Using GrowGreen Biofertilisers to Increase Yield and Quality in Wine Grapes.

Product Description and Characteristics

GrowGreen's AminoElite, AminoKelp and Microbe Plus Kelp are produced using a proprietary manufacturing process which includes amino acids from marine sources and hormones from seaweeds. This results in a balanced product that optimises the plant's ability to uptake nutrients directly from the leaves. As it works in combination with existing soil microbes, it improves the plants ability to make nutrients available from the soil whilst increasing both the quality and the yield of the plant. GrowGreen products have been created from a holistic point of view where not only the plant nutrition has been considered but also the free workforce supplied by naturally existing beneficial microorganisms that live symbiotically with the plant. Combining biostimulants with specific microbes that improve plant nutrition, has been demonstrated to further enhance plant benefits *(Colla et al., 2017)*.

Increasing quality and yield is the result of several factors:

- Biostimulants are incorporated in the form of amino acids, plant hormones and beneficial microorganisms;
- Both macro and micronutrients are combined which result in plant growth stimulation;
- Plant beneficial fungi and bacteria are incorporated to aid the plants in dealing with diseases and insect attack.

This balanced and optimised product results in the plant reaching its maximum genetic potential and optimises production of primary and secondary plant metabolites, whilst improving soil health through an increase in plant available nutrients and a healthy rhizosphere with microbes.

Effects of Biofertilisers on Yield and Quality

Biofertilisers have been shown to improve nutritional status, vegetative growth, yield and fruit quality in orchards and vineyards *(Eman and Abd-Allah, 2008; Green, 2010; Kahn et al., 2012)*. Kahn et al., 2012, also demonstrated that plant metabolites, both primary and secondary, increase with foliar applications of an amino acid-seaweed extract.

More recently, Nagy and Tamis, 2015, demonstrated that biofertiliser application on a 24-year-old vineyard resulted in significantly increased yield compared to the control, primarily through the increase in bunch weight and berry size.

Effects of GrowGreen Biofertilisers on Wine Grape Quality

During 2016, GrowGreen products were tested in a vineyard located in the *Riverina Wine Region, NSW*, *Australia*. The objective of the work was to evaluate the efficacy of GrowGreen's AminoElite, Microbe Plus Kelp and Xtend Plant Oil Adjuvant to increase the quality of wine grapes (var. Shiraz).
The parameters studied in this trial were, sugar content (Baume), organic acids concentration (Titratable Acidity) and colour of the berries. GrowGreen products were applied in a surface covering 3 hectares.
Control treatments (next to GrowGreen treatment) received the conventional program used by the winery whilst GrowGreen treatment incorporated the below program on top of the conventional program.

Foliar Nutrients							
Products for Foliar application (Lts/Kgs/g) per Ha							
M+ Kelp (Lts)		**4**		**2**	**3**		
Amino Elite (Lts)		**2**	**2**	**1**	**2**	**2**	**2**
Xtend (Lts)		**0.2**	**0.2**	**0.2**	**0.2**	**0.2**	**0.2**

GrowGreen products were sprayed in the SIX most important phenological stages of the vines (budburst, pre-flowering, fruit set, pea sized berries, veraison and pre-harvest). Except for the first application (at budburst), mainly designed to help plant to recover from winter while providing with frost protection, the applications of GrowGreen products, are approximately four weeks apart which is the length of the stimulation of our products in the vine.
GrowGreen products were added with fungicides or other Agri-chemicals. Both treatments received the same quantity of water during irrigations. Harvest was done with a harvester which covered both treatments on the same day.
Our data, taken from the first year of a multi-year study, which was also one of the worst seasons on record due to flooding and the subsequent pathogen infestation (mainly caused by Botrytis cinerea Pers.:Fr) demonstrated a positive and significant effect on **Baume**, (Fig. 1, Table 1) and **Titratable Acidity** (Fig. 2, Table 2) and a measurable, but not significant increase in **Fruit Colour** (Fig. 3, Table 3).

Baume

Baume is a measurement of the dissolved solids in grape juice that indicates the grapes' sugar level and ripeness, and therefore the potential alcohol in the wine.

GrowGreen treatment increased the level of both primary and secondary metabolites, including sugars, resulting in the significantly higher Baume than the control.

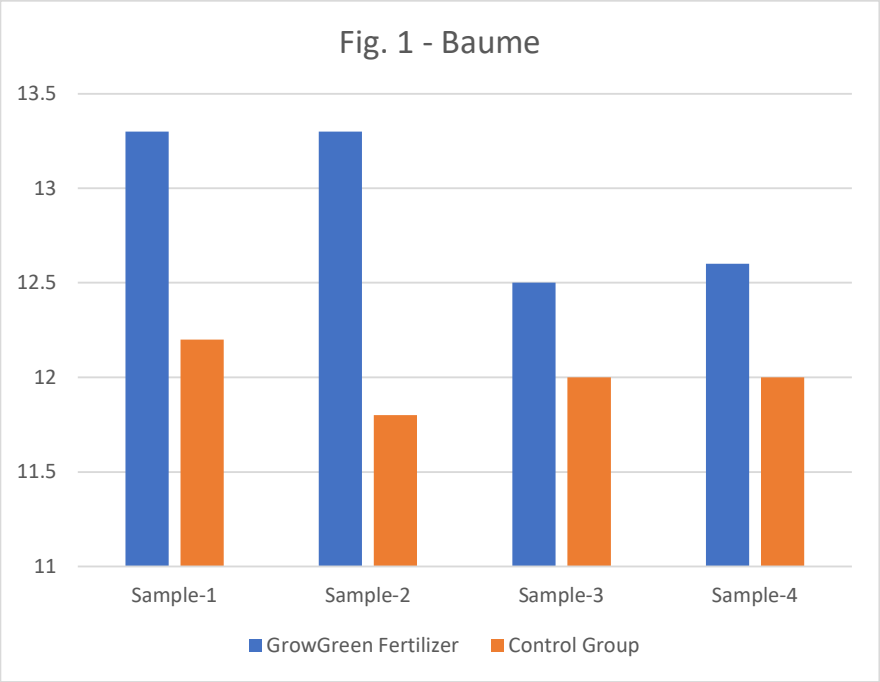

Table 1 - Baume	GrowGreen	Control
Average	12.925	12
ST Dev	0.43	0.16

The Data in Table 1 demonstrates that the GrowGreen treatment significantly improved Baume over the Control, likely resulting in Must that would reach the minimum 13% alcohol range (1 Baume unit = 1% alcohol). In a season where the whole region suffered the damages of the floods, having a 10% increase in Baume levels is remarkable as it meant an increase in the quality of the grapes that received GrowGreen products.

Titratable Acidity

Titratable Acidity, or TA, indicates the total amount of organic acids in solution, and is closely related with Baume. Acidity is important for flavour balance. In hot, flood or drought conditions, the TA tends to drop, forcing the winemaker to make more adjustments. The GrowGreen treatment actually negated the impact of weather conditions on pH (no significant difference, average = 3.46 and 3.44, respectively) which usually drops with floods or drought.

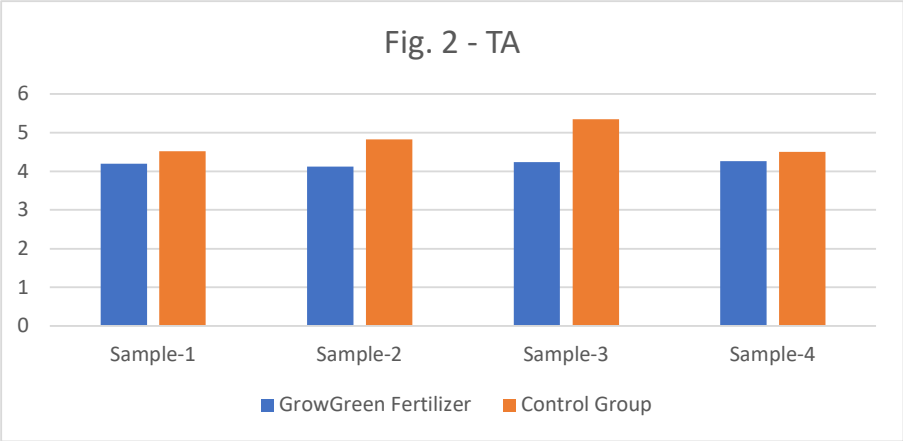

Table 2 - TA	GrowGreen	Control
Average	4.21	4.80
ST Dev	0.06	0.40

The average TA of the must from both the GrowGreen and the Control samples was low, however, it is common that grapes grown in warm areas usually contain low acid and additions of tartaric acid are often needed to produce balanced wine. However, the average pH for both samples was 3.46 and 3.44, respectively.

Fruit Colour

Colour intensity tends to decrease in hot, flooded or droughty years *(Allan, 2003)*. The fact that the GrowGreen treated berries had a measurably higher colour intensity (Fig. 3 and Table 3), although not statistically significant, than the control, points to the ability of the GrowGreen biofertilisers to mitigate the colour-intensity robbing impact of the adverse conditions under which the first year of the study was conducted.

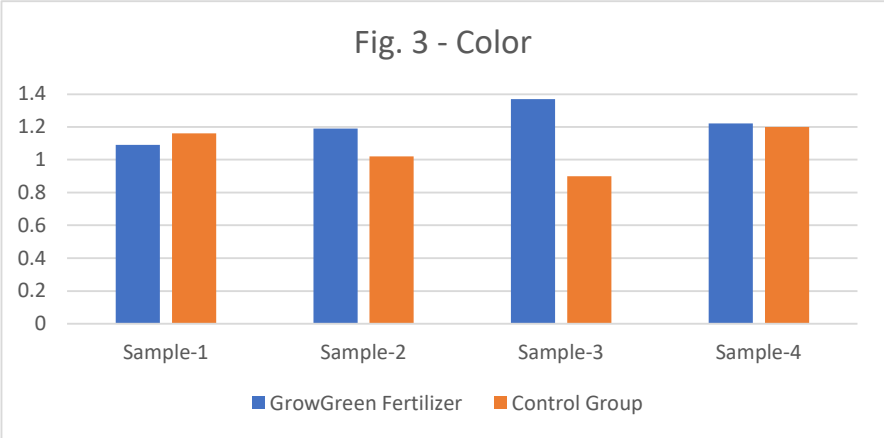

Table 3 - Colour	GrowGreen	Control
Average	1.22	1.07
ST Dev	0.12	0.14

Fig. 4 shows the average ratio between colour and Baume levels for Shiraz grapes. The grapes that were fertilised with GrowGreen products had a Baume level of 13, which according to the table below, corresponds to a colour of 0.9. But due to the beneficial effect of the biostimulants properties of our products, GrowGreen treatment reached an average colour of 1.22 in the grapes.

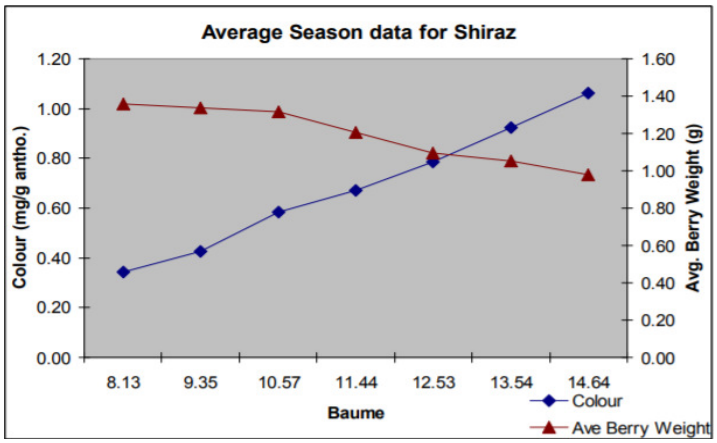

Figure 4. Average ratio between colour and Baume levels in Shiraz grapes in the Riverina region.

The increase in colour is another parameter of quality. Since wineries may be given incentives for achieving a certain colour threshold for each variety, colour has become one of the factors that make up the overall quality of the wine. Failing to meet the minimum threshold may result in a penalty, which impacts the income the grower was expecting, or result in possible rejection of the crop in its entirety.

CONCLUSION

GrowGreen treatments had a positive and highly significant impact on quality under the intense yield-limiting flooding conditions that occurred during 2016. This quality improvement proves the value of GrowGreen products in producing a crop that can be used in higher value single vintage products versus selling on the bulk market. This is especially true when considering that quality of the Must, as well as berry quality, is more indicative of the quality of the finished product then is the yield.

Vineyard owners can be sure that by using GrowGreen Biofertiliser they can increase the quality of their grapes in low yield conditions. In high yield conditions, GrowGreen Biofertiliser will increase vineyard yield, as well as improve the quality of the Must resulting in a superior wine.

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