



High density planting cotton variety 'Suraj' response to harvest-aid defoliant

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ABSTRACT

A field experiment was conducted during *kharif* 2016 to determine the effect of harvest-aid defoliant on boll opening percentage (BOP) and yield of cotton. Defoliation @ 60 BOP with Etherel @ 2000 ppm resulted in higher number of picked bolls plant⁻¹ and boll opening percentage. Seed cotton yield (2359 kg ha⁻¹) also higher with Etherel @ 2000 ppm. Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha recorded significantly higher leaf defoliation (99.7 %) and was superior over other defoliant tried.

Key words: *Boll opening percentage, Defoliant, Seed cotton yield.*

Cotton is a major cash crop of *kharif* season in Andhra Pradesh. It occupied an area of about 4.41 lakh hectares with an annual production of 13.1 lakh bales and productivity of 719 kg lint ha⁻¹ (AICCIP, Annual Report, 2016-17). Cotton production is labour intensive in almost all the developing countries. A novel way to avoid labour problem is to go for mechanical harvesting. Cotton being indeterminate in nature, it is difficult to harvest the seed cotton in one time. But research results suggest that, by manipulating the crop geometry especially by providing close spacing one time harvest is possible and the yield reduction may be compensated by increasing the plant population by way of High Density Planting Systems (HDPS). This system offers an opportunity to maximize productivity of cotton in India. Cotton varieties and hybrids that are presently cultivated are large bushy plant type. The large number of long branches get interlocked and cause great inconvenience for mechanical harvesting which actually is essential due to the present changed situations of labour scarcity. Chemical defoliation is an attempt to enhance a natural physiological process that occurs in the plant as it matures. As the cotton plant matures and begins to desiccate, an abscission layer begins to form at the base of the petiole where the leaf is attached to the stem. Several chemicals which contain ethylene help in leaf drop, leading to 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 present investigation was, therefore, undertaken to study the effect of defoliant boll opening percentage and on seed cotton yield.

MATERIAL AND METHODS

The experiment was carried out 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⁻¹), and phosphorus (25.2 kg ha⁻¹) and high in available potassium (310.6 kg ha⁻¹). The experiment was laid out in Randomized Block Design replicated thrice with nine treatments comprising of T₁ - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml/ha; T₂ - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha; T₃ - Etherel @ 1500 ppm; T₄ - Etherel @ 2000 ppm; T₅ - Urea @ 10%; T₆ - Urea @ 15%; T₇ - NaCl @ 15%; T₈ - NaCl @ 20%; T₉ - Control. The chemical defoliant were applied as a foliar spray as per treatments when cotton crop attained 60 BOP. Control treatment was sprayed with water only. Cotton variety Suraj was sown on 21 July 2016, at high density i.e., at inter-row spacing of 45 cm and intra-row spacing of 10 cm (2,22,222 plants ha⁻¹). Recommended cultural practices and plant protection measures were followed throughout the crop growing season.

RESULTS AND DISCUSSION

Percent defoliation

Significant increase in per cent defoliation at 15 days after defoliant spray was observed with Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha (T_2 -99.7 %) and it was on par with Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml/ha (T_1 -93.1 %) and significantly higher than the remaining treatments (Table 1). Higher percent 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 defoliant 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 their nutrients and metabolites to developing bolls (Kerby, 1988). These results of per cent defoliation are in conformity with the findings by Osman *et al.* (2010).

Yield attributing characters

The number of picked bolls plant⁻¹ and boll opening percentage increased significantly with application of defoliants (Table 1). Significantly higher number of picked bolls plant⁻¹ (19.0) was recorded with Etherel @ 2000 ppm than T_9 , T_5 , T_7 and T_8 treatments. All the levels of Etherel and Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) resulted in significantly more number of picked bolls plant⁻¹ when compared with remaining all other treatments but were statistically on par with each other. Increased number of picked bolls per 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. The present study is in conformity with the findings of Singh *et al.* (2003). Maximum boll opening percentage of (99.1) at harvest was recorded with Etherel @ 2000 ppm (T_4) which was on par with all the other treatments except for NaCl @ 20% (T_8 -87.7) and Control (T_9 -85.1) treatments. Increase in boll opening percentage with increased levels of defoliants was clearly evident from increased number of picked bolls per plant.

These results are in conformity with those of Rajini and Brar (2011) and Tuppad *et al.* (2016).

Seed cotton yield

Maximum seed cotton yield of 2359 kg ha⁻¹ was obtained with Etherel @ 2000 ppm (T_4) and it was on par with all the other treatments except NaCl @ 20% (T_8) (1975 kg ha⁻¹) and control (T_9) (1829 kg ha⁻¹). There was a significant increase in seed cotton yield by 22.5, 20.8, 19.3 and 17.4 % in Etherel @ 2000 ppm (T_4), Etherel @ 1500 ppm (T_3), Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha (T_2) and Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml/ha (T_1), respectively compared to control (T_9) treatment. 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 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 are in conformity with Wankhade and Bathkal (1994) and Buttar and Singh (2013).

LITERATURE CITED

- AICCIP 2016** All India Coordinated Cotton Improvement Project, Annual Report, Central Institute for Cotton Research, Nagpur.
- Bange M P, Caton S J and Milroy S P 2008** Managing yield of fruits retention in transgenic cotton (*Gossypium hirsutum* L.). *Austria Journal of Research*, 59: 733-74.
- Buttar G S and Singh S 2013** 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*, 27: 56-59.
- Kader A A 1985** Ethylene-induced senescence and physiological disorders in harvested horticultural crops. *Hort Science* 20: 54-57.
- Kerby T A 1988** Cotton physiology and cotton harvest aid. *Cotton Consultant Conference*. pp: 1-7. ICI. America Inc.
- Malik M N, S Din and M I Makhdum 1991** Accelerated boll dehiscence with thidiazuron. *Tropical Agriculture*, 68: 149-50.

Table 1. Effect of various defoliant treatments on per cent defoliation, number of picked bolls plant⁻¹, Boll opening percentage (%) and seed cotton yield.

Treatments	Per cent defoliation at 15 days after defoliants spray	Number of picked bolls plant ⁻¹	Boll opening percentage (%) (At harvest)	Seed cotton yield (kg ha ⁻¹)
T ₁ - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml ha ⁻¹	93.1	17.4	95.2	2212
50T ₂ - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml ha ⁻¹	99.7	17.8	96.5	2265
T ₃ - Etherel @ 1500 ppm	68.0	18.2	97.7	2307
T ₄ - Etherel @ 2000 ppm	71.6	19.0	99.1	2359
T ₅ - Urea @ 10%	21.4	15.8	91.9	2064
T ₆ - Urea @ 15%	7.1	17.6	91.4	2058
T ₇ - NaCl @ 20%	43.8	14.7	87.7	1975
T ₉ - Control	33.0	16.1	85.1	1829
SEm±	4.23	0.64	2.96	126.0
CD(0.05)	12.7	1.9	8.9	379
CV (%)	13.6	6.5	5.5	10.2

- Osman Copur, U Demirel, R Polat and M A Gur 2010** Effect of different defoliant and application times on the yield and quality components of cotton in semi-arid conditions. *African Journal of Biotechnology*, 9(14): 2095-2100.
- Rajini D J S and Brar A S 2011** Effect of chemical defoliation on boll opening percentage, yield and quality parameters of *Bt* Cotton (*Gossypium hirsutum*). *Indian Journal of Agronomy*, 56(1): 74-77.
- Singh T, Brar Z S, Prakash R and Hassan H 2003** Effect of dates of planting and defoliant on yield and quality of cotton (*Gossypium hirsutum* L). *Journal of Cotton Research and Development*, 17: 146-149.
- Suttle J C 1985** Involvement of ethylene in the action of the cotton defoliant thidiazuron. *Plant Physiology*, 78: 272-276.
- Tuppad G B, Shashidhara G B, Biradar D P, Alagundagi S C and Patil S S 2016** Effect of chemical defoliant application on yield and economics of compact genotypes. *Research in Environment and Life Sciences*, 9(3): 292-296.
- Wankhade S T and Bathkal B G 1994** Yield potential of Asiatic cottons under different nitrogen and plant density levels (rainfed). *Punjab Rao Krishi Vidyapeeth Journal*, 196: 53-54.

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