COTTON CULTIVAR RESPONSE TO CLRDV AS INFLUENCED BY PLANTING DATES

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Abstract

In 2017 virus like symptoms were observed in a producer's field in Barbour County, AL. It was later confirmed as Cotton Leaf Roll Dwarf Virus (CLRDV) from plant and tissue samples collected from this field. After two seasons of virus observations and some understanding of the occurrence, incidence, and severity of the cotton virus the following objectives were determined and evaluated in 2019. The two objectives were 1.) What influence does CLRDV have on commercial cultivars and 2.) Determine what influence planting dates have on CLRDV incidence, severity, and yield. Cotton cultivars were selected by their popularity and recommendations based off performances in south Alabama and planted in three different field trials. The planting dates consisted of May 1st, May 15th, May 30th, and June 12. There were no effects by cultivars or the interaction of planting dates x cultivars at either location. However significant differences in incidence and yield were found at both Brewton and Fairhope as influenced by planting dates. At Brewton, CLRDV percent incidence was 15% on May 1st planting date and significantly increased in cotton planted on May 30th and June 15th, to 45% and 100%, respectively (Table 2). Yields were significantly lower in the May 30th and June 15th planting dates compared to cotton planted at May 1st and May 15th. Similar results were found at Fairhope in that CLRDV incidence significantly increased from May1st planting date to late May planting date, 7% to 12.4 %, respectively. Yields were also significantly reduced at Fairhope when comparing planting dates May1st to May 31st. Only numerical differences were found between cultivars in the On-Farm Trials at Santa Rosa County, FL. CLRDV percent incidence among cultivars in this trial was variable and ranged from 18.1% to 58%.

Introduction

Virus like symptoms were found and observed in a producer's field in Barbour County, AL in 2017. Symptomatic plants were sampled and sent to the University of Arizona to be analyzed for possible virus identification (Avelar et al., 2019). It was later confirmed through PCR Illumination Sequencing as Cotton Leaf Roll Dwarf Virus CLRDV and was the first report of this virus to infect cotton grown in the United States. The virus symptoms progressed in 2017 and became severe as the cotton matured and impacted yields at harvest. In the 2018 growing season, CLRDV symptoms began to appear in production fields in late August in many counties across south Alabama. Similar to 2017, the virus was believed to impact yields especially in fields along the coast in Baldwin County, AL. In both growing seasons, 2017 and 2018, the more severe cases occurred where planting dates were delayed to mid to late June. After two seasons of virus observations and some understanding of the occurrence, incidence, and severity of the cotton virus the following objectives were determined and evaluated in 2019. The two objectives were 1.) What influence does CLRDV have on commercial cultivars and 2.) Determine what influence planting dates have on CLRDV incidence, severity, and yield.

Materials and Methods

Cotton cultivars were selected by their popularity and recommendations based off performances in south Alabama and planted in three different field trials. Two separate field trials using a split plot design were established; one at the Brewton Agriculture Research Unit (BARU) in Brewton, Alabama and another at the Gulf Coast Research and Extension Center (GCREC) in Fairhope, AL. A separate On-Farm Trial was established in Santa Rosa County, Florida to evaluate what influence CLRDV had on commercial varieties in a producer's field. Seed of cotton cultivars from several companies along with experimental lines were provided by Agri-AFC, LLC and planted at each of the

locations. Planting dates at each location were at or near May 1st, May 15th, May 30th and June 15th. The On-Farm Trial in Santa Rosa County, FL was planted on June 11th. The percent incidence was evaluated by calculating the percentage of symptomatic plants versus healthy plants in five foot of row. The severity ratings were determined by using a 1 to 5 rating scale in which 1 is best (Figure 1). Seed cotton yields were collected from the two row plots by a two-row cotton picker at the Brewton and Gulf Coast Research Center. Each planting date was defoliated and harvested separately according to standard defoliation recommendations to reduce any environmental influence on yields. The data collected from trials at BARU and GREC were analyzed in SAS 9.4 using Proc Glimix and LS-means were compared using Tukey-Kramer's method ($P \leq 0.05$).

1. Healthy 2. Leaf folding 3. Leaf crumpling

Rating scale for CLRDV severity

4. Leaf distortion 5. Severe distortion & dwarfing

Figure 1: Scale used to rate CLRDV symptoms.

Results

In our planting date trials, greater disease pressure and higher incidence ratings were found at Brewton than at Fairhope. There were no effects by cultivars or the interaction of planting dates x cultivars at either location (Table 1). However significant differences in incidence and yield were found at both Brewton and Fairhope as influenced by planting dates. At Brewton, CLRDV percent incidence was 15% on May 1st planting date and significantly increased in cotton planted on May 30th and June 15th, to 45% and 100%, respectively (Table 2). Yields were significantly lower in the May 30th and June 15th planting dates compared to cotton planted at May 1st and May 15th. Similar results were found at Fairhope in that CLRDV incidence significantly increased from May1st planting date to late May planting date, 7% to 12.4 %, respectively (Table 2). Yields were also significantly reduced at Fairhope when comparing planting dates May1st to May 31st. Only numerical differences were found between cultivars in the On-Farm Trials at Santa Rosa County, FL. CLRDV percent incidence among cultivars in this trial was variable and ranged from 18.1% to 58% (Figure 4). Severity ratings ranged from 1.25 to 3.75 and nodes with foliar symptoms ranged from 1.5 to 3, indicating very low disease pressure was observed in this trial at Santa Rosa County, FL (Figure 3).

Table 1: Fixed effects from P values (< 0.05) at both Fairhope and Brewton locations.

Type III Tests of Fixed Effects P values at Brewton, AL					
	Incidence			Severity	Yield
Effect	June	August	September	Nodes	lb./A
DOP	0.0953	0.0021	<.0001	<.0001	<.0001
Cultivar	0.2638	0.8868	0.8435	0.922	0.956
DOP*Cultivar	0.9407	0.178	0.9874	0.9696	0.8968

Type III Tests of Fixed Effects P values at Fairhope, AL			
	Incidence		Yield
Effect	July	September	lb./A
DOP	0.0296	0.0353	0.0002
Cultivar	0.3469	0.9024	0.9587
DOP*Cultivar	0.3121	0.7548	0.9209

Table 2: Incidence and seed cotton yields for planting dates and cultivars at both Brewton and Fairhope locations.

	Brewton, AL		Fairhope, AL	
Date of planting	CLRDV Incidence %	Seed Cotton Yield lb./a	CLRDV Incidence %	Seed Cotton Yield lb./a
1-May	15 a	3909 a	7 ab	2367 a
15-May	30 a	3666 ab	5.9 ab	2567 a
30-May	45 b	3540 b	12.4 a	1434 b
12-Jun	100 c	2423 c	4 b	2189 ab
Cultivars	CLRDV Incidence %	Seed Cotton Yield lb./a	CLRDV Incidence %	Seed Cotton Yield lb./a
CG 3885 B2XF	55 a	3520 a	8.4 a	2207 a
CG 9608 B3XF	44 a	3463 a	9.8 a	2156 a
DP 1646 B2XF	51 a	3465 a	4.1 a	2217 a
DP 1840 B3XF	48 a	3363 a	8.4 a	2477 a
DP 1851 B3XF	50 a	3340 a	7.3 a	2167 a
PHY 430 W3FE	45 a	3324 a	7.8 a	2230 a
PHY 440 W3FE	44 a	3354 a	4.2 a	2087 a
PHY 480 W3FE	49 a	3412 a	6.3 a	2055 a
ST 5471 GLTP	43 a	3368 a	10.8 a	1844 a
ST 5600 B2XF	44 a	3234 a	6.1 a	1951 a

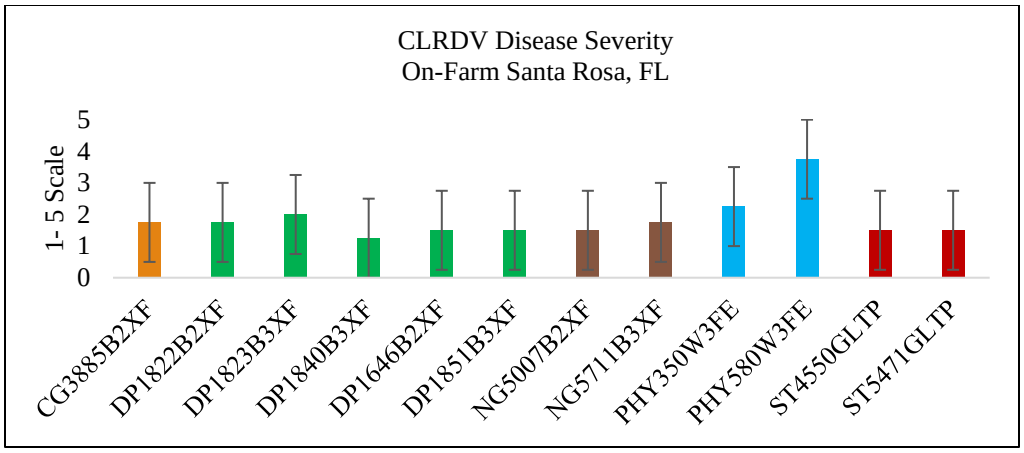

Figure 3: CLRDV Severity ratings from On-Farm Trial in Santa Rosa County, Florida.

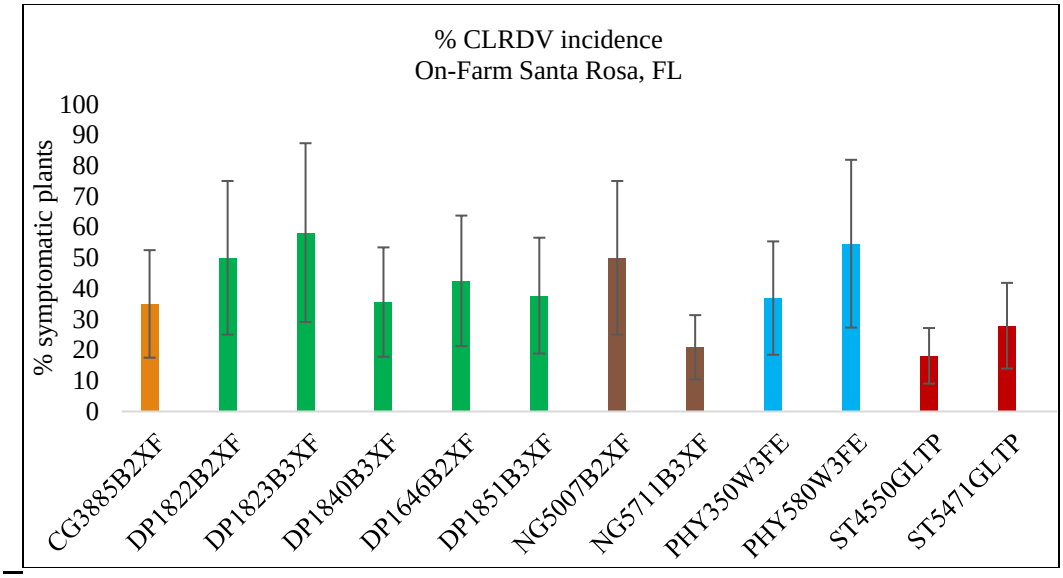

Figure 4: Percent Incidence of CLRDV symptomatic plants among cultivars in On-Farm Trial at Santa Rosa County, Florida.

Conclusions

The greatest impact that CLRDV had on cotton in our study was influenced by planting dates rather than cultivar. As planting dates were delayed in the southern coastal cotton growing regions, disease incidence was subject to increase and yields were reduced. Although there were numerical differences among cotton varieties in disease incidence and yield, all varieties in our trials were susceptible to CLRDV.

References

Avelar, S., Schrimsher, D. W., Lawrence, K., & Brown, J. K. (2019). First Report of Cotton leafroll dwarf virus Associated with Cotton Blue Disease Symptoms in Alabama. Plant disease, 103(3), 592-592.