EFFECT OF REMOVING COTTON TERMINALS DURING VARIOUS TIMES OF COTTON GROWTH AND DEVELOPMENT

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Abstract

Many natural occurrences have the potential to reduce crop productivity by causing damage to cotton terminals at various stages of growth and development. Mechanical damage to terminals from crusting, sandblasting, insect damage, deer feeding, and severe weather events can cause damage to stems and foliage at various stages of crop development. More specifically, hail damage is the most common cause of terminal damage and is capable of causing light to severe damage to many crops including cotton. Hail storms vary in their severity and duration, and injury levels often vary greatly within the same field due to their sporadic nature of the storms. One way to simulate the effect of hail storms occurring during different times in the growing season is by removing cotton terminals manually at different growth stages during the growing season. Estimating the expected yield loss based on the timing and severity of hailstorms is important for the purpose of grower compensation to the event of crop injury.
The objective of this study was to determine the response of cotton to terminal removal at different stages of cotton growth and development.

Materials and Methods

A replicated field trial was conducted at the Pee Dee Research & Education Center located in Florence, SC in 2011. Treatments consisted of 16 different growth stages of terminal removal based on nodal development. Terminals were removed at various stages at node 2, 4, 6, 8, 12, 16, and 20. An untreated check was also included, and treatments were imposed on dryland and irrigated cotton. Plots consisted of 4 rows, spaced 38 inches apart and were 40 feet long. PHY 499WRF was planted on May 18 with a John Deere 1700 Vacuum planter at a rate of 4 seed per row foot. Plots were arranged as split plots in a randomized complete block design with four replications. Irrigation or dryland were main plots, and the 16 terminal removal treatments were sub-plots. Data collected included above-ground plant dry matter at peak bloom, and a final plant map at the end of the season (plant height, number of nodes, total fruiting sites, vegetative branches, boll location on main stem nodes and sympodia). At season's end, the middle two rows of each four row plots was machine-harvested with a Case 1822 2-row picker. Seedcotton was ginned on a 10-saw gin and gin turnout calculated, and fiber quality determined by HVI analysis at Star Lab (Knoxville, TN). Data were evaluated by analysis of variance (SAS Institute Inc., Cary, NC).

Summary

No irrigation x terminal removal interactions were found for any of the parameters measured in this study.

As expected, irrigated cotton plants were taller throughout the season (Table 1) and had produced more total nodes (Table 1) and squares (data not shown) at peak bloom compared to the dryland cotton. Surprisingly, the irrigated cotton had a reduced total boll weight (Table 1) at peak bloom, which resulted in a reduced reproductive: vegetative ratio (RVR) compared to dryland cotton. By season's end, irrigated cotton plants had produced more bolls (Table 2) at all locations throughout the canopy compared to dryland cotton, which resulted in a significant lint yield increase (Table 2) with irrigation.

Table 1. Growth responses of PHY 499 WRF to irrigation and terminal removal. Measurements were made at mid-bloom (July 25) and at season's end (Oct. 20) at Florence, SC, in 2011.

Parameter	Plant Stand	Plant Height		Total Nodes		No. of Veg. Branches		Total Dry Wt.	Rep. Dry Wt .	Veg. Dry Wt.	RVR
	20-Oct	*25-Jul*	*20-Oct*	*25-Jul*	*20-Oct*	*25-Jul*	*20-Oct*	*25-Jul*	*25-Jul*	*25-Jul*	*25-Jul*
	(plants/m2)	(cm/plant)		(nodes /plant)		#/plant		g/m2	g/m2	g/m2	g/g
Irrigation											
Irrigated	8.4	48	53	13	13	1	2	202	56	145	0.42
Dryland	8.6	44	50	12	13	1	2	214	70	144	0.49
LSD (0.05)	NS	2	3	1	NS	NS	NS	NS	9	NS	0.05
Terminal Removal											
Node 2 at node 2	8.8	47	52	**13**	**14**	**2**	3	216	**48**	167	**0.29**
Node 2 at node 4	9.1	49	55	14	**14**	**2**	2	176	**19**	157	**0.12**
Node 4 at node 4	8.5	53	61	**13**	**14**	**2**	2	195	**33**	162	**0.2**
Node 4 at node 8	8.3	48	60	**13**	**12**	**2**	3	**146**	**16**	130	**0.12**
Node 6 at node 8	9.6	**57**	**63**	14	**14**	**2**	2	215	**23**	**192**	**0.12**
Node 8 at node 8	8.5	42	**48**	**12**	**12**	1	2	212	68	144	0.48
Node 8 at node 12	8.1	**26**	**37**	**7**	**10**	1	2	**146**	57	**89**	0.64
Node 10 at node 12	8.5	**31**	**35**	**9**	**10**	1	1	183	70	112	0.62
Node 12 at node 12	8	**39**	**41**	**10**	**11**	1	2	214	83	131	0.63
Node 12 at node 16	7.9	51	**48**	14	**12**	1	2	241	95	146	0.64
Node 14 at node 16	8.4	49	53	14	**13**	1	2	213	76	137	0.56
Node 16 at node 16	9	47	53	14	15	1	2	254	97	157	0.63
Node 16 at node 20	8.3	52	58	14	16	1	2	261	97	165	0.58
Node 18 at node 20	8	48	57	14	16	1	2	227	77	151	0.53
Node 20 at node 20	8.5	48	55	14	16	1	2	206	71	135	0.55
Untreated	8.3	48	55	14	16	1	2	220	79	141	0.57
LSD (0.05)	NS	7	7	1	2	1	NS	53	24	34	0.13

Irrigation X Terminal	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 2. Lint yield, total bolls, fruit retention, location of bolls on sympodia and vegetative branches, and location of bolls on mainstem nodes as determined by plant mapping PHY 499WRF on October 20, 2011 in response to irrigation and terminal removal in Florence, SC.

Parameter	Lint Yield	Gin Turnout	Fruit Retention	Total Bolls	No. of Veg. bolls	Sympodia Position 1st pos.	2nd pos.	≥3rd pos.
	(lb/acre)	(%)	(%)	(bolls/m2)	(bolls/m2)	(bolls/m2)	(bolls/m2)	(bolls/m2)
<u>Irrigation</u>								
Irrigated	1039	44	45	43	7	28	6	1
Dryland	918	45	43	33	6	25	3	0
LSD (0.05)	49	NS	NS	4	NS	3	1	1
<u>Terminal Removal</u>								
Node 2 at node 2	**903**	45	39	42	**11**	28	3	0
Node 2 at node 4	**883**	45	43	43	**10**	36	3	0
Node 4 at node 4	939	45	46	44	**8**	30	3	0
Node 4 at node 8	**815**	45	47	40	**13**	23	**2**	0
Node 6 at node 8	990	44	41	41	**10**	28	4	0
Node 8 at node 8	960	45	40	38	**13**	**19**	4	1
Node 8 at node 12	**783**	44	**57**	44	**23**	**15**	5	2
Node 10 at node 12	**861**	45	44	**27**	4	**16**	4	1
Node 12 at node 12	987	45	**58**	34	4	**20**	7	**4**
Node 12 at node 16	974	44	**53**	31	2	23	6	0
Node 14 at node 16	1096	45	46	36	2	28	6	1
Node 16 at node 16	1059	44	42	46	4	33	8	1
Node 16 at node 20	1144	45	35	35	1	31	4	1

Node 18 at node 20	1132	45	36	37	2	31	5	1
Node 20 at node 20	1067	44	34	33	1	29	5	0
Untreated	1068	44	38	39	1	32	5	1
LSD (0.05)	138	NS	11	10	4	10	3	2
Irr. X Terminal	NS	NS	NS	NS	NS	NS	NS	NS

1) Removing terminals at nodes 2, 4, and 6 did not cause significant reductions in plant height (Table 1) at peak bloom or at harvest, but did result in reduced reproductive dry weight (Table 1) and RVR (Table 1) at peak bloom.

2) Removing terminals at nodes 2, 4, 6, 8, and 10 resulted in significant lint yield reductions compared to the untreated check plots (Table 2), although reductions were not as severe as expected. Plants with their terminals removed at nodes 2, 4, 6, and 8 had produced as many total bolls (Table 2) at season's end as plants with no terminal damage. Plants with early-season terminal damage (before node 10) increased boll production on vegetative branches (Table 2). Plants with terminals removed during mid-season (nodes 8 to 12) had increased boll retention compared to untreated plants (Table 2), but also had a reduction in the total number of "money bolls" produced at 1st position sympodial locations and at nodes 11 to 15 in the canopy (Table 2).