

Sovereign manufacturing of new lignite containing fertilisers

Project background

The Commonwealth of Australia Future Drought Fund has provided funding to support a number of regional drought hubs. Victoria established a drought hub in July 2020. This hub funds projects in five regions across Victoria. The SE node is based in Gippsland and is managed by Food & Fibre Gippsland – a large NFP agri-food supply chain organisation. The Gippsland region is home to a \$7 bn agri-food supply chain with all major agricultural sectors represented. The major industries that are represented are dairy, vegetable production, beef and other red meat, some cereals, oilseeds, fruit and wine production. All sectors have a demonstrated demand for fertiliser inputs. The region is also the major base for Victorian energy production with significant reserves of brown coal (lignite) and natural gas, emerging solar and wind energy production.

Food & Fibre Gippsland and Ahrko has been working with commercial horticulture producers across eastern Gippsland supporting new fertiliser products that utilise lignite (an approach to build soil carbon, retain N in the soil (reducing GHG emissions) and build advanced soil water holding capacity). New fertiliser formulations have been developed with producers that can be used in field trials comparing new products with business as usual (normal practice).

Project activity

A recent study sponsored by FDF funding and led by the SE node evaluated three new lignite-based fertilisers. These products claim to build soil organic matter, alter soil water holding capacity through the aggregation of soil peds (thereby increasing irrigation efficiency) and alter N release patterns sparing N inputs.

Batches of three commercial grade fertilisers were manufactured using dried lignite products from Ahrko and commercial fertiliser blends/straights. The batches were blended and pelletised for ease of handling and application into raised bed vegetable production systems. The three batches were:

- LO lignite – organic blend fertiliser product
- LB lignite – blended base (inorganic) fertiliser product
- LU lignite – urea (50:50) blend product

All blends manufactured were shelf stable pellets, however the LU pellets were hygroscopic and potentially deliquescent by nature. This reflected the high rate of urea addition to the product. It is recommended that the rate of inclusion of urea should not be above 30%.

A spinach trial was conducted at a major growing enterprise in the Lindenow district of East Gippsland. The area is renowned for field scale vegetable production and has a number of large enterprises growing short cycle vegetable crops for domestic and international supply chains.

The work was conducted with spinach growers over a single 7 weeks growing cycle during Q1,2023.

Three lignite mixes (LO, LB and LU) were evaluated and one ‘business as usual’ commercial controlled (CC) release product. The trial was a complete randomised design with five replicates per

treatment. The plot size was 1.2 x 10 m length, raised bed with overhead irrigation (3.5 Ml/ha. The application rate for CC was 400 kg per ha (N equivalent of 82 kg N/ha) whereas the application rates of the lignite blends was 65 kg N/ha. The soils at the site are classified as melanic, eutrophic brown kandosols. The soils are moderately to slightly acidic dark greyish brown deep fine sandy to silty loams and silty clay loams, with occasional layers of coarser material such as stones and gravel occurring deeper in the subsoil. They are inherently fertile with good (>25cmol/kg and exchange dominated by calcium.

The application rates for LU, LO and LB were N equivalent of 64 kg N/ha reflecting the research literature suggesting N release and delivery to crops from lignite fertilisers is better synchronised with plant growth.

On a fresh weight basis, the yields of spinach under treatments CC (18.9 t/ha), LU (19.1t/ha), LO (18.8t/ha) and LB (19.4t/ha). No significant differences between yield data were observed. N content of spinach was similar being 19.56 g/kg DM (CC), 18.42 (LU), 18.77 (LO), 18.84 (LB). The lowering of the N content did not impact on the colour of the spinach between all treatments.

CC	R = 33.3495	G = -11.7037	B = 16.4017
LU	R = 27.8163	G = -4.8745	B = 20.8295
LB	R = 27.916	G = -4.3819	B = 20.9746
LO	R = 34.1257	G = -11.4587	B = 14.5068

Conclusion

There was no impact on growth of spinach using the three novel fertiliser types compared to the control (proprietary product). The reduced N application rate per ha is important reflecting reduced potential losses of N from soil, leaching to groundwater or through emissions of nitrous oxide. Further trials are planned for late 2023 and early 2024.