



Better Soil | Better Crops | Better Return

LONGRIDGE OLIVES SOIL & LEAF REPORT 2015-2020

Background:

Jim and Lisa Rountree started using the Bactivate Program in 2015 after initial soil samples were collected and a visual and physical assessment was conducted on their olive trees and soil structure near Coonalpyn, SA.

The Bactivate Program is designed to add specific microbes required for nutrition conversion, plant immune health and growth by adding in key Bacillus bacteria in an antagonistic form while feeding those microbes, initiating soil structure improvements and driving increased cropping outcomes for a long-term sustainable solution.

The soil was considered very sandy, and the trees were underperforming in many areas of the farm due to the inability of the soil to hold nutrients applied and the trees' inability to process these nutrients. This was highlighted by an extensive foliar fertiliser spray program that was costly and less effective than improving the soil structure, biological content and balance, hence the decision by Longridge Olives to begin on the Bactivate Program.

The Bactivate Program was implemented with a long-term view of building the soil structure, the nutrient holding capacity, nutrient availability, organic matter and tree health through the addition of specific Bacillus bacteria (Bactivate 5 Liquid), high grade seaweed fortified with 18 amino acids (Bactivate Seaweed Solution) and carbon/humic based biostimulants (Bactivate BioBoost/Bactivate BioBoost Enhance). Amino acids can do a number of functions in the soil such as making calcium up to 1 million times more available for uptake and provide a nitrogen source for the plant and microbes. The aim was to reduce the number of foliar fertilisers required, improve the organic matter content of the soil, build the soil structure, increase the soils' ability to hold on to nutrition leading to improved nutrient uptake by the tree and improve cropping outcomes.

Leaf samples conducted in Jan/Feb 2021 are also attached to show the trees' uptake of nutrients to analyse against the soil samples collected in 2020 with a full comparison of the soil compared to initial tests taken in 2015.

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The Bactivate Program:

Longridge Olives applied their tailored Bactivate Program twice per annum between 2015-2018 and have moved to one application per annum since 2019 based on the trees response and the improvements to the soil structure, organic matter and nutrient holding capacity (CEC).

Their program consisted of Bactivate 5 Microbial Liquid (5 species of Bacillus bacteria), Bactivate Seaweed Solution (Seaweed solution fortified with 18 amino acids) and Bactivate BioBoost (lignite-based carbon/humic) applied twice per annum starting in spring.

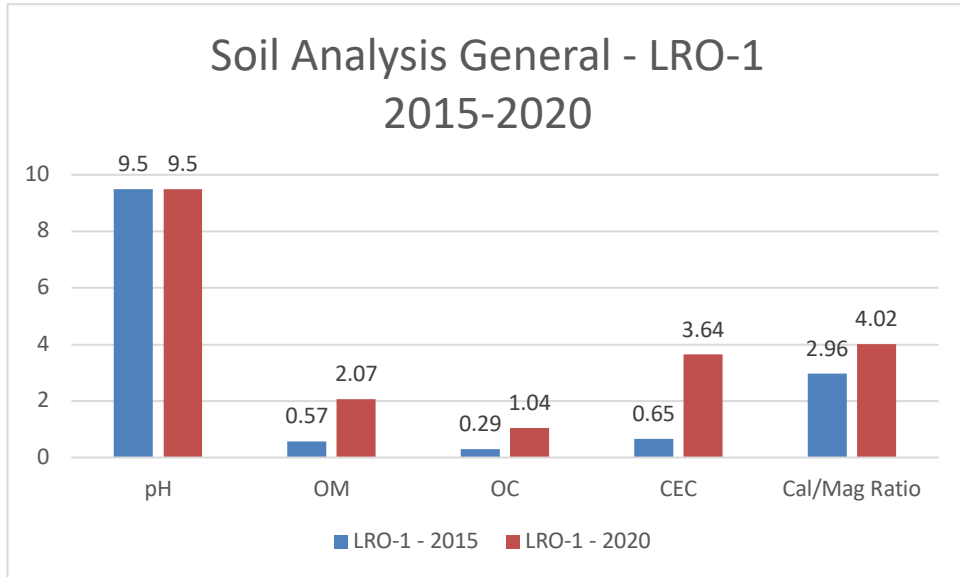
In 2020, after assessing the most recent soil samples, the program was re-assessed and Bactivate BioBoost was replaced with Bactivate BioBoost Enhance (Plant based carbon/humic product with key trace elements) as this product has been developed to replicate the exact food and energy source that the tree excretes through its roots to feed and stimulate biological growth. With the pH levels still far too high and the soil structure improving, it was decided that stimulating biological growth was a priority based on the current data.

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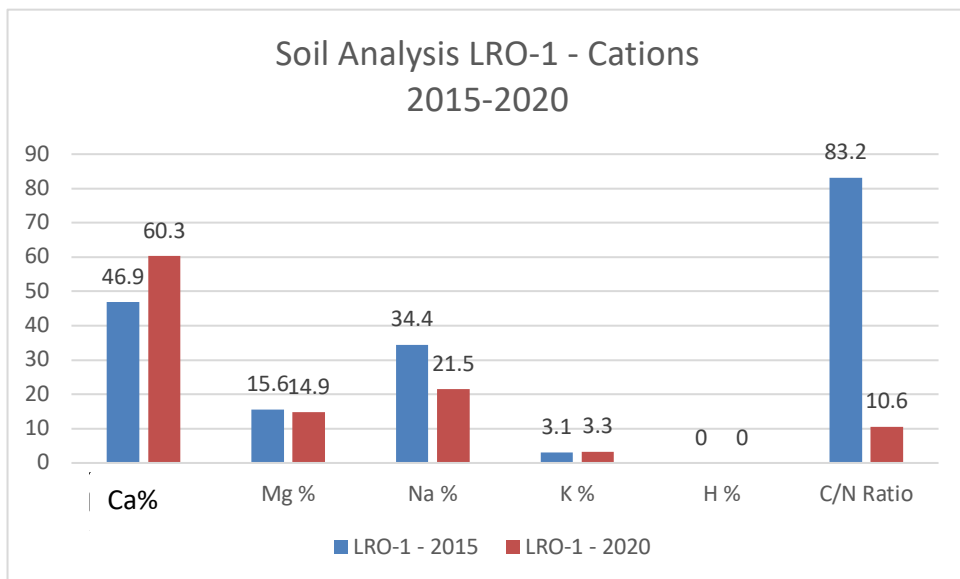
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ABN 30 640 475 832

The Results so Far...

SOIL COMPARISONS LRO-1



- Organic matter has increased by 263% and organic carbon has increased by 258%
- CEC has increased by 460%
- Cal/Mag ratio should be between 2-4 but it is important to reference this against the cation balance of each nutrient



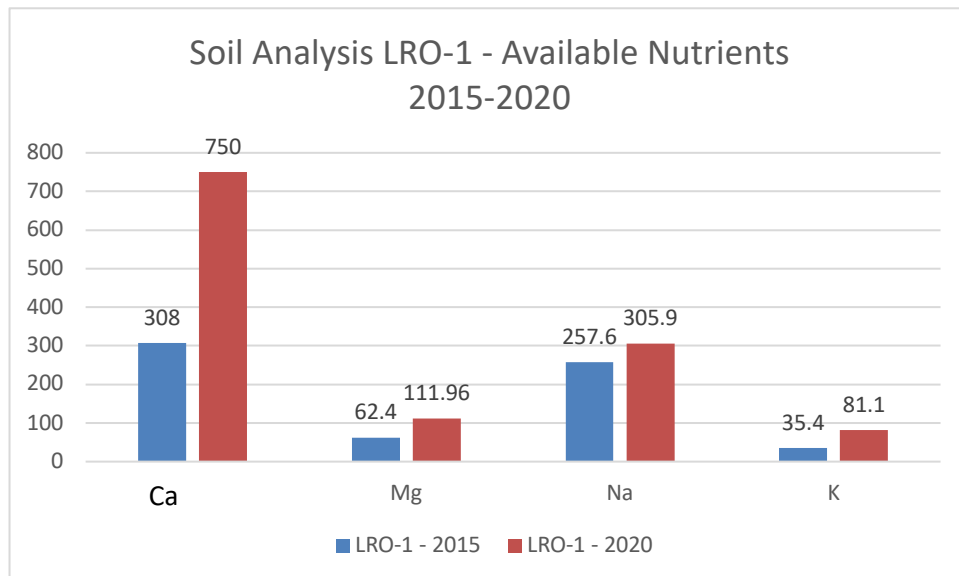
- Calcium is closer to the desired percentage of 65%
- Magnesium is within the desired percentage of 15%

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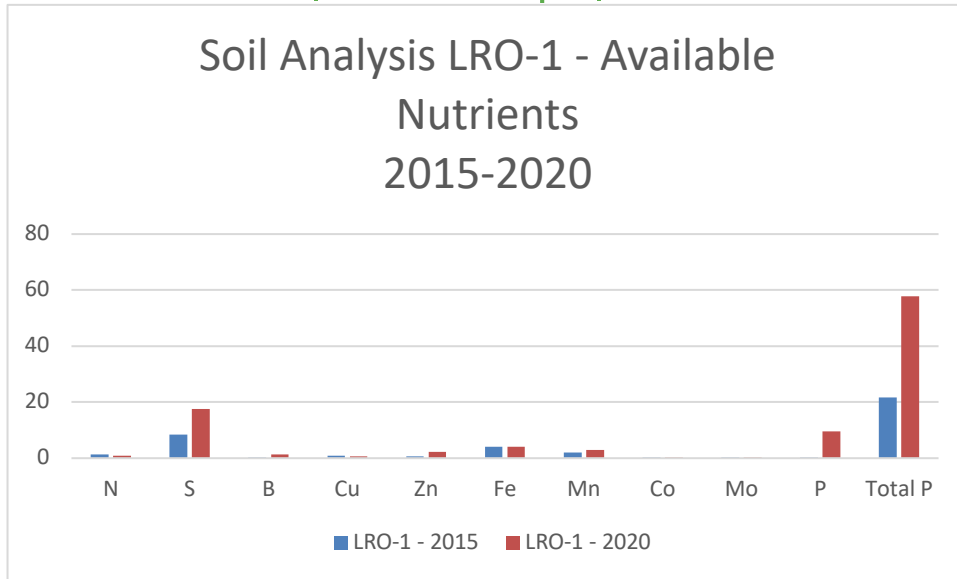
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- The soil is extremely sodic. Sodic soil is soil with an exchangeable sodium percentage of 6% or greater of the exchange capacity. Although levels have decreased by 60%, the sodium levels are extremely high and need addressing.
- Carbon/Nitrogen ration is important for biological growth. To acquire the **carbon** and **nitrogen** a **soil** microorganism needs to stay alive (body maintenance + energy) it needs a diet with a **C:N ratio** near 24:1, with 16 parts of **carbon** used for energy and eight parts for maintenance
- The average soil c/n ratio should be between 10-15 as this strikes a good balance of the tree's requirements and the microbial requirements. The results are now within the desired range and this is evident with the increases in organic matter
- When the carbon/nitrogen ratio is too high as it was previously, decomposition of plant materials ceases and organic matter production stops. This was evident at an organic matter content of 0.1%. There is improvement in the organic matter levels and the c/n ratio has reduced significantly

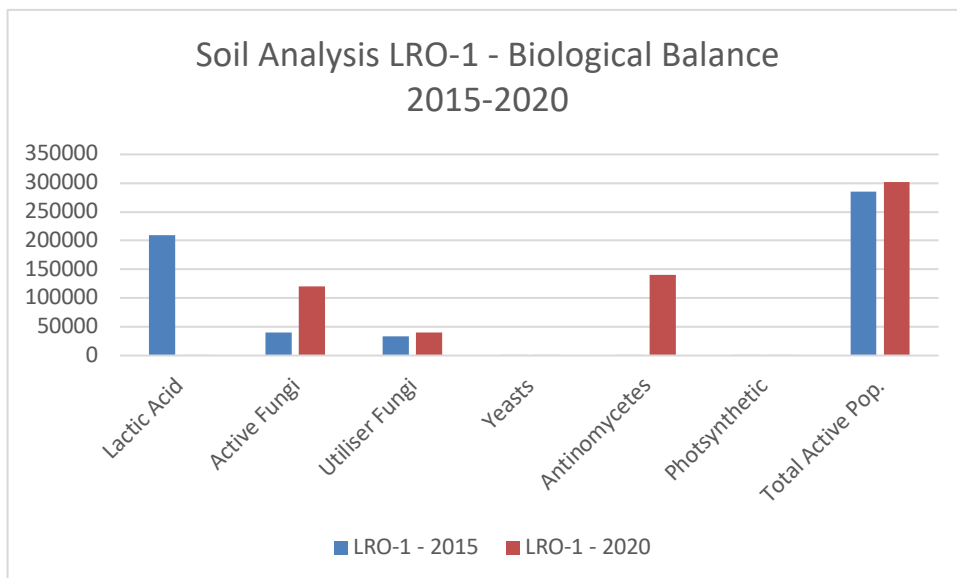


- Calcium availability has increased by 143%
- Magnesium availability has increased by 79%
- Potassium has increased by 129%
- It is clear that the Bactivate Program is improving the soil structure, the organic matter and carbon content, the cation balance, the nutrient availability and the biological balance

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- Available phosphorous has increased by 9360%
- Total phosphorous has increased by 166%. This is directly related to the soils CEC (the cation exchange capacity) as this is the soils ability to hold on to nutrients for the bacteria and fungi to convert.
- Available sodium has increased over the period by 18%. This could be due to the unlocking of nutrients by the bacteria but over the next few years, this number should start to decrease as the sodium cations continue to fall



- Lactic Acid bacteria proliferate in anaerobic soil and are also present when there is pathogen activity in the soil. The reduction of Lactic Acid Bacteria along with the increase in active and utiliser fungi shows the change in the biological content of the soil.



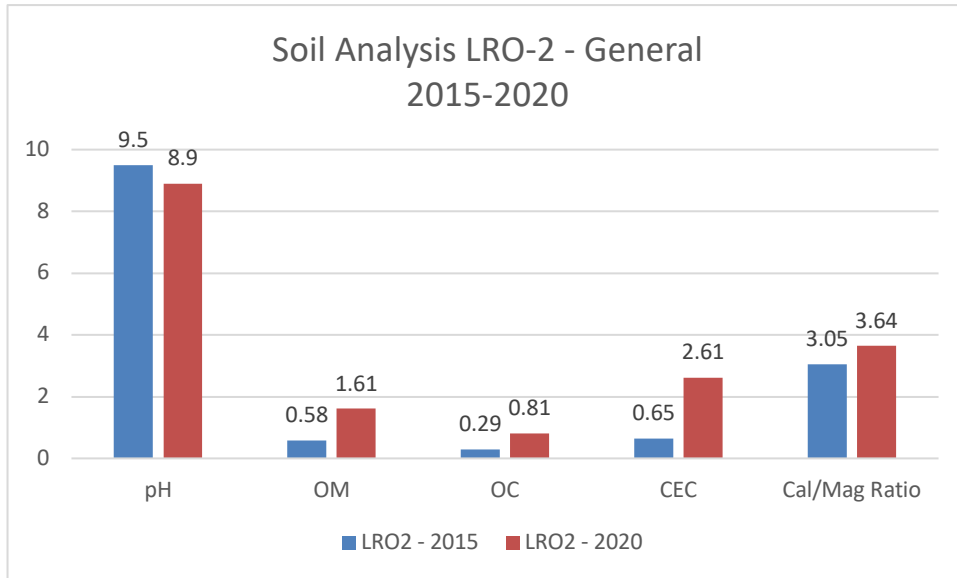
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- Antinomycetes are converters in the soil and can break down hard to decompose compounds. These species are found in higher levels in higher pH soils. These bacteria will be breaking down the organic matter in the soil. These bacteria can also show up in the test SWEP provide as the Bacillus bacteria that have been applied.
- The soil is still in need of repair and with the pH at the levels they are at, the bacteria added from Bactivate won't be functioning at their full capacity. This will be addressed with BioBoost Enhance as this carbon source will directly stimulate the bacteria to grow and multiply and improve their rate of function.

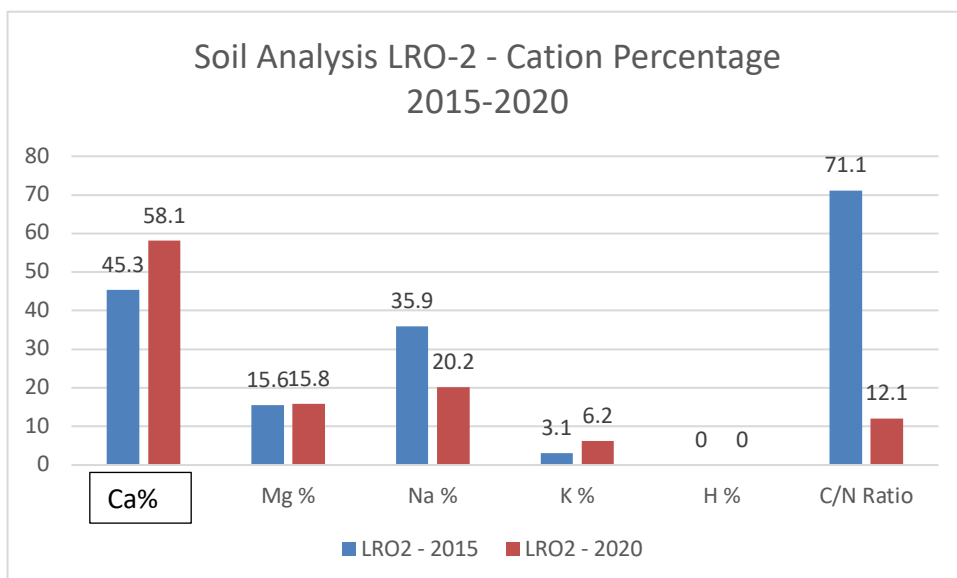
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SOIL COMPARISONS LRO-2



- pH has reduced by 0.6
- Organic matter has increased by 177%
- CEC has increased by 301%
- Cal/Mag ration is in a much better shape as the calcium cations have increased closer to the desired level in the soil while magnesium has stayed at the correct levels

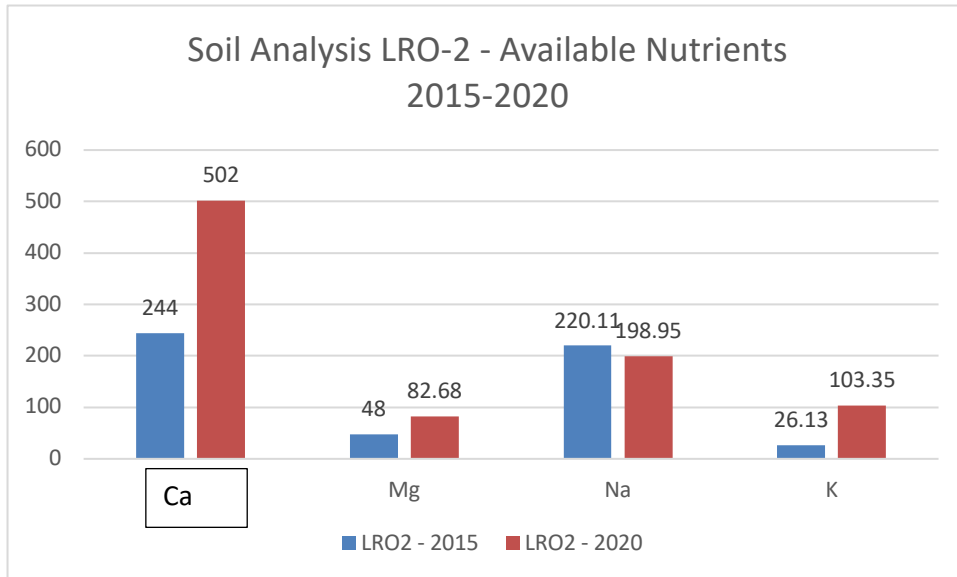


- Calcium cations have increased to closer to the desired levels

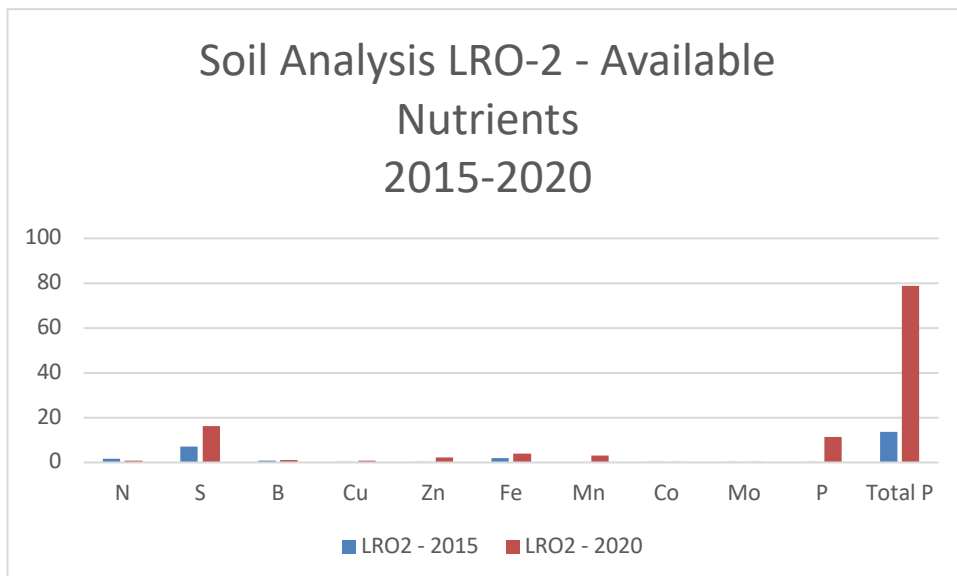


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- Sodium cations have reduced by 78%. This is critical to continue to reduce the sodium cations in the soil
- Potassium cations have increased closer to the desired levels
- Carbon/Nitrogen ratio has reduced back to desired levels and will stimulate decomposition of organic materials on the soil



- Calcium availability has increased by 105%
- Available magnesium has increased by 72%
- Available sodium has decreased by 9.6% although this number needs to be reduced to less than 70 ppm. BioBoost Enhance will stimulate the bacteria further to continue to bring this number back down. Other amendments should be also considered to reduce this further

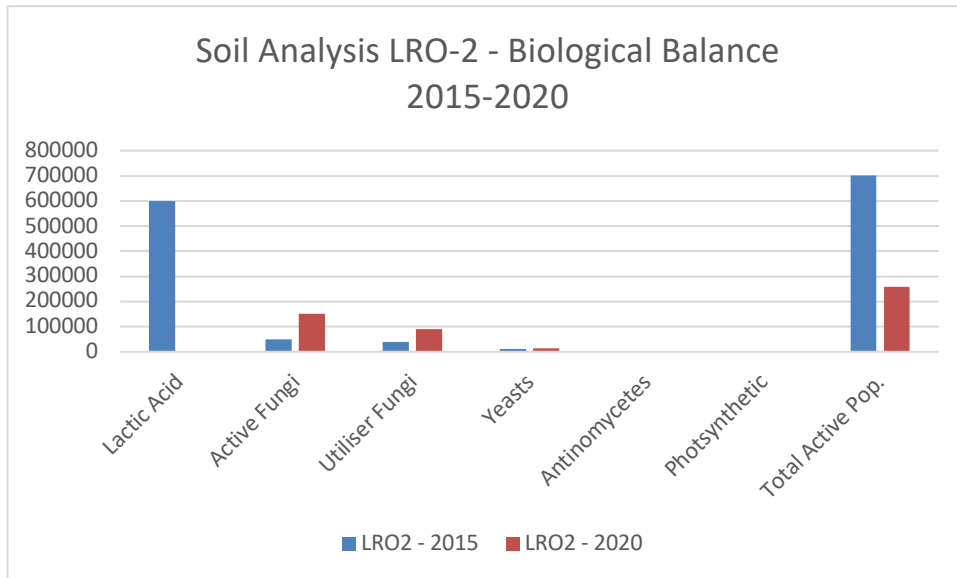


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- Of biggest note is the available phosphorous increasing by 11300%
- Total phosphorous has increased in the soil by 480% indicated by the increased CEC allowing the soil to hold onto nutrients better for conversion



- The biology counts are similar to LRO-1 showing improved fungal activity (the fungi can sometimes include bacteria in these counts)
- The biological population is in better balance with the bulk of the microbes counted in the 2015 soil test being lactic acid bacteria (see note from LRO-1 biological assessment)
- Antinomytes will grow depending on a number of factors outside of organic matter content such as mycelium growth and density. In higher density plantings, antinomytes will not grow anywhere near the level they grow in less dense plantings.

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LEAF TEST RESULTS 2021



DJ's GROWERS TISSUE TEST

Customer
Rowntree
Date
23 Feb 2021

Crop
Olive
Growth Stage
Jan/Feb

Standard/Test Type
DJ's Tissue Test
Barcode
110723467

Rowntree

► Barnea

NUTRIENT ELEMENT BALANCE CHART

	Result	Deficiency	Marginal	Normal	Above Normal	Excess	Target
Nitrogen	1.45 %						1.50-2.00 %
Nitrate - N	30 mg/kg						# mg/kg
Sulfur	S 0.14 %						0.10-0.25 %
Phosphorus	P 0.14 %						0.10-0.30 %
Potassium	K 1.11 %						0.800-1.20 %
Magnesium	Mg 0.16 %						0.10-0.50 %
Calcium	Ca 1.25 %						1.00-1.50 %
Sodium	Na 0.11 %						0.080-0.14 %
Chloride	Cl 0.16 %						0.20-0.39 %
Iron	Fe 51 mg/kg						30-130 mg/kg
Aluminium	Al 43 mg/kg						# mg/kg
Manganese	Mn 17 mg/kg						20-40 mg/kg
Boron	B 33 mg/kg						19-100 mg/kg
Copper	Cu 6.7 mg/kg						4.0-10 mg/kg
Zinc	Zn 15 mg/kg						10-30 mg/kg
Molybdenum	Mo 0.36 mg/kg						0.80-1.8 mg/kg

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DJ's GROWERS TISSUE TEST

Customer
Rowntree

Crop
Olive

Standard/Test Type
DJ's Tissue Test

Date
23 Feb 2021

Growth Stage
Jan/Feb

Barcode
110723468

Rowntree

▶ Arbequina 5

NUTRIENT ELEMENT BALANCE CHART

	Result	Deficiency	Marginal	Normal	Above Normal	Excess	Target
Nitrogen	1.70 %						1.50-2.00 %
Nitrate - N	30 mg/kg						# mg/kg
Sulfur	S 0.15 %						0.10-0.25 %
Phosphorus	P 0.17 %						0.10-0.30 %
Potassium	K 0.831 %						0.800-1.20 %
Magnesium	Mg 0.13 %						0.10-0.50 %
Calcium	Ca 1.27 %						1.00-1.50 %
Sodium	Na 0.32 %						0.080-0.14 %
Chloride	Cl 0.060 %						0.20-0.39 %
Iron	Fe 68 mg/kg						30-130 mg/kg
Aluminium	Al 66 mg/kg						# mg/kg
Manganese	Mn 33 mg/kg						20-40 mg/kg
Boron	B 46 mg/kg						19-100 mg/kg
Copper	Cu 9.5 mg/kg						4.0-10 mg/kg
Zinc	Zn 17 mg/kg						10-30 mg/kg
Molybdenum	Mo 0.66 mg/kg						0.80-1.8 mg/kg

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DJ's GROWERS TISSUE TEST

Customer
Rowntree

Crop
Olive

Standard/Test Type
DJ's Tissue Test

Date
23 Feb 2021








Growth Stage
Jan/Feb

Barcode
110723469

Rowntree

▶ Arbaquina 16

NUTRIENT ELEMENT BALANCE CHART

	Result	Deficiency	Marginal	Normal	Above Normal	Excess	Target
Nitrogen	1.81 %						1.50-2.00 %
Nitrate - N	30 mg/kg						# mg/kg
Sulfur	S 0.16 %						0.10-0.25 %
Phosphorus	P 0.17 %						0.10-0.30 %
Potassium	K 1.15 %						0.800-1.20 %
Magnesium	Mg 0.12 %						0.10-0.50 %
Calcium	Ca 1.56 %						1.00-1.50 %
Sodium	Na 0.17 %						0.080-0.14 %
Chloride	Cl 0.10 %						0.20-0.39 %
Iron	Fe 64 mg/kg						30-130 mg/kg
Aluminium	Al 59 mg/kg						# mg/kg
Manganese	Mn 32 mg/kg						20-40 mg/kg
Boron	B 51 mg/kg						19-100 mg/kg
Copper	Cu 6.5 mg/kg						4.0-10 mg/kg
Zinc	Zn 17 mg/kg						10-30 mg/kg
Molybdenum	Mo 0.56 mg/kg						0.80-1.8 mg/kg

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DJ's GROWERS TISSUE TEST

Customer
Rowntree

Date
23 Feb 2021

Crop
Olive

Growth Stage
Jan/Feb

Standard/Test Type
DJ's Tissue Test

Barcode
110723470

Rowntree

► Kononeiki

NUTRIENT ELEMENT BALANCE CHART

	Result	Deficiency	Marginal	Normal	Above Normal	Excess	Target
Nitrogen	1.49 %						1.50-2.00 %
Nitrate - N	30 mg/kg						# mg/kg
Sulfur	S 0.13 %						0.10-0.25 %
Phosphorus	P 0.10 %						0.10-0.30 %
Potassium	K 0.902 %						0.800-1.20 %
Magnesium	Mg 0.16 %						0.10-0.50 %
Calcium	Ca 1.48 %						1.00-1.50 %
Sodium	Na 0.30 %						0.080-0.14 %
Chloride	Cl 0.070 %						0.20-0.39 %
Iron	Fe 100 mg/kg						30-130 mg/kg
Aluminium	Al 120 mg/kg						# mg/kg
Manganese	Mn 44 mg/kg						20-40 mg/kg
Boron	B 31 mg/kg						19-100 mg/kg
Copper	Cu 8.1 mg/kg						4.0-10 mg/kg
Zinc	Zn 18 mg/kg						10-30 mg/kg
Molybdenum	Mo 1.2 mg/kg						0.80-1.8 mg/kg

Leaf samples were collected across the farm with samples collected over 4 varieties (see above). With the exception of N being marginally under the required range (but not in the deficient zone), all nutrients are within the zones they require, showing a well-functioning tree from a nutritional perspective.

The trees have improved from a visual perspective and look in good health with excellent lateral growth and fruit set (see below)

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CONCLUSIONS:

With the soil structure as it was, and the water source being used from the bore, the improvements in the soil structure, organic matter, CEC and nutrient availability is excellent over a 5-year period. One of your biggest limiting factors is the water coming from the bore. Sodium is extreme, and the chloride level is very high, along with a pH of 8.2 adding to the already high pH levels found in the soil.

The improvements in the soil and biological content of the soil have led to reductions in fertiliser requirements, less foliar feeding and improved cropping outcomes compared to prior to the implementation of the Bactivate Program.

Bactivate BioBoost (lignite coal-based soil conditioner) was replaced with Bactivate BioBoost Enhance (plant-based bio-stimulant) based on the pH and sodium levels in the soil samples. Lignite coal-based soil conditioners containing carbon, humic and fulvic acids will assist in rebuilding the soil structure but will only provide limited food requirements for microbes. Bactivate BioBoost Enhance is a plant-based bio-stimulant that contains phosphorous and other micro and macro elements that drive biological energy production and will increase population density. This can have a beneficial effect on the pH and increase the reduction in sodium in the soil, offsetting some of the problems by using highly salty bore water.

It is recommended to speak to a water specialist to investigate ways of reducing the salinity in the bore water.

Further soil and leaf tests will be conducted at the same times in 2021/2022 to assess the performance of the changed program along with visual assessments of the soil and trees.

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