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Dose dependent response of different defoliants on per cent defoliation in high density cotton

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ABSTRACT : Field experiment was conducted at Agricultural College Farm, Bapatla, Andhra Pradesh, during *kharif,* 2016 to study the effect of defoliants application on per cent defoliation and seed cotton yield in cotton. Per cent defoliation was significantly influenced by different defoliant treatments, when they were applied at 60 per cent boll opening. There was significant increase in per cent defoliation with Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha (T_2) (99.7) at 15 days after defoliant spray followed by Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml/ha (T_1) (93.1) and lowest per cent defoliation was observed in urea @ 15% (T_6). However, defoliation with Etherel @ 2000 ppm resulted in higher number of picked bolls/plant and boll opening percentage. Seed cotton yield (2359 kg/ha) was also higher with Etherel @ 2000 ppm.

Key words : Boll opening percentage, defoliation, dropp ultra, etherel

Defoliation describes a management practice which aids the formation of abscission layers in the leaf petioles and results in the desiccation/shedding of foliage earlier than that would have occurred naturally. Advantages associated with harvest aid applications prior to cotton harvest are reduction in leaf and trash content in harvested lint, quicker drying of dew and early boll opening due to full exposure to sunlight. These advantages can include retarding boll rot, straightening lodged plants, maintaining/improving certain fibre quality characteristics and stimulating boll opening (Bange *et al.,* 2008). Cotton has a continuous flowering and fruit formation order which changes depending on the cotton genotypes and environmental conditions. Therefore, managing earliness involves limiting cotton's vegetative growth with cultivar selection and use of plant growth regulators (PGRs)/ harvest-aid defoliants. Mechanized picking also requires application of harvest facilitating defoliants to shed leaves before harvesting at an appropriate time and to ensure clean and smooth picking of seed cotton. Several chemicals which contain ethylene help in leaf drop, synchronous and early boll opening due to full exposure to sunlight. It makes cotton ready for single picking by machine (Bange *et al.*, 2008).

The experiment was conducted at Agricultural College Farm, Bapatla, Andhra Pradesh during *kharif,* 2016. The soil of experimental field was clay in texture, slightly alkaline in reaction (7.64), low in organic carbon (0.5 %) and medium in available nitrogen (219.5 kg/ha), and phosphorus (25.2 kg /ha) and high in available potassium (310.6 kg /ha). The experiment comprising of nine treatments, T-

Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml/ha; T, - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha; T*f* - Etherel @ 1500 ppm; T„ - Etherel @ 2000 ppm; T… - Urea @ (10%); T† - Urea @ (15%); T‡ - NaCl @ (15%); T_8 - NaCl @ (20%); T_9 – Control was conducted in randomized block design and replicated thrice. The chemical defoliators were applied as foliar spray as per treatments when cotton crop attained 60 BOP. Control treatment was sprayed with water. Cotton variety, Suraj was sown on 21 July 2016, at high density *i.e.,* at 45 x 10 cm (2,22,222 plants/ha). Recommended cultural practices and plant protection measures were followed throughout the crop growing period. Total number of fully opened leaves on main stem and branches were recorded before application of chemical defoliants and at alternate days interval of application and calculated as the ratio of number of leaves present on the plant after spraying of defoliants to the number of leaves present on the plant before spraying defoliants and expressed in percentage.

Per cent defoliation : The results on per cent defoliation as influenced by various defoliant treatments at 3, 5, 7, 9, 11, 13 and 15 days after defoliant spray are furnished in table 1 a and 1 b. There was a gradual increase in per cent defoliation of cotton from 3 days to 15 days after defoliant spray in all the treatments except in control (T_9).

Per cent defoliation was significantly influenced by different defoliant treatments, when they were applied at 60 per cent boll opening. At 3 days after defoliant application, highest percent defoliation (19.4 %) was obtained in Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml /ha (T_2), which was *on par* with Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml /ha (T_1- 18.5 %) and Etherel @ 2000 ppm (T_4- 16.6 %), lowest per cent of defoliation (2.9 %) was observed in Urea @ 10% (T_5).

At 5 days after defoliant spray, higher defoliation was noticed in all the treatments expect in control compared to 3 days after defoliant spray. Maximum per cent defoliation (74.6 %) was recorded with Dropp ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha (T_2) which was *on par* (74.3 %) with Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml /ha (T_1) and it was significantly superior over remaining treatments. However, lowest per cent defoliation was recorded with control (T_9- 10.3%) treatment.

A significant increase in per cent defoliation by 18.2 per cent was obtained at 7 days after defoliant spray (90.9 %) when compared to 5 days after defoliant spray (74.6 %) with Dropp ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha (T_2) and it showed significantly higher per cent defoliation than all other treatments. However, lowest per cent defoliation was observed in control (T_9- 13.7 %) treatment (Table 1 a).

At 9 days after defoliant spray, significantly higher per cent defoliation (93.2 %) was observed with Dropp ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha (T_2) which was *on par* with Dropp ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml /ha (T_1 -74.3 %) and significantly higher than the remaining treatments. However, per cent defoliation was lowest with control (T_9) treatment

(Table 1 b).

At 11, 13 and 15 days after defoliant spray also, similar trend was observed with Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml /ha (T_2) and it was *on par* with Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml /ha (T_1).

Per cent defoliation was lowest in Urea @ (15%) (T_6) and it recorded decreasing trend by 26.7, 79.1 and 35.2 per cent at 11, 13 and 15 days after defoliant spray, respectively. This significant decrease in per cent defoliation was due to active participation of nitrogen in the plant metabolism by the application of urea as foliar spray which activated the enzymes, increasing the photosynthetic activity, assimilation of photosynthates, efficient translocation, and increase in both cell division and cell elongation in apical meristems leading to increased growth rate and put forth new flush. Similar trend of decrease in per cent defoliation was observed with Urea @ (10%) (T_5), NaCl @ 15% (T‡) and NaCl @ (20%) (T_8). However, in control (T_9) an increased trend in per cent defoliation from 3 to 15 days after defoliant spray was observed.

Higher per cent defoliation was due to application of defoliants which promotes senescence and abscission by promoting the synthesis of cell wall degrading enzymes like cellulase (Kader, 1985). So, the application of chemical defoliants in the later crop growth stages resulted in defoliation which lead to less number of leaves and leaf area. Leaf defoliation is accelerated by increasing ethylene level in cotton leaves (Suttle, 1985). Light penetration is also improved by leaf removal. These crop conditions lead to early and higher opening of bolls (Malik *et al.,* 1991). With the stimulation of defoliation process, leaves transport most of

Table 1a. Number of leaves before spraying and percent defoliation (%) at 3, 5, and 7 days after defoliant spray in Cotton as influenced by application of different defoliants

Treatments	Per cent defoliation			
	Leaves before spraying	3	5	7
T_1 - Dropp ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml/ha	48.0	18.5(39.1)	74.3(12.3)	80.6(9.3)
T_2 - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha	74.5	19.4(60.0)	74.6(18.9)	90.9(6.7)
T_3 - Etherel @ 1500 ppm	54.0	12.5(47.2)	39.7(32.5)	48.1(28.0)
T_4 - Etherel @ 2000 ppm	62.2	16.6(51.9)	41.8(36.2)	56.3(27.2)
T_5 - Urea @ (10%)	79.0	2.9(76.7)	19.1(63.9)	28.4(56.6)
T_6 - Urea @ (15%)	58.2	4.5(55.6)	21.0(46.0)	30.3(40.6)
T_7 - NaCl @ (15%)	88.5	8.8(80.7)	26.6(65.0)	36.2(56.5)
T_8 - NaCl @ (20%)	57.7	12.8(50.3)	46.3(31.0)	56.9(24.9)
T_9 - Control	50.7	5.1(48.1)	10.3(45.5)	13.7(43.8)
SEm+ 5.73	1.32	3.05	2.72	
CD(p=0.05)	17.2	3.9	9.1	8.0
CV (%)	15.5	20.3	13.4	9.5

*Figures in parentheses indicate the number of leaves

their nutrients and metabolites to developing bolls (Kerby, 1988).These results of per cent defoliation are in conformity with the findings of Godoy *et al.,* (1995), Malik *et al.,* (2002), Osman *et al.,* (2010) and AICCIP (2013).

Seed cotton yield : Significantly higher number of picked bolls/plant (19.2) and maximum boll opening percentage of (99.1) at harvest was recorded with Etherel @ 2000 ppm (table 2). Increased number of picked bolls/plant with application of defoliants might be due to increased production of ethylene inside the bolls, which tend to weaken and cause dissolution of cell walls and build up of internal pressure causing carpels to split apart and allowing bolls to open naturally. Increase in boll opening percentage with increased levels of defoliants

Table 1b. Percent defoliation (%) at 9, 11, 13 and 15 days after defoliant spray of cotton as influenced by application of different defoliants

Treatments	Percent defoliation			
	9	11	13	15
T_1 - Dropp ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml/ha	83.1(8.1)	87.1(6.2)	91.6(4.0)	93.1(3.3)
T_2 - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha	93.2(5.0)	95.4(3.4)	97.9(1.5)	99.7(0.2)
T_3 - Etherel @ 1500 ppm	56.6(23.4)	58.9(22.2)	63.1(19.9)	68.0(17.3)
T_4 - Etherel @ 2000 ppm	63.4(22.8)	64.6(22.0)	67.3(20.3)	71.6(17.7)
T_5 - Urea @ (10%)	28.5(56.5)	25.3(59.0)	21.3(62.2)	21.4(62.1)
T_6 - Urea @ (15%)	21.8(45.5)	17.2(48.2)	9.6(52.6)	7.1(54.1)
T_7 - NaCl @ (15%)	39.6(53.5)	33.1(59.2)	29.4(62.5)	27.4(64.2)
T_8 - NaCl @ (20%)	59.9(23.1)	51.8(27.8)	46.5(30.9)	43.8(32.4)
T_9 – Control	19.2(41.0)	23.6(38.7)	28.4(36.3)	33.0(34.0)
SEm+	4.0	5.2	3.36	4.23
CD(p=0.05)	12.0	15.6	10.1	12.7
CV (%)	13.4	17.4	11.4	13.6

*Figures in parentheses indicate the number of leaves

was clearly evident from increased number of picked bolls/plant. Maximum seed cotton yield of 2359 kg/ha was obtained with Etherel @ 2000 ppm (T_4) and it was *on par* with all the other treatments except NaCl @ (15%) (T‡) (1975 kg/ha) and control (T_9) (1829 kg /ha) (table 2). Increase in yield with application of defoliants *viz.,* Etherel and Dropp ultra can be attributed to their favourable effect on yield determining parameters like number of picked bolls/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 are in conformity with Wankhade and Bathkal (1994) and Buttar and Singh (2013).

CONCLUSIONS

It can be concluded that use of defoliants in cotton under semi arid conditions could be a useful production practice for managing plant

Table 2. Effect of various defoliant treatments on picked bolls/plant, Boll opening percentage (%) and seed cotton yield of cotton

Treatments	Picked bolls/ plant	Boll opening percentage (At harvest)	Seed cotton yield (kg/ha)
T_1 - Dropp ultra 560 SC (Thidiazuron 360 + Diuron 180) @ 150 ml/ha	17.4	95.2	2212
T_2 - Dropp ultra 560 SC (Thidiazuron 360 + Diuron180) @ 200 ml/ha	17.8	96.5	2265
T_3 - Etherel @ 1500 ppm	18.2	97.7	2307
T_4 - Etherel @ 2000 ppm	19.0	99.1	2359
T_5 - Urea @ (10%)	15.8	91.9	2064
T_6 - Urea @ (15%)	17.6	92.8	2121
T_7 - NaCl @ (15%)	15.1	91.4	2058
T_8 - NaCl @ (20%)	14.7	87.7	1975
T_9 – Control	16.1	85.1	1829
SEm+	0.64	2.96	126.0
CD (p=0.05)	1.9	8.9	379
CV (%)	6.5	5.5	10.2

growth and enhancing yield. Application of Dropp ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha at 60 per cent boll opening can be a good management decision necessary for enhancing earliness in cotton for timely sowing of succeeding *rabi* crops.

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