8 May 2023

SOIL CARBON AND NUTRIENT MANAGEMENT TRIALS DELIVER PROMISING RESULTS

Emerging mineral processing technology company, Zeotech Limited (ASX: ZEO, "Zeotech" or "the Company") is pleased to provide an update on its nutrient management and soil carbon research program ("Program") at Griffith University ("Griffith").

Results from the dual-stream agri-soil program continue to validate the potential for Zeotech targeted products to offer an economic controlled release fertiliser delivery compound, together with the potential to sequester organic and inorganic soil carbon.

HIGHLIGHTS

- Comprehensive datasets from the Program show that the application of Zeotech products to the soil can protect approximately 30% of added carbon, determined over a five-month timeframe.
- Zeotech products demonstrate potential to bolster soil organic carbon, which could result in additional carbon sequestration of approximately 110 tonnes per hectare over a five-year period.
- Encouraging results show that the addition of Zeotech products can provide the necessary chemical conditions for inorganic carbon protection in the soil.
- Zeotech engages Griffith to evaluate the optimal pathway for alignment with existing materials-based soil organic carbon ACCU methodologies.
- Early data supports that the zeolites are buffering pH in common agricultural soil types – a key advantage for soils which commonly experience acidification resulting from continued application of ammonium-based fertilisers.
- Zeotech products exhibit superior phosphate, nitrate and ammonia retention capacities when compared to natural zeolite and biochar products, supporting the potential for developing them into nutrient delivery compounds.
- Several binding agents evaluated for blending the Company's targeted products with fertiliser compounds that offers a practical configuration for large-scale agricultural applications.

Griffith University, School of Environment and Science, Australian Rivers Institute, Dr Chris Pratt commented:

"The positive results reported to date and the focus on evaluating scientific evidence for Zeotech's agricultural soil products will contribute towards improving on-farm economics, environmental outcomes and offer potential solutions to rural communities for the transition required to meet Australia's commitment to net zero emissions by 2050."

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Zeotech, Managing Director Peter Zardo said:

"The results to date have exceeded our expectations and continue to support the potential for Zeotech products to play a role in agricultural enterprise, aimed at improving fertiliser delivery and soil carbon sequestration."

"Proprietary datasets emerging from the Program have provided Zeotech with the early validation that is needed to attract players in the agri-sector. Alongside our soil carbon methodology alignment, which will aim to advance carbon crediting activity, we are encouraged by the breadth of benefits Zeotech products could offer farmers."

"Zeotech would also like to acknowledge the ongoing efforts of Dr. Chris Pratt and the rest of the team at Griffith working on its projects for their continued dedication and focus."

Dual-Stream Nutrient Management & Soil Carbon Program

The Program launched in November 2021[1] with the aim of establishing scientific validation for developing Zeotech agri-products that aim to improve fertiliser delivery economics, whilst at the same time enhancing and protecting soil carbon.

The Griffith research is being conducted under two parallel streams:

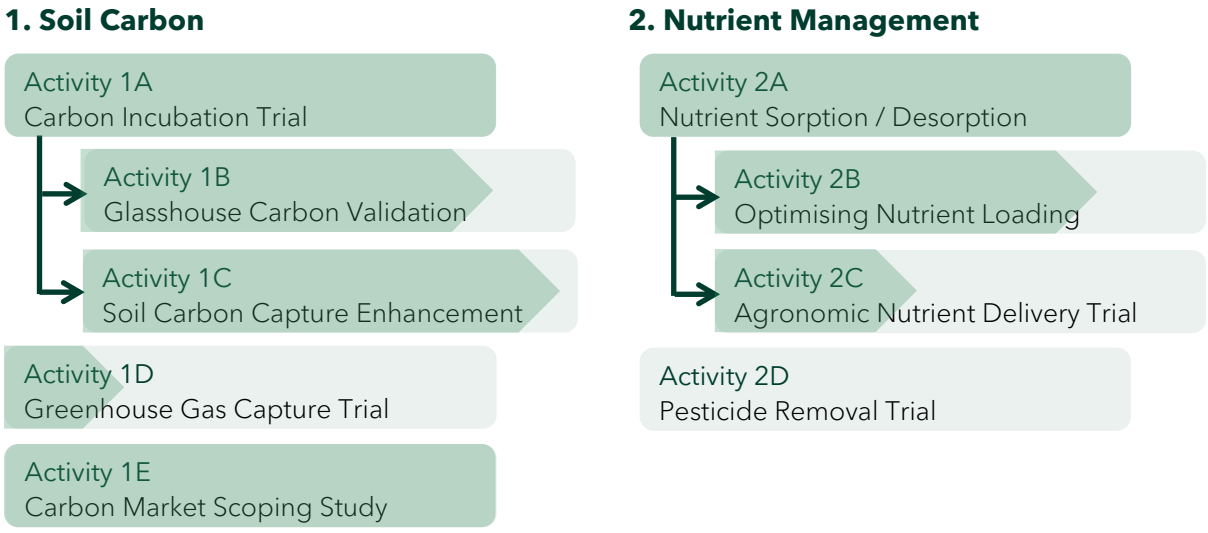

Figure 1 - Key activities under the Soil Carbon and Nutrient Management streams, with the dark green indicating the approximate progress of each activity.

Soil Carbon Program

Activities under the soil carbon stream aim to establish the carbon sequestration potential of Zeotech products when applied to common agricultural soil types.

[1] ASX Announcement 08/11/2021 "Zeotech Collaboration to Develop Products for Carbon Markets"

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Whilst data acquisition from the program is continuing, comprehensive datasets emerging from the program validate that the application of Zeotech products to soil can protect substantial portions of added carbon.

Carbon sequestration by soils involves complex processes and based on the promising results achieved to date, the Company is taking practical steps to protect the new intellectual property that is being generated. Consequently, it will balance the dissemination of results and data from the program in a manner that preserves the future commercial value of its research & development.

Soil Organic Carbon

The Program includes Zeotech targeted products, together with an Australian natural zeolite (control) and biochar product.

Characterisation work has highlighted the ability of the manufactured zeolites to enhance the moisture factor of the soil, which is particularly useful for soil studies as it offers insights into processes including:

- Water retention;
- Nutrient retention;
- Carbon sequestration potential; and
- Microbial community development.

In general, the higher the moisture factor, the more efficient soils will be across all of the above aspects. Based on results to date, Zeotech products show promise for improving soil processes as their moisture factors far exceed those of most soils. Results indicate that introduced carbon is participating in chemical interactions with the zeolite surface. This is significant because it indicates that if the zeolite additions are shown to result in increased carbon retention in the soil, then carbon is likely to be protected in the soil and shows promise for effective long-term soil organic carbon retention.

Results from Activity 1A have revealed that application of Zeotech products to common agricultural soils can protect approximately 30% of organic added carbon, determined over a five-month timeframe, and this accords with outcomes from preliminary trials[2] which indicated 25% protection.

The Company's zeolite products therefore demonstrate significant potential to bolster soil organic carbon. This could translate to an estimated increase in soil organic carbon content of 0.50%[3] over a five-year period, and result in additional carbon sequestration of approximately 110 tonnes per hectare over the same period.

Together with the encouraging nutrient management results, which is targeting enhanced nutrient use efficiency and lower greenhouse gas (GHG) emissions, it presents a compelling economic proposition for a controlled release fertiliser delivery platform.

[2] ASX Announcement 09/03/2022 "Promising Soil Carbon and Nutrient Retention Trial Results"

[3] Dr Chris Pratt – Griffith University

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Activities in workstream 1B have progressed toward evaluating the impacts of plant growth on carbon retention. A dedicated accelerated plant growth facility has been set up, with experiments underway to evaluate the influence of plant growth on soil carbon protection by zeolites (Fig. 2).

Figure 2 - Image of a plant growth facility trial underway for Activity 1B showing seedling emergence.
Photo: Dr. Chris Pratt – Griffith University

Wheat is being used as a test crop in the current experiment and plants are in the early stages of germination and establishment.

Enhanced Carbon Sequestration

Activity 1C has delivered encouraging results that show the addition of Zeotech products can provide the necessary chemical conditions for organic and inorganic carbon protection in soil.

Early pH data from experiments support that the zeolites are buffering pH in both common agricultural soil types tested (vertisol and dermosol) and perform more effectively than natural zeolite and biochar.

This process is particularly promising for agricultural soils which commonly experience acidification resulting from continued application of ammonium-based fertilisers. Over time, the ammonium is oxidised to nitrate by the soil microbial community and the soil becomes acidic[4].

Soil acidity is a major environmental and economic concern. In highly acidic soils, all the major plant nutrients (nitrogen, phosphorous, potassium, sulphur, and calcium) may be lost, unavailable, or only available in insufficient quantities. Plants can show deficiency symptoms despite adequate fertiliser application[5].

[4] Bouman et al. (1995). "Soil Acidification from Long-Term Use of Anhydrous Ammonia and Urea."
[5] soilquality.org.au

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It has been estimated that the cost of soil acidity in terms of annual lost agricultural production in Australia is A$1.58 billion[6].

Figure 3 shows how this change in pH affects the stability of inorganic carbon phases in the soils. Zeotech products can protect approximately 95% of inorganic carbon during the short-term period after fertilisation.

Fertilisers themselves protect approximately 75%, as ammonia is released from urea and diammonium phosphate. However, over time, the fertiliser-amended soils will acidify due to ammonium oxidation and trend toward the 'old soil' pH level with a corresponding decrease in inorganic carbon stability.

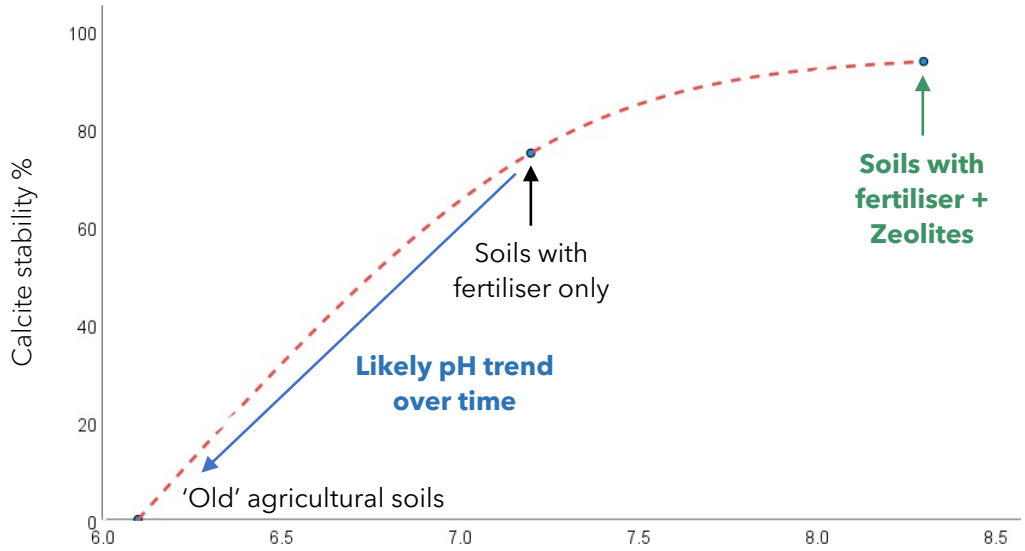

Figure 3 - Relationship between soil pH and inorganic carbon solubility.

By maintaining the capacity to buffer against this acid-generating process, the Company's products can directly protect common soil inorganic carbon compounds.

Inorganic carbon content of soils is relatively small. However, when scaled up, it potentially equates to tonnes of additional carbon stocks on a per hectare basis. Therefore, this offers a tangible pathway for Zeotech products to further enhance and protect soil carbon.

Activity 1E - extended carbon market Scoping study ("Study"), was completed in April 2022[7] and investigated opportunities to materials-based GHG mitigation, made possible with Zeotech's proprietary mineral processing technology.

The study was the catalyst for a new 12-month multi-stage research program with Griffith[8] to develop and validate the application of Zeotech products for controlling landfill methane emissions, in collaboration with Cleanaway Waste Management Limited ("Cleanaway").

[6] NSW Government – Department of Primary Industries. "Soil acidity and liming 4th edition"

[7] ASX Announcement 12/04/2022 "Opportunities for Zeolite-Based Greenhouse Gas Mitigation"

[8] ASX Announcement 24/10/2022 "Zeotech to Develop Products for Methane Control"

Soil Carbon Method Development & Alignment

Whilst high surface area minerals, such as zeolites, are known to offer good prospects for meaningful long-term soil organic carbon sequestration, it is apparent from the results that not all zeolites perform the same.

It is therefore encouraging to see Zeotech products achieve strong results, and this validation has accelerated discussions with Griffith relating to carbon credit methodology and alignment.

Zeotech has engaged Griffith to develop a program to evaluate the optimal pathway for alignment with existing materials-based soil organic carbon methodologies, together with the steps required to develop a potentially novel method for increasing baseline inorganic carbon.

The program will inform potential future field trial methodology and will initially focus on Australian Carbon Credit Units (ACCUs), with prospects to expand across other carbon crediting frameworks in the future.

Nutrient Management Program

Nutrient sorption and desorption treatments are mirrored with the soil carbon program and included Zeotech products, benchmarked with an Australian natural zeolite and biochar product.

Batch experiments have been completed and analysed for phosphate, nitrate and ammonium at various adsorbent doses.

Results demonstrate the superior nutrient retention capacity of the Zeotech products relative to natural zeolites and biochar (Figs. 4, 5 and 6). The data implies that zeolites have the potential to regulate nutrient delivery to crops in the soil environment, which could improve net nutrient use efficiency.

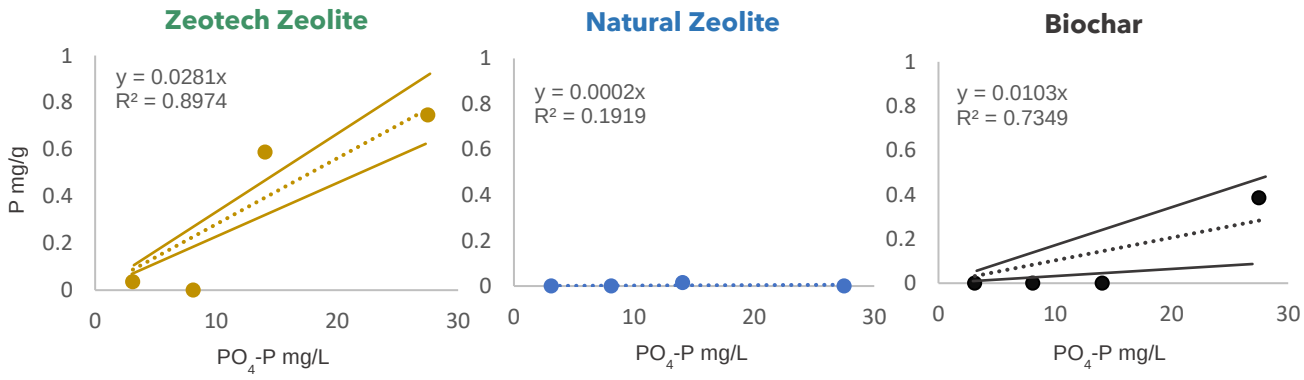

Figure 4 - Phosphate-P sorption isotherms for a manufactured zeolite sample, compared with natural zeolite and biochar. N=3 for each data point with trendlines representing mean, upper and lower model fits for the regression relationships.

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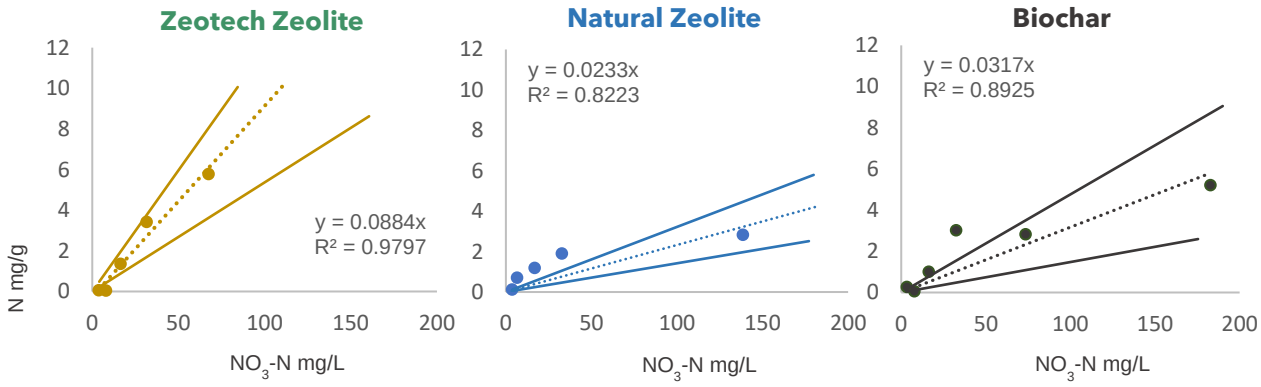

Figure 5 - Nitrate-N sorption isotherms for a manufactured zeolite sample, compared with natural zeolite and biochar. N=3 for each data point with trendlines representing mean, upper and lower model fits for the regression relationships.

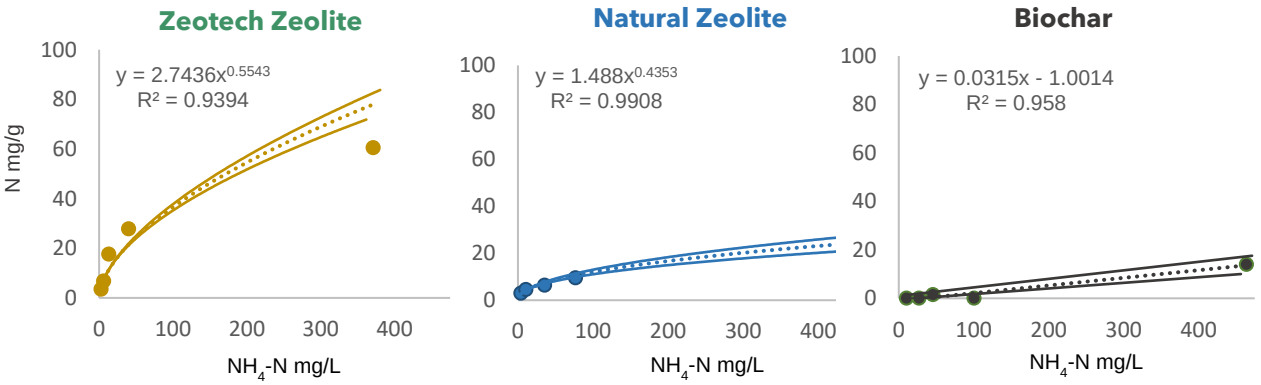

Figure 6 – Ammonium-N sorption isotherms for a manufactured zeolite sample, compared with natural zeolite and biochar. N=3 for each data point with trendlines representing mean, upper and lower model fits for the regression relationships.

Enhanced nutrient use efficiency delivered by the Company's products underscores a targeted 20% reduction in fertiliser application costs, which will be evaluated under the program.

Nearly two-thirds of applied nitrogen and more than half of applied phosphorous is lost to the environment (runoff) and becomes a pollutant[9]. Further, nitrogen-based fertiliser production and use accounts for approximately 5% of global GHG emissions[10].

Therefore, incremental improvements in fertiliser delivery and use can have a profound impact on application rates, and in doing so, potentially improve on-farm economics, reduce pollution and accelerate off-farm revenues (i.e. carbon credits) by lowering a farms direct and indirect GHG emissions.

[9] H. Ritchie - Our World Data (2021) "Excess fertilizer use: Which countries cause environmental damage by overapplying fertilizers?"
[10] Yunhu Gao and André Cabrera Serrenho. Nature Food (2023)

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The research will now investigate blends of zeolite with commercial fertilisers and explore nutrient release mechanisms, including diffusion and migration.

Product Development

Whilst the Company's manufactured zeolite samples are produced in powder form, Griffith is developing low-cost approaches for converting these into granule, bead or pellet form, that will offer a practical nutrient delivery compound for large-scale agricultural applications.

Zeolite and commercial fertiliser blends are currently under development, and early phases of this activity have involved trialling various binding agents to produce a stable zeolite granule.

An optimal method has been successfully determined and granules or pellets will be further blended with dry fertiliser compounds to produce the Company's zeolite-based fertiliser delivery product for the upcoming trials

Summary

The results and data emerging from each program is very promising. Moreover, the combination of results delivers a compelling economic proposition for a controlled release fertiliser delivery platform with strong prospects for enhancing and protecting soil carbon.

Highlighted by Figure 7, the Company's targeted products have the potential to deliver multiple direct and indirect benefits which could improve on-farm economics, lower GHG emissions and diversify income.

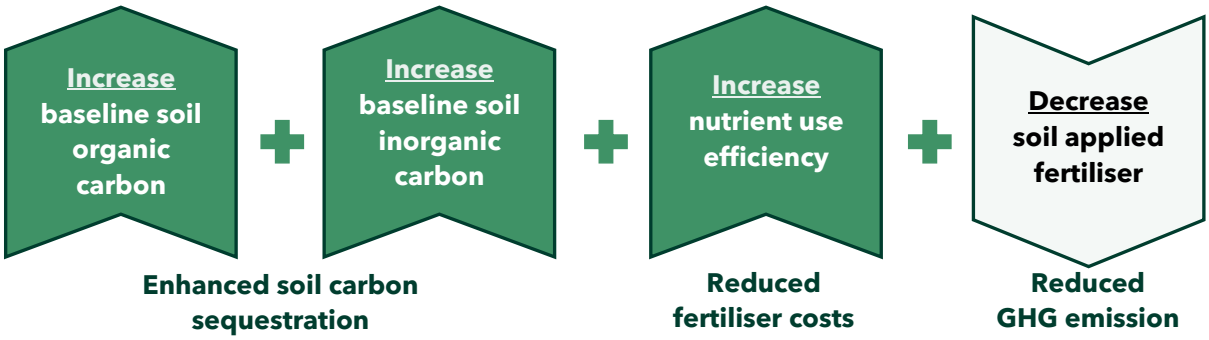

Figure 7 – diagram showing the multiple potential benefits that can be delivered from the application of Zeotech products to agricultural soils.

This announcement has been approved by the Board.

- End -

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About Zeotech

Zeotech Limited (ASX: ZEO) is a team of dedicated people, working together to build a future focused company, leveraging proprietary technology for the low-cost production of advanced materials 'manufactured zeolites' to deliver solutions aimed at addressing sustainability challenges.

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Words such as "anticipates," "expects," "intends," "potential," "plans," "believes," "seeks," "estimates", "guidance" and similar expressions are intended to identify forward looking statements and should be considered an at-risk statement.

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