Control of vine mealybug (*Planococcus ficus* Signoret) in organic viticulture

Khushwinder Singh[1], Kent Daane[2], Luca Brillante[1*]
[1]Department of Viticulture and Enology, California State University Fresno, Fresno, CA
[2]Department of Environmental Science, Policy & Management, University of California Berkeley, CA
*lucabrillante@csufresno.edu

Abstract

Vineyard mealybugs (Hemiptera:Pseudococcidae) are an increasing matter of concern for grape growers, as the economic losses resulting from their infestations continue to increase. Several species of mealybugs are present in California, but the vine mealybug (Planococcus ficus, Signoret) is the one creating most problems. It is an invasive species introduced ~20 years ago, and not yet under control. The control is complex in conventional viticulture but is even harder in organic production where systemic insecticides (e.g. spirotetramate) are not available and only contact products are allowed. These products cannot easily reach the insect population often located under the bark. This project aimed to compare on a large vineyard trial the efficacy of most common and best-suited products commercially available in organic production: pyrethrins, neem oil, diatomaceous earth, Chromobacterium subtsugae. The project also controlled for side effects on grapevine physiology and grape composition related to spraying dusts and oils on leaf and berry surfaces. The experiment was set up as a randomized complete block design with 4 treatments plus control and 4 replicates. Each replicate was 1 acre large for a total size of the trial of 20 acres. The vineyard was planted with Pinot Noir and moderately infested with mealybugs.

Scope

- Develop scientific knowledge about the efficacy of insecticides commercially available in organic production: pyrethrins, neem oil, diatomaceous earth, *Chromobacterium subtsugae*.
- Provide new and unbiased information that will help organic growers to choose the right products for controlling mealybugs in organic California vineyards.

Methodology

Experimental design & tested products:

Randomized complete block design with 4 treatments + control and 4 replicates (Fig. 1). Tested products: A = Diatomaceous Earth; B = Neem oil; C = Control, no insecticides; D = Chromobacterium subtsugae strain; E = Pyrethrins. Products were sprayed three times overnight, on 2020-07-07 (bunch closure), 2020-07-22 (fifteen days after first application), 2020-08-18 (~2 weeks before harvest) by a commercial contractor with professional equipment. Doses applied were the maximum allowed, we sprayed 100 gallons/ha and covered also the trunk region, canopies were small and we ensured a great coverage (see Figure 2).

Mealybug counts:

Before the first spray, we did a preliminary sampling and finally located the trial in the regions with a higher presence of mealybugs. Plants belonging to class 2 (VMB and damage) and 3 (heavy VMB) were flagged to be later measured by destructive samplings (trunk counts). For *trunk counts,* we counted the number of mealybugs after removal of the bark for 3 minutes per vines and on 10 vines per. For *leaf counts,* we counted the number of mealybugs on the abaxial surface of leaves on 90 leaves per replication taken from different plants. For *cluster counts* we counted the mealybugs inside clusters on 150 clusters per replication and from different plants.

Plant measurements:

Plant water status was assessed by taking stem water potential measurements and leaf gas exchange measurements.

Photosynthetic carbon isotope discrimination and yield components were assessed at time of harvest.

Total Soluble Solids (TSS), juice pH and titrable acidity (TA) were measured from one hundred random grape berries collected weekly from veraison to harvest. Grape skin flavonoids were measured through HPLC.

Materials & Methods

Fig.1a: Map of experimental Design. Each block is 5 acre large. Total area of blocks is 20 acres.

Fig 1b. vine mealybugs at the study site.

Fig.2. canopy size on the left panel, leaf after spraying in the center and some of the equipment used to spray on the right

Results

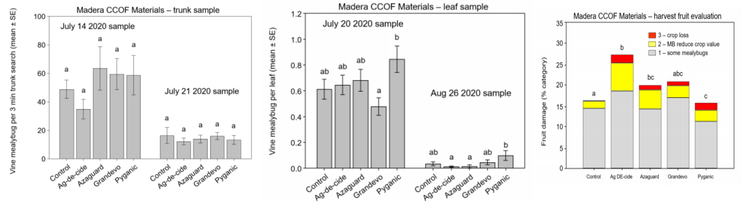

Fig.3 Counts of vine mealybugs on trunk, leaves, and cluster respectively from left to right.

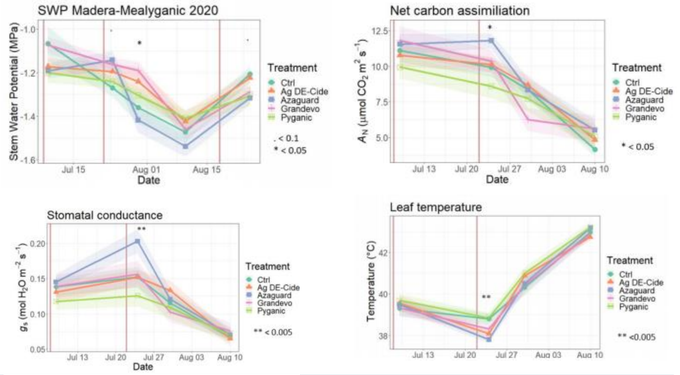

Fig.4 Effect of vine mealy bug on vine physiology.

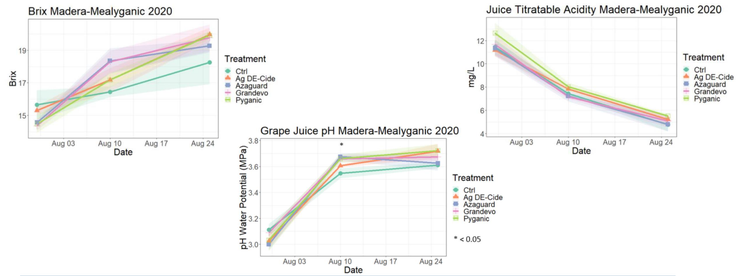

Fig.5. Trends in grape composition after spray.

Conclusion

None of the tested products were effective in controlling mealybugs on the trunk and performed similarly. Pyrethrins were the least effective in controlling mealybugs on leaves and most effective in clusters, while this was inverse in case of diatomaceous earth and neem oil. Plants treated with neem oil had significantly lower stem water potentials. Treatments did not have any significant effect on gas exchange measurements, except for one date, when neem had cooler leaves and higher photosynthesis and stomatal conductance. Brix level was lower in the control than in all other treatments and reached up to 1.9 °Bx of difference. In the second year of this study we will also work on effect of parasitoids and test additional products.