Application of Foliar Nutrients after Trimming Strawberry Plants Accelerates Yield Recovery

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In southern Australia, strawberry growers commonly trim their plants in summer to remove old leaves and flower trusses (Figure 1). This practice revitalises the plants and prepares them for increased production later in the season. However, trimming can also stress the plants. For instance, research in Victoria found that heavy summer trimming made strawberry plants more susceptible to diseases like charcoal rot. Prior to the current study, there was limited information on how to reduce post-trimming stress in strawberry plants and accelerate their recovery for improved production.

Figure 1. Vase-trimmed strawberry plant. Photo credit: Dylan McFarlane

Some researchers suggest that the level of soluble solids in crops is a reliable indicator of plant health, and the balance of macro- and micro-nutrients. For instance, fungicide applications for powdery mildew in grapevines can stop once soluble solids in the berries reach high levels and the plants mature. Soluble solids refer to a wide range of compounds in solutions in the plant, though they most commonly represent sugars, like fructose and glucose. Brix is a unit used to measure soluble solids, particularly sugars, in plant solutions such as sap or juice. Some growers measure Brix in the juice of strawberry as an indicator of fruit quality.

The application of foliar nutrients, especially those containing chelated trace elements, offers a potential method for increasing soluble solids in crops and reducing plant stress. Trace elements like manganese (Mn), iron (Fe), and zinc (Zn) are essential for various plant functions, though they are required only in small amounts. However, factors such as soil pH imbalances can render these nutrients unavailable by causing them to form insoluble compounds. Chelation is a chemical process that prevents this by binding trace elements to organic molecules (e.g., EDTA), forming a stable complex. This chelated form keeps the nutrients soluble and protects them from reacting with other soil or water compounds, ensuring they remain available for plant uptake.

We conducted a field experiment on a commercial farm at Silvan, Victoria, to evaluate the impact of foliar application of chelated nutrients on strawberry plants after trimming.

How we ran the experiment and what we measured

Immediately after trimming strawberry plants in March 2024 ('vase' cut, Figure 1), we applied chelated foliar nutrients regularly over the course of one month, following the manufacturer's guidelines. We used the product **'High K'** (KD Plant Care Pty Ltd, Alphington, Victoria, https://www.kendon.com.au/products/high-k/) as the foliar nutrient treatment in our experiment and compared it with an untreated control. The High K formulation we used was chelated with EDTA and contained 15% nitrogen (N), 6.22% phosphorus (P), 15.7% potassium (K), 0.012% manganese (Mn), 0.006% magnesium (Mg), 0.008% zinc (Zn), and other trace elements. We applied the nutrient treatment at a rate equivalent to 2L in 1000L of water per hectare (Figure 2).

We extracted leaf sap and measured soluble solids daily and nutrient concentration at the end of the experiment. Fruit was harvested and weighed every three days, and soluble solids were measured in the juice. Revenue from the harvested fruit was calculated using weekly wholesale prices from the Melbourne market (FreshLogic, Hawthorn, Victoria). At the end of the experiment, we also evaluated the incidence of blight, caused by the fungus *Phomopsis obscurans*, by measuring the percentage of affected leaves on each plant (Figure 3). The experiment included four strawberry varieties: *Albion*, *San Andreas*, *Monterey* and *Cabrillo*. We conducted the experiment using a scientific design called a randomised split-plot design, which had four replications of each nutrient and variety treatment.

Figure 2. Application of foliar nutrients to strawberry plants in a field experiment at Silvan, Victoria.
Photo credit: Dylan McFarlane

Figure 3. Leaf blight of strawberry (var. *Albion*) caused by the fungus *Phomopsis obscurans* in a field experiment at Silvan, Victoria. Photo credit: Dylan McFarlane

Foliar chelated nutrients increased yield and revenue

In the month following plant trimming, the foliar application of chelated nutrients boosted commercial fruit yield by 29% and increased the number of marketable fruit by 27%, although it did not affect fruit size (Table 1). This resulted in additional revenue from fruit of $0.26 per plant over the four-week period following trimming. The increase in marketable fruit was partly due to the effect of the foliar nutrients in reducing the proportion of rejected, misshapen fruit. There was no statistical difference in yields between the different varieties over the four weeks of the experiment.

Table 1. Strawberry productivity (from March to April 2024) in a field experiment evaluating foliar application of chelated nutrients following plant trimming. P-values of less than 0.05 (in RED) represent parameters of strawberry productivity (in columns) where treatments were statistically different from each other.

Nutrient Treatment	Total Fruit Yield (g/plant)	Marketable Fruit Yield (g/plant)	Percentage of Rejected Fruit (g/g)	Number of Marketable Fruit/plant	Size of Marketable Fruit (g/plant)	Revenue from Marketable Fruit ($/plant)
Untreated Control	131.9	94.5	28.3	4.1	23.1	0.97
Foliar Nutrients (High K)	155.6	121.7	21.8	5.2	23.4	1.23
P-Value	**0.032**	**0.005**	**0.034**	**0.005**	0.836	**0.008**

The foliar application of chelated nutrients also enhanced soluble solids in strawberry fruit, increasing the average Brix from 7.8° in the untreated control to 8.2° Brix (Figure 4). This indicates that the treatment not only boosted fruit yield but also improved fruit quality. Among the varieties, *Albion* peaked at a fruit Brix of 9° following plant trimming, which was higher than *Cabrillo*, *San Andreas*, and *Monterey*, each of which peaked at 8° Brix.

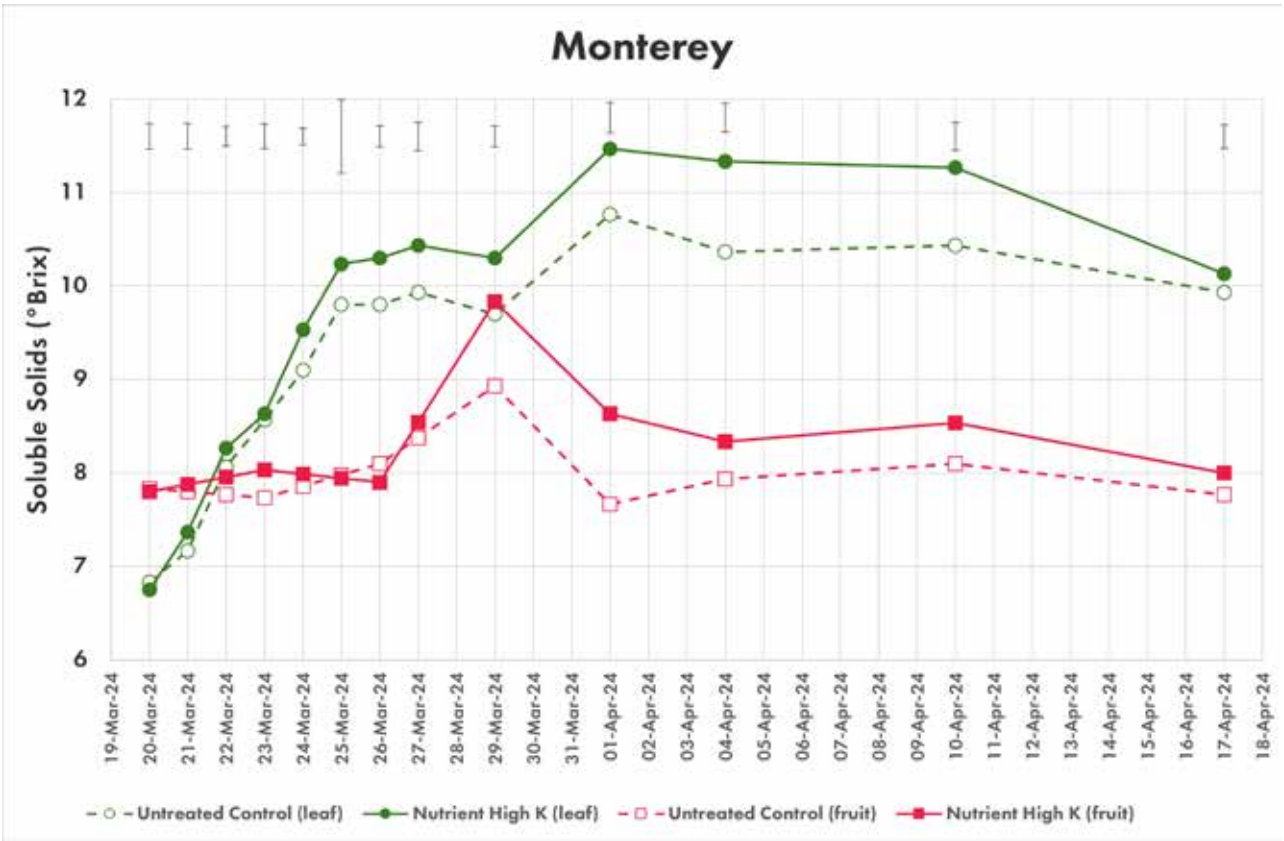

Figure 4. The effect of foliar application of chelated nutrients (High K) on soluble solids (Brix) in the leaves and fruit of two contrasting strawberry varieties following plant trimming on 20 March 2024. Some researchers suggest that soluble solids are an indicator of crop health. Application of the nutrient treatment consistently increased soluble solids in the crops.

Impact of chelated nutrients on foliar disease

The foliar application of chelated nutrients reduced the incidence of leaf blight in trimmed strawberry plants from 5.66% to 2.61%. There was no statistical difference in blight incidence among the different strawberry varieties. A strong linear relationship occurred where fruit yield decreased as leaf blight increased (Figure 5). This suggests that the nutrient treatment's ability to suppress leaf blight likely contributed to its ability to improve fruit yields.

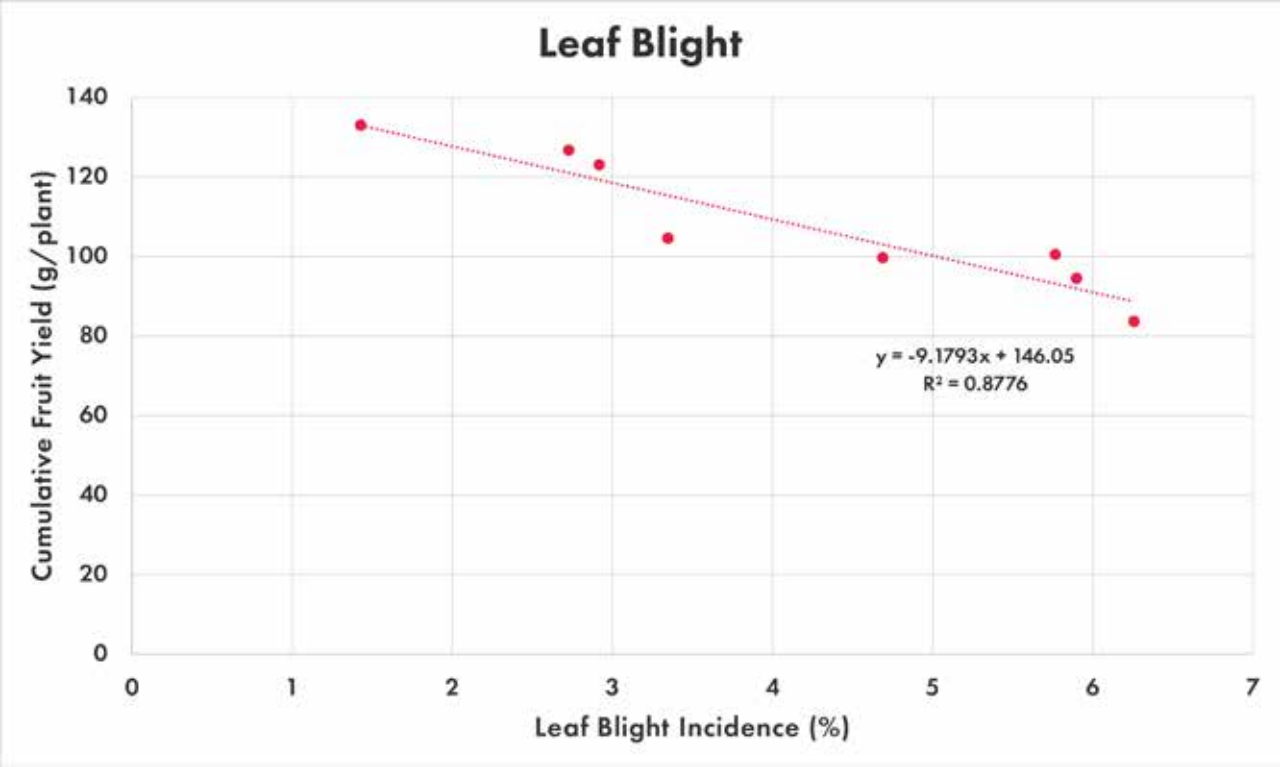

Figure 5. Relationship between leaf blight cause by the fungus *Phomopsis obscurans* and fruit yield in the month following plant trimming in a field experiment at Silvan, Victoria.

Association between soluble solids, crop nutrition and yield

The foliar application of chelated nutrients rapidly increased soluble solids in the leaves of trimmed plants, raising Brix levels from a peak of 9.9° in the untreated control to 10.8° Brix (e.g., Figure 4). This effect was consistent across all strawberry varieties tested. Among the varieties, *Albion* and *Monterey* showed higher soluble solids in their leaves compared with *Cabrillo* and *San Andreas*. The data revealed a positive relationship between fruit yield and soluble solid levels in the leaves (r = 0.754). This suggests that soluble solids in the leaves may serve as an indicator of a plant's productive capacity following trimming.

The application of foliar fertiliser increased several nutrients in the vegetative sap of strawberry plants, notably raising nitrate levels by 177% and manganese levels by 124% (Table 2). Additionally, strong associations were observed between the increased uptake of manganese and nitrate and corresponding increases in soluble solids and fruit yield (r = 0.840 to 0.796), reflecting the essential roles these nutrients play in plant health. For example, manganese is crucial for energy production in the photosynthetic machinery of the plant, specifically in the oxygen-evolving complex of photosystem II. Overall, the fertiliser treatment's ability to increase plant uptake of key macro- and micro-nutrients likely contributed to its ability to improve fruit yields.

Table 2. The effect of foliar application of chelated nutrients (High K) on macro- and micro-nutrients in the foliage sap of strawberry following plant trimming. There are statistical differences between the treatments for RED nutrient parameters.

Nutrient Parameter	Untreated Control	Foliar Nutrients (High K)	P-Value
NO3	169.9	471.4	0.031
NH4	1.9	3.7	0.044
P	233.3	304.6	0.004
K	5323.7	5476.1	0.369
S	39.1	33.7	0.060
Ca	1289.9	1089.7	0.158
Mg	517.1	426.7	0.010
Zn	1.2	1.4	0.264
Fe	0.6	0.6	0.372
Mn	2.2	5.0	0.002
Cu	0.2	0.4	0.003
B	0.3	0.3	0.892
Mo	0.006	0.006	0.938
Na	23.7	28.4	0.004
Cl	1022.5	775.5	0.142

Conclusions

This experiment highlighted the potential advantages of treating strawberry plants with chelated foliar nutrients, such as High K, following trimming. This approach not only accelerated recovery from plant stress but also significantly boosted yields and reduced low incidences of foliar disease. These beneficial effects were associated with increased levels of soluble solids, manganese, and nitrate in the leaves.

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For more information on the experiment or the use of foliar nutrients in strawberry please contact Chali at chali@kendon.com.au