COTTON DEFOLIANT EFFICACY: EFFECT OF CARRIER VOLUME AND NOZZLE TYPE

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One of the major limitations to effective defoliation in cotton is the inconsistent response of leaves to chemical treatment for abscission. The efficiency of a defoliant is directly related to plant condition and weather at the time of application; however, other important factors include spray coverage, canopy penetration, volatilization, photodecomposition, translocation and absorption. Many of these factors can be manipulated by varying carrier volume and nozzle type to enhance cotton defoliant efficacy.

Field studies were conducted at the Dean Lee Research Station in Alexandria, LA (2003), the Northeast Research Station in St. Joseph, LA (2003 & 2004), and the West Tennessee Experiment Station in Jackson, TN (2004) to determine the optimum combination of carrier volume and nozzle type to maximize defoliation while minimizing desiccation and regrowth. A factorial treatment arrangement was used to evaluate all combinations of flat fan, hollow cone, and air induction nozzles at carrier volumes of 5, 10, and 15 gallons per acre (GPA) with both herbicidal (DEF®) and hormonal (Dropp®) defoliants applied alone. Spray equipment was calibrated to deliver 10 GPA and carrier volumes were varied by adjusting ground speed to maintain a constant spray pressure. Defoliants were applied to mature cotton with approximately 70% open bolls. Visual defoliation, desiccation, and regrowth evaluations were made 3 to 35 days after treatment (DAT).

At Dean Lee, averaged across defoliants and carrier volumes, flat fan and hollow cone nozzles provided greater defoliation than did air induction nozzles at 14 DAT. Defoliation with flat fan and air induction nozzles was similar 21 DAT; however defoliation with hollow cone nozzles was still greater than air induction nozzles. Less terminal regrowth (21 DAT) was observed when using flat fan and hollow cone nozzles when compared to air induction nozzles and basal regrowth was not influenced by nozzle type. More desiccated leaf material present 7 DAT with application at 15 GPA when compared to 5 or 10 GPA regardless of type of defoliant or nozzle used.

Studies in both 2003 and 2004 at St. Joseph showed very similar results. Regardless of defoliant and carrier volume, flat fan and hollow cone nozzles increased defoliation at least 16.3% at both 7 and 19 DAT, compared to air induction nozzles. In both years, regardless of defoliant and nozzle type, defoliation generally increased as carrier volume increased.

In Jackson, due to cool temperatures, treatments containing Dropp® provided little defoliation activity and were omitted from analysis. Hollow cone nozzles provided greater defoliation than air induction nozzles 7 DAT and were superior to both flat fan and air induction nozzles at 14 DAT, regardless of carrier volume. Leaf defoliation and desiccation was significantly greater with application at 10 and 15 GPA (7 DAT) compared to 5 GPA across all nozzle types. Leaf defoliation increased as carrier volume increased from 5 to 15 GPA. Higher levels of terminal regrowth were associated with use of flat fan nozzles and application with carrier volumes less than 15 GPA.

Enhanced defoliation and regrowth control with flat fan or hollow cone nozzles at high carrier volumes is attributed to increased canopy coverage, which was evident on water sensitive cards. These data support current defoliation application recommendations in both LA and TN (and product labels of many currently registered cotton defoliants) which advise using flat fan or hollow cone nozzles at carrier volumes no less than 10 GPA. Even though most defoliation recommendations prefer hollow cone nozzles, these data indicate that performance of flat fan nozzles can be very similar to hollow cones. In any case, air induction nozzles should not be used for cotton defoliation due to inconsistent and generally inferior performance. These recommendations are even more crucial for producers wishing to achieve adequate defoliation for a once over harvest with a single harvest-aid application.

Table 1. Effect of carrier volume and nozzle type on desiccation, defoliation, and regrowth; Dean Lee Research Station.

Carrier Volume	% Desic. 7 DAT	% Defol. 21 DAT	Regrowth (21 DAT) Terminal	Regrowth (21 DAT) Basal
5 GPA	6.5 b	66.4	16.8	23.8
10 GPA	6.0 b	64.5	17.0	24.3
15 GPA	9.1 a	71.7	15.8	21.6
LSD (0.05)	2.6	NS	NS	NS

Nozzle Type	% Defoliation 14 DAT	% Defoliation 21 DAT	Regrowth (21DAT) Terminal	Regrowth (21DAT) Basal
Flat Fan	77.7 a	67.9 ab	14.2 b	20.3
Hollow Cone	77.5 a	71.5 a	15.3 b	24.0
Air Induction	71.1 b	62.7 b	20.0 a	25.5
LSD (0.10)	6.3	8.0	4.6	NS

Table 2. Effect of carrier volume and nozzle type on defoliation and regrowth; Northeast Research Station (2003 & 2004).

Carrier Volume	% Defoliation 7 DAT (03)	% Defoliation 19 DAT (03)	% Defoliation 12 DAT (04)
5 GPA	34.4 b	50.0 b	75.8 b
10 GPA	36.9 ab	55.0 ab	77.7 b
15 GPA	40.4 a	59.4 a	81.3 a
LSD (0.05)	3.6	5.1	2.4

Nozzle Type	% Defoliation (2003) 7 DAT	% Defoliation (2003) 19 DAT	% Defoliation (2004) 12 DAT	% Defoliation (2004) 21 DAT
Flat Fan	43.3 a	61.5 a	80.8 a	90.8 a
Hollow Cone	42.3 a	59.8 a	81.9 a	91.3 a
Air Induction	26.0 b	43.1 b	72.1 b	87.3 b
LSD (0.05)	3.6	5.1	2.4	2.1

Table 3. Effect of carrier volume and nozzle type on desiccation, defoliation, and regrowth; West TN Experiment Station.

Carrier Volume	% Desic. 7 DAT	% Defoliation 7 DAT	% Defoliation 14 DAT	Regrowth (T) 26 DAT
5 GPA	0.9 b	71.4 b	81.6 c	19.4 a
10 GPA	2.3 a	80.8 a	86.6 b	19.0 a
15 GPA	2.5 a	83.0 a	90.2 a	13.5 b
LSD (0.05)	1.1	5.5	2.5	4.4

Nozzle Type	% Defoliation 7 DAT	% Defoliation 14 DAT	Regrowth (T) 26 DAT
Flat Fan	78.2 ab	85.4 b	21.8 a
Hollow Cone	82.1 a	89.0 a	16.6 b
Air Induction	75.0 b	83.9 b	13.6 b
LSD (0.05)	5.5	2.5	4.4