The impact of adjuvants on late season cluster rot, 2019 season

A Research and Extension project
Final Report

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Summary: *Botrytis cinerea* is a serious pathogen of grapevines worldwide particularly in temperate regions with growing season rainfall. Vinifera cultivars, such as those grown on Long Island and in the Finger Lakes, are the most susceptible. Significant losses in yield and quality can occur. To improve the efficacy of pesticides, particularly botrycides, spray adjuvants are often included in the tank mix. Adjuvants are a product, apart from the pesticide, that purportedly improves the performance of the pesticide (3). Studies suggest that certain adjuvants may actually degrade the berry cuticle, rendering the fruit more susceptible to cluster rot (1,2). A trial evaluating the impact of several common adjuvants on late season cluster rot was implemented in a Chardonnay block at the Long Island Horticultural Research and Extension Center. A nearby commercial vineyard implemented a demonstration trial with a third adjuvant. Due to sunny, dry weather in August and September, cluster rot did not occur in these blocks. Penetrometer readings were taken to gauge the firmness of the berry skin. Results were inconclusive, likely because the instrumentation used was not appropriate for the work.

Objectives

1. Evaluate impact of two commonly used adjuvants on Botrytis bunch rot and sour rot through replicated treatments in a Chardonnay block.
2. Assess a grower demonstration trial in a Chardonnay block for the impact of a third adjuvant product on cluster rot at harvest.

Materials and methods: In the LIHREC vineyard, a replicated trial was established in a Chardonnay block at the Cornell University Long Island Horticultural Research and Extension Center, Riverhead, NY. Vines were 24 years old and trained to a low wire VSP system. Treatments were applied as cluster zone sprays with a CO_2 backpack in 90 GPA, 50 psi. Botrycides were not used in this block. Seven treatments were replicated by panel with 4 vines/panel and 5 panels/treatment. Sets of 3 sprays were applied at ~ 10 day intervals. Treatments were designed to evaluate early use of adjuvants vs. later season use and a combination of both. Both adjuvants in this trial were manufactured by Drexel Chemical Company, Memphis, TN, 38113-0327. They were selected as they are commonly used in local vineyards.

Table 1. Adjuvants tested in LIHREC vineyard, cv. Chardonnay, 2019

Trade name	**Rate range on label**	**Rate used**	**Uses stated on label**
PAS-800	0.5-2 pts/100 GPA	2 pts/100	Penetrant, acidifier, surfactant
Surf-Ac 910	1-2 pts/100	2 pts/100	Non ionic surfactant, wetting agent, spreader, penetrant

Table 2. Adjuvant treatment timing, LIHREC vineyard, cv. Chardonnay, 2019

		Treatment dates					
Trt no.	Product	July 4	July 15	July 25	Aug. 5	Aug. 15	Aug. 26
1	PAS-800	✓	✓	✓	---	---	---
2	"	---	---	---	✓	✓	✓
3	"	✓	✓	✓	✓	✓	✓
4	Surf Ac 910	✓	✓	✓	---	---	---
5	"	---	---	---	✓	✓	✓
6	"	✓	✓	✓	✓	✓	✓
7	Untreated	---	---	---	---	---	---

Disease severity was not rated as cluster rot did not occur despite this block having a history of cluster rot. Though not part of the original proposal, a decision was made to evaluate berry skin firmness with a penetrometer. A FHP-801 Fruit Firmness Tester (~$300, available on-line from a number of companies) with a 3.5 mm stainless steel tip was recommended for soft fruit and vegetables including grapes. The range of readings is 0.4-11 lbs. or 0.2-5.0 kg/cm^2. In each treat/rep combination, 10 berries were sampled from each of 3 clusters. All sampling was done on the east side of the trellis and on the exposed side of the cluster. In total, 150 berries in each of the 7 treatments were tested for firmness (total of 1050 berries). Data was analyzed using one way anova via the JMP statistical program (SAS Institute, Cary, NC 27513-2414).

In the commercial vineyard, the adjuvant Exit (Miller Chemical Co., Hanover, PA, 17331) at a rate of 6 oz/100 was included with botrycides. Treatments were directed at clusters and applied to entire rows with a Lipco recycling sprayer, 2 passes/row for a total of 140 GPA. Again, cluster rot was minimal. Berry firmness testing was done by collecting 10 berries from each of 5 clusters/row for a total of 600 berries.

Table 3. Adjuvant treatment timing, commercial vineyard, cv. Chardonnay, 2019

Row→ Trt Date↓	86	85	84	83	82	81	80	79	78	77	76	75
6-16			✓	✓								
7-7			✓	✓	✓	✓						
8-9	✓	✓	✓	✓	✓	✓						
8-31	✓	✓	✓	✓	✓	✓	✓	✓				
9-22	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
10-2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Results and discussion

In the absence of data on cluster rot, a decision was made to conduct berry firmness readings. In other studies, berry firmness has been linked to a reduction in cluster rot (2). In the replicated LIHREC trial, there was no statistical difference between treatments.

Table 4. Berry firmness, LIHREC vineyard, cv. Chardonnay, Sept. 27, 2019

Trt no.	Product	No. app's	Treatment timing	Penetrometer data*, kg/cm^2
1	PAS-800	3	Early season	5.17
2	"	3	Late season	5.21
3	"	6	Full season	5.12
4	Surf Ac 910	3	Early season	5.19
5	"	3	Late season	5.19
6	"	6	Full season	5.32
7	Untreated	---	---	5.21

* – Values are not significantly different at p=0.05

Results from the commercial vineyard follow. In this Chardonnay block, there were scattered Pinot Gris vines. We sampled those as well, in part because, unlike the Chardonnay, the fruit was suffering from moderate *Botrytis* bunch rot.

Table 5. Berry firmness as determined by a penetrometer, commercial vineyard, cv. Chardonnay, Oct. 7, 2019

Row→	86	85	84	83	82	81	80	79	78	77	76	75
No. adjuvant sprays→	4	4	6	6	4	4	3	3	2	2	1	1
Chardonnay penetrometer data, Kg/cm^2	5.24	4.97	5.17	5.31	5.13	5.19	4.84	5.12	5.33	4.85	5.32	5.37
Pinot Gris penetrometer data, Kg/cm^2	---	---	4.60	4.39	---	---	4.85	4.20	---	---	4.24	4.92

This study was not replicated. Based on averages, treatments appear to produce similar skin firmness results. However, the Pinot Gris penetrometer readings were consistently lower than those of the Chardonnay. This suggests that there are differences among varieties in inherent berry skin firmness or it may be indicative of the advanced state of ripeness of the Pinot Gris as it is normally harvested in September.

Based on this study and several others on Long Island in 2019, it is likely that, despite being recommended for grapes, this particular firmness tester may not be the best choice, particularly for Chardonnay. The penetrometer tip was relatively large, 3.5 mm stainless steel tip. This may work well for tough-skinned fruit such as apples, but for more tender grape berries, during the process of trying to test the skin firmness, many of the berries were simply smashed. Those results were discarded. Also, the sampling process involves very gently pulled berries off the cluster. Any slight tear or crack, particularly near the point of attachment between the berry and the pedicel, often resulted in the berries being smashed by the penetrometer tip (vs. the skin penetrated). Finally, even when the skin was successfully penetrated by the penetrometer, often the tip would hit the hard surface below the berry (in this case, a picking lug). Therefore, it was unclear if it was a legitimate reading or if the instrument was influenced by hitting the hard surface. Sampling was done immediately prior to harvest. Perhaps testing earlier would minimize some of these issues. For future work with evaluation of berry skin firmness, another brand of penetrometer has been recommended.

Conclusion

Studies done 2018-2019 on the impact of adjuvants on late season cluster rot and berry skin firmness were inconclusive. It seems logical that products that act as penetrants may impact the waxy cuticle of the berry. In other work on Long Island, season long use of horticultural oil degraded leaf cuticles significantly (A.Wise, unpublished data). While a firm cause and effect was not determined, oil-treated plots had much higher levels of downy mildew. Regardless, adjuvants should be used carefully as many have caustic properties. Some even carry a 'Warning' label for this reason. A cautious approach would be to only use adjuvants when pesticide labels state their importance as a means of enhancing pesticide uptake and efficacy and/or when research trials prove their efficacy.

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References
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3. Witt, J. Agricultural spray adjuvants. Oregon State University fact sheet located on Cornell Pesticide Safety Education Program website: http://psep.cce.cornell.edu/facts-slides-self/facts/gen-peapp-adjuvants.aspx.

Appendix

The impact of adjuvants on late season cluster rot, 2019 season

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Impact statement

Several studies in the literature suggest that the use of adjuvants, products designed to improve pesticide performance, may degrade the waxy berry cuticle, potentially worsening late season cluster rot. Research trials implemented to assess the impact of adjuvants on grape cluster rot were not successful likely due to minimal cluster rot in 2018-19. However, products that have penetrant capabilities may impact the integrity of the waxy cuticles of leaves and berries. Therefore, the prudent strategy is to use adjuvants only when required by pesticide label recommendations.

Publications

- Presentation: This work will be presented at a grape pest management meeting in April, 2020 in Riverhead.
- Newsletter: An article on this project is scheduled for publication in the March, 2020 issue of the Suffolk County Agricultural News (circ. 330).
- Websites: Summary reports will be posted to the CCE-SC Grape Program website (>2400 website hits in 2019), http://ccesuffolk.org/agriculture/grape-program, and will be included in the LIHREC Annual report, http://cuaes.cals.cornell.edu/farms/lihrec.
- During vineyard tours on July 31 and Sept. 4, 2019, a presentation was given to a total of 37 growers as they viewed the research plot at LIHREC.