

Safe-and-Sustainable-by-Design Nanofertilizers for Efficient Nitrogen Use and Occupational Safety in Agriculture

INAIL BRIC2025 – ID 67 funded project | PI: Prof. Luca Marchiol, University of Udine

WHY Nano2U?

Nano-enabled fertilization can improve nitrogen-use efficiency, but requires evidence on safety, sustainability and field-scale behaviour. Nano2U integrates nanomaterial design, occupational-safety assessment and agronomic validation in a single project pathway.

STRATEGIC POSITIONING

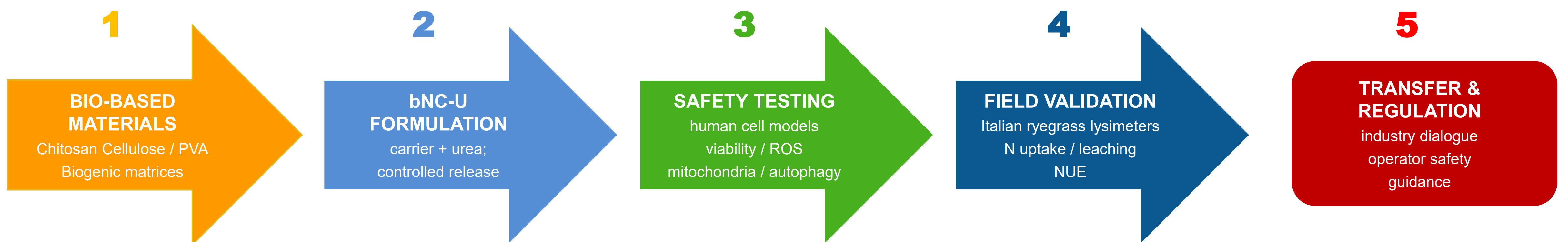
Second-generation nitrogen nanofertilizer: a bio-based nanocarrier associated with urea molecules. Safe and Sustainable by Design is the organizing principle for future guidelines, industrial transfer and regulation.



The Nano2U logo links worker safety, agriculture, and nanoscale innovation.

The shield signifies protection, the leaf agronomic application, and the dots the nanocarrier structure.

CENTRAL LOGICAL SCHEME: FROM NANO-DESIGN TO FIELD AND TRANSFER



Project architecture: three scientific workstreams plus safety-policy and industrial transfer interfaces

PARTNERS AND ROLES



CNR NANOTEC

Dr Francesca Scalera

Material design & characterization

Chitosan-based bNC-U formulations
Green chemistry and screening
Morphology, stability and N-release kinetics



**University of Rome
Tor Vergata**

Prof. Katia Aquilano

Cellular and biochemical safety

Human cell models for operator exposure
Viability, oxidative stress and mitochondria
Lysosomal/autophagic responses



University of Udine

Prof. Luca Marchiol

Coordinator & Agronomic validation

Project coordination and lysimeter validation
Italian ryegrass trials in drainage lysimeters
N uptake, leaching, physiology and NUE



INAIL - Dit

Dr Mara Stefanelli

Additional participation: occupational-safety perspective

Exposure and prevention relevance
Contribution to risk-assessment framing and evidence transfer



FABBRICA
COOPERATIVA
PERFOSFATI
CEREA

FCP Cerea

Dr Giuseppe Ciuffreda

Industrial observer: fertilizer producer

Fertilizer-sector perspective
Dialogue on feasibility, transferability and scale-up
Attention to production/use scenarios and worker safety

EXPECTED OUTPUTS

- Bio-based bNC-U nanofertilizer prototypes
- Safety-relevant cellular datasets
- Evidence on Nutrient Use Efficiency
- Framework for safer nano-enabled fertilization

TAKE-HOME MESSAGE

Nano2U develops a pathway for nanofertilizers that are not only efficient, but also safe, assessable and transferable.