Brought to you by Argus Media argus Vol 40 • Issue 5 – September/October 2023

Fertilizer Focus

Enhanced Efficiency Fertilizer technology

- Nitrogen fixation
- Nanoscale nutrients
- Biostimulants

Breakthroughs in nitrogen fixing

The short shelf-life of nitrogen-fixing fertilizer products is a problem that scientists at BioConsortia have been trying to solve. Fertilizer Focus speaks with Marcus Meadows-Smith, CEO of BioConsortia, about the research that has been carried out to address this issue - and the results look promising.

Fertilizer Focus (FF): Could you give an introduction to nitrogen fixing products?

Marcus Meadows-Smith (MMS): Nitrogen fixing products are beneficial microbes that take nitrogen from our air and convert it to ammonium, a form that is taken up by plants. They have the potential to add yield to current fertility practices or to reduce the amount of synthetic nitrogen needed.

FF: What are the advances you have made with your research?

MMS: Over the last year, we've significantly expanded our field trials programme to better understand the performance of our nitrogen fixing microbes in wheat, corn, soy and vegetables. Results in initial soy trials in 2022 demonstrated an additive effect when our microbes are used in conjunction with rhizobia in soybeans, increasing yields by an average of 9%. We've also advanced our understanding of the genetic functions that control nitrogen fixation. We now have better understanding about how to design microbes to optimally fix nitrogen, even when they detect nitrogen in the soil, and we are establishing a strong IP position.

FF: Why is long shelf-life important for nitrogen fixing products?

MMS: Long shelf-life is critical to the adoptability of many innovations at the grower level. For nitrogen fixing microbes, best performance comes from early application of the microbes to crops, enabling a strong colonization of the root. BioConsortia's nitrogen fixing products are unique in that they rely on spore-forming gram-positive bacteria, which means they are shelf-stable for more than two years and can be applied through industrial seed treatment because they survive on the surface of the seed for years, enabling the storing, shipment and planting of treated seed.

FF: What are your results of the major row crops such as corn and wheat?

MMS: In hundreds of field trials of our first generation microbials in wheat and corn, we've demonstrated that our nitrogen-fixing microbes deliver 3.6% additional yield over a full fertilizer treatment, or could displace as much as 15% applied nitrogen fertilizer. Our development process is iterative – we aim for future versions to deliver as much as 30% fertilizer replacement and 20% additional yield. Early readings from lab and greenhouse studies indicate our next generation of microbial n-fixers deliver significantly more yield.

FF: Why do you need to 'gene edit' the nitrogen fixing microbes?

MMS: Microbes use a metabolically costly process to fix nitrogen. It's so costly, they would prefer not to use their resources to run the fixing process. When they detect nitrogen in their environment, many microbes shut down this process. We use gene editing to delete this 'off-switch', ensuring the microbes are fixing nitrogen even in the presence of detectable nitrogen in the soil.

FF: Will you be able to launch these products in the EU and other markets that are not yet registering gene edited microbes?

MMS: While we someday anticipate the door may open in the EU to gene-edited microbes, today we are planning to introduce un-edited (we call them wildtype) microbes. Our gene-editing platform serves as a proof of concept that demonstrates the changed genome delivers the desired functionality. That finding gives us confidence to conduct a microbe improvement breeding programme acceptable to regulators in places like the EU. Additionally, our microbial discovery tools have identified natural mutations or other aspects in some wildtype microbes that make them ideal candidates for commercialization in Europe and other markets.

(left) Greenhouse testing Nitrogen-fixing of fertilizers in various soils; *(above)* Scientist optimizes the latest nitrogen-fixing microbial product giving it a two year shelf-life

FF: Will you develop products for organic agriculture?

MMS: We design solutions to improve the impact of agriculture on the environment. Our team focuses on where our products can be used in organic production, we look forward to building partnerships with the commercial organisations that serve these organic and other specialty markets.

FF: You now have an agreement with the company Mosaic – what does this partnership involve?

MMS: Mosaic Company partnered with BioConsortia in a R&D and Commercial agreement that underwrote our basic research efforts. They hold commercial rights to the products in row crops in the Americas. The company is an excellent partner in our efforts, bringing their deep understanding of crop physiology and fertility to our understanding of microbes.

FF: Are you looking for partnerships elsewhere?

MMS: We are actively pursuing partners in other crops including fruits, vegetables, and turf, and for all crops in other territories such as Europe, Asia Pacific and Africa. We are particularly interested to work with companies that can reach small-holder farmers - we think the stability of these products makes them well-suited for small-holder farming operation.

FF: What does 2024 hold for BioConsortia?

MMS: In 2024, we anticipate first market launches of our nitrogen fixing materials in seed treatment formats. We also look forward to product launches through partners in other segments, including launches of microbial fungicides and nematicides across North America and in Brazil. ■