Trial Report: Squash and Zucchini Whitefly-Transmitted Virus Trial, Spring 2025

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Objective

To evaluate squash and zucchini varieties for their response to whitefly-transmitted virus pressure under field conditions, assessing symptom severity (CuLCrV, CYSDV, and potyvirus-like infections), yield, and marketable fruit quality to identify tolerant or resistant varieties suitable for Georgia production systems.

Materials & Methods

Field trials were conducted during Spring 2025 at the UGA Hort Hill Research Farm under natural whitefly-transmitted virus pressure. The experiment was arranged in a randomized complete block design with 11 varieties: zucchini types (HMC1, HMC2, Respect, Renegade, Rocio, Spineless King, and Spineless Perfection) and yellow squash types (Gentry, Gold Star, Grand Prize, and Lioness). The trial included four replications and consisted of two rows, each containing all 11 varieties arranged in randomized order within each replication. Each row measured 242 ft in length, with plants spaced 18 inches apart within rows and 6 ft between rows. Weekly fertigation was provided using 7-0-7 liquid fertilizer at 1 gal/acre per week from August 27 to October 8, 2025. To supply magnesium, Epsom salt (magnesium sulfate) was applied at a rate of 25 lb. Mg/acre, divided into two equal applications of 8.5 lb. each on September 3 and September 17, 2025. Orondis Gold (oxathiapiprolin + mefenoxam) was applied at 40 fl oz/acre, equivalent to 2.5 fl oz (78 mL) per 242-ft plot, for disease management. Standard cultural and pest management practices for cucurbits were followed throughout the growing season.

Harvests & Data Collection

A total of nine harvests were conducted during the production period. Fruits were graded as marketable or unmarketable based on shape, size, and virus-induced deformation.

Virus severity ratings were recorded periodically using a 0-90% visual scale, where 0% represented no visible symptoms and 90% indicated severe leaf curling, crumpling, or yellowing typical of advanced infection.

- CuLCrV severity and leaf silvering were rated four times on September 15, 22, 29, and October 6, 2025.
- CYSDV severity was rated three times on September 22, 29, and October 6, 2025.

In addition to these viruses, visual symptoms resembling potyvirus infection, including fruit mottling, mosaic, and distortion, were observed on zucchini fruits during harvesting. Although the presence of potyvirus was not confirmed through laboratory testing, these symptoms were documented as part of fruit quality observations.

Data Analysis

Analysis of variance (ANOVA) was performed using JMP Pro 18 (SAS Institute, Cary, NC). Means were separated by Tukey's HSD test ($p \leq 0.05$). Nonparametric variables such as fruit color and shape were analyzed using the Kruskal-Wallis test, followed by Dunn's all-pairs comparison with joint ranking to determine significant differences among varieties. AUDPC values were calculated for each virus and leaf silvering using the standard trapezoidal integration method.

Results

Table 1: Marketable, unmarketable, and virus-affected fruit counts per plant among squash and zucchini cultivars under whitefly-transmitted virus pressure, Spring 2025, Tifton, GA.

Variety	Marketable count/plant	Misshaped count/plant	Broken neck count/plant	Virus-affected fruit count/plant	Total count/plant
Gentry	4.5 ab[i]	0.8 a	0.1 cd	2.4 a	7.7 a
Gold Star	3.3 b	0.7 ab	0.1 cd	1.5 ab	5.5 a
Grand prize	4.4 ab	0.8 a	0.0 d	0.7 bc	5.9 a
HMC1	4.3 ab	0.1 ab	0.9 bcd	0.3 c	4.7 a
HMC2	5.3 ab	0.2 ab	1.7 ab	0.0 c	5.4 a
Lioness	2.5 b	0.7 ab	0.0 d	0.3 c	3.6 a
Renegade	7.6 a	0.1 ab	2.8 a	0.0 c	7.8 a
Respect	5.2 ab	0.1 b	1.2 bc	0.0 c	5.3 a
Rocio	5.6 ab	0.1 b	0.3 cd	0.1 c	5.8 a
Spineless King	4.0 ab	0.2 ab	0.7 bcd	0.1 c	4.2 a
Spineless Perfection	4.9 ab	0.3 ab	0.4 cd	0.3 c	5.4 a
p-value	**0.0375***	**0.0002***	**<.0001***	**<.0001***	**0.0896**

[i]Means within a column followed by the same letter are not significantly different according to Tukey's HSD test ($p \leq 0.05$).

Note: 1. Broken neck counts are included within the marketable count category.

2. In zucchini cultivars, virus symptoms primarily resembled potyvirus infection (mottling and mosaic on fruits), whereas CuLCrV and CYSDV symptoms predominated in squash.

Table 2: Percentage distribution of marketable, unmarketable, broken-neck, and virus-affected fruits among squash and zucchini cultivars under whitefly-transmitted virus pressure, Spring 2025, Tifton, GA.

Variety	Percent marketable count (%)	Percent misshaped count (%)	Percent broken neck of marketable count (%)	Percent broken neck of total count (%)	Percent virus-affected fruit count (%)
Gentry	58.9 c[i]	10.6 bc	2.0 c	1.2 c	30.5 a
Gold Star	58.3 c	13.5 ab	3.1 c	1.6 c	28.2 a
Grand prize	74.2 bc	13.6 ab	0.0c	0.0 c	12.2 b
HMC1	92.0 ab	2.6 cd	23.8 abc	22.2 abc	5.4 b
HMC2	96.9 a	2.6 cd	32.8 ab	31.8 ab	0.4 b
Lioness	74.3 bc	20.0 a	0.0 c	0.0 c	5.8 b
Renegade	97.5 a	2.1 d	40.0 a	38.9 a	0.4 b
Respect	97.0 a	3.0 cd	26.1 abc	25.4 abc	0.0 b
Rocio	97.8 a	0.8 d	8.7 bc	8.6 bc	1.5 b
Spineless King	93.3 a	4.5 cd	18.8 abc	17.6 abc	2.2 b
Spineless Perfection	90.5 ab	4.6 cd	8.8 bc	7.9 bc	5.0 b
p-value	**<.0001***	**<.0001***	**<.0001***	**<.0001***	**<.0001***

[i]Means within a column followed by the same letter are not significantly different according to Tukey's HSD test ($p \leq 0.05$).

Table 3: Yield performance of squash and zucchini cultivars under whitefly-transmitted virus pressure, Spring 2025, Tifton, GA.

Variety	Total yield (lbs/A)	Total marketable yield (lbs/A)	Total unmarketable yield (lbs/A)	Misshaped fruit yield (lbs/A)	Virus-affected fruit yield (lbs/A)	Average weight (lbs)
Gentry	15704.3 a[i]	11016.1 a	4688.0 a	1117.1 ab	3571.0 a	0.3 a
Gold Star	23823.7 a	19312.0 a	4512.0 ab	1938.0 ab	2574.0 ab	0.7 a
Grand prize	18710.6 a	14654.3 a	4056.3 abc	2079.5 a	1976.8 abc	0.5 a
HMC1	23638.6 a	22270.9 a	1368.0 bcd	498.5 ab	869.0 bcd	0.7 a
HMC2	25001.4 a	24547.6 a	454.0 d	435.6 ab	18.0 cd	0.6 a
Lioness	10397.2 a	7869.6 a	2528.0 abcd	1934.7 ab	593.0 cd	0.4 a
Renegade	33984.1 a	33581.7 a	402.0 d	281.3 ab	121.0 cd	0.6 a
Respect	22110.3 a	21906.1 a	204.0 d	204.2 b	0.0 d	0.6 a
Rocio	32792.6 a	32320.7 a	472.0 d	117.0 b	355.0 cd	0.8 a
Spineless King	21074.0 a	20053.0 a	1021.0 cd	694.2 ab	327.0 cd	0.7 a
Spineless Perfection	29181.6 a	27225.0 a	1957.0 abcd	922.0 ab	1035.0 bcd	0.8 a
p-value	**0.2369**	**0.084**	**<.0001***	**0.0017***	**<.0001***	**0.1393**

[i]Means within a column followed by the same letter are not significantly different according to Tukey's HSD test ($p \leq 0.05$).

Note: Unmarketable fruit = misshapen + virus-affected fruit.

Table 4: Fruit color rating of zucchini cultivars grown under whitefly-transmitted virus pressure, analyzed using Dunn's all-pairs comparison with joint ranking following Kruskal-Wallis test, Spring 2025, Tifton, GA.

Variety	Fruit color (Mean Rank)
Respect	24.5 a[i]
HMC1	20.3 a
HMC2	14.1 ab
Renegade	16.0 ab
Spineless King	12.0 ab
Spineless Perfection	12.1 ab
Rocio	2.5 b
p-value	**0.0049***

[i]Means followed by the same letter are not significantly different according to Dunn's all-pairs comparison using joint ranking ($p \leq 0.05$).

Note: 'Respect' and 'HMC1' exhibited the darkest fruit color, while 'Rocio' had the lightest.

Table 5: Fruit shape rating of squash cultivars (semi-crooked neck and straight neck types) grown under whitefly-transmitted virus pressure, analyzed using Dunn's all-pairs comparison with joint ranking following Kruskal-Wallis test, Spring 2025, Tifton, GA.

Variety	Fruit color (Mean Rank)
Gentry	12.5 a[i]
Gold Star	10.5 ab
Grand prize	6.5 ab
Lioness	4.5 b
p-value	**0.0247***

[i]Means followed by the same letter are not significantly different according to Dunn's all-pairs comparison using joint ranking ($p \leq 0.05$).

Note: 'Lioness' produced straight-neck fruits, whereas other cultivars exhibited semi-crooked-neck fruit shape.

Table 6: Area under disease progress curve (AUDPC) values for Cucurbit Leaf Crumple Virus (CuLCrV), Cucurbit Yellow Stunting Disorder Virus (CYSDV), and leaf silvering severity in squash and zucchini cultivars grown under whitefly-transmitted virus pressure, Spring 2025, Tifton, GA.

Variety	**Area Under Disease Progress Curve (AUDPC)**		
	Cucurbit leaf crumple virus (CuLCrV)	**Cucurbit yellow stunting disorder virus (CYSDV)**	**Leaf silvering**
Gentry	1198.8 a[i]	875.0 a	551.3 ab
Gold Star	1277.5 a	787.5 a	280.0 b
Grand prize	945.0 ab	612.5 ab	1146.3 ab
HMC1	17.5 c	96.3 de	918.8 ab
HMC2	0.0 c	70.0 e	953.8 ab
Lioness	1426.3 a	551.3 abc	726.3 ab
Renegade	166.3 c	148.8 de	1050 ab
Respect	341.3 bc	122.5 de	1286.3 a
Rocio	245.0 c	315.0 bcde	463.8 ab
Spineless King	411.3 bc	411.3 bcd	918.8 ab
Spineless Perfection	113.8 c	227.5 cde	866.3 ab
p-value	**<.0001***	**<.0001***	**0.0119***

[i]Means within a column followed by the same letter are not significantly different according to Tukey's HSD test ($p \leq 0.05$).

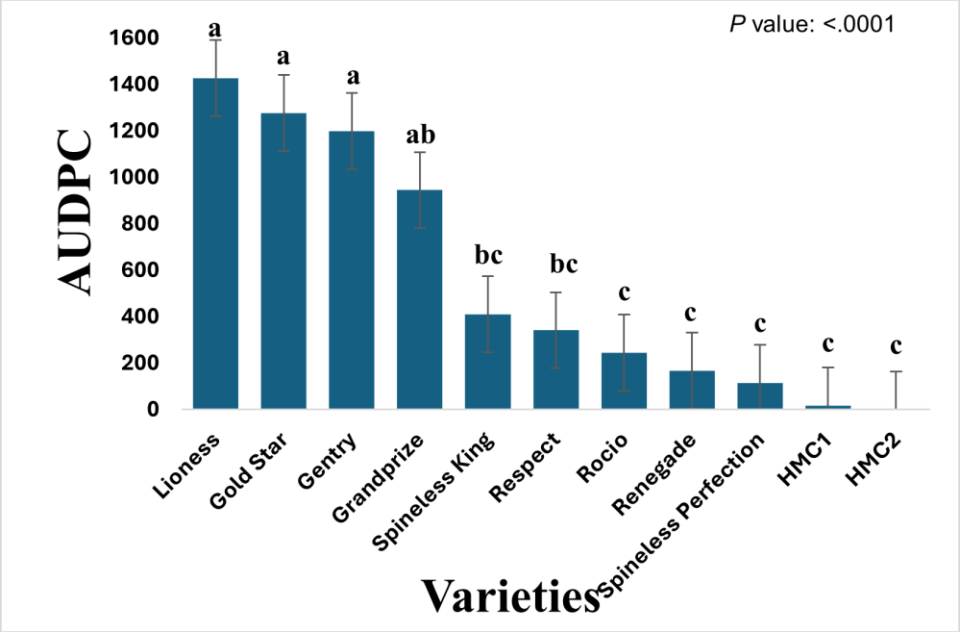

Figure 1. AUDPC values for Cucurbit Leaf Crumple Virus (CuLCrV) severity among squash and zucchini cultivars, Spring 2025, Tifton, GA. Bars with the same letter are not significantly different (Tukey's HSD, $p \leq 0.05$).

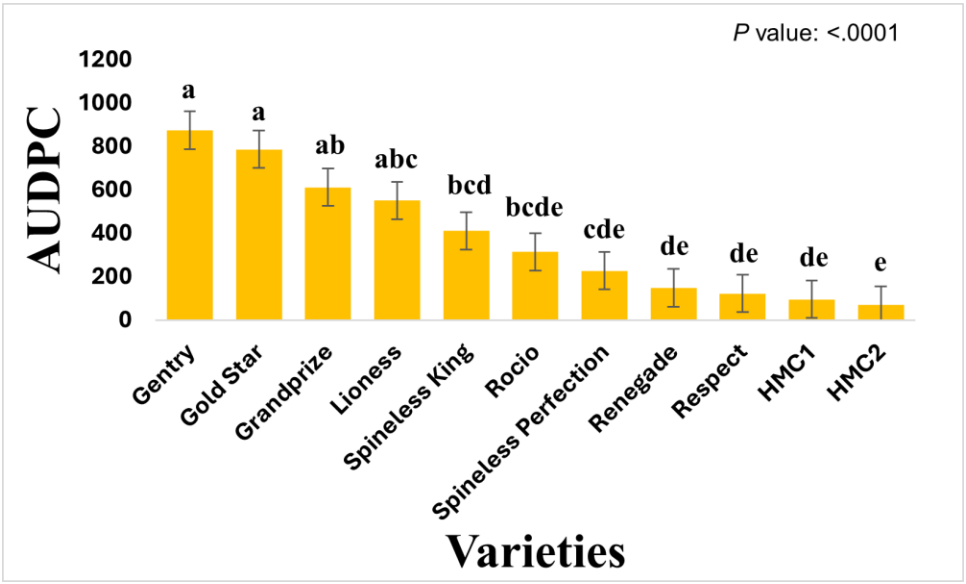

Figure 2. AUDPC values for Cucurbit Yellow Stunting Disorder Virus (CYSDV) severity among squash and zucchini cultivars grown under whitefly-transmitted virus pressure, Spring 2025, Tifton, GA. Bars with the same letter are not significantly different (Tukey's HSD, $p \leq 0.05$).

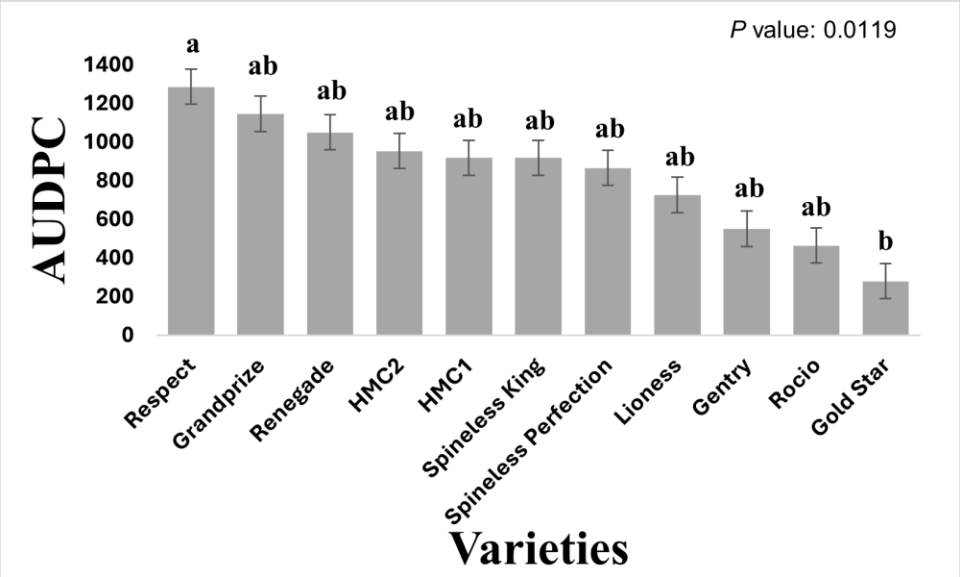

Figure 3. AUDPC values for leaf silvering severity among squash and zucchini cultivars grown under whitefly-transmitted virus pressure, Spring 2025, Tifton, GA. Bars with the same letter are not significantly different (Tukey's HSD, $p \leq 0.05$).

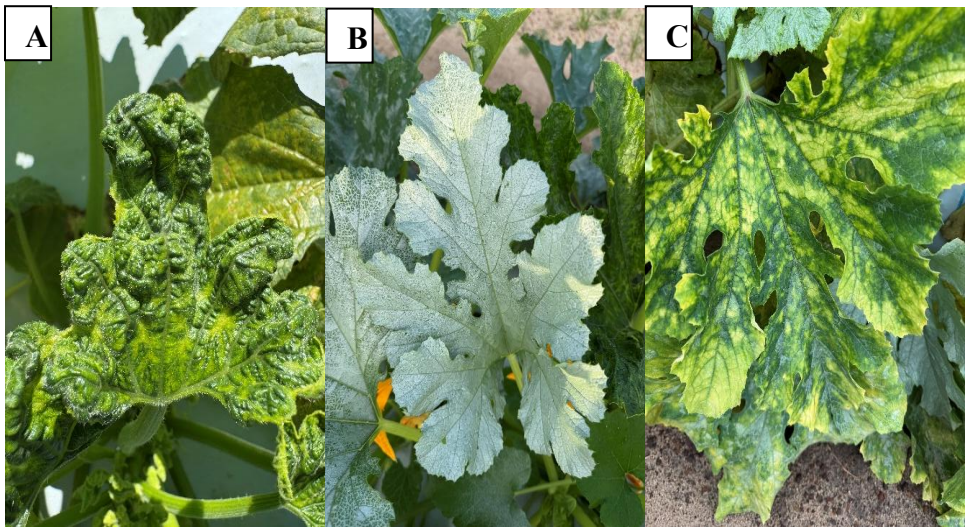

Figure 4. Foliar symptoms observed in zucchini and squash under field conditions. (A) Upward leaf curling and crumpling with chlorosis CuLCrV infection. (B) Leaf silvering symptom (C) Interveinal chlorosis with green vein retention and mottled appearance characteristic of Cucurbit yellow stunting disorder virus (CYSDV) infection.

Conclusions

Significant differences were observed among varieties in yield, fruit quality, and virus severity under whitefly-transmitted virus pressure.

- **Top overall performers (virus tolerance + fruit quality):** 'HMC2', 'HMC1', 'Respect', and 'Renegade' combined very low CuLCrV and CYSDV AUDPC with high marketable proportions (≥90%) and low virus-affected yield.
  - 'HMC2' and 'HMC1' showed near-zero CuLCrV/CYSDV and low cull yields.
  - 'Respect' paired low virus with excellent fruit color among zucchini, though it had a higher leaf silvering AUDPC that did not convert to culls.
  - 'Renegade' had the highest marketable count/plant and very low virus.
- **Squash shape & quality: 'Lioness'** was the only straight-neck squash, but it showed moderate virus severity and a higher proportion of misshapen fruit. 'Gold Star', 'Gentry', and 'Grand Prize' exhibited high CuLCrV/CYSDV, more misshapen/virus-affected fruit, and lower marketable %.
- **Broken-neck incidence (shipping risk):** The broken-neck % of marketable fruit was highest in 'Renegade' and 'HMC2' and moderately elevated in 'Respect' and 'HMC1'. These varieties still rank as top performers, but harvest handling should be emphasized to protect pack-out.
- **Zucchini fruit color:** Among zucchini, 'Respect' and 'HMC1' had the darkest color; 'Rocio' was the lightest.
- **Leaf silvering:** Differences were significant but not strongly predictive of culls, e.g., 'Respect' had high silvering AUDPC yet minimal unmarketable/virus-affected yield.

Based on the results of this trial, '**HMC2', 'HMC1', 'Respect',** and '**Renegade'** are the most promising varieties for production under whitefly-transmitted virus pressure in Georgia. These varieties combined low virus severity, high marketable yield, and good fruit quality. Where broken-neck losses are a concern, particularly with **'Renegade'** and **'HMC2',** growers should emphasize gentle harvest techniques and proper crew training to reduce handling damage. **'Rocio'** yielded well and had minimal cull losses, but its light fruit color and moderate virus expression

make it less desirable than ‘HMC1’, ‘HMC2’, ‘Respect’, and ‘Renegade’, which combined darker color, lower virus severity, and strong yield. Varieties such as **‘Gentry’**, **‘Gold Star’**, and **‘Grand Prize’** should be used with caution or avoided during periods of high whitefly activity due to their greater virus susceptibility and higher proportion of misshapen or cull fruit.