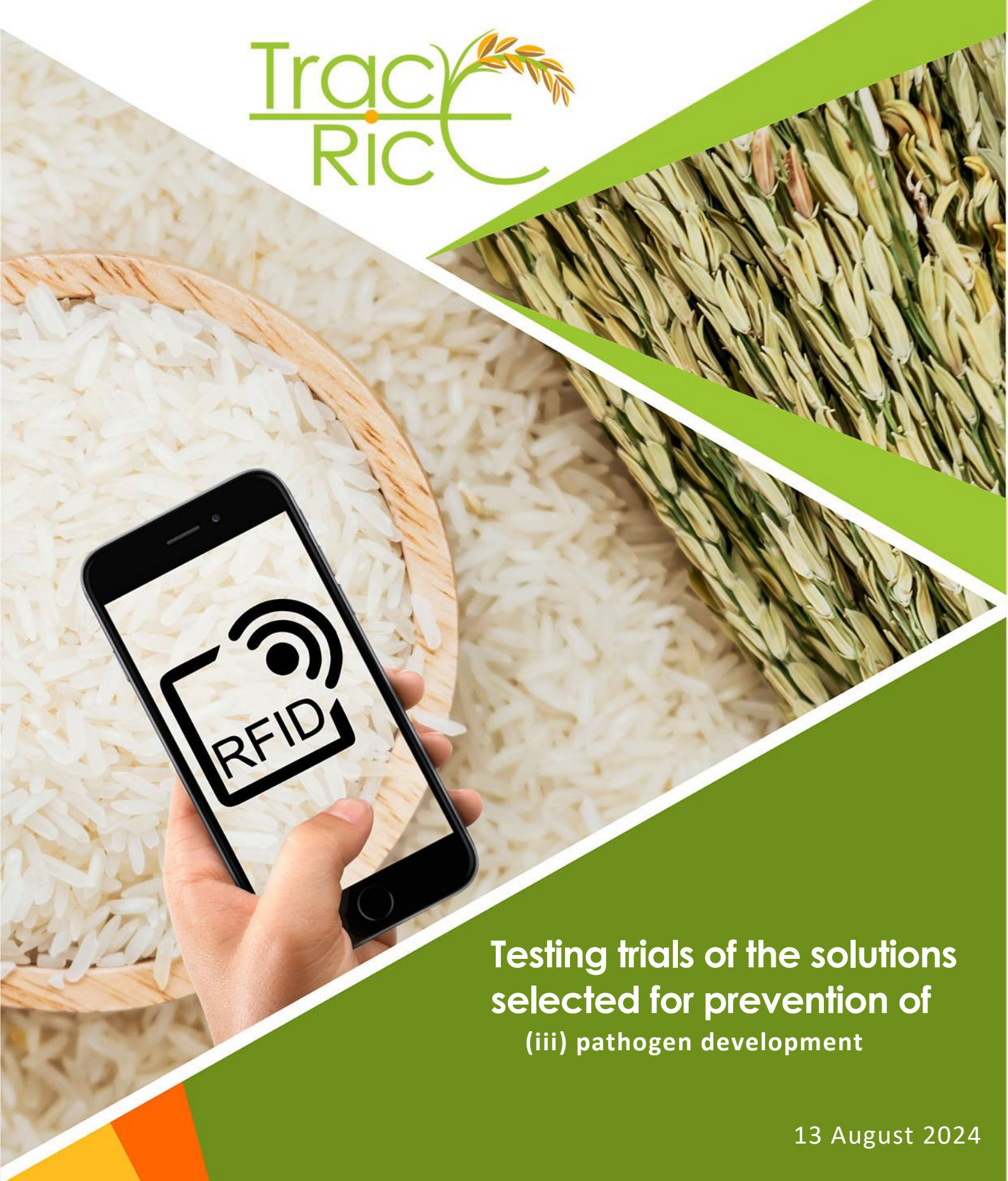

Testing trials of the solutions selected for prevention of

(iii) pathogen development

13 August 2024

TRACE-RICE with Grant nº 1934, is part of the PRIMA Programme supported under Horizon 2020, the European Union's Framework Programme for Research and Innovation

PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

http://trace-rice.eu

TECHNICAL REFERENCES

Project Acronym	TRACE-RICE
Project Title	Tracing rice and valorizing side streams along Mediterranean blockchain
Project Coordinator	Carla Moita Brites carla.brites@iniav.pt
Project Duration	September 2020 – August 2024 (48 months)

Deliverable No.	2.2
Dissemination level*	CONFIDENTIAL
Work Package	2
Task	2.2
Lead beneficiary	INIAV
Contributing beneficiaries	IATA/CSIC
Due date of deliverable	31 August 2023
Actual submission date	13 August 2024

Written by: Carla Brites

HISTORY OF CHANGES			
Date	Beneficiary	Version	Change
07/08/2024	INIAV	V1	Draft version sent to IATA/CSIC
13/08/2024	INIAV	V2	Final Version approved by project coordinator

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EXECUTIVE SUMMARY

Bacillus cereus is the most commonly present bacteria in rice and rice-based products. A primary factor contributing to *B. cereus* outbreaks in cooked rice is improper cooling or storage at unsuitable temperatures (above 4ºC or below 55ºC) for extended periods, especially when large quantities are prepared in restaurants or canteens. The main source of contamination is heat-resistant spores that survive standard cooking temperatures (around 100 ºC). While normal cooking can achieve a 2-3 log reduction in the initial spore load, the final risk levels depend heavily on the initial concentration of microorganisms and hygiene practices during handling, cooking, and processing. After cooking, the remaining spores can germinate and proliferate, reaching 10^7 or 10^9 CFU/g after 24 hours at 26°C or 32°C, respectively, producing a heat-stable emetic toxin. Approximately 95% of emetic syndrome outbreaks are caused by consuming cooked or fried rice.

Controlling storage temperature is a widely accepted method by food safety authorities. However, there is a need for additional control measures beyond post-cooking storage temperature. A catalogue of mathematical models was developed by IATA/CSIC, as documented in D2.4, to identify the most suitable models for each process involving rice-based products. This knowledge can enhance the control of *B. cereus* during and after the cooking of rice and its derivatives. The models were used to evaluate and quantify the antimicrobial activity of two natural agents, grape extract and insect chitosan, against *B. cereus* in a rice matrix, serving as additional control measures during the cooking process (thermal treatment) and subsequent storage.

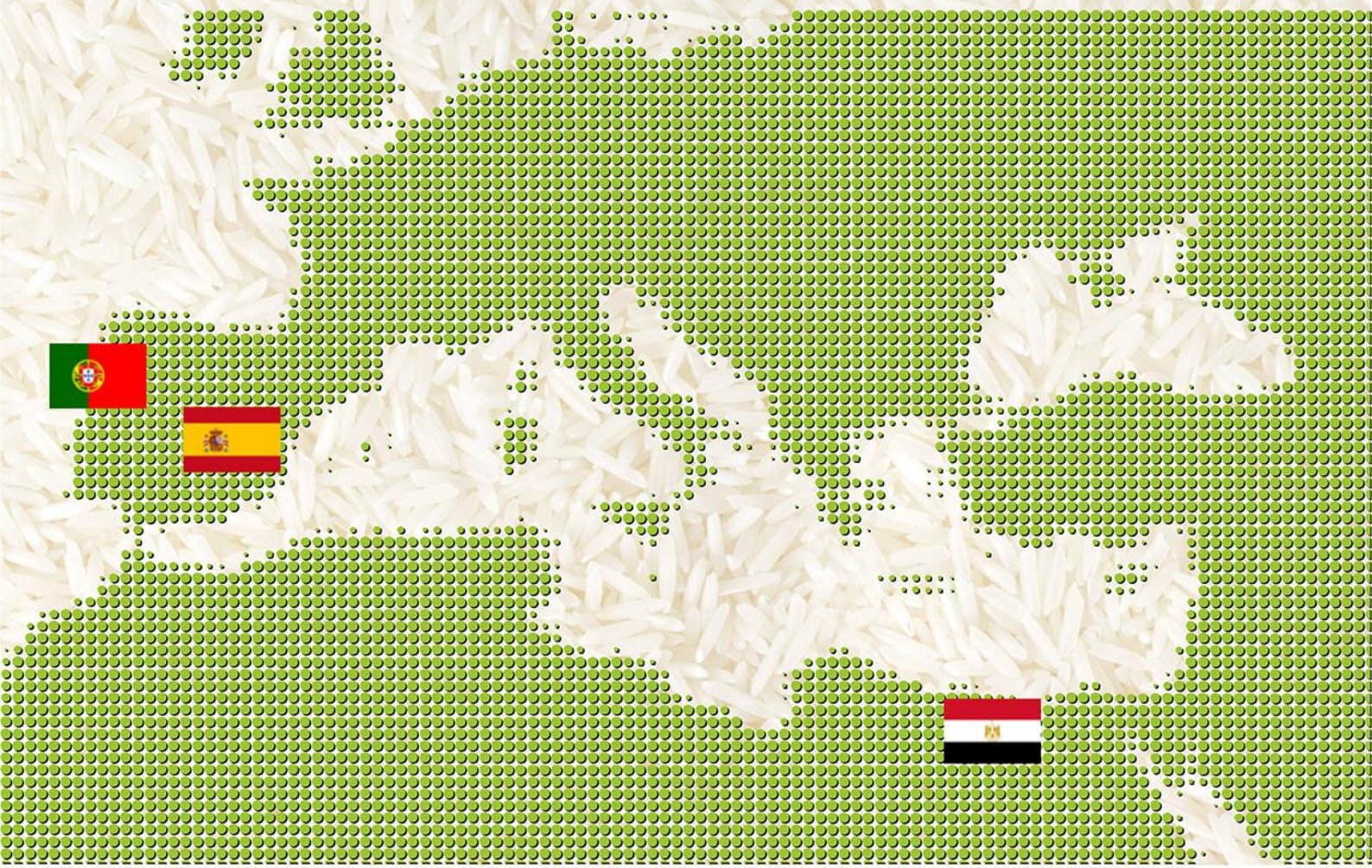
The study's results demonstrate that combining mild cooking temperatures (90-95°C) with natural antimicrobials (chitosan or grape extract) can be an effective hurdle preservation process for acidic, ready-to-eat rice products. This approach enhances safety by reducing *B. cereus* in rice. The Bigelow model and Weibull distribution function were suitable for inactivation models, while Gompertz and Baranyi and Roberts were appropriate for growth models, depending on the process conditions.

Industrial Exploitation Strategy

- **User-Friendly Software**: Developed by IATA/CSIC, this software allows industry professionals to calculate the residual number of microorganisms under specific pH, temperature, and time conditions for two concentrations of grape extract.
- **Exposure Assessment Models**: Available for heat/chitosan and heat/grape extract processes, these models help industry professionals make informed decisions about processing conditions. They provide an estimation of the probability of residual microorganisms based on the heat/antimicrobial combination and other environmental factors such as storage temperature.
- **Industry Engagement**: Arranging meetings with business operators to introduce the models for ready-to-eat rice products is essential. These meetings will explain the context, applicability, and usage of the models.

This detailed approach offers a promising solution for enhancing the safety of rice-based products by combining thermal treatment with natural antimicrobials, backed by robust mathematical modeling and industry collaboration.

TRACE-RICE



TRACE-RICE Consortium

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ITQB Universidade Nova de Lisboa

Casa do Arroz

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Mater Dynamics

BGI www.bgi.pt

Grupo Desarrollo

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