

29 May 2018

## OHD PROJECT UPDATE

### Summary

- Second PDU Design Complete, Build to Commence
- OHD liquid as Plant Growth Biostimulant Tests Status
- Plant Growth Market Statistics
- Consultant Agronomist Engaged
- Other OHD Uses Being Investigated

### SECOND PDU PROGRESS

Greenpower is pleased to report that its intention to build and operate its own Oxidative Hydrothermal Dissolution (OHD) Process Demonstration Unit (PDU) has progressed to the point where the PDU design has now been completed by Epic Systems Inc in St Louis USA.

Greenpower's retained engineering consultants, HRL Technology of Mulgrave Victoria, will travel in June to St Louis USA to complete a final review of the design with the Epic Systems engineers, and will then travel to visit Thermaquatica in Illinois to discuss improvements including the new add on being a Gas Collection analyzer and the results of recent PDU 1 tests.

The Greenpower's PDU will be based on, but substantially improved from, the only existing OHD plant in the world namely the PDU operated by Thermaquatica in Illinois. Our PDU will be constructed in the US by Epic (which is the firm that built Thermaquatica's PDU) and is designed to be brought to Victoria in a complete state in a container, and will be housed by HRL in Mulgrave, where it will initially process Victorian Brown Coal ("VBC") to obtain liquid for Greenpower's testing work.

When HRL completes their design review in June and confirms approval, the first construction phase will commence, with ordering of long lead items such as heaters and pumps. The plant build will be carried out in the USA. Subject to funding Greenpower envisages having its' PDU in Victoria and operating by mid next year.

Having our own PDU operational in Australia will greatly facilitate and enhance Greenpower's conduct of tests of the liquid produced from VBC and enable the planning of downstream platform chemical production.



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## **TESTING OHD LIQUID AS A PLANT GROWTH BIOSTIMULANT**

### **Recap: OHD Liquid As An Agricultural Biostimulant**

The chemical makeup of the OHD liquid is similar to the “Fulvic” products currently being marketed as agricultural bio stimulants. Research chemists at Monash University were tasked with carrying out trials to understand whether the OHD liquid had any bio stimulant effect on plants. This is an active ongoing investigation.

Initial glass house trials reported that productivity for tomatoes and wheat is substantially improved with an application of the OHD liquor. The results from glass house trials with tomatoes and wheat where the trials established that the OHD liquid can stimulate plant productivity. Refer Monash University Presentation following.

### **Most Recent Tests**

In late 2017 Monash University, in conjunction with Chisholm TAFE College undertook 2 studies, which were reported to Greenpower in May 2018. One study was a pot trial using Cranbourne soil in glasshouse conditions, of processing tomatoes, and, separately, of wheat in Ouyen soil, and the other was a glasshouse hydroponic trial of fresh tomatoes.

Regrettably, the results from Both studies have had to be discarded by Greenpower, as unbeknown to Monash, the OHD material obtained from Thermaquatica and supplied to Monash was, at a substantially different strength (by a factor of 4) to that which Monash thought they had received and were utilizing. This issue was only discovered late in the trial process; however, it was determined to run the trial to completion, then extensive chemical analysis of the OHD material used was undertaken to ascertain the characteristics of the OHD liquid that had been applied. Whilst some increase in plant fruiting was noted, the fact the program did not test the Biostimulant liquid as intended has now meant further tests are being planned, with additional safeguards being implemented to ensure this error is not repeated.

There are a large number of variables involved in any plant productivity and more trials mainly at pot scale are planned to determine the effective parameters for the enhanced plant productivity as seen in the original glasshouse trials. Those further tests are now being planned and an announcement will be made when they are ready to commence.

## **AUSTRALIAN COMMERCIAL PLANT PRODUCTION ANALYSIS COMPLETE**

The survey and analysis commissioned by Greenpower to be carried out by Melbourne Consultancy firm Metrix has been completed, and now gives Greenpower a powerful picture of all of the fruit, vegetables, cereal crops, other commercial crops (e.g. cotton, turf, flowers, trees etc.) grown commercially in Australia and will be a useful tool in planning future testing, and eventually marketing product.

Commercial Plan, GPP has had two separate models prepared by external consultants both of which support the project. These will be remodeled once the further bio-stimulant plant trials have been completed.

### **CONSULTANT AGRONOMIST ENGAGED**

Greenpower is pleased to report that it has retained the consultant services of Dr. Cassandra Schefe, a Victorian based practicing agronomist, to assist the Monash personnel in the planning and design of tests on plants of the liquid converted from Victorian Brown Coal.

### **INVESTIGATION OF DOWNSTREAM OHD USES**

Greenpower is now participating in programmes designed to develop protocols for converting its constituent chemicals into useful platform chemicals which are usually derived from hydrocarbon feedstock. One of the world leaders in this work is NREL\* in Colorado, USA via its "lignin valorization programme". We have supplied some of our OHD fluid derived from Victorian Brown Coal to NREL for testing to determine whether it is likely to be a suitable feedstock for their valorization programme.

\*NREL: The National Renewable Energy Laboratories based in Golden Colorado.  
A USA Federal Government facility.

### **Greenpower Executive Chairman, Gerard King:**

*"Greenpower's OHD project continues unabated and the Company has allocated significant resources to continue to develop the process and hopefully a significant future revenue driver. GPP is extremely excited about the prospects for OHD and particularly to have our PDU 2 built in the short term."*

### **ENDS**

#### **For further information:**

Gerard King  
Chairman of the Board

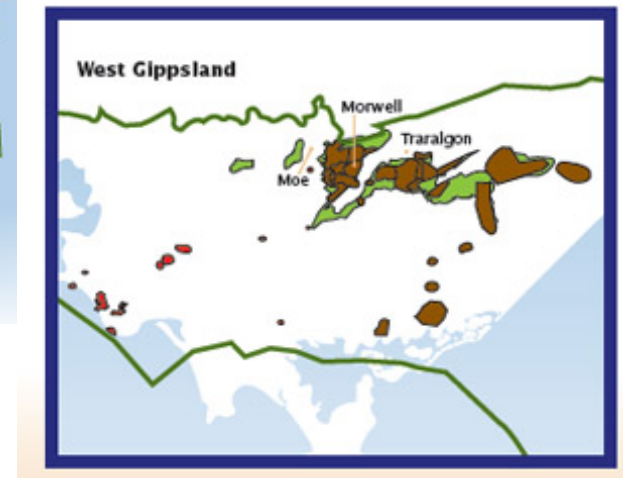
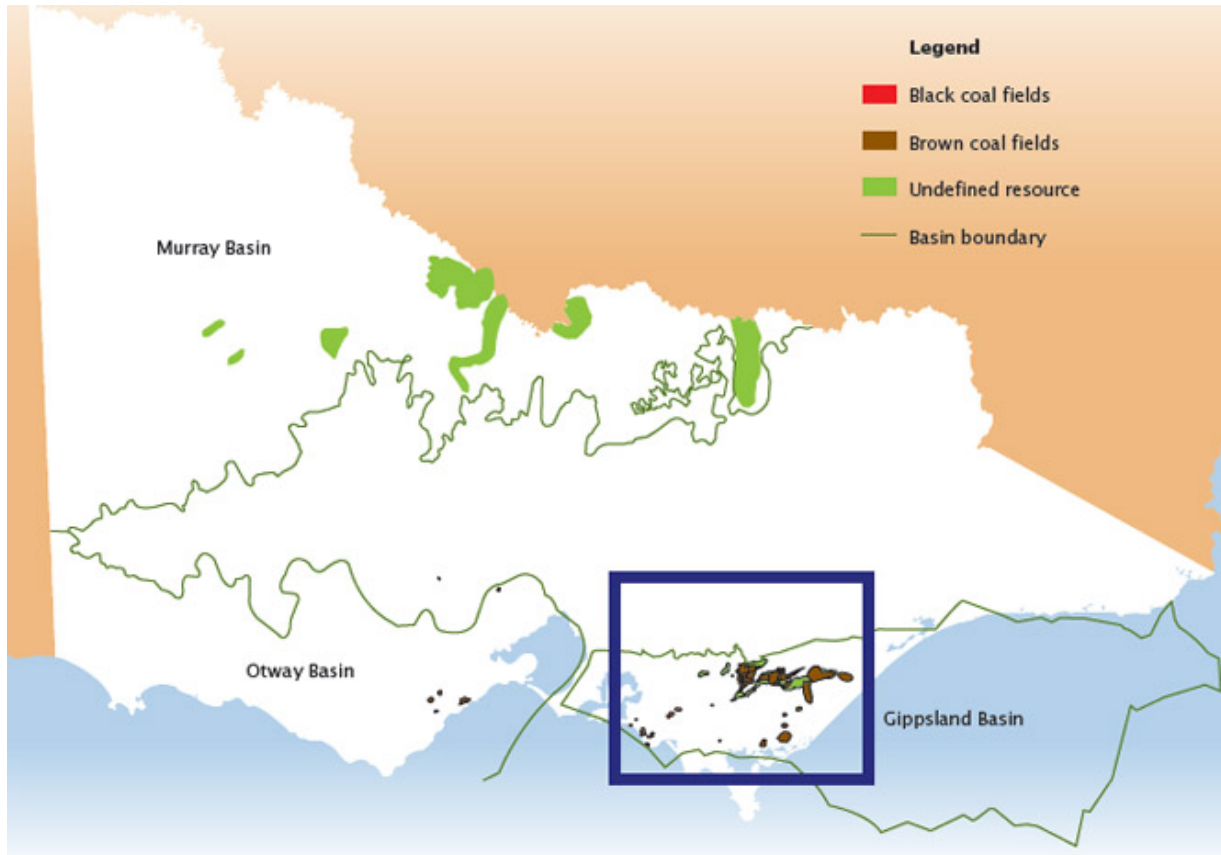


# Fulvic-like product increased yield and decreased blossom end rot in tomatoes

Dr. Karen Little, Associate Professor Tony Patti and Professor Roy Jackson



# Brown coal in Victoria



C %	H %	N %	S %	Ash %	Moisture %
65 - 70	4 - 5.5	<1	<1	<4	48-70

# Uses for Victorian brown coal

- Typically not exported
- Power generation – lignite fuels 86% of Victoria's grid electricity generation.
- Agriculture
  - Raw or humic/fulvic



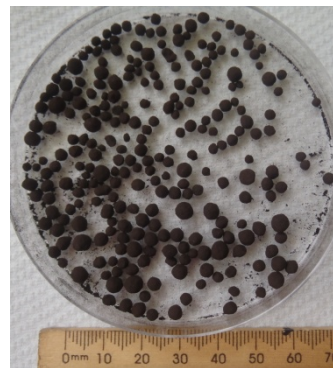
Yallourn power station in the Latrobe Valley



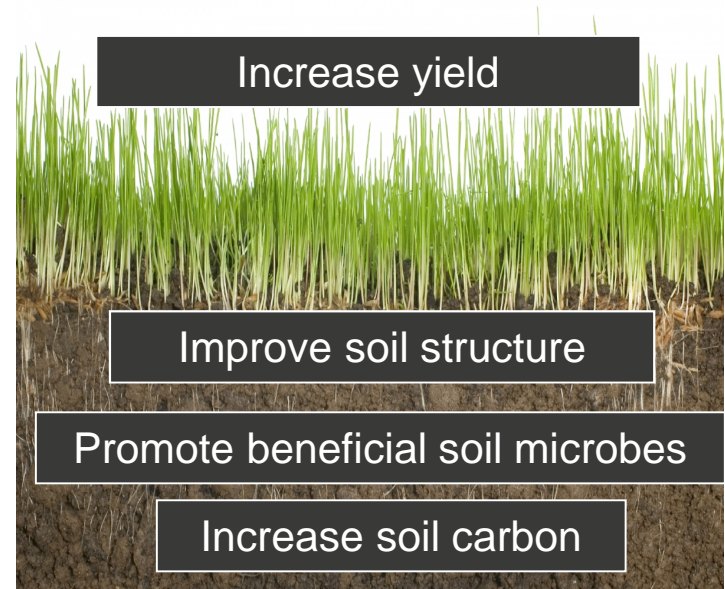
Raw coal



Liquid

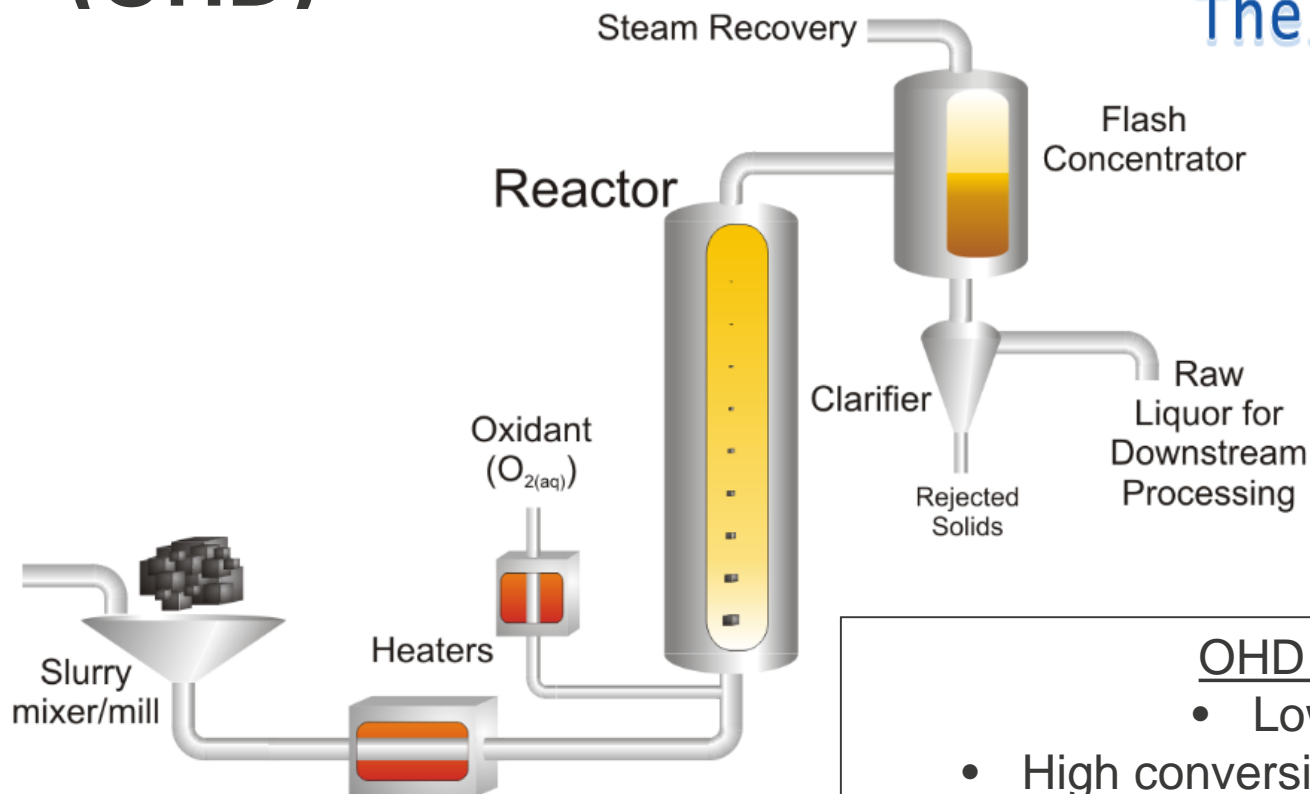


Soluble solids



# Oxidative Hydrothermal Dissolution (OHD)

Thermaquatica 



## OHD liquor

- Low cost
- High conversion rate (70-90%)
- Fulvic-like product (low molecular weight products)
- Vanillic acid (27%), benzoic acid (26%), vanillin (9.2%)

# Study 1 – Screening study



Capsicum



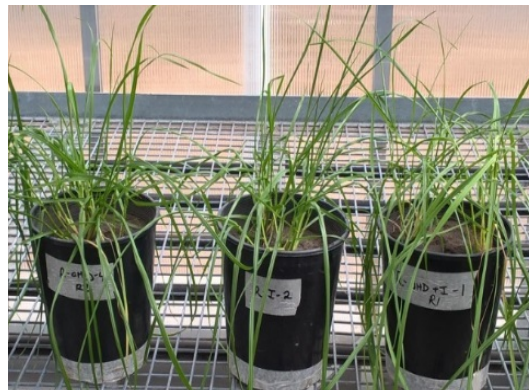
Lucerne



Pak choi



Lettuce



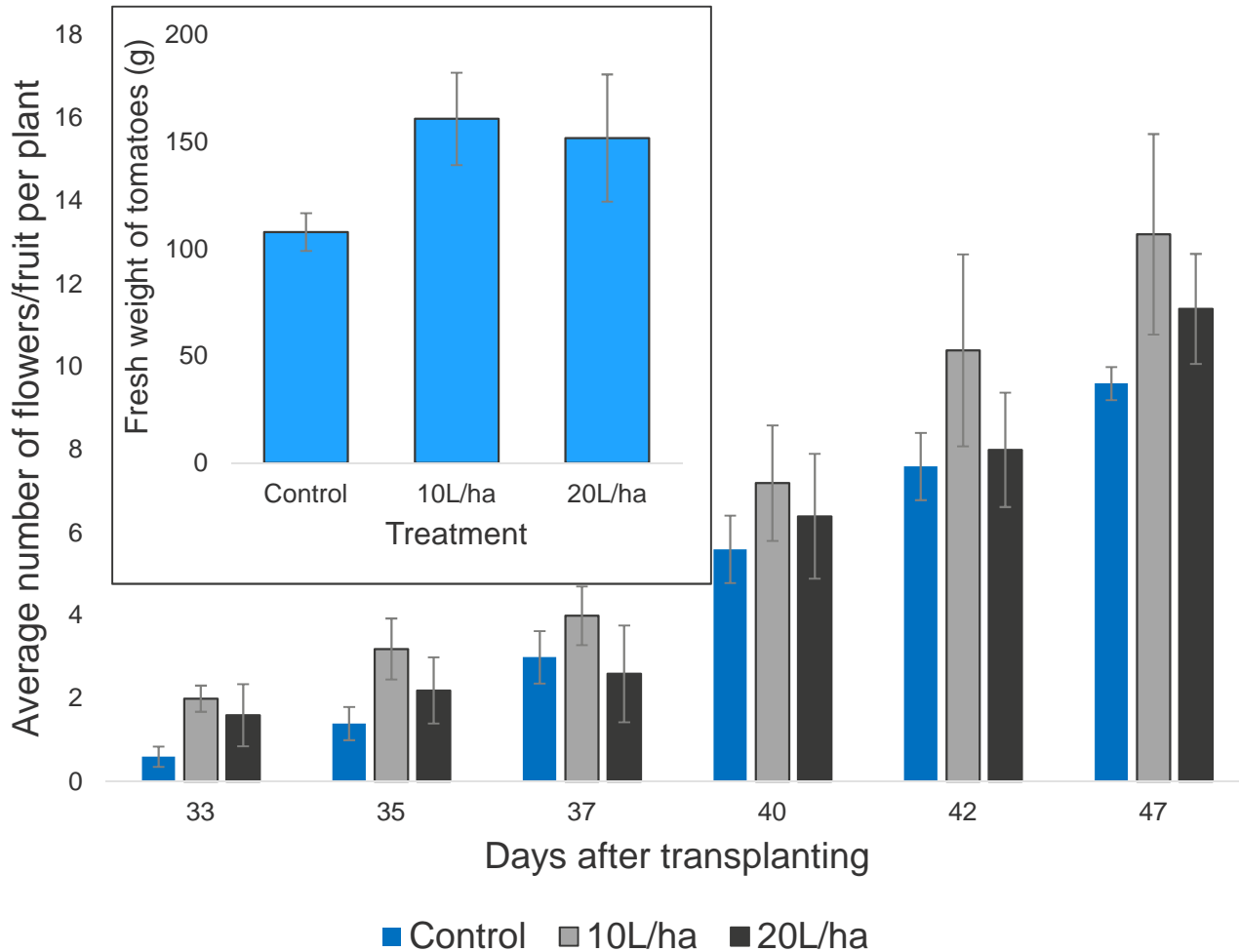
Ryegrass



Tomato



# Study 1 – Tomatoes - flowers and fruit

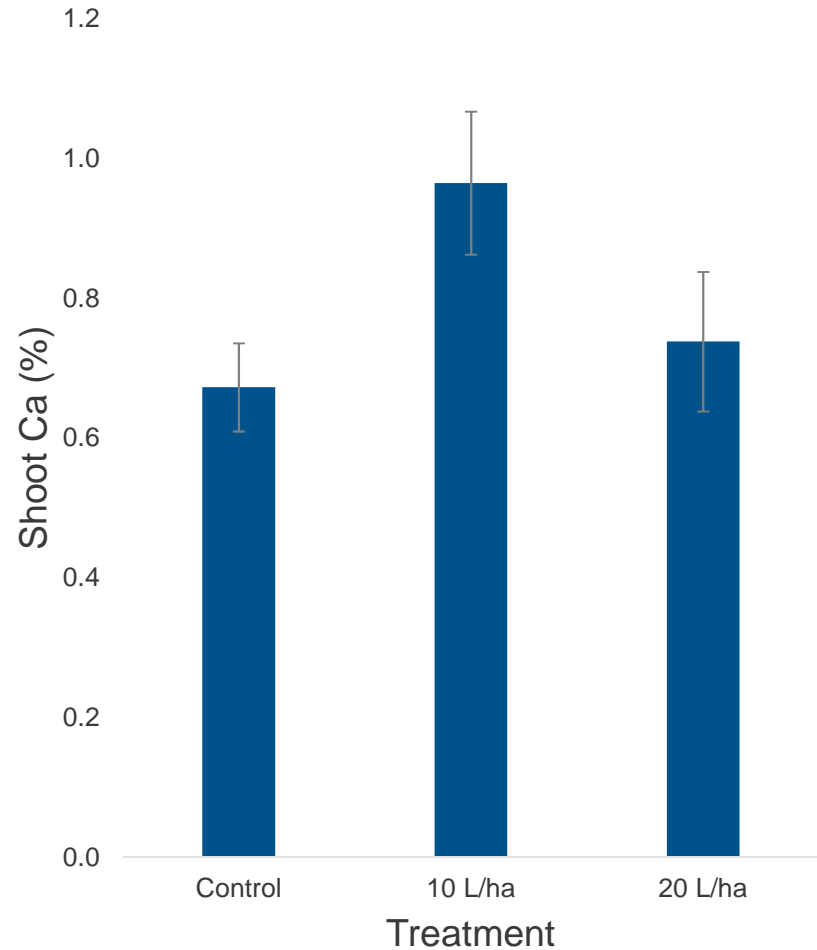
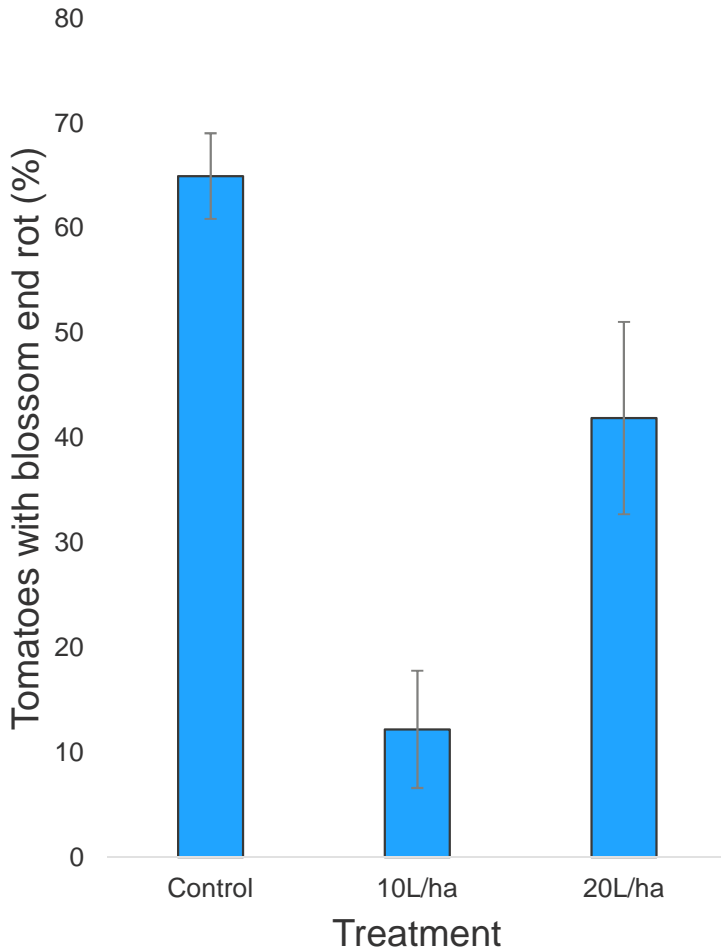


# Blossom end rot



Lack of calcium in the developing fruit

# Study 1 - Blossom end rot

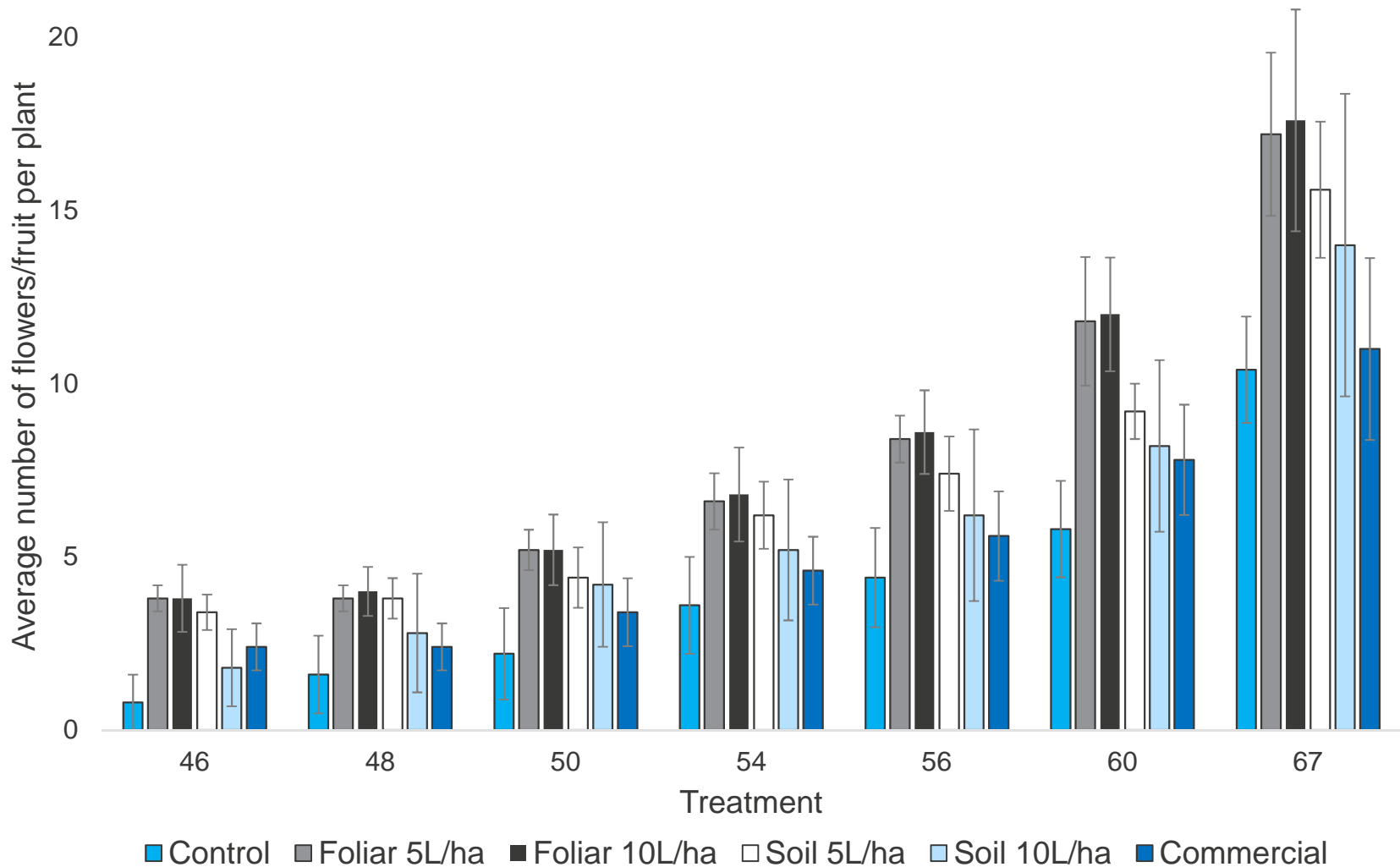


# Study 2 - Separate foliar and soil application

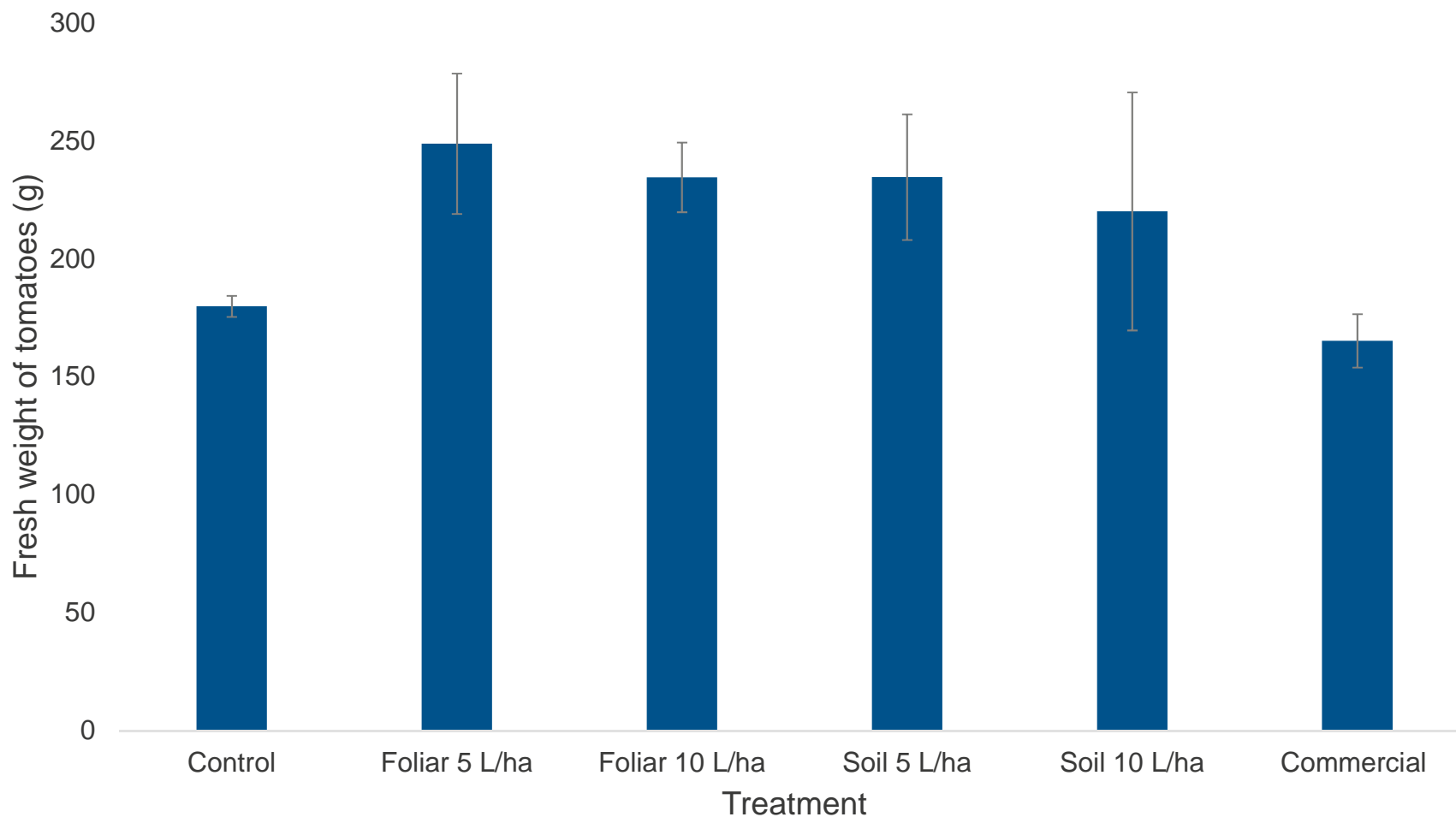
- Foliar application
  - 5 L/ha, 10 L/ha
- Soil application
  - 5 L/ha, 10 L/ha
- Commercial fulvic product (foliar)
  - Equivalent C to 10 L/ha
- Control



# Study 2 - Flowers and fruit



# Study 2 – Tomato yield



## Study 2 - Blossom end rot

Application method and rate	Incidence of blossom end rot (%)
Foliar 5 L/ha	0
Foliar 10 L/ha	0
Soil 5 L/ha	0
Soil 10 L/ha	0
Commercial fulvic product (foliar)	9
Control	6



# Possible mechanisms

- Chelation of nutrients in soil
- Hormone effects – auxin/cytokinin ratio
- Increased exudation of compounds into root zone and stimulation of the microbial community

## Further studies

- Timing of application
- Hydroponic
- Effects on the soil microbial community
- Other crops including wheat, cotton
- Hormone study





**We gratefully acknowledge funding from**



Research Connections grant



**Australian Government**