

TECHNOLOGY EVALUATION AND VALIDATION REPORT

Liquid Natural Clay (LNC): Evaluation of Irrigation Water-Use Efficiency, Soil Performance, and Sustainable Date Palm Production, Sudair, Riyadh, Kingdom of Saudi Arabia

The National Research and Development Center for Sustainable Agriculture (Estidamah), in collaboration with Saudi Desert Control, conducted a technical evaluation and field validation of Liquid Natural Clay (LNC) technology through a pilot demonstration project implemented at a commercial date palm farm in Sudair, Riyadh, Kingdom of Saudi Arabia, during the period 2024–2026.

The primary objective of the project was to evaluate the performance of Liquid Natural Clay (LNC) technology in improving soil hydraulic properties and irrigation water-use efficiency while maintaining date palm productivity and fruit quality under arid sandy soil conditions. The project was undertaken in line with Estidamah's mandate to evaluate innovative, science-based agricultural technologies that contribute to sustainable resource management, water conservation, and the strategic objectives of Saudi Vision 2030. Where Saudi Desert Control (SDC) contributed for the implementation of the technology, including field application of the Liquid Natural Clay (LNC), irrigation optimization, soil monitoring, laboratory analyses, and technical support throughout the demonstration period. Estidamah independently supervised the technical validation activities, monitored project implementation, reviewed the scientific methodology, and evaluated the technical findings generated under the agreed validation framework.

The validation was undertaken in accordance with a structured technical protocol comprising:

- I. Controlled treatment and control irrigation zones.
- II. Continuous irrigation monitoring using calibrated flow meters.
- III. Multi-depth soil moisture monitoring.
- IV. Accredited laboratory analyses.
- V. Date palm yield and fruit quality assessments.
- VI. Documented irrigation management and project governance.



Based on field observations, laboratory analyses, and the technical assessment conducted throughout the validation period, the following outcomes were observed under the defined project conditions:

- Approximately 25% improvement in soil water-holding capacity.
- About 30–40% increase in plant-available water.
- More than 3.5-fold improvement in cation exchange capacity (CEC).
- Improved soil moisture stability during irrigation reduction periods.
- A 23% reduction in irrigation water use per tree under stabilized field conditions.
- Date palm yield and fruit quality were maintained following one complete production cycle under reduced irrigation conditions.

Based on the technical evidence generated during the pilot project, Estidamah concludes that Liquid Natural Clay (LNC) demonstrated measurable improvements in soil hydraulic performance and irrigation water-use efficiency under the specific environmental, agronomic, and irrigation management conditions of this validation project. The observed results indicate the technology's potential to enhance soil performance and optimize irrigation practices in sandy arid soils while maintaining crop productivity when implemented within an appropriate agronomic and irrigation management framework.

The findings of this validation support the potential application of Liquid Natural Clay (LNC) as a promising soil enhancement technology for sustainable agricultural production systems in arid environments. Estidamah encourages further evaluation and implementation of the technology across varying agro-climatic conditions, crop production systems, and operational scales to further assess its broader applicability and long-term performance, where needed.

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