



Biostart soil biostimulant trial

KIWIFRUIT

AIM

The aim of this trial was to measure the long-term impact of a Mycorrcin and Digester Programme on fruit yield, soil fertility, plant nutrition and profitability in a commercial Hayward kiwifruit orchard.

PRODUCTS

Mycorrcin



Mycorrcin stimulates plant root growth and branching, activates beneficial soil microbes and mycorrhizal fungi associations with plant roots which assists the plant in taking up more soil nutrients and improves soil structure.

Digester



Digester stimulates soil microorganisms to rapidly breakdown orchard pruning's, old roots and leaf litter into soil organic matter over winter. This returns both plant nutrients and organic matter (OM) to the orchard soil which improves soil water holding capacity and soil nutrients available for plant growth. This process also interrupts the life cycle of disease organisms that over-winter on organic matter.

TRIAL DESIGN

The trial site was in a well-established (>25 years) commercial Hayward kiwifruit orchard located in Edgecumbe, Bay of Plenty. The soil type is Omeheu gritty, loamy sand and the two blocks were poorly drained. There was trickle irrigation throughout each block. The altitude of the blocks was 7.0 m.

The trial was conducted over three years starting in 2010/11 and concluding in 2012/13. The weather in each of the years varied which impacted the yields.

The orchard consisted of two adjacent blocks, where one was treated with the Biostart Mycorrcin and Digester programme (Block 2, 1.92 ha) and one was the control (Block 1, 1.87 ha). The fertiliser and Psa control programmes used on each Block was identical.

Each year of the trial kiwifruit harvest yields were recorded, and the soil and leaves were tested in March. Soil samples were taken to a depth of 150 mm and analysed by Soil Testing Services. Both blocks had similar soil fertility when tested prior to the trial.

APPLICATION RATES

Product was applied either by floodjet or added to herbicide applications.

Product	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Digester												6 L
Mycorrcin			6 L	2 L		2 L		4 L				

RESULTS

Soil Test Results

Figure 1. shows that after three years of applying the Biostart Programme there were the following changes in the soil:

1. The Biostart Programme lifted the soil organic matter (SOM) by 25% from 8.9 to 11.1%, while there was no change in the untreated block. This increase in SOM in the Biostart-treated block is attributable to a 27% increase in soil carbon.
2. The soil cation exchange capacity (CEC) increased by 21%, from 19 to 23 in the Biostart treated block, while there was no change in the untreated block.
3. The total soil N was 34% higher in the Biostart-treated block than the untreated block, where the level of total soil N remained the same.
4. More importantly the soil available N increased from 100 kg/ha in the untreated soil to 139 kg/ha in the Biostart-treated soil. The Biostart-treated soil had a larger and more readily available pool of N, potentially reducing the requirement for N fertilisers.

The benefits of increasing SOM and CEC in the soils include:

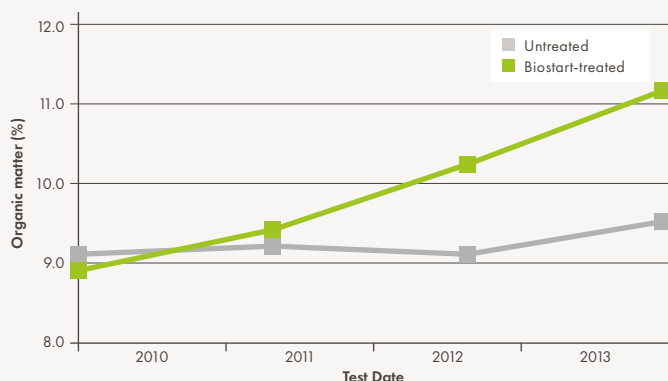
- Increasing the soil's capacity to store cation nutrients due to the higher CEC capacity
- Enabling a bigger pool of soil anion nutrients (N, P, S and B) in the soil
- Increasing microbial life in the soil which improves nutrient recycling (mineralisation) and availability
- Higher moisture holding capacity during droughts.



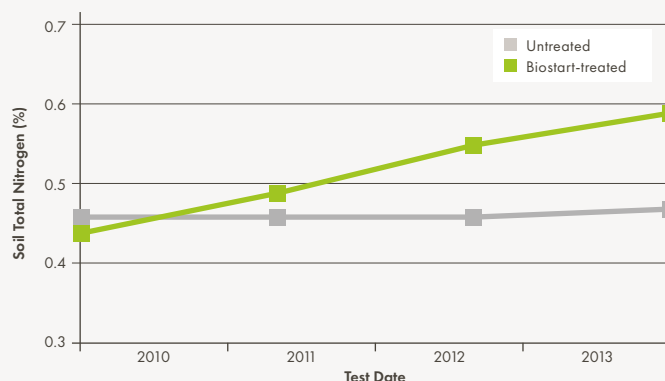
Photo from a Bay of Plenty kiwifruit orchard, comparing untreated and Biostart-treated soil.

FIGURE 1.

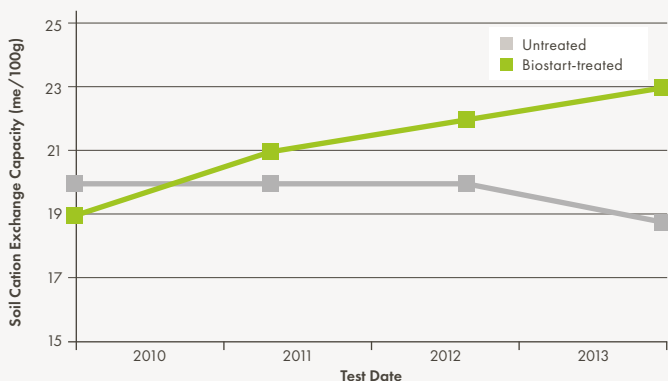
Soil organic matter (%)



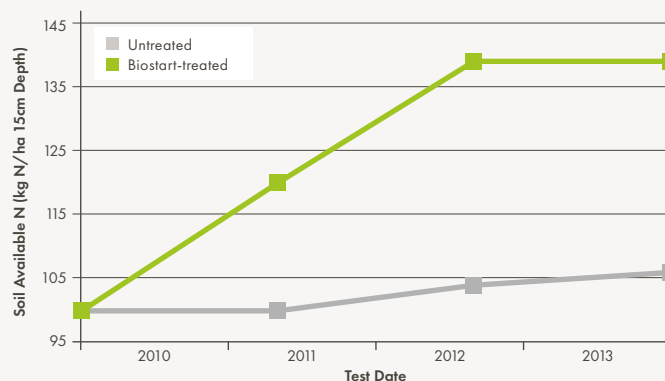
Soil Total Nitrogen (%)



Soil Cation Exchange Capacity (me/100g)



Soil Available Nitrogen (kg N/ha 15cm Depth)



Leaf Test Results

The higher yields in the Biostart-treated block led to some soil nutrients being more depleted than in the untreated block, however, the leaf tests of the Biostart-treated vines consistently showed higher mineral levels than the untreated vines throughout the trial (**Figure 2**).

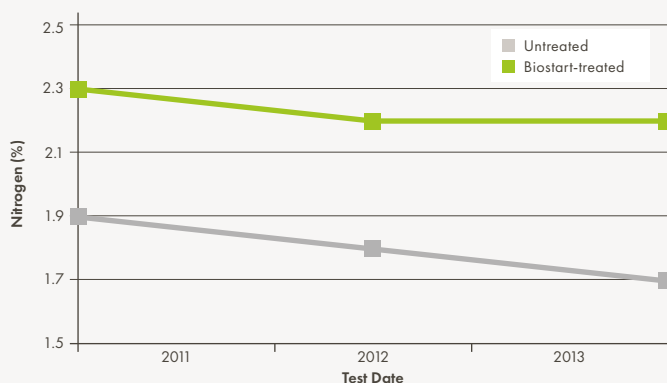
One pertinent example is soil phosphorous where the Olsen P levels in the Biostart-treated block decreased below that of the untreated block, but in the leaf P levels were higher in the Biostart-treated block (**Figure 2**) compared to those in the untreated block.

Similarly, levels of calcium, potassium and magnesium decreased in the soil of the Biostart-treated block, again due to the higher yields removing these minerals. Again the leaf tests showed greater levels of these nutrients in the vines in the Biostart-treated block when compared to the untreated vines.

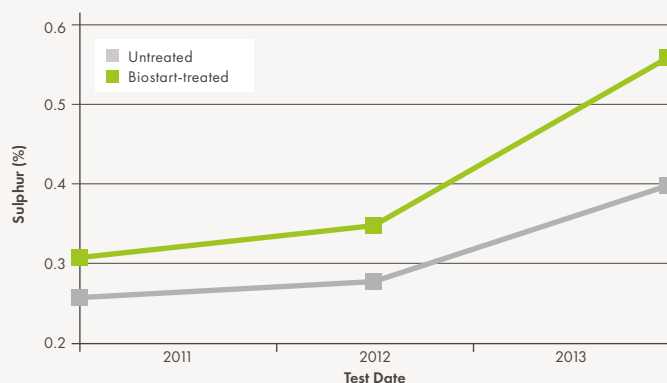
Having a more biologically active soil and a more active root system meant vines could not just take up more minerals to create bigger yields, but they could also compensate for lower soil levels of key plant nutrients (**Figure 2**).

FIGURE 2. Impact of the Biostart Programme on Kiwifruit Leaf Nutrient Status – Macronutrients and Micronutrients.

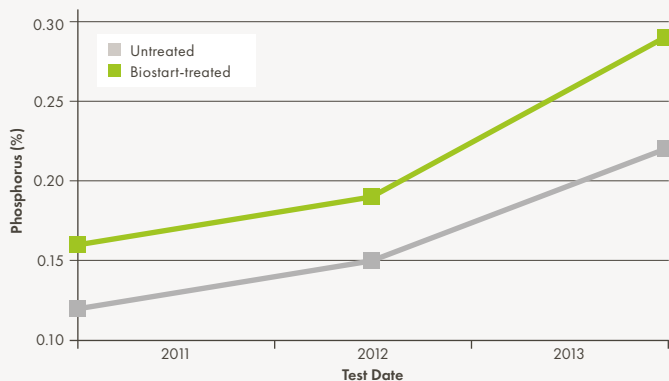
Leaf Nitrogen (%)



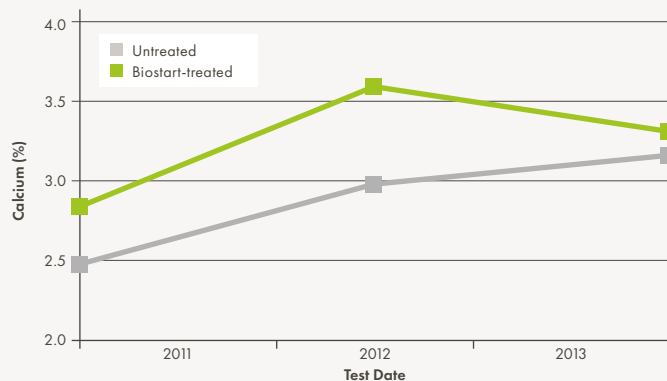
Leaf Sulphur (%)



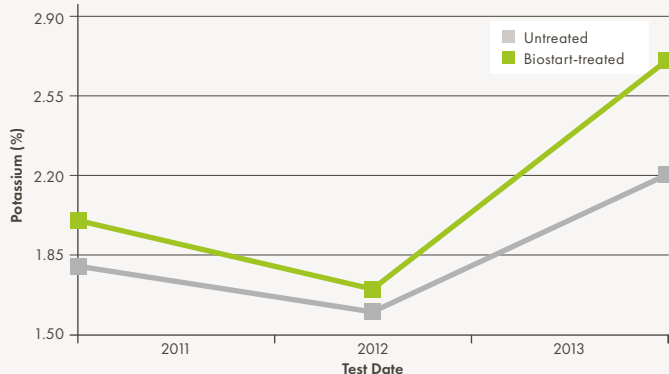
Leaf Phosphorus (%)



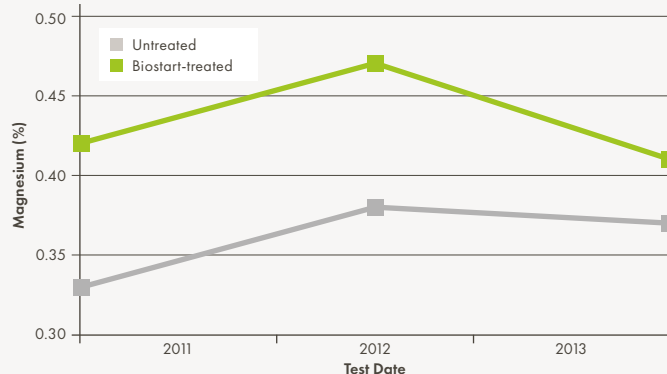
Leaf Calcium (%)



Leaf Potassium (%)



Leaf Magnesium (%)



HARVEST RESULTS

2010/11 Season

The Biostart programme increased the harvest weight by 5,161 kg/ha (12%) and the number of export trays/ha by 2,953 (27%) over the standard block. The weather was normal and the yield was well above the Whakatane District average. Average fruit size was similar in both blocks, showing that the yield increase did not impact fruit size. The reject rates were similar for both treatments.

2011/12 Season

The Biostart programme increased the harvest weight by 3,593 kg/ha (8%) and the export trays/ha by 362 (3%) over the standard block. The season was wet and yield was well above the Whakatane District average. Average fruit size and the reject rate was similar for both blocks.

2012/13 Season

The Biostart-treated block had a higher harvest weight by 3,948 kg/ha (19%) and 949 (18%) more export trays/ha above the standard treatment. There was severe frost damage in spring and a drought after December which negatively affected fruit set, fruit size and yield. The blocks were harvested for Kiwistart which further reduced the yield and fruit size. The yield from both blocks was below the Whakatane District average.



ORCHARD GATE RETURNS

In 2010/11 the use of the Biostart Programme increased OGR by \$12,388/ha (34%), whereas in the wet 2011/12 season the OGR was increased by \$1,458/ha (3%). In the frost and drought affected 2012/13 season the Biostart Programme increased profitability by \$5,228/ha.

Over the three years of the trial the average orchard gate return for the Standard and Biostart-treated blocks was \$36,283 and \$42,624/ha/yr, respectively. The total increase in OGR of the programme was \$19,024/ha or \$6,341 /ha/yr (17.5%).

CONCLUSION

A three-year programme using Biostart Mycorrhin and Digester products in a commercial Hayward kiwifruit orchard resulted in:

- Improved soil fertility due to increases in soil organic matter, soil cation exchange capacity and soil plant-available nitrogen levels
- Mobilisation of soil phosphorous reserves making it plant-available
- An improvement in the plant uptake of macronutrients, micronutrients and trace elements.
- A consistent increase in fruit yield over three very different growing seasons: normal, wet, frost and drought.
- Better water use efficiency
- A 17.5% (\$6,341/ha/yr) increase in orchard gate returns over the three years for an annual investment of \$640/yr.

This trial demonstrated that improving soil fertility through use of the Biostart Programme resulted in financial benefits for the grower.

	2010/11		2011/12		2012/13	
	Standard	Biostart	Standard	Biostart	Standard	Biostart
Picking date	6 June 11	30 May 11	13 May 12	13 May 12	3 Apr 13	3 Apr 13
Harvest weight (kg/ha)	42,304	47,465	42,295	45,888	21,318	25,266
Average size	30	29	34	33	35	36
Export trays/ha	10,775	13,728	10,439	10,801	5,416	6,365
Orchard Gate Returns (\$/ha)	\$35,978	\$48,316	\$41,945	\$43,403	\$30,926	\$36,154
Increase in OGR (\$/ha)		\$12,338		\$1,458		\$5,228
Whakatane Avg trays/ha	5,943		7,419		7,536	

Note: costings are for 2013