JANUARY 2021

MANAGING SOIL HEALTH IN WERRIBEE SOUTH

Year 1 update

BACKGROUND

About Werribee South

Werribee South is located 32 km south-west of Melbourne and covers an area of 3,000 hectares. It contains approximately 150 vegetable farms which produce a range of vegetable crops consisting predominantly of brassicas and lettuce cultivars.

Since January 2007, the Werribee South growing region has been part of the Werribee Irrigation District Recycled Water Scheme. The scheme delivers significant amounts of much-needed water to a large proportion of the region, thus assisting year-round cropping of vegetables.

Whilst this irrigation water is beneficial to the region, a downside is that it has a relatively high salt concentration, especially high levels of sodium and chloride resulting in a high electrical conductivity (EC). Salt levels may fluctuate between 800 mg/L and more than 1000 mg/L salt or an EC of 1.4 dS/m to more than 1.8 dS/m. The low annual rainfall of approximately 542 mm means that salts are not washed from the rootzone.

Continuous vegetable production and associated tillage means that soils in the region are generally low in organic carbon. These factors combined with the naturally sodic soils (red Sodosols) presents a range of production challenges for vegetable growers in the region. Irrigation, nutrition and overall soil health need careful management.

About the demonstration site

The Soil Wealth and Integrated Crop Protection project worked with growers Adam Ballan, Shane Sutherland and John Fabian of Fresh Select, and agronomist Stuart Grigg of Stuart Grigg Ag-Hort Consulting, to set up a demonstration site in Werribee South. E.E. Muir & Sons agronomy services contributed to the work on the site in 2020 via investigating effects of applying calcium thiosulfate (CaTS). The objective of the ongoing demonstration trial site is to:

- find out how to lessen the effects of high water and soil salinity and soil sodicity on vegetable crops
- improve resilience against challenging and variable conditions due to variable water quality and soil conditions within management units
- reduce input costs related to current management approaches and/or increase profit margins via increased marketable yields of high quality vegetables.

KEY MESSAGES

- Victoria's Werribee South vegetable growing region predominately produces brassicas and leafy greens. A relatively high salt concentration in irrigation water, combined with low annual rainfall and naturally sodic soils, presents a range of production challenges for vegetable growers.
- A demonstration site was developed to improve crop resilience and investigate the impact of compost, gypsum and soluble calcium on salinity, sodicity effects on crops and overall soil health in the region.
- The growers and agronomists involved in this trial said it has resulted in improved crop yield and quality, and provided a great use of resources to target a major issue specific to Werribee South.

This project has been funded by Hort Innovation using the vegetable, fresh potato and potato processing research and development levies and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

MANAGING SOIL HEALTH IN WERRIBEE SOUTH

January 2021

SoilWealth NURTURING CROPS

Integrated Crop Protection PROTECTING CROPS

FARM DEMONSTRATION TRIAL SET-UP

To achieve the objectives of the demonstration trial site, the use of compost along with gypsum and soluble calcium was investigated to improve overall soil condition, as well as the availability of nutrients and supress the uptake of sodium and chloride by crops.

The Soil Wealth and Integrated Crop Protection project worked with Adam, Shane, John and Stuart on demonstrating management approaches aimed at reducing the negative effects of saline water, sodic soils and low soil organic matter levels on a broccoli, cauliflower and lettuce crop.

The cauliflower crop was planted in May 2020 and harvested in October 2020.

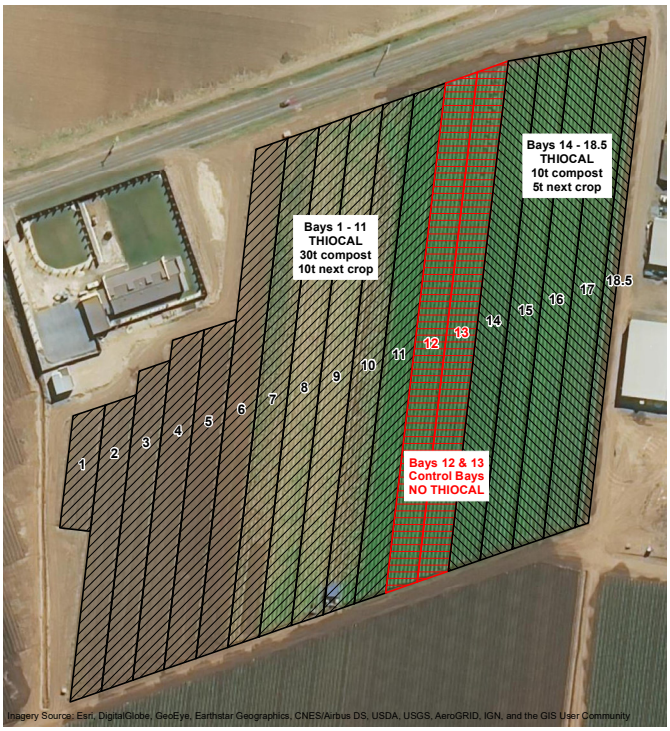

Figure 1: Demonstration site trial map.

The trial site is located on a 4.08 ha block at Fresh Select in Werribee South. It undergoes a regular intensive cropping cycle of lettuce, cauliflower and broccoli.

The site, similar to large parts of the region, has had significant problems with the combined effects of sodicity and salinity.

In recent years, these issues have been alleviated with the application of gypsum, CaTS and high inputs of mineral fertilisers.

While these inputs have resulted in beneficial outcomes in the short-term, they are not seen as sustainable long-term solutions.

A tailored approach

The demonstration trial was designed to examine the effects of different application rates of compost, gypsum and CaTS, to improve justification for future decision-making on the farm and the wider Werribee area.

To adequately understand the variations within the trial site, at the beginning of the trial both EM38 and gridded soil testing were undertaken.

Results of the testing showed a range of variations within the field which could be specifically addressed with variable rate application of ameliorants. In this case, the testing showed specific 'hot spots' within the field that were highly sodic.

The information was used for the trial site design and ultimately to alleviate the issues associated with sodicity and salinity.

Figure 1 shows a map of the trial site design, which consisted of a total of 18.5 bays over the 4.08 ha block.

Hort Innovation

ahr applied horticultural research

RMCG

This project has been funded by Hort Innovation using the vegetable, fresh potato and potato processing research and development levies and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

Specific applications

Gypsum was intended to be applied to the site at rates according to the results of the EM38 soil mapping which were recommended at 5 or 8 tonnes per hectare (see Figure 2). However due to complications with the application, bays 14-18.5 only received 3 tonnes per hectare. CaTS was applied three times in the crop at 50L/ha each time evenly spaced out through the growing period.

In order to gain an understanding of the effects of CaTS on sodicity and salinity expression in the crop, CaTS was withheld from the control bays (12-13) for the months of June, July and August 2020. During this time, plant sap samples were taken from control bay 12 (gypsum, no compost and no CaTS) with treated bay 10 (gypsum, 30 t/ha compost and CaTS) by E.E Muir & Sons agronomist Camila Humphries.

CaTS applications resumed to crops following cauliflower in September 2020. Results of this testing showed higher plant sodium levels in the bays where CaTS was withheld (control) than in the bays that were treated with CaTS during that time.

Although a positive result, it does not demonstrate the effect of CaTS by itself, but its effect in combination with compost compared to the control that only had received gypsum and no CaTS.

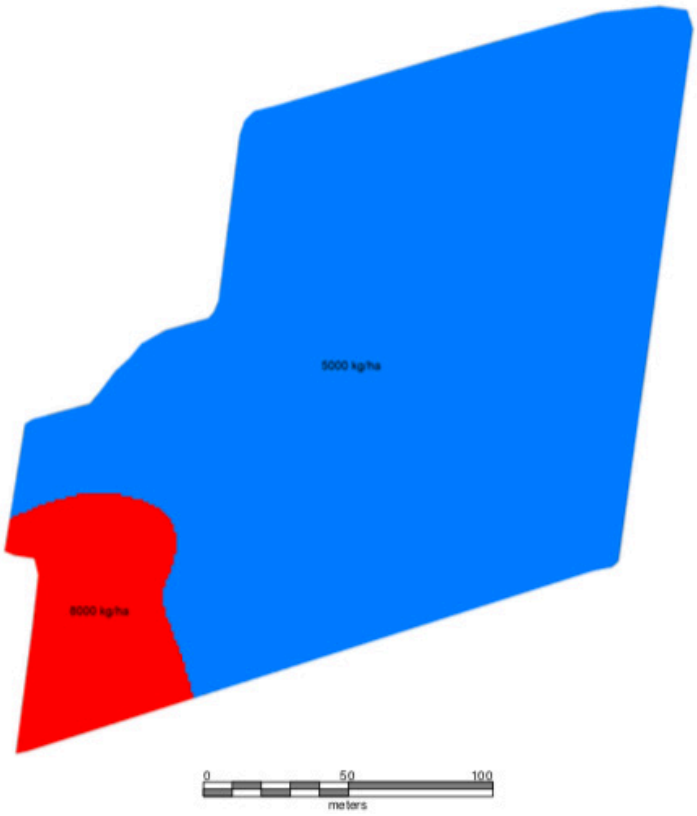

Figure 2: Variable rate gypsum application.

Treatment	Bay 1-11	Bay 12-13	Bay 14-18.5	Application Timing
Compost (t/ha)	30	0	10	December 2019
Gypsum (t/ha)	5-8 depending on EM38 map		3	January 2020
Calcium thiosulfate (L/ha)	50 x 3 applications	0	50 x 3 applications	June to August 2020

Table 1: Treatment applications.

Hort Innovation
ahr applied horticultural research
RMCG

This project has been funded by Hort Innovation using the vegetable, fresh potato and potato processing research and development levies and contributions from the Australian Government. Hort Innovation is the grower-owned, not-for-profit research and development corporation for Australian horticulture.

Figure 3: High applications of compost have reduced surface crusting.

SOIL QUALITY AND CROP OUTCOMES

Although still in its early stages, the trial site is seeing some positive results specifically in relation to soil condition.

Visual assessment of the site's soil physical characteristics demonstrated that both application rates of compost reduced soil surface crusting and cracking compared to the control. Crusting and cracking, as well as stickiness during wet times, are an indicator of high levels of sodium in the soil (see Figure 3).

These observations are yet to be backed up by soil testing data. The hypothesis is that the effects of the combination of the ameliorants applied will most likely be realised at the site in the longer term rather than in the first crop after treatment.

Yield, root density and quality assessments were undertaken at the site at the end of year 1. Root samples from the recently harvested cauliflower crop were compared from bays 12-13 (control) and bays 1-11 to observe whether there were any visual differences in the first year. Minimal observable differences were found between yield, quality and root density in the first year's crop rotation. The effects of applications of organic ameliorants often take time to be realised in intensively cropped soils with multiple challenges and high nutrient inputs. Therefore, notable change in the above-mentioned variables were not expected to occur within the first year.

It is expected that further beneficial outcomes will be reported over the coming years, which will be useful for the entire Werribee region and other vegetable growing regions affected by salinity or sodicity.

What does this mean for growers?

Both Shane and Stuart are pleased with the progress of the trial site.

"We have seen a massive difference in the size and quality of the crop and have been able to get it in faster. It has improved yield, there are cost savings through reduced fertiliser use and potential water savings as well," Shane said.

Stuart added the trial is a great use of resources to target a major issue specific to Werribee South.

"Water quality and availability is a challenge we must all manage with great focus to produce nutritious crops sustainably," he said.

"We are taking the approach in this trial of 'build it and they will come'. We have seen the benefits of cover crops and growing in new paddocks (those without a long term vegetable production history) where soil organic carbon levels are much higher than the norm and work towards sustainably remediating our soils, but recognising it won't happen overnight. Fresh Select has a focus on soil health and is committed to growing for the future."

FURTHER READING

Want to know more? Access these great resources from the Soil Wealth ICP website.

- Managing sodicity in vegetable crops fact sheet
- Managing salinity in vegetable crops fact sheet
- South Australian grower compost trial case study
- Organic soil amendments global scan and review