ICAR-AICRP on cotton, Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka, India.

<sup>2</sup> Scientist, Agronomy, ICAR-AICRP on cotton, Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka, India.

<sup>3</sup> Scientist, Biochemistry, ICAR-AICRP on cotton, Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka, India.

<sup>4</sup> Scientist, Agriculture Entomology, ICAR-AICRP on cotton, Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka, India.

<sup>5</sup> Scientist, Plant Pathology, ICAR-AICRP on cotton, Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka, India.

<sup>6</sup> Scientist, Genetics and Plant Breeding, ICAR-AICRP on cotton, Agricultural Research Station, University of Agricultural Sciences, Dharwad, Karnataka, India.

### 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 per cent boll opening stage resulted in higher number of bolls per square meter and boll weight (g) and seed cotton yield (1376 kg ha<sup>-1</sup>). Etherel @ 3000 ppm + Sodium chlorate @0.9 % at 50 per cent boll opening stage 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 (Rs. /ha) was maximum in T<sub>10</sub>-T<sub>3</sub>+Diuron@400 ppm (Rs.89492) which is as par with T<sub>3</sub>-Thidiazuron@500 ppm (Rs.86498).

**Keywords:** Boll opening per cent, defoliants, ethereal, 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 (Christidis and Herrisen, 1995). 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<sup>-1</sup>): 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. CICRDefoliant, T6. Hydrogencyanamide@5000ppm, 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 T<sub>3</sub>- Thidiazuron @500ppm (106.40 cm) and lowest plant height is recorded in T<sub>10</sub>-T<sub>3</sub>+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<sup>-1</sup> (T<sub>2</sub>), there was reduction in plant height (103.5 cm).

The no of sympodia at harvest was maximum in T<sub>6</sub> - Hydrogen cyanamide@5000 pm (20.60) and lowest was recorded in T<sub>9</sub>-T<sub>2</sub>+Sodium chlorate @0.9% and T<sub>10</sub>-T<sub>3</sub>+Diuron@400 ppm (17.13). No. of monopodia at harvest was maximum in T<sub>9</sub>. T<sub>2</sub>+Sodium chlorate @0.9 % (1.60)

and lowest data was recorded in T<sub>3</sub>-Thidiazuron @500ppm (1.00). The percent defoliant effect after 5 days and 10

days recorded maximum T<sub>9</sub>-T<sub>2</sub>+Sodium chlorate@0.9% (84.67 and 98.33) respectively.

**Table 1:** Effect of different defoliant on growth characters in cotton genotype to facilitate mechanical picking

Treatments	Plant height (cm) at harvest	No of Sympodia 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 <sub>1</sub> . Control	93.47	19.73	1.30	84.00	5.00	7.33
T <sub>2</sub> . Ethrel @3000 ppm	94.87	17.80	1.35	83.33	68.33	90.33
T <sub>3</sub> . Thidiazuron @500 ppm	106.40	19.13	1.00	84.00	63.33	90.00
T <sub>4</sub> . Sodium chlorate @0.9 %	98.93	18.00	1.25	83.00	76.33	94.67
T <sub>5</sub> . CICR Defoliant	101.27	20.53	1.10	84.00	60.33	90.33
T <sub>6</sub> . Hydrogen cyanamide @5000 ppm	100.40	20.60	1.11	83.67	70.33	93.00
T <sub>7</sub> . T <sub>2</sub> +5% Urea	96.47	18.13	1.23	83.33	67.33	95.33
T <sub>8</sub> . T <sub>2</sub> +Diuron@400 ppm	97.60	18.87	1.09	84.00	71.67	94.33
T <sub>9</sub> . T <sub>2</sub> +Sodium chlorate @0.9 %	94.93	17.13	1.60	83.00	84.67	98.33
T <sub>10</sub> . T <sub>3</sub> +Diuron @400 PPM	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
SEd	5.00	0.96	0.88	0.43	2.95	1.60
CD (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

**Yield attributing characters**

The seed cotton yield (kg/ha) was recorded maximum (Table no.2) in treatment T<sub>9</sub>-T<sub>2</sub>+Sodium chlorate@0.9% (1375.67 kg/ha) and lowest seed cotton yield (kg/ha) was recorded in T<sub>6</sub>-Hydrogen cyanamide@5000pm (806.81 kg/ha). However considerable increase in yield was recorded in T<sub>2</sub>. Ethrel @3000 ppm(1249.79kg/ha.) followed by T<sub>10</sub>. T<sub>3</sub>+Diuron @400 PPM (1209.37 kg/ha.). Similar results recorded by Mrunalini, (2019) and reported that Ethrel and Dropp Ultra can be attributed to their favourable effect on yield determining parameters like number of picked bolls per plant, 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 T<sub>9</sub>-T<sub>2</sub>+Sodium chlorate@0.9% (4.8 and 74.00) respectively and lowest boll weight (gm) was recorded in T<sub>3</sub>-Thidiazuron@500 ppm. (2.5). and lowest no of bolls per sq meters recorded in T<sub>8</sub>-T<sub>2</sub>+Diuron@400 ppm (52.79).

**Table 2:** Effect of different defoliant 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 cultivation (Rs/ha.)	Gross Return (Rs/ha.)	Net Return (Rs/ha.)	B:C Ratio
T <sub>1</sub> . Control	1056.89	4.0	58.71	65259	138750	73491	2.13
T <sub>2</sub> . Ethrel @3000 ppm	1249.79	4.4	66.35	65105	144586	79481	2.22
T <sub>3</sub> . Thidiazuron @500 ppm	972.38	2.5	54.51	74177	160675	86498	2.17
T <sub>4</sub> . Sodium chlorate @0.9 %	1029.33	4.2	62.90	66120	148854	82734	2.25
T <sub>5</sub> . CICR Defoliant	831.43	3.7	54.76	72273	150684	78411	2.08
T <sub>6</sub> . Hydrogen cyanamide @5000 ppm	806.81	3.5	59.20	64361	126852	62491	1.97
T <sub>7</sub> . T <sub>2</sub> +5% Urea	1011.54	4.2	68.33	65431	145924	80493	2.23
T <sub>8</sub> . T <sub>2</sub> +Diuron@ 400 ppm	929.53	3.5	52.79	65000	134492	69492	2.07
T <sub>9</sub> . T <sub>2</sub> +Sodium chlorate@0.9 %	1375.67	4.8	74.00	69891	150689	80798	2.16
T <sub>10</sub> . T <sub>3</sub> +Diuron @400 PPM	1209.37	4.2	70.36	72894	162386	89492	2.23
Mean	1047.27	3.9	62.19	68051	146389	78338	2.15
SEd	18.27	0.20	3.22	5835	6295	6760	0.09
CD (5%)	38.38	0.43	6.77	12259	13225	14202	0.19
CV	2.13	6.40	6.35	10.5	5.26	10.56	5.25

**Economics**

The net returns (Rs. /ha) was maximum in T<sub>10</sub>-T<sub>3</sub>+Diuron@400 ppm (Rs.89492) which is as par with T<sub>3</sub>-Thidiazuron@500 ppm (Rs.86498). Lowest net returns (Rs. /ha) was recorded in T<sub>6</sub>-Hydrogen cyanamide@5000 ppm (Rs.62491). The B: C ratio recorded maximum is T<sub>4</sub>-Sodium chlorate@0.9% (2.25) which is as par with T<sub>7</sub>-T<sub>2</sub>+5% of urea, T<sub>3</sub>-Thidiazuron@500 ppm.

defoliant on cotton quality parameters that the seed index recorded highest in treatment T<sub>4</sub>. Sodium chlorate @0.9 % (10.53) and lowest data recorded in T<sub>10</sub>.T<sub>3</sub>+Diuron @400 PPM (9.07). T<sub>2</sub>. Ethrel @3000 ppm recorded maximum lint index (6.64) and lowest was recorded in T<sub>10</sub>.T<sub>3</sub>+Diuron @400 PPM (5.23). Raghavendra T (2020) reported at 7 days after defoliant application, there was a significant increase in percent defoliation (92.3%) in Dropp ultra @250ml/ha and (90.0%) in Dropp ultra @ 200ml/ha at and was at par with Ethrel @3000ppm (89.0). The upper half mean leangth (mm) was recorded maximum in T<sub>1</sub>. Control(29.90mm)

**Fiber quality**

The table no 3. Indicates the data on application of

which is on par with T<sub>4</sub>. Sodium chlorate @0.9 % (29.80 mm), T<sub>7</sub>. T<sub>2</sub>+5% Urea (29.30mm) and T<sub>10</sub>.T<sub>3</sub>+Diuron @400 PPM (29.20mm) respectively. Where as lowest upper half mean length (mm) was recorded maximum in T<sub>6</sub>. 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<sup>-6</sup>g/in) was maximum in T<sub>2</sub>. Ethrel @3000 ppm (3.70 10<sup>-6</sup>g/in) and lowest micronaire (10<sup>-6</sup>g/in)

recorded in T<sub>10</sub>.T<sub>3</sub>+Diuron @400 PPM (2.90 10<sup>-6</sup>g/in). Tenacity 3.2 mm (g/tex) and elongation % was recorded maximum in T<sub>1</sub>. Control (30.20 and 4.70 %) respectively, and lowest tenacity 3.2 mm (g/tex) and elongation % was recorded in T<sub>6</sub>. Hydrogen cyanamide @5000 ppm (26.60 and 4.00 %). Earliness index was recorded maximum in T<sub>6</sub>. Hydrogen cyanamide @5000 ppm (56.70) and lowest value recorded in T<sub>9</sub>. T<sub>2</sub>+Sodium chlorate @0.9 % (50.10).

**Table 3:** Effect of different defoliant on Earliness index and Quality parameters in cotton

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

### Earliness

Application of defoliant i.e., T<sub>9</sub>- T<sub>2</sub>+Sodium chlorate @0.9 %+ and T<sub>2</sub>. 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 T<sub>6</sub>. Hydrogen cyanamide @5000 ppm (Table 3). By using defoliant 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 defoliant effect after 5 days and 10 days recorded maximum with T<sub>9</sub>-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<sup>-1</sup>. Higher net returns (Rs. Rs.89492 ha<sup>-1</sup>) and BC ratio (2.23) were obtained with T<sub>10</sub>.T<sub>3</sub>+Diuron @400 PPM.

### References

- Buttar GS, Singh S. Effect of Ethrel dose and time of application on growth, yield and duration of BT cotton in semi arid region of Punjab. *Journal of Cotton Research and Development*,2013:27:56–59.
- Mrunalini, Kancheti M, Sree Rekha, Murthy VRK, Jayalalitha K. Impact of harvest-aid defoliant on yield and economics of high-density cotton. *Indian Journal of Agricultural Research*,2019:53(1):116–119.
- Karademir E, Karademir C, Basbag S. Determination the effect of defoliation timing on cotton yield and quality. *Journal of Central European Agriculture*,2007:8(3):357–362.

- Meena RA, Monga D, Ratna S. Effect of defoliation on maturity behaviour and seed cotton yield in cotton. *Journal of Cotton Research and Development*,2016:30(1):63–35.
- Raghavendra T, Reddy Rama Y. Efficacy of Defoliant on Yield and Fibre Quality of American Cotton in Semi-Arid Conditions. *Indian Journal of Agricultural Research*,2020:54(3):404–407.
- Ramesh Babu, Rao MVH, Murali Krishna S, Gurmurthy R, Krishnappa MR. Effect of chemical defoliant on earliness, seed cotton yield and quality of upland cotton (*Gossypium hirsutum* L.) under irrigated conditions. *Indian Journal of Agronomy*,1995:40(1):157–159.
- Wankhade ST, Bathkal BG. Yield potential of Asiatic cottons under different nitrogen and plant density levels (rainfed). *Punjabrao Krishi Vidyapeeth Journal*,1994:18:53–54.