

**Stella
Maris[®]**

on Wine Grapes





Turn on Your Plants to Optimize Crop Health



All APH™ products are powered by Acadian BioSwitch™ technology, an advanced technology that enhances natural processes within plants by switching on gene expression and production of active compounds that stimulate plant growth and protect against environmental stresses.

Beneficial Bioactive Compounds



Organic acids

Uronic acid and many other organic acids serve as a source of energy production as well as precursors for many organic compounds including hormones



Alginic Acid

Mineral chelator that aids in nutrient availability and as a food source for microbes



Amino acids

Serve as building blocks in plant development, contribute to plant metabolism and promote microbial activity in the rhizosphere



Mannitol (sugar alcohol)

Osmoprotectant and chelator, helps with cell water retention and nutrient mobility



Oligosaccharides

Elicitors of plant defense mechanisms that promote plant health and strengthening



Fucose-containing polysaccharides (FCP's)

Antioxidant and stress protection capabilities



Macronutrients

Nutrients essential to the growth of healthy plants



Micronutrients

Present as organically chelated forms, which makes them more available to plants



Application Program for Wine Grapes

rate: 1-2 L / acre or 2.5-5 L / hectare



Application Timings

- 1-4 inch shoot growth, foliar and soil
- 10-12 inch shoot growth, foliar and soil
- 5 days pre bloom, foliar
- 'BB' size berries (2-3 mm), foliar
- Veraison, foliar
- Postharvest, soil

Benefits

- Shoot uniformity, rachis length, stress resistance, root growth, nutrient uptake
- Rachis length, stress resistance, bloom uniformity
- Berry set, plant health, reduced shatter
- Size and colour uniformity, plant health
- Plant health, uniformity, stress mitigation
- Root flush, nutrient uptake, carbohydrate accumulation, bud differentiation

Benefits to New Plantings



Stress resistance

- Transplant shock, biotic and abiotic stress

Improved, more vigorous root growth

- Increased water efficiencies
- Increased nutrient levels
- Growing platform
- Roots developed in fall flush are feeder roots for water and nutrient uptake in the spring

Improved establishment

- Thicker trunks, increased photosynthesis



Apply at transplant at 1-2 L / acre followed by soil applications every 2-3 weeks.

Root soak rate: 3.5 L / 100 L



Wine Grape Root Development - Marchal Foch



Control



Stella Maris®



Roots of equally developed Marchal Foch grape vines were pruned to the same length prior to planting in rhizotrons. After 7 weeks of the experiment, the vines treated with 3.5 ml/L of Stella Maris® weekly show more lateral roots. (Both treatments received the same amount of water and fertilizer.)

Wine Grapes - Merlot



Roots of equally developed Merlot grape vines were pruned to the same length prior to planting in rhizotrons. After one treatment with Stella Maris® at 3 ml/L, the treated plants showed longer roots and more branching. (Both treatments received the same amount of water and fertilizer.)



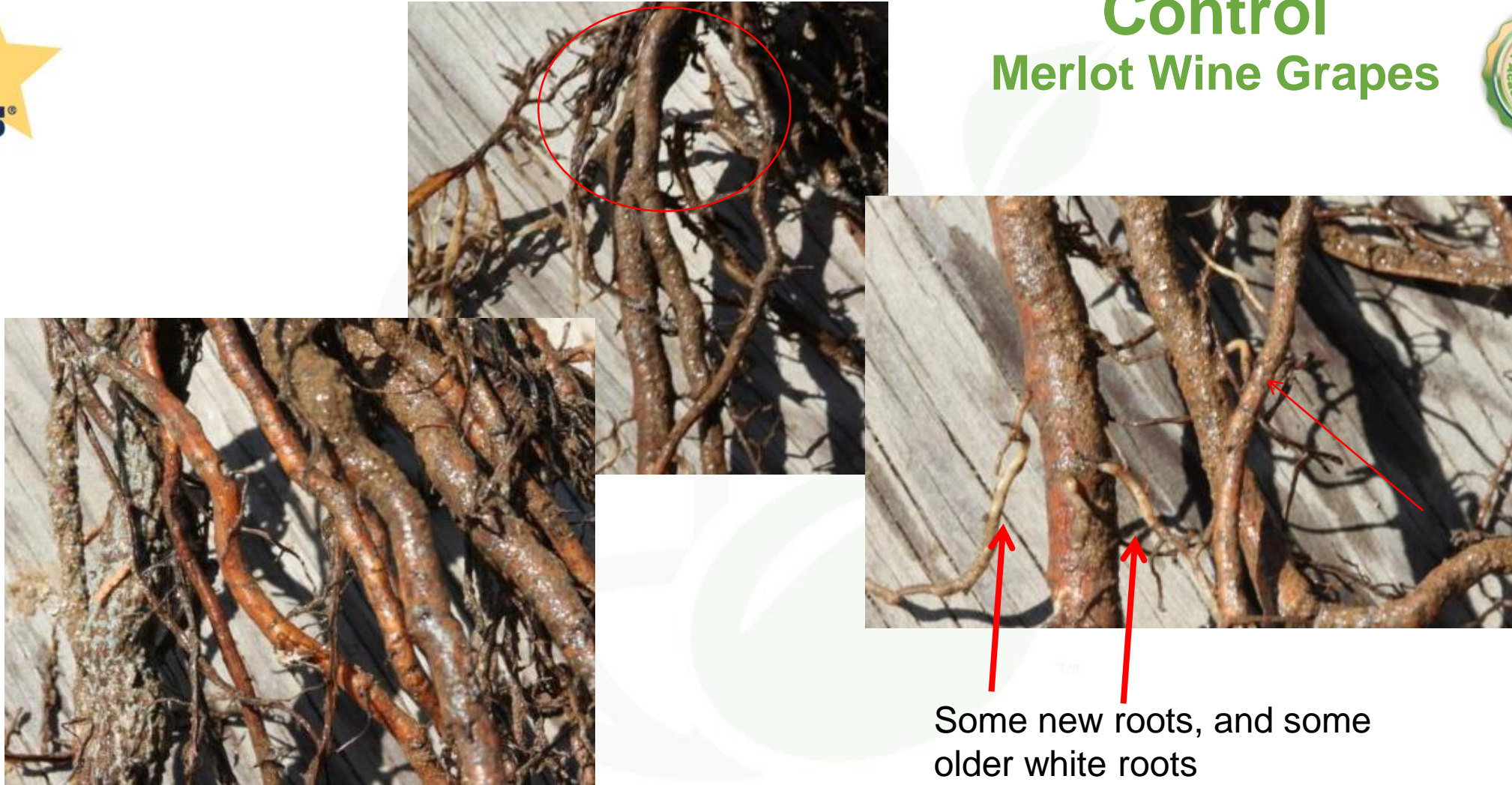
Control Merlot Wine Grapes



Few new roots present.



Control Merlot Wine Grapes



Some new roots, and some older white roots



Merlot Wine Grapes Treated With Stella Maris®



Lots of new, white root growth





Merlot Wine Grapes Treated With Stella Maris®



A lot of lateral branching



Four Weeks After First Treatment





After Heat Stress



Control

Stella Maris®



Control

Stella Maris®



Benefits to Plant Health



Stronger, healthier plants

Healthier plants are more resistant to infections

- Fungal diseases
- Pests (such as mites, thrips, etc.)

Less electrolyte leakage, indicates less cell membrane damage due to stress

Stronger cell walls

- Improved anti-oxidant levels
- More phenolics, anthocyanins and tannins

Visual improvements

- Greener (more chlorophyll content)
- Turgid, upright plants
- *"Nicest looking plants I've had."*

Resistance to oxidative stresses (better water use efficiency)

Drought, heat, salt

Resistance to cold stress (late-season vine health)



Improved Water Status

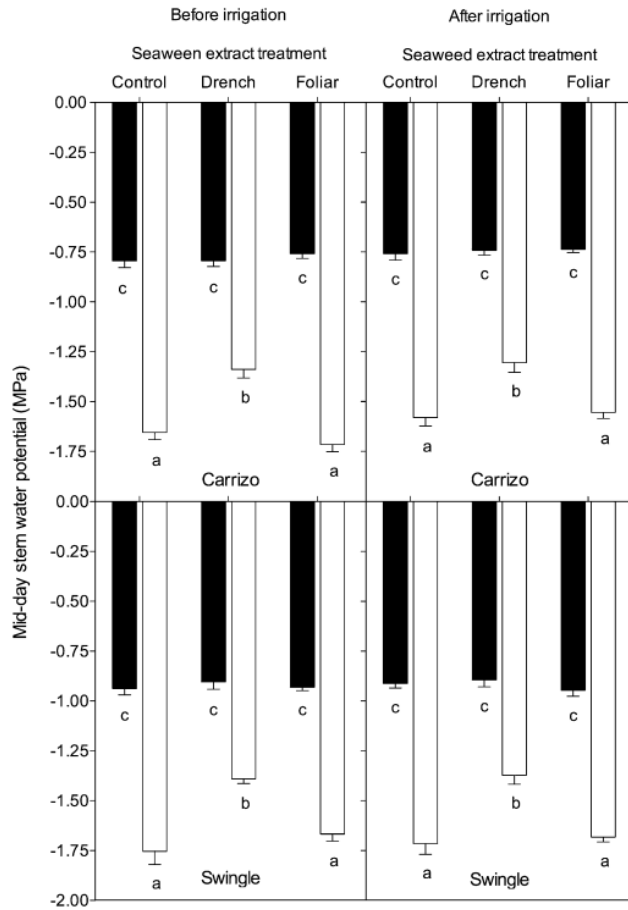


Fig. 6. Midday stem water potential of 'Hamlin' sweet orange grown on 'Carrizo' citrange (A–B) and 'Swingle' citrumelo (C–D) rootstocks grown for 8 weeks under well-watered (100% ET = black bars) or drought stress (50% ET = white bars) conditions and treated with seaweed extract as a soil drench or foliar spray compared with untreated control trees. Measurements were made immediately before irrigation (A and C) and again 24 h after irrigation (B and D) for each rootstock to observe stress recovery. Lowercase letters indicate significant differences among treatments within a rootstock (Tukey's honestly significant difference test, $P = 0.05$). ET = evapotranspiration.

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Applications of a Commercial Extract of the Brown Seaweed *Ascophyllum nodosum* Increases Drought Tolerance in Container-grown 'Hamlin' Sweet Orange Nursery Trees

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Additional index words. citrus sinensis, seaweed extract, deficit irrigation, drought stress, water use efficiency

Abstract. 'Hamlin' sweet orange trees on 'Carrizo' citrange and 'Swingle' citrumelo rootstocks were treated weekly with a commercial extract of the brown seaweed *Ascophyllum nodosum* at 5 and 10 mL·L⁻¹ as either a soil drench or foliar spray. Half of the trees in each treatment were subjected to drought stress [irrigated at 50% of evapotranspiration (ET)], whereas the other half remained fully irrigated (100% ET). Drought stress reduced shoot growth and leaf photosynthesis but increased root and total plant growth relative to the amount of water applied, thus increasing whole plant water use efficiency. Trees treated with seaweed extract and drought-stressed had significantly more total growth than untreated drought-stressed trees for both rootstocks. The maintenance of

ammonium compounds (Crouch et al., 1992; Crouch and van Staden, 1993; Durand et al., 2003; Ördög et al., 2004; Reitz and Trumble, 1996; Stirk et al., 2003). However, some doubt has recently been shed on the actual levels of plant growth hormones in SWEs (Craigie, 2010).

Commercial extracts of *A. nodosum* have been reported to increase fruit yield and quality of citrus (Fomes et al., 1995, 2002; Koo, 1988; Koo and Mayo, 1994) and grapes (Norrie et al., 2002). Extracts from *A. nodosum* have also been reported to increase drought stress tolerance of grasses (Schmidt and Zhang, 1997; Zhang and Ervin, 2004) and vegetable and ornamental crops (Neily et al., 2010), but there are no published reports about their effects on drought stress tolerance in woody plants in general or citrus specifically.

The objective of this study was to determine if a commercially available alkaline extract of *A. nodosum* (Stimplex® Crop Biostimulant; Acadian Seaplants, Nova Scotia, Canada) improves drought stress tolerance and maintains shoot growth under drought conditions of sweet orange nursery trees grown on commonly used rootstocks.

Materials and Methods

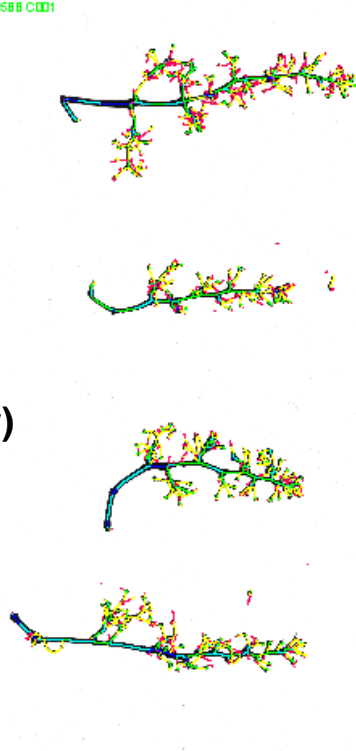
Plant material. Forty-eight uniform 1-year-old nursery trees of 'Hamlin' sweet orange [*Citrus sinensis* (L.) Osbeck] grafted on 'Carrizo' citrange [*Poncirus trifoliata* (L.)



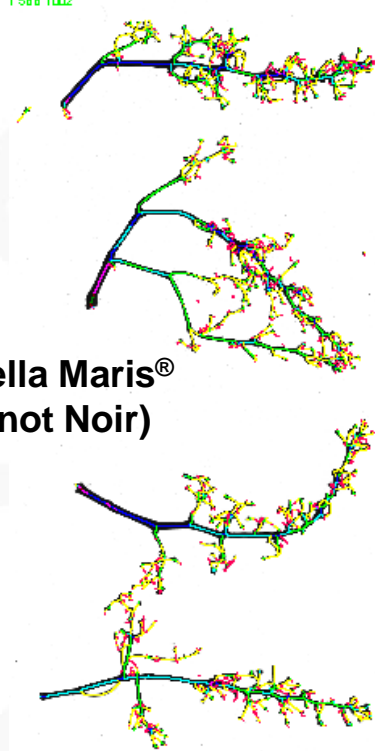
Effect on Rachis Stretch



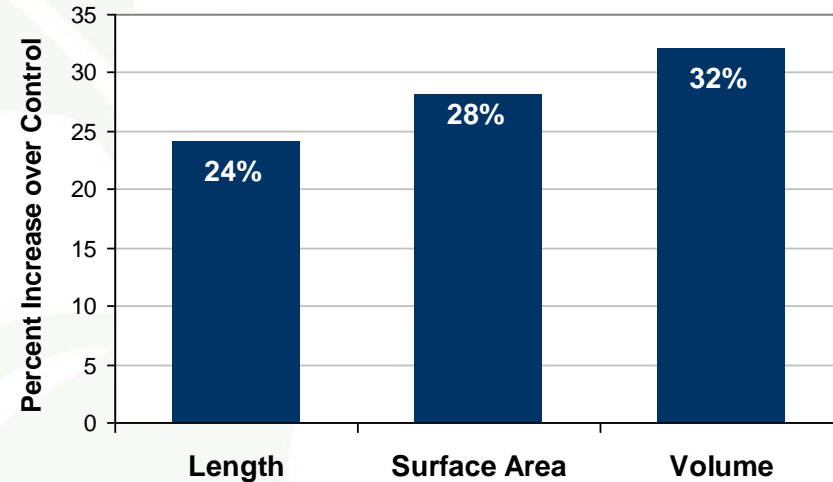
Control
(Pinot Noir)



Stella Maris®
(Pinot Noir)



Effect on Bunch Development



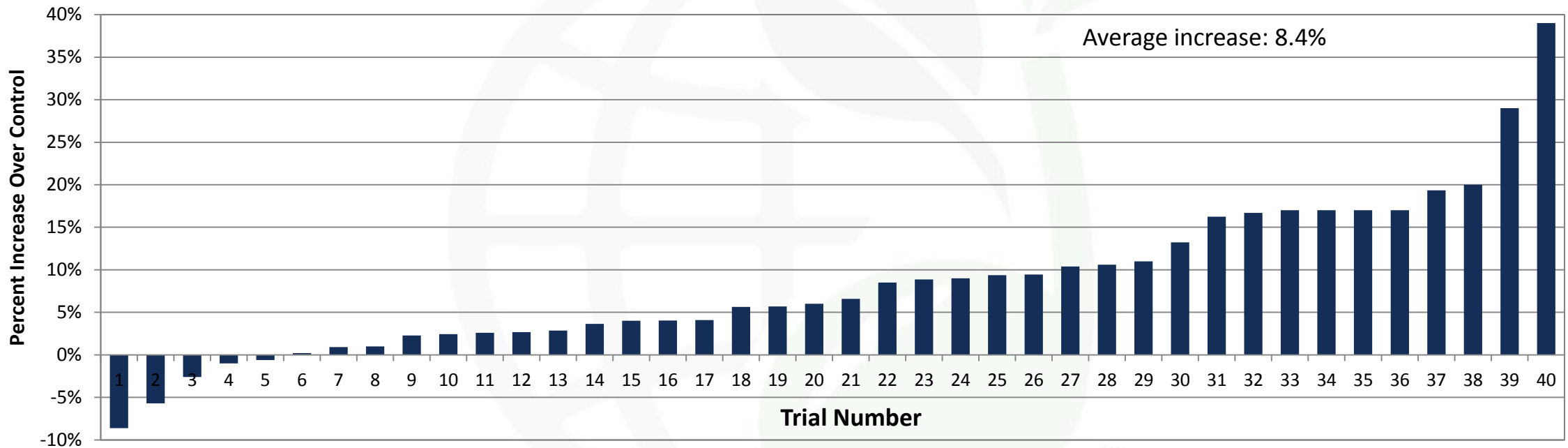
In several locations of the wine grape trial, bunches were stripped of berries and the rachis was analyzed with a WinRhizo® scanning device. The results confirmed that the treated bunches were longer, had more surface area and more volume.



Effect on Rachis Stretch



Increase in Rachis Length



In majority of 40 trials in which the rachis length was measured, treatment with Stella Maris® increased the length. Longer, looser bunches allow for better spray penetration resulting in healthier berries.



Uniformity and Quality



Flowers on vines do not bloom uniformly within a bunch.

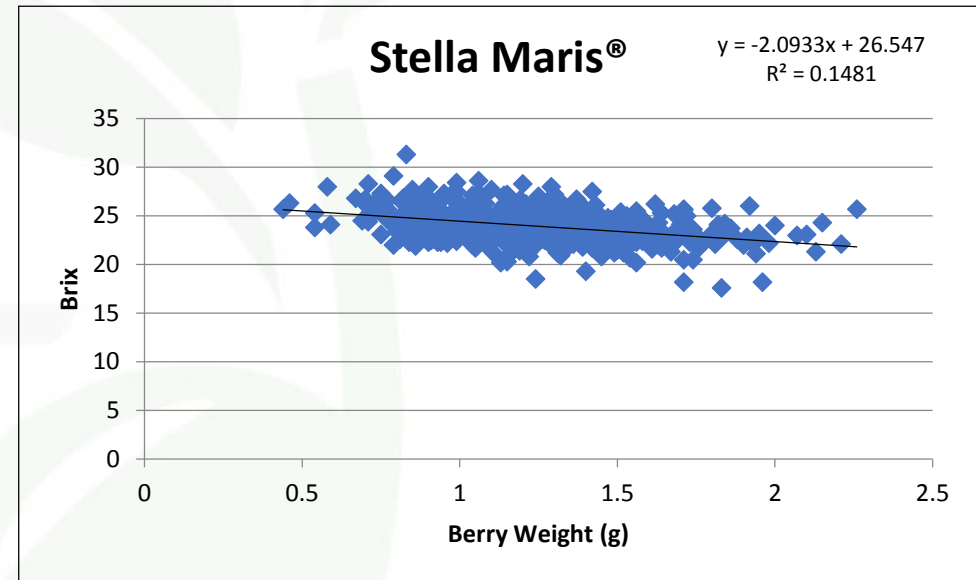
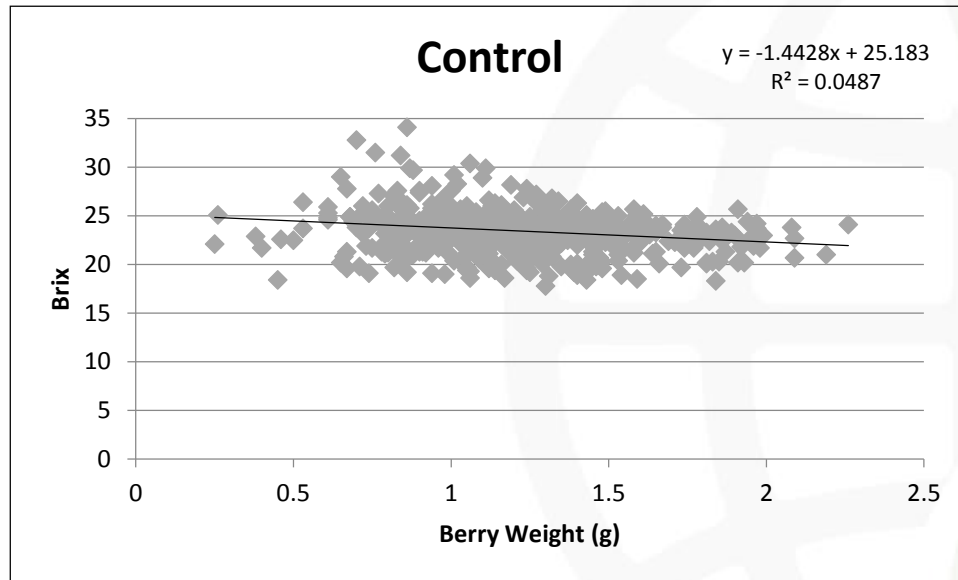
Pinot Noir flowers generally open in the middle of the inflorescence first, followed by the bottom, then the top.

In cold or rainy weather, flowers open irregularly.

Inflorescences on different positions on the vine bloom at different times.

All this leads to non-uniform ripening and large variations in Brix between clusters and within a bunch.

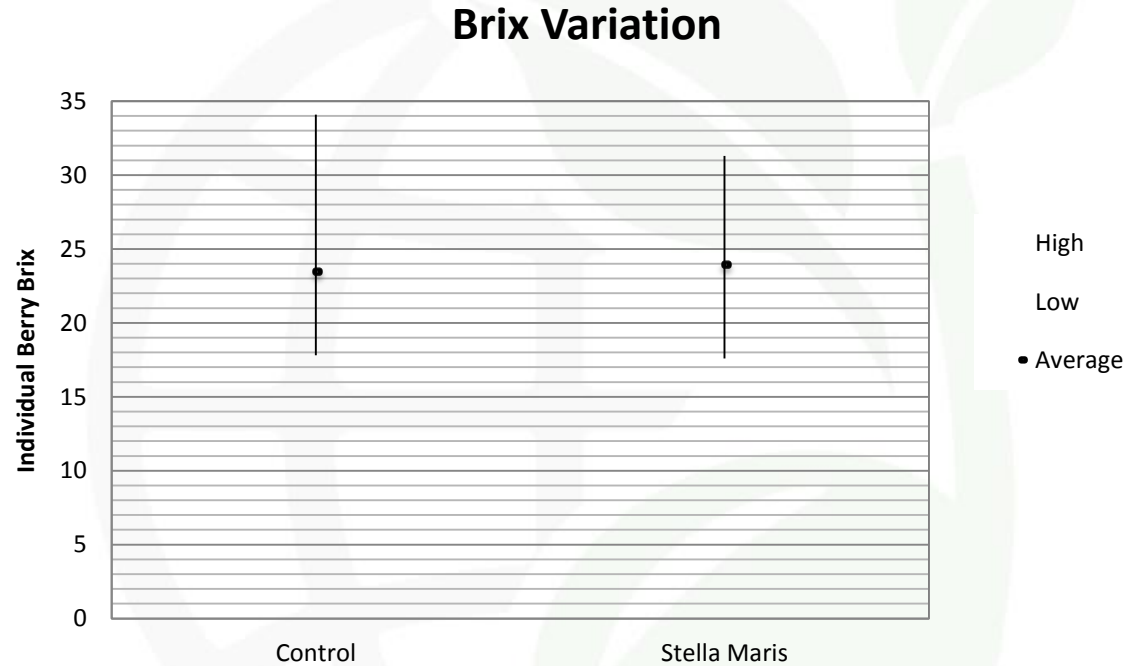
Brix and Berry Weight



Treated berries were more uniform in Brix and weight, as shown by a more uniform cluster on the graph on the right.



Brix Variation



The range of Brix measurements from treated berries was narrower than that of control. The treated fruit had lower maximum Brix, indicating less late-season water loss and less shrivel in the fruit.



Conclusion – Brix Results From the Field



Bunches from plants treated with Stella Maris® had less variation in Brix within bunches and between vines.

- This indicates more uniform maturity and ripening, which leads to improved wine quality.

There may have been delayed water loss and shrivel in the treated bunches, which accounted for the differences in pre-harvest weights and Brix.

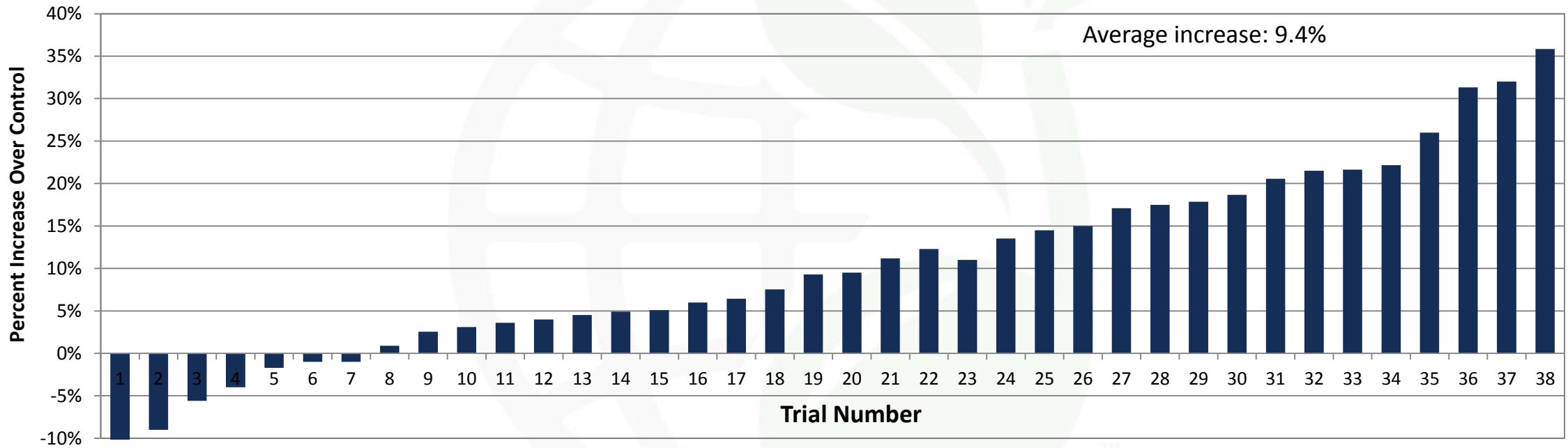
Increased Brix uniformity reflects the more uniform set and ripening of the berries treated with Stella Maris®.



Increase in Number of Berries



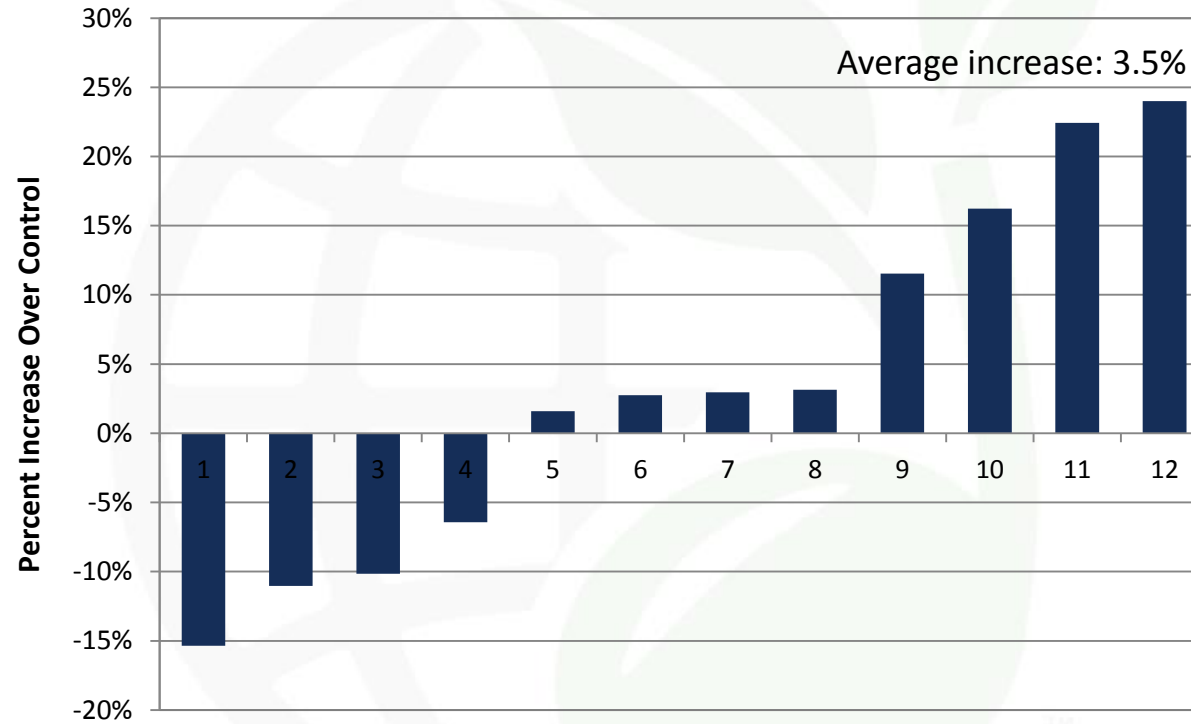
Increase in Berry Number



In the majority of 38 trials in which berry numbers were recorded, applications of Stella Maris® increased berry number per bunch.



Increase in Berry Weight



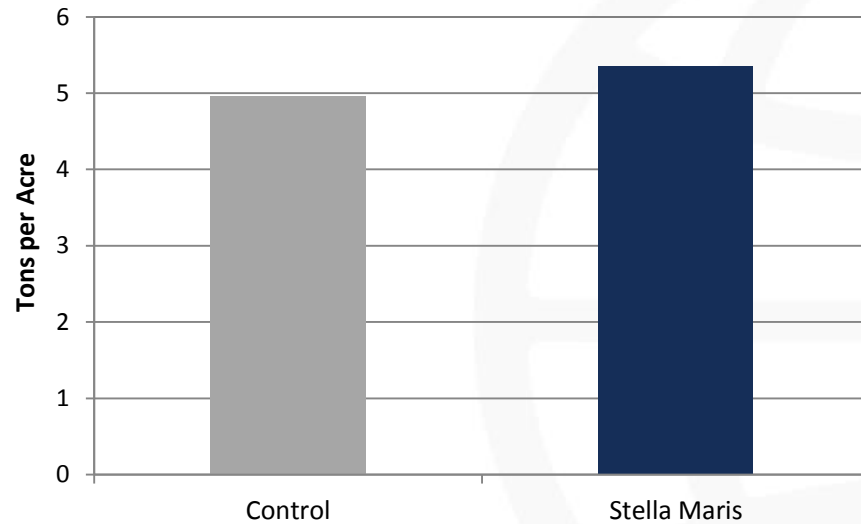
On average, Stella Maris® increased berry weight by 3.5%. That indicates that the product increases berry number but maintains berry size.



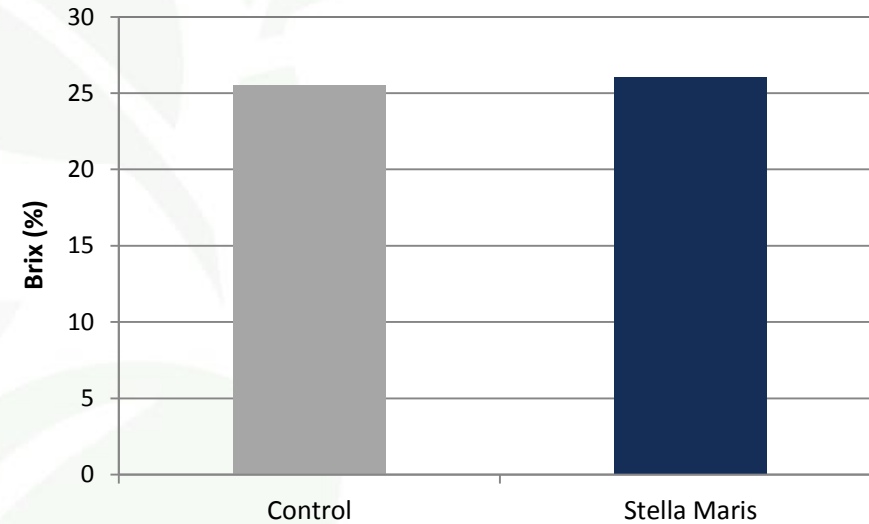
Commercial Yield



Wine Grape Yield



Wine Grape Brix



Yield was 7.4% greater in Stella-Maris-treated plots, while Brix was 1.5 percentage points higher.

The difference in yield was lower than the pre-harvest bunch weights.

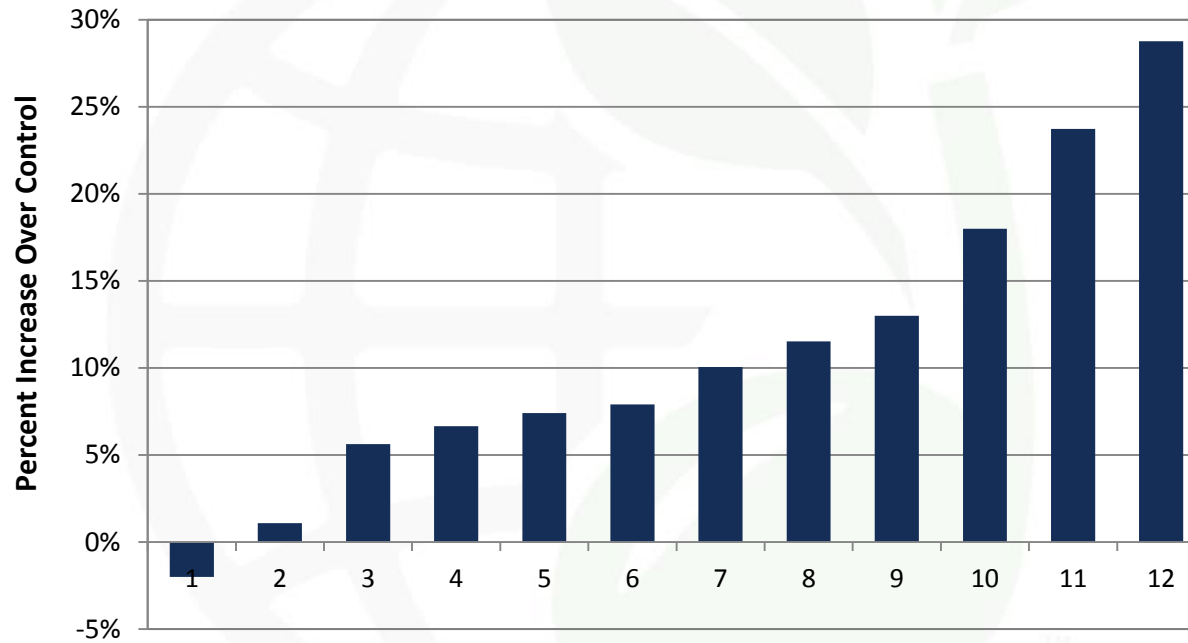
The difference in Brix was smaller than the pre-harvest samples.



Commercial Yield



Wine Grape Yield at Harvest



In a series of 12 trials in which the commercial yield was recorded, Stella Maris[®] increased it by an average of 11%.



Responses in the Field



Root growth

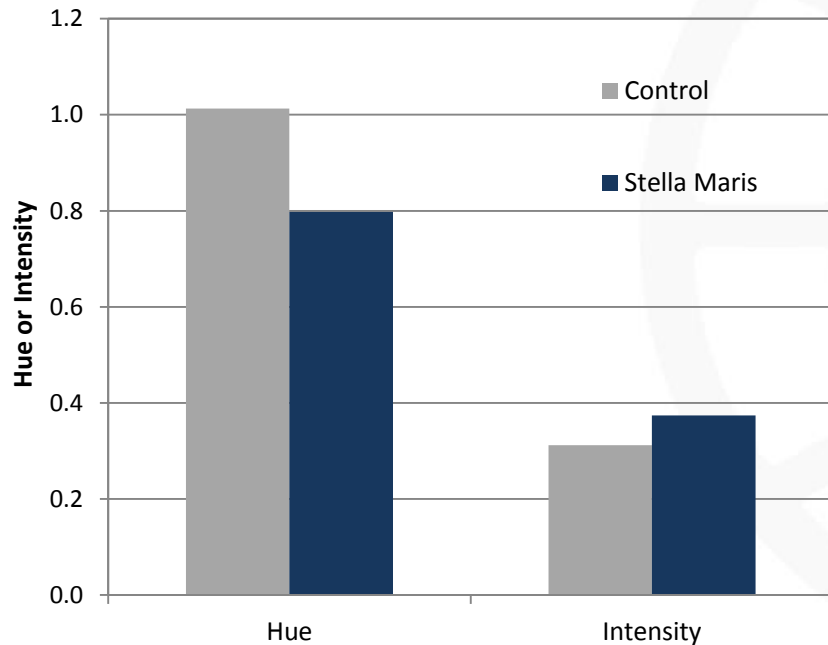
Nutrient uptake

Yield, fruit size and quality

Stress resistance

Less variation in Brix, indicating more uniform set and ripening

Wine Colour

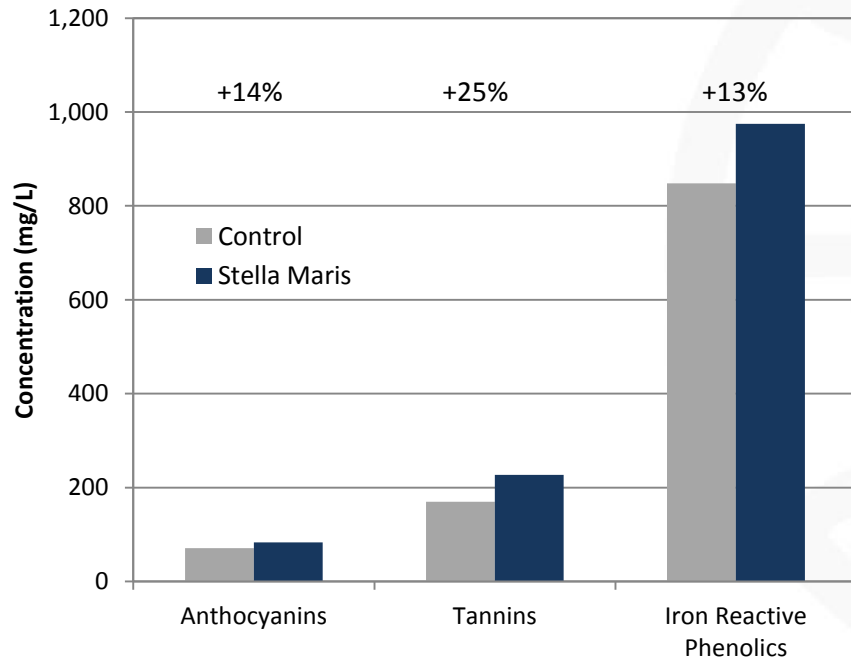


Colour intensity gives an idea of how much colour there is.

Colour hue is normally used to monitor wine aging. (Hue values increase with aging; lower values mean more red, and higher values mean more brown.)

Grapes treated with Stella Maris® had more red colour and their colour was more intense.

Anthocyanins, Tannins, Phenolics



Phenolics and tannins in grapes and wine products have dramatic effects on wine flavour, quality and storability.

Both viticultural and enological practices have important influences on concentrations of tannins and polyphenolics in the subsequent wine products.

These compounds can also play important roles as antioxidants and cancer-preventative agents in humans and other mammalian systems.

Grapes treated with Stella Maris® showed an increase in levels of all these compounds.



Treatments

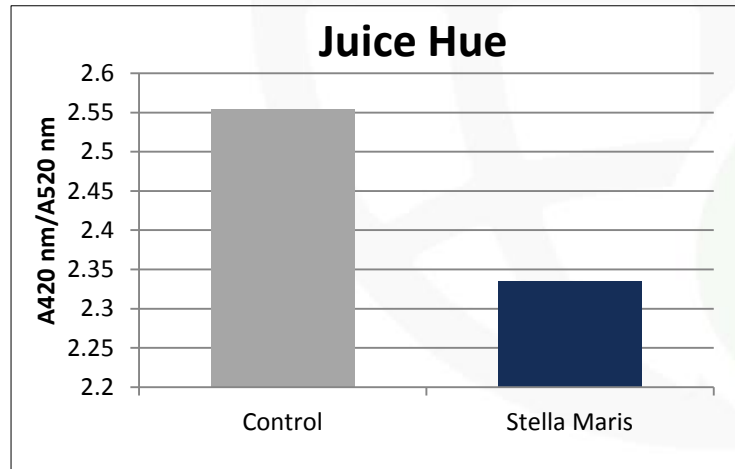
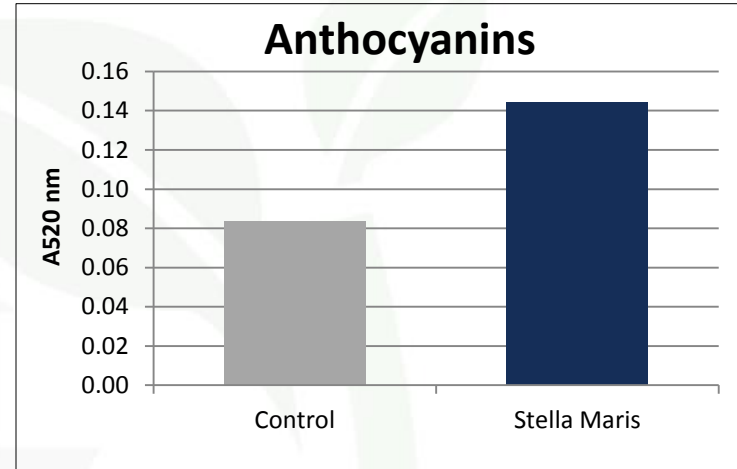
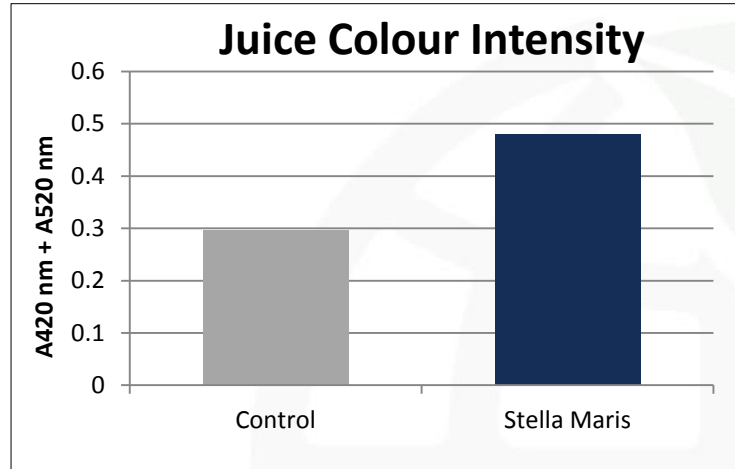
- Grower standard control (routine fungicide and insecticide applications and viticultural practices, such as leaf removal, hedging, shoot positioning, were done as per commercial practice)
- Grower standard + 2 pre-bloom and 2 post-bloom applications of Stella Maris®

Stella Maris® was applied at 5 L/ha to the full canopy.

Location: a commercial Pinot Noir vineyard in Niagara, ON, Canada



Improvement in Juice Quality



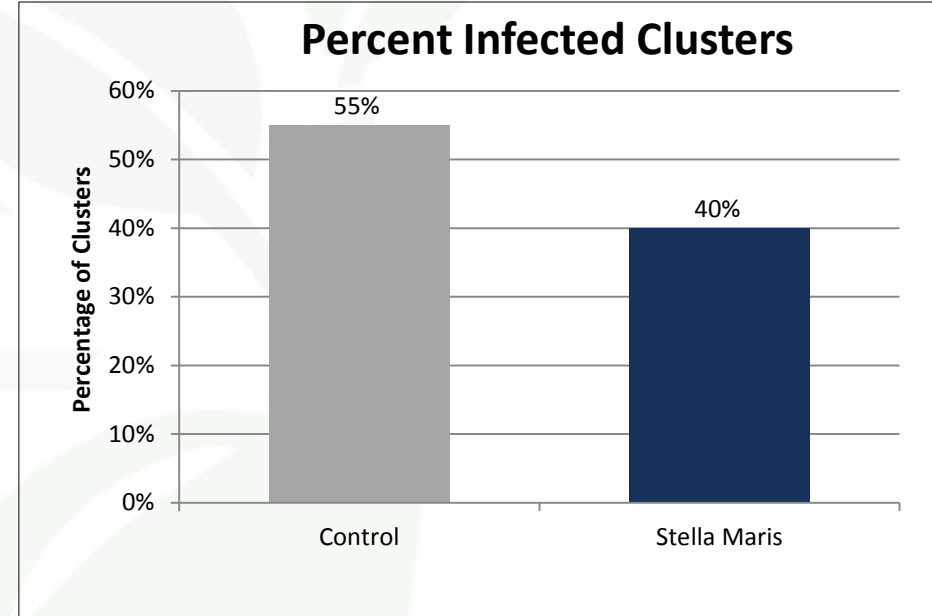
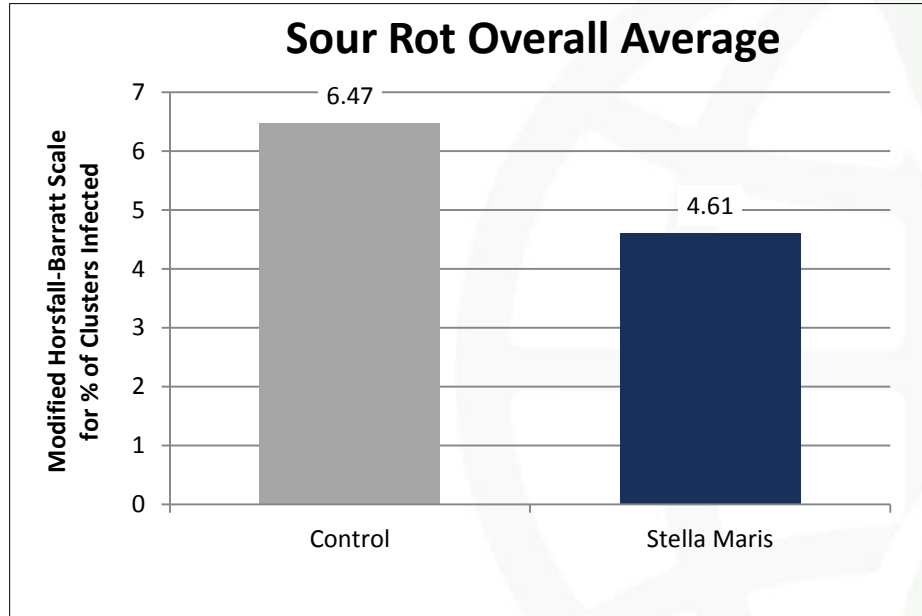
Although there were no statistically significant differences, lab analysis showed numerical increases in:

- Colour intensity
- Hue (more red)
- Levels of anthocyanins™

All these parameters indicate improved juice quality.



Sour Rot Incidence



The incidence and severity of sour rot was low; however, applications of Stella Maris[®] numerically decreased the average sour rot rating as well as the percentage of infected clusters. Botrytis levels were low in all treatments in this trial.



Conclusions



Applying Stella Maris®



Improved juice quality

Increased Brix levels

Reduced Brix variation

Increased number of clusters per vine and yield

Reduced sour rot



Application Program for Wine Grape

rate: 1-2 L / acre or 2.5-5 L / hectare



Application Timings

- 1-4 inch shoot growth, foliar and soil
- 10-12 inch shoot growth, foliar and soil
- 5 days pre bloom, foliar
- 'BB' size berries (2-3 mm), foliar
- Veraison, foliar
- Postharvest, soil

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