THEME 1 - SMART NITROGEN FERTILISERS

Nitrogen losses reduce nitrogen use efficiency increasing the cost of farming and damaging the environment. Coatings can control fertiliser release, tailoring nutrient availability to the times crops need nutrients most. Current fertiliser coatings are costly and have their own set of environmental issues however new and improved 'smart' fertiliser coatings could provide a solution.

THE OPPORTUNITY

- Fertiliser coatings are used in a variety of agricultural and commercial applications but have negative environmental impacts.

- 'Green' fertiliser coatings, characterised by low cost, efficiency, flexibility, and low environmental impact are in high demand.

- Coating properties such as thickness, durability, and permeability are determined by coating composition, production conditions, and manufacturing methods, all of which can enable control over nutrient release.

GOALS

- Develop a new class of smart fertiliser coatings using sustainable bioderived materials.

- Investigate different combinations of materials and manufacturing methods to understand how these factors influence coating properties.

- Develop tailorable fertiliser coatings that suit the requirements of different agricultural systems.

INDUSTRY OUTPUT

- ·Develop new controlled-release fertilisers with environmentally friendly coatings suitable for a range of intensive agricultural systems.

OUR PARTNERS

RESEARCH ACTIVITIES

Coating composition, engineering parameters, and manufacturing methods can all influence the properties of smart fertiliser coatings. Choosing the right combination is essential for success. Theme 1 will investigate different combinations of these factors in order to develop a new class of smart fertilisers. New fertilisers will also be characterised to gauge their quality and performance in different environmental conditions.

Research Activities

Coating Composition Selection	• Coating composition determines mechanical characteristics such as durability (important for controlled nutrient release). • Material selection also determines the coating's permeability and strength making it equally important in advanced fertiliser development.
Manufacturing Method	• Manufacturing method influences coating thickness and strength. Dip-coating and spray-coating approaches will be investigated.
Coating Fabrication Condition	• The environment (e.g. temperature, pH, concentration) that the coating is formed in (the solution) determines properties such as coating thickness and permeability.
Characterisation	• Performance of smart fertilisers will be characterised in different environmental conditions (e.g. temperature, soil type, moisture content, pH) and compared to other fertilisers currently under development or in production.

Research Team

Professor Frank Caruso
Theme Leader

A/Professor Kathryn Mumford
Theme Leader

Dr. Pavel Cherepanov
Postdoctoral researcher

Dr. Rebecca Mcquillan
Postdoctoral researcher

Dr. Zhixing Lin
Postdoctoral researcher

Professor Deli Chen
Hub Director

A/Professor Helen Suter
Hub Deputy Director

PhD Candidates

Omid Mazaheri