**SRSFC Project 2020-15 Project: Evaluation of the efficacy and crop safety of minimal-, moderate-, and high-input disease management systems for Pierce's disease resistant hybrids**

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**Abstract:** The objective of this project was to evaluate two Pierce's disease resistant hybrid grape cultivars for their ability to tolerate Georgia's climate. Pierce's disease resistant hybrid cultivars are an important alternative to *Vitis vinifera* cultivars, and it is important to establish how these and other grapevine cultivars will respond to the disease pressure in the southeastern US. A randomized complete block with five replications per treatment was used to test minimal, moderate, and high intensity fungicide programs for their performance in controlling grapevine diseases within these two cultivars. Treatments utilized a panel consisting of four grapevines; the two center grapevines were treated with the fungicide programs while the border plants on each side of the treated grapevines were left unsprayed to increase the uniformity of available disease spread potential within the experiment. Additionally, an unsprayed buffer row was implemented to allow for increased disease pressure. Treatments were applied with a Jacto battery powered self agitating backpack sprayers calibrated to deliver 50 gallons per acre. Powdery mildew was not observed within the cultivars. On 28 Jul and 11 Aug, 20 leaves were collected from each vine and assessed for downy mildew incidence (% leaves infected) and severity (% leaf area with downy mildew). Fruit clusters (10 per plant) were rated for rot incidence (% of clusters infected) and severity (% of fruit cluster with rot) on 28 Jul, 11 Aug, and 2 Sep. JMP Pro 15 was used for data analysis, and Tukey's HSD was utilized for treatment means separation. Differences were observed in each hybrid among downy mildew, fruit rot, and harvest weight due to treatments.

**Objective**: The objective of this project was to evaluate two Pierce's disease resistant hybrid grape cultivars for their ability to tolerate Georgia's climate, and to determine the level of spray program required for management of diseases in these cultivars.

**Description and Justification:** Pierce's disease (PD) tolerant hybrid wine grape cultivars are an important alternative to *Vitis vinifera* cultivars in the southeastern United States. These cultivars are growing in popularity due to their tolerance to PD; however, performance in a high disease pressure climate, such as the southeastern US, has not been fully evaluated. It is unknown whether these hybrids will bring a higher level of tolerance or resistance to other pathogens prevalent in the southeastern United States. It is important to establish how these and other grapevine cultivars will respond to the disease pressure in the local climate.

**Procedures:** In 2020, two cultivars from the UC Davis Walker breeding program, UC Davis selections 07370-84 and Camminare noir, were evaluated for their ability to tolerate Georgia's climate at the University of Georgia Horticulture Research Farm in Watkinsville, GA. A randomized complete block with five replications per treatment was used to test minimal, moderate, and high intensity fungicide programs for their performance in controlling grapevine diseases within these two cultivars. Treatments utilized a panel consisting of four grapevines; the two center grapevines were treated with the fungicide programs

while the border plants on each side of the treated grapevines were left unsprayed to increase the uniformity of available disease spread potential within the experiment. Additionally, an unsprayed buffer row was implemented to allow for increased disease pressure. Treatments were applied with Jacto battery powered self agitating backpack sprayers calibrated to deliver 50 gallons per acre. Treatment applications were made seven times (27 April, 8 May, 21 May, 17 June, 6 July, 15 July, and 30 July). Cultural practices mimicked those observed in commercial vineyards. Table 1 shows treatments with the corresponding fungicides per date for the two hybrid vines. On 28 Jul and 11 Aug, 20 leaves were collected from each vine and assessed for downy mildew incidence (% leaves infected) and severity (% leaf area with downy mildew). Fruit clusters (10 per plant) were rated for rot incidence (% of clusters infected) and severity (% of fruit cluster with rot) on 28 Jul, 11 Aug, and 2 Sep. JMP Pro 15 was used for data analysis, and Tukey's HSD was utilized for treatment means separation.

**Results and Discussion:** Treatments with the corresponding fungicide application dates are listed in Table 1 for the two hybrid vines. Downy mildew (Fig. 1) and rots (Fig. 2) were readily observed on both varieties; macraphoma rot (*Botryosphaeria dothidea*) (Fig 3.) and bitter rot (*Greenaria uvicola*) were most often observed on the two hybrid cultivars. Interestingly Powdery mildew was not observed among the two varieties. White grape hybrid 07370-84 downy mildew incidence was reduced by all treatments with the moderate and high fungicide programs reducing percent infected leaves more than the minimal program (Table 2). Downy mildew severity was impacted by all treatments equally on 28 Jul and 11 Aug with less than 10 percent severity (Table 2). Camminare noir downy mildew leaf incidence and severity were affected by minimal, moderate, and high level fungicide treatment programs equally reducing incidence below 30 percent infected leaves and well below 5 percent leaf downy mildew coverage respectively (Table 3). White grape hybrid 07370-84 fruit rot incidence treatments provided better results than the untreated control; however, by two weeks after the last treatment application date only the high level intensity had lower than 50 percent infected fruit and all were 100 percent infected by 2 Sep (Table 4). Similarly, the severity of the fruit rot was impacted by treatments with all treatments reducing the percent of fruit clusters with rot at the same levels until we extend our rating date out to 30 days. The moderate and high treatments reduced severity below that of the untreated control, with the high level intensity program reducing the severity to 35.8 percent of the fruit cluster with rot (Table 4). Camminare noir fruit rot incidence was effected by treatments on 28 Jul (Table 5). The highest treatment intensity separated out from the untreated control on 28 Jul; however, on 11 Aug and 2 Sep all treatments had a higher than 95 percent incidence rating. Fruit rot severity differences in treatments were noted on 11 Aug and 2 Sep. It should be noted that 2 Sep is 30 days after the last treatment was applied and it was not until this rating that the high level intensity treatment separated from the minimal and moderate treatment programs. White hybrid grape harvest weight (kg/(10 clusters/vine)) was statistically different with each treatment increasing the harvest yield with the high level intensity treatment yielding larger, more intact, and more mature fruit clusters (Table 6). Camminare noir harvest weight was not as drastically impacted by treatments, with only the highest level intensity yielding a higher harvest weight (Table 6). It is interesting that powdery mildew was not observed in the two hybrids.

**Impact:** These trials developed knowledge such that growers and extension personnel supporting these cultivars will be able to have established expectations. These trials are allowing for the development of spray programs that take into account the cultivars and their sensitivity or insensitivity to pathogens.

**Table 1.** Treatment intensity programs by fungicide and date.

| | Maintenance Intensity Treatment Application* Timings | | | |
|---|---|---|---|---|
| Treatment and amount/A | High | Moderate | Low | Untreated |
| Untreated | --- | --- | --- | ABCDEFGH |
| Abound @ 10 fl.oz | ADEFH | --- | --- | --- |
| Captan 4L @ 1.5 qts | DEFGH | DEFGH | DEFGH | --- |
| Elevate @ 1 lb | G | G | G | --- |
| Endura @ 8 oz | BE | B | B | --- |
| Malathion | H | H | H | --- |
| Manzate Prostick @ 3 lb | ABC | ABC | ABC | --- |
| Mustang Max | G | G | G | --- |
| Oxidate | GH | GH | GH | --- |
| Prophyt @ 4 pt | ACEFG | ACEFG | --- | --- |
| Rally @ 3 oz | CDG | --- | --- | --- |
| Ridomil Gold MZ @ 2.5 lb | D | D | --- | --- |
| Rovral 2 pt | H | H | H | --- |
| Switch @ 14 oz | F | F | F | --- |
| Vangard @ 10 oz | C | C | C | --- |
| Zampro @ 14 oz | B | B | --- | --- |

*Treatment dates: A = 27 April (prebloom) B = 8 May (bloom) C = 21 May (bloom), D = 17 Jun (cover), E = 6 Jul (cover), F = 15 Jul (Veraison), G = 30 Jul (Veraison).

**Table 2.** Downy mildew incidence and severity on white grape hybrid 07370-84.

| | Downy mildew leaf incidence | | Downy mildew leaf severity | |
|---|---|---|---|---|
| Treatment | 28 Jul** | 11 Aug ** | 28 Jul ** | 11 Aug ** |
| Untreated | 99 a | 95 a | 46.3 a | 55.7 a |
| Low Maintenance | 36 b | 44 b | 3.6 b | 7.8 b |
| Moderate Maintenance | 14 c | 12 b | 0.3 b | 1.1 b |
| High Maintenance | 8 c | 6 c | 0.2 b | 0.4 b |

*Treatment dates: A = 27 April (prebloom) B = 8 May (bloom) C = 21 May (bloom), D = 17 Jun (cover), E = 6 Jul (cover), F = 15 Jul (Veraison), and G = 30 Jul (Veraison).

** Downy mildew incidence (% infected leaves) and severity (% of leaf covered by Downy mildew) were calculated from 20 leaves per treated plant. Means following the same letter are not significantly different from one another when using Tukey's HSD ($P \leq 0.05$).

**Table 3.** Downy mildew incidence and severity on Camminare noir.

| Treatment and amount/A | Downy mildew leaf incidence 11 Aug ** | Downy mildew leaf severity 11 Aug ** |
|---|---|---|
| Untreated | 100 a | 27.1 a |
| Low Maintenance | 18 b | 0.8 b |
| Moderate Maintenance | 14 b | 0.6 b |
| High Maintenance | 33 b | 1.2 b |

*Treatment dates: A = 27 April (prebloom) B = 8 May (bloom) C = 21 May (bloom), D = 17 Jun (cover), E = 6 Jul (cover), F = 15 Jul (Veraison), and G = 30 Jul (Veraison).

** Downy mildew incidence (% infected leaves) and severity (% of leaf covered by downy mildew) were calculated from 20 leaves per treated plant. Means following the same letter are not significantly different from one another when using Tukey's HSD ($P \leq 0.05$).

**Table 4.** Fruit rot incidence and severity on white grape hybrid 07370-84.

| | Fruit rot incidence | | | Fruit rot severity | | |
|---|---|---|---|---|---|---|
| Treatment and amount/A | 28 Jul** | 11 Aug ** | 2 Sep ** | 28 Jul ** | 11 Aug ** | 2 Sep ** |
| Untreated | 86 a | 100 a | 100 a | 13.6 a | 58.3 a | 96.4 a |
| Low Maintenance | 36 b | 86 ab | 100 a | 2.7 b | 14.2 b | 81.4 ab |
| Moderate Maintenance | 18 c | 78 b | 100 a | 1.3 b | 8.4 b | 75.2 b |
| High Maintenance | 18 c | 48 c | 100 a | 1.0 b | 4 b | 35.8 c |

*Treatment dates: A = 27 April (prebloom) B = 8 May (bloom) C = 21 May (bloom), D = 17 Jun (cover), E = 6 Jul (cover), F = 15 Jul (Veraison), and G = 30 Jul (Veraison).

** Fruit rot incidence (% infected fruit) and severity (% of fruit cluster with rot) were calculated from 10 clusters per treated plant. Means following the same letter are not significantly different from one another when using Tukey's HSD ($P \leq 0.05$).

**Table 5.** Fruit rot incidence and severity on Camminare noir.

| | Fruit rot incidence | | | Fruit rot severity | | |
|---|---|---|---|---|---|---|
| Treatment and amount/A | 28 Jul** | 11 Aug ** | 2 Sep ** | 28 Jul** | 11 Aug ** | 2 Sep ** |
| Untreated | 48 a | 100 a | 100 a | 3.9 a | 32.9 a | 92.1 a |
| Low Maintenance | 30 ab | 96 a | 100 a | 3.7 a | 16.4 b | 66.9 b |
| Moderate Maintenance | 26 ab | 98 a | 100 a | 2 a | 16.1 b | 65 b |
| High Maintenance | 12 b | 94 a | 100 a | 1.1 a | 14.3 b | 41.4 c |

*Treatment dates: A = 27 April (prebloom) B = 8 May (bloom) C = 21 May (bloom), D = 17 Jun (cover), E = 6 Jul (cover), F = 15 Jul (Veraison), and G = 30 Jul (Veraison).

** Fruit rot incidence (% infected fruit) and severity (% of fruit cluster with rot) were calculated from 10 clusters per treated plant. Means following the same letter are not significantly different from one another when using Tukey's HSD ($P \leq 0.05$).

**Table 6.** Harvest weight of white grape hybrid 07370-84 and Camminare noir.

| | | White grape harvest weight (kg/(10 clusters/vine)) | Camminare noir harvest weight (kg/(10 clusters/vine)) |
|---|---|---|---|
| Treatment and amount/A | Application timing * | 13 Aug ** | 13 Aug ** |
| Untreated | --- | 1.1 c | 1.9 b |
| Low Maintenance | ABCDEFG | 1.4 b | 2.1 b |
| Moderate Maintenance | ABCDEFG | 1.5 ab | 1.8 b |
| High Maintenance | ABCDEFG | 1.8 a | 2.5 a |

*Treatment dates: A = 27 April (prebloom) B = 8 May (bloom) C = 21 May (bloom), D = 17 Jun (cover), E = 6 Jul (cover), F = 15 Jul (Veraison), and G = 30 Jul (Veraison).

** Harvest Weight (kg/(10 clusters/vine)) were calculated from 10 random clusters from the two center vines within the treatments. Means following the same letter are not significantly different from one another when using Tukey's HSD ($P \leq 0.05$).

Figure 1. Downy mildew on the untreated white grape hybrid 07370-84.

Figure 2. Rots on the untreated white grape hybrid 07370-84.

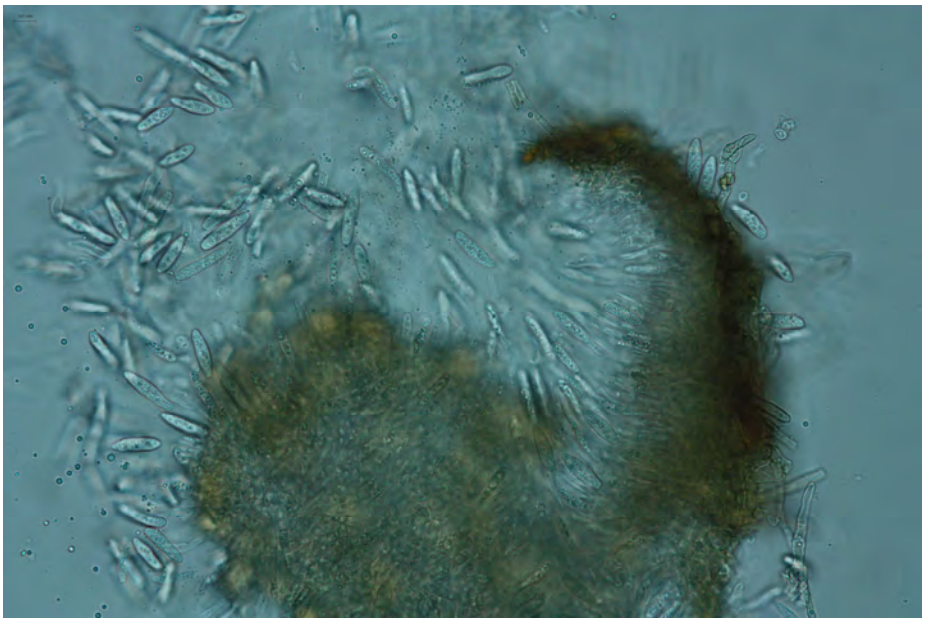

Figure 3. Macrophoma rot (*Botryosphaeria dothidea*).

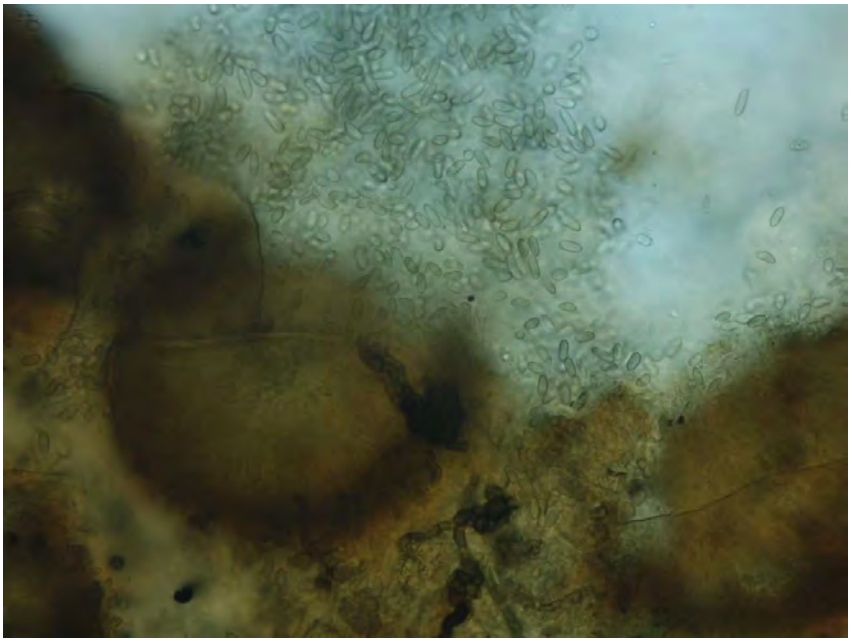

Figure 4. Bitter rot (*Greenaria uvicola*).