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Effectiveness of Harvest – Aid Defoliants and Environmental Conditions in High Density Cotton

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ABSTRACT

A research trail was conducted to determine the effect of defoliants on defoliation and yield of cotton. Cotton (*Gossypium hirsutum* L.) cultivar 'Suraj' was planted during *kharif* 2016 and defoliants were sprayed at 60 boll opening percentage (BOP). A degree day above than 100°C was required after defoliants application for completion of defoliation process and opening of boll. The atmospheric minimum and maximum temperatures of 17.7 and 32.1°C, respectively, were found conducive for inducement of defoliation process.

Introduction

Harvest-aid defoliants have been introduced to facilitate mechanical harvesting in cotton. Defoliants are chemicals that either impact plant hormonal activity related to leaf loss or cause direct injury to leaves, both at a level that promotes leaf drop (abscission) and often represents the final step in the production of a cotton crop.

The defoliation process usually completes in 7 to 10 days, but in some situations, it may be delayed for as long as 30 days (Cathey, 1986; Gwathmey and Hayes, 1997; Malik and Din, 1997). The success of defoliation process depends on the maturity of cotton crop and prevailing weather conditions at the time of application. Brown and Hyer (1956) reported that defoliant efficiency was associated with both the number of mature bolls and mature leaves at the time of chemical termination. The Night temperature of 16°C has been found most suitable for defoliation (Cathey, 1986). Cotton defoliation is often practiced when 60% of bolls are opened to avoid loss in yield and fibre quality (Snipes and Baskin, 1994).

The objectives of this research were to compare the effectiveness of defoliants in cotton and relate these effects to crop maturity and temperature regimes prevalent during and after treatments.

Materials 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 T_1 - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml/ha; T_2 - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml/ha; T_3 - Etherel @ 1500 ppm; T_4 - Etherel @ 2000 ppm; T_5 - Urea @ 10%; T_6 - Urea @ 15%; T_7 - NaCl @ 15%; T_8 - NaCl @ 20%; T_9 – Control. The chemical defoliants were applied as a 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 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. Cumulative degree days were calculated using base temperature of 10 and 5°C for *kharif* and *rabi* seasons, respectively.

Results and Discussion

Defoliation in cotton by using different defoliants and desiccants was influenced by various factors like type of chemical, rate of application, crop coverage, maturity of the plant and weather conditions. The crop completed its defoliation in 15 days after treatment imposition indicating that the temperature prevailing at the time of defoliant application played a significant role in inducing defoliation.

Minimum temperature of 16°C and a diurnal temperature of 24°C have been found critical for minimal leaf response to most defoliants (Cathey, 1985; 1986).

In this experiment, maximum (32.1°C) and minimum (17.7 °C) temperatures that occurred during the fifteen days following defoliant treatment were above the threshold limits. Degree-days unit of more than 100°C days favours good defoliation in cotton. In the trial 270.7 °C days were received which hastened the defoliation process (Table 1).

At 3 days after defoliant application, there was a significant increase in percent defoliation (19.4 %) in Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml ha^{-1} (T_2) which was on par with Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml ha^{-1} (T_1) and Etherel @ 2000 ppm (T_4) and it was also significantly highest defoliation than remaining treatments (Table 2).

Application of Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml ha^{-1} (T_2- 99.7 %) and Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml ha^{-1} (T_1- 93.1 %) (Table 2) was found equally effective to induce defoliation at 15 days after defoliant spray. Thidiazuron accelerates boll dehiscence by increasing ethylene level in cotton leaves (Suttle, 1985). Light penetration is also improved by leaf removal. These crop conditions lead to early maturity and opening of bolls (Malik *et al.,* 1991).

This implies that warm temperatures played dominant role to stimulate defoliation and boll opening processes. The role of crop maturity was of lesser degree than that of temperatures not withstanding differences in crop ontogeny. Cathey (1986) stated that condition of plant and prevailing weather at the time of application are the major factors that limit efficiency of defoliation process.

Table.2 Percent defoliation (%) and seed cotton yield (kg ha^{-1}) of cotton as influenced by application of different defoliants

Treatments	Percent defoliation (%) (At 3 Days after defoliant spray)	Percent defoliation (%) (At 15 Days after defoliant spray)	Seed cotton yield (kg ha^{-1})
T_1 - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml ha^{-1}	39.1	93.1	2212
T_2 - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml ha^{-1}	60.0	99.7	2265
T_3 - Etherel @ 1500 ppm	12.5	68.0	2307
T_4 - Etherel @ 2000 ppm	16.6	71.6	2359
T_5 - Urea @ 10%	2.9	21.4	2064
T_6 - Urea @ 15%	4.5	7.1	2121
T_7- NaCl @ 15%	8.8	27.4	2058
T_8 - NaCl @ 20%	12.8	43.8	1975
T_9 – Control	5.1	33.0	1829
SEm$\pm$	1.32	4.23	126
CD(0.05)	3.9	12.7	379
CV (%)	20.3	13.6	10.2

Table.3 Quality parameters of cotton as influenced by application of different defoliants

Treatments	2.5 per cent span length (mm)	Bundle strength (g tex^{-1})	Fineness (µg inch^{-1})	Uniformity ratio	Elongation (%)
T_1 - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml ha^{-1}	32.1	23.6	4.4	44.0	4.4
T_2 - Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml ha^{-1}	31.3	23.1	4.6	44.9	4.1
T_3 - Etherel @ 1500 ppm	32.1	25.0	5.0	47.6	5.0
T_4 - Etherel @ 2000 ppm	32.3	25.7	5.3	48.0	5.3
T_5 - Urea @ 10%	32.1	25.0	4.3	47.6	4.6
T_6 - Urea @ 15%	32.0	25.2	4.6	46.6	4.6
T_7- NaCl @ 15%	30.4	22.6	4.1	46.6	4.8
T_8 - NaCl @ 20%	30.2	21.4	4.0	44.6	4.5
T_9 - Control	32.0	22.4	4.3	45.3	4.1
SEm$\pm$	2.76	2.16	0.24	4.11	0.28
CD(0.05)	NS	NS	0.7	NS	1.1
CV (%)	15.1	15.7	9.6	15.4	10.6

Table.1 Crop calendar, temperature regimes and degree days during crop season

Parameters	Cotton crop
Date of sowing	**21st July, 2016**
Date of defoliant spray	**23st December, 2016**
Boll opening percentage (%) at Defoliation	**60**
Degree-days (°C day) from sowing to defoliant application	**3075** (21-07-2016 to 23-12-2016)
Degree-days (°C day) from sowing to harvest	**3616.5** (21-07-2016 to 21-01-2017)
Degree-days (°C day) during defoliation process (15 days after defoliant spray)	**270.7** (23-12-2016 to 07-01-2017)
Average maximum temperature during defoliation	**32.1** (23-12-2016 to 07-01-2017)
Average minimum temperature during defoliation	**17.7** (23-12-2016 to 07-01-2017)

The primary task of an efficient defoliation programme is timely harvest and no loss in yield and fibre quality. The defoliant efficiency is highest when moisture level of leaves is high, and when both temperature and humidity are high. These conditions were fully met in the experiment at the time of defoliant application.

These results verify the earlier findings on cotton defoliation with respect to thidiazuron (Malik *et al.*, 1991; Malik and Din, 1997). The most important factor to be considered in the practice of chemical defoliation is the stage of crop maturity. The time of defoliation in present study coincided with the cut out phase of cotton crop.

Maximum seed cotton yield (2359 kg ha^{-1}) was obtained with Etherel @ 2000 ppm (T_4) and it was on par with all the other treatments except NaCl @ 15% (T_7) (1975 kg ha^{-1}) and control (T_9) (1829 kg ha^{-1}).

There was a significant increase in seed cotton yield compared to control (T_9) by 28.1, 26.1, 23.8, and 20.9 % with Etherel @ 2000 ppm (T_4), Etherel @ 1500 ppm (T_3), Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 200 ml ha^{-1} (T_2) and Dropp Ultra 540 SC (Thidiazuron 360 + Diuron 180) @ 150 ml ha^{-1} (T_1), respectively (Table 2).

Kerby (1988) stated that with stimulation of defoliation process, leaves transport most of their nutrients and metabolites to developing bolls. Cotton end use depends on fibre quality. Any agronomic practice, which brings deterioration in fibre quality is not desirable. Data presented in Table 3, shows no deleterious effects of the defoliants on fibre quality.

Brown and Hyer (1956) reported that adverse effects of defoliants and desiccants are limited to those bolls that are less than 35 days old. Further, environment accounted more in fibre quality variations than defoliants. Results from this study indicate that defoliants did not cause yield loss or deterioration in fibre quality in a physiologically matured crop (Table 3).

It can be concluded that cotton under high density planting 60% open boll may be sprayed with defoliants without loss in seed cotton and fibre quality. The atmospheric minimum and maximum temperatures of 17.7 and 32.1°C were found conducive for inducement of defoliation process.

References

Brown, L.C. and A.H. Hyer, 1956. Chemical defoliation of cotton: Effects of premature defoliant and dessicant treatments on boll components, fibre properties, germination and yield of cotton. *Agronomy Journal*. 48: 50–5.

Cathey, G.W. 1985. Conditioning cotton for increased response to defoliant chemicals. *Field Crop Research.* 10: 347–53.

Cathey, G.W. 1986. Physiology of defoliation in cotton production. *In:* J.R. Mauney and J.M. Stewart (Eds.), *Cotton Physiology*. pp: 143–54. The Cotton Foundation, Memphis, T.N. USA.

Gwathmey, C.W. and R. Hayes, 1997. Harvest aid interactions under different temperature regimes in field grown cotton. *Journal of Cotton Science.* 1: 1–9.

Kerby, T.A. 1988. Cotton physiology and cotton harvest aid. *Cotton Consultant Conference.* pp: 1–7. ICI. America Inc.

Malik, M.N. and Din, S. 1997. Efficacy of thidiazuron defoliant in cotton cultivars varying in maturity. *The Pakistan Cottons.* 41: 36–42.

Malik, M.N., Din, S and Makhdum, M.I. 1991. Accelerated boll dehiscence with thidiazuron. *Tropical Agriculture*. 68: 149–50.

Snipes, C.E., and C.C. Baskin. 1994. Influence of early defoliation on cotton yield, seed quality, and fibre properties. *Field Crop Research.* 37:137-143.

Suttle, J.C. 1985. Involvement of ethylene in the action of the cotton defoliant thidiazuron. *Plant Physiology.* 78: 272–6.

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