Effect of Cotton Leaf Crumple (CLC) Disease on Stub and Planted Cotton

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Cotton Leaf Crumple was the only major widespread disease observed in stub cotton since the inception of the research project. Prior to 1981, the disease was observed affecting only a few plants in limited number of fields. In 1981, the disease was of epidemic proportions in all stub fields and in many planted fields. The disease was present in the Mexicali Valley of Mexico (Nigh); widespread in the Imperial Valley of California with the heaviest symptoms along the Colorado River all the way to Blythe (Troutman & Russell); widespread in the Yuma, Parker, Gila Bend, Harquahala Valley, Rainbow Valley, Buckeye, Phoenix area, and to a lesser extent in Pinal and Pima county (Russell), with one observation in Safford (Taylor).

Conclusive proof is not available, but there is strong evidence to suggest that the disease is caused by a gemini virus. White flies transmit this virus, as well as other gemini viruses, such as the one which causes a yellowing and leaf curling in melons. The melon crop in the Imperial Valley may have been heavily damaged this last summer by a combination of a gemini virus and white fly injury.

We believe that because of the heavy white fly infestation some cotton leaf crumple would have been observed even if there was no stub cotton. But, we also feel that stub cotton provided a massive source of inoculum which contributed greatly to early symptoms and spread in planted cotton grown in the vicinity of stub cotton. There is no evidence to suggest that the appearance of CLC in planted cotton areas where stub cotton was not grown could be related to stubbing in other locations.

Positive symptoms were first observed in stub cotton in early March with the infestation approaching 5-10% of the plants by the end of April.

Plots were established in Deltapine 120 fields located near Cosmo, AZ, to measure the rate of spread within stub fields. The effect of cotton leaf crumple on yield was estimated on the basis of when symptoms first appeared on individual plants. Plants in replicated plots established in planted, first and second year stub fields were tagged throughout the season as each initially showed symptoms of cotton leaf crumple. Just prior to commercial harvest, each tagged plant was stripped of all seed cotton and returned to the laboratory for ginning.

The impact on yield as related to the seasonal expression of cotton leaf crumple symptoms can be seen in Table 1 (1st and 2nd year stub and Table 2 (planted).

In all cases where symptomless plants were available in plots for comparison there was statistically significant reduction in yield. In general, the earlier in the season symptoms were observed on plants the lower the yield when compared to plants either showing symptoms late in the fruiting cycle or not showing symptoms at all.

Yield lost in practical terms might be roughly estimated from Tables 1 and 2. These estimates can be seen in Table 3. Unfortunately not all the yield and expected yield data are available from the grower at this time. But, we estimate a 23-55% yield loss due to CLC in 1st year stub and 11-17% loss in adjacent planted.

To determine the spread rate of CLC to and within planted cotton, plots with 100 plants/replication were established in planted fields which were across the ditch or road from and between stub fields 1, 4, 13, and 15. The first replications were ten rows in from the edge of the field and subsequently then established every 100 rows across the field.

At regular intervals throughout the season each replication was inspected and the number of plants showing CLC symptoms for the first time on that date were recorded. Tables 4, 5 and 6 reflect the incremental changes in disease development.

Initially in all three cases (Fields 4, 5 and 14) the replications near the edge of fields and the stub cotton showed a tendency to have higher CLC counts than the interior replications. This trend continued until about the middle of August when it became difficult to see differences among all replications. This pattern of CLC spread to and within planted fields suggests that a vector relationship exists.

The lint (100 samples) and seed (360 samples) from samples used to calculate the data in Tables 1 and 2 were examined for loss in quality. There appears to be no overall difference in the seed index among plants displaying CLC symptoms and symptomless plants in both stub and planted cotton. The overall seed index was low (7.61 g/100 seed) compared to the expected value for Deltapine 7120 at 8.5 g/100 seed.

Fiber quality figures suggest that cotton leaf crumple has no influence on this production area.

Table 1. Seasonal development of cotton leaf crumple symptoms in stub cotton and the effect on yield. (1981)

1981 Dates Sampled	S1(1st yr stub) Symptoms Increase %[a]	S1(1st yr stub) Fiber % of N.S.[b]	S13(1st yr stub) Symptoms Increase %[a]	S13(1st yr stub) Fiber % of N.S.[b]	S4(2nd yr stub) Symptoms Increase %[a]	S4(2nd yr stub) Fiber % of N.S.[b]	S15(2nd yr stub) Symptoms Increase %[a]	S15(2nd yr stub) Fiber % of N.S.[b]
05/19	20	22a[c]	13	21a	80	--[d]	50	--[d]
05/26	8	28a	13	23a	5	--	4	--
06/04	1	39a	3	28a	0	--	8	--
06/28	2	44a	1	41a	5	--	10	--
07/14	5	51a	3	50a	10	--	28	--
08/11	6	90 b	21	38a	--	--	--	--
08/27	29	100 b	16	58a	--	--	--	--
09/21	19	100 b	20	56a	--	--	--	--
N.S.	--	100 b	--	100 b	--	--	--	--

[a] $\bar{x}$ percentage of new plants showing symptoms of cotton leaf crumple on that corresponding date.
[b] $\bar{x}$ fiber yield calculated as a percentage of $\bar{x}$ fiber yield harvested from plants not displaying symptoms (N.S.) at commercial harvest.
[c] $\bar{x}$ values followed by the same letters are not significantly different at the 1% level ($P < .01$) according to Duncan's Multiple Range Test. Fiber yields for 2nd year stub were not significantly different among dates at any level. (Statistics actually calculated on plant lint weights)
[d] No symptomless plants available for comparison but per plant fiber yields were 50% less than detected in 1st year stub symptomless plants.

Table 2. Seasonal development of cotton leaf crumple symptoms in planted cotton and the effect on yield. (1981)

1981 Dates Sampled	Planted #4 Symptoms Increase %[a]	Planted #4 Fiber % of N.S.[b]	Planted #14 Symptoms Increase %[a]	Planted #14 Fiber % of N.S.[b]
05/19	2.6	22a[c]	0.5	0a
05/26	0.3	39a	0.5	35a
06/04	1.4	27a	2.0	24a
06/28	10.3	61 b	5.9	37a
07/14	10.0	61 b	2.3	75 b
08/11	13.8	98 c	14.4	67a
08/27	25.0	93 c	13.2	74 b
09/21	13.7	96 c	13.7	86 b
10/15	12.6	95 c	19.4	96 c
N.S.	--	100 c	--	100 c

[a] $\bar{x}$ percentage of new plants showing symptoms of cotton leaf crumple on that corresponding date.
[b] $\bar{x}$ fiber yield calculated as a percentage of the $\bar{x}$ fiber yield harvested from plants not displaying symptoms (N.S.) at commerical harvest.
[c] $\bar{x}$ values followed by the same letters are not significantly different at 1% level ($P<.01$) according to Duncan's Multiple Range Test.

Table 3. Estimated yield losses from cotton leaf crumple in stub and planted cotton. (1981)

Field	Growers Expected Yield lbs lint/Ac	Yield Loss Factor[a] %	Estimated Yield Loss lbs lint/Ac	Growers Actual Yield lbs lint/Ac
Stub #1 (1st yr)	3471 (6.3 bales) (1980 plant = 4.81 bales)	.227a	788	2910 (5.29 bales)
Stub #13 (1st yr)	2750 (5.0 bales) (1980 plant = 3.50 bales)	.545	?	2101 (3.82 bales)
Stub #15	--- (1980 stub = 5.36 bales)	---	---	1672 (3.04 bales)
Planted #4	? (1980 plant = out)	.106	239	2019 (3.67 bales)
Planted #14	? (1980 plant = out)	.174	514	2508 (4.56 bales)

[a]Calculated by setting growers expected yield = to 100% (value for symptomless plants and those not significantly different from this group) and then actual yield = (exp. yield) (total % of plants in 100% group) + (exp. yield) (total % of plants in next significantly different group) (avg % yield difference from 100% group) + etc. 1-(act yield ÷ exp. yield) = yield loss factor.
Example: (2475) (0.64) (1) + (2475) (0.36) (0.50) = 1-(2029.5 ÷2475) = .18 (100) = 18% (100) = 18% loss (estimated)

Table 4. Seasonal development and the distribution of cotton leaf crumple (CLC) symptoms within planted Field #4. (1981)

1st Year Stub (S-1)

Observation Dates	Rep 1 %[a]	Rep 2 %	Rep 3 %	Rep 4 %	Rep 5 %	Rep 6 %	Rep 7 %	Rep 8 %	Rep 9 %	$\bar{x}$ %
	Incremental changes in symptom expression									
05/06	0	0	0	0	0	0	0	0	0	0.0
05/19	2	4	3	0	1	0	0	2	6	2.0
05/26	3	2	0	1	0	0	2	0	0	9.0
06/04	3	2	0	1	3	1	0	2	1	1.4
06/28	13	20	2	3	4	0	16	13	21	10.2
07/14	4	0	2	17	7	32	6	5	17	10.0
08/11	17	13	14	11	6	4	24	16	20	12.5
08/27	32	37	28	19	20	22	24	27	16	22.5
09/21	15	11	16	20	20	10	18	24	9	14.3
10/15	7	5	23	14	19	5	4	7	7	9.1
Total	96	94	88	86	80	74	95	96	97	82.9[b]

2nd Year Stub (S-4)

[a]Replications were comprised of 100 plants and established every 100 rows. The % values represent the change in the number of plants showing CLC symptoms from the prior observation date.
[b]Total.

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Table 5. Seasonal development and the distribution of cotton leaf crumple (CLC) symptoms within planted Field #5. (1981)

2nd Year Stub (S-4)

Observation Dates	Rep 1 %[a]	Rep 2 %	Rep 3 %	Rep 4 %	Rep 5 %	Rep 6 %	Rep 7 %	Rep 8 %	Rep 9 %	Rep 10 %	$\bar{x}$
	Incremental changes in symptom expression										
05/06	0	0	0	0	0	0	0	0	0	0	0.0
05/19	2	0	0	0	0	0	0	0	0	0	0.2
05/26	3	0	0	0	0	0	0	0	0	0	0.3
06/04	10	0	1	1	2	0	0	2	1	0	1.7
06/28	26	11	3	6	2	5	4	2	0	0	5.9
07/14	9	3	0	0	0	5	2	0	4	0	2.3
08/11	13	22	16	18	16	6	6	11	17	19[b]	14.4
08/27	13	15	26	17	10	10	12	6	4	--	12.6
09/21	14	11	9	11	17	15	20	15	11	--	13.7
10/15	5	22	21	28	29	21	24	13	17	--	20.3
Total	95	84	76	81	76	62	68	49	54	19	71.4[c]

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[a]Replications were comprised of 100 plants and established every 100 rows. The % values represent the change in the number of plants showing CLC symptoms from the prior observation.
[b]Plots lost.
[c]Total.

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Table 6. Seasonal development and the distribution of cotton leaf crumple (CLC) symptoms within planted Field #14. (1981)

1st Year Stub Field (S-13)

Observation Date	Incremental changes in symptom expression					$\bar{x}$
	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	
	%[a]	%	%	%	%	
05/06	0	0	0	0	0	0.0
05/19	0	0	0	0	0	0.0
05/26	2	1	2	0	8	2.6
06/04	0	1	0	0	0	0.2
06/28	2	3	1	5	3	2.8
07/14	0	5	14	12	4	7.0
08/11	11	14	5	27	10	13.4
08/27	12	4	8	12	29	13.0
09/21	29	37	21	24	22	26.6
10/15	16	11	17	8	10	12.4
Total	72	76	68	88	86	78.0[b]

2nd Year Stub Field (S-15)

[a]Replications were comprised of 100 plants and established every 100 rows. The % values represent the change in the number of plants showing CLC symptoms from the prior observation.

[b]Total.

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Table 7. The effect of date of initial cotton leaf crumple symptom expression on seed index, and fiber length, strength and micronaire.

	May-June-July				Aug-Sept-Oct				Symptomless			
	Seed	Fiber Quality			Seed	Fiber Quality			Seed	Fiber Quality		
Field	Index[a] g/100	Lngth[b] in.	Mic.[c]	Strnth[d] Press.	Index g/100	Lngth in.	Mic.	Strnth Press.	Index g/100	Lngth in.	Mic.	Strnth Press.
Stub #1 (1st yr)	7.5	1.08	5.22	3.20	7.3	1.08	5.17	3.17	7.5	1.09	5.20	3.21
Stub #13 (1st yr)	6.0	1.02	5.13	3.23	7.2	1.03	5.49	3.27	7.4	1.04	5.36	3.20
Stub #15 (2nd yr)	8.3	1.08	5.32	3.22	8.9	1.11	5.61	3.27	8.4	1.06	5.35	3.24
Planted #4	7.4	1.08	5.06	3.25	7.3	1.06	5.21	3.11	7.7	1.07	5.21	3.42
Planted #14	7.8	1.07	5.30	3.37	7.8	1.05	5.60	3.20	7.6	1.08	5.46	3.40

[a]Seed index weight in grams/100 seeds.
[b]Fiber length in inches.
[c]Micronaire.
[d]Pressley index.