Ecofriendly technology for *in-situ* and *ex-situ* rice straw decomposition through Lignin-Degrading-Solid-Microbial Formulation (CR-Composter)

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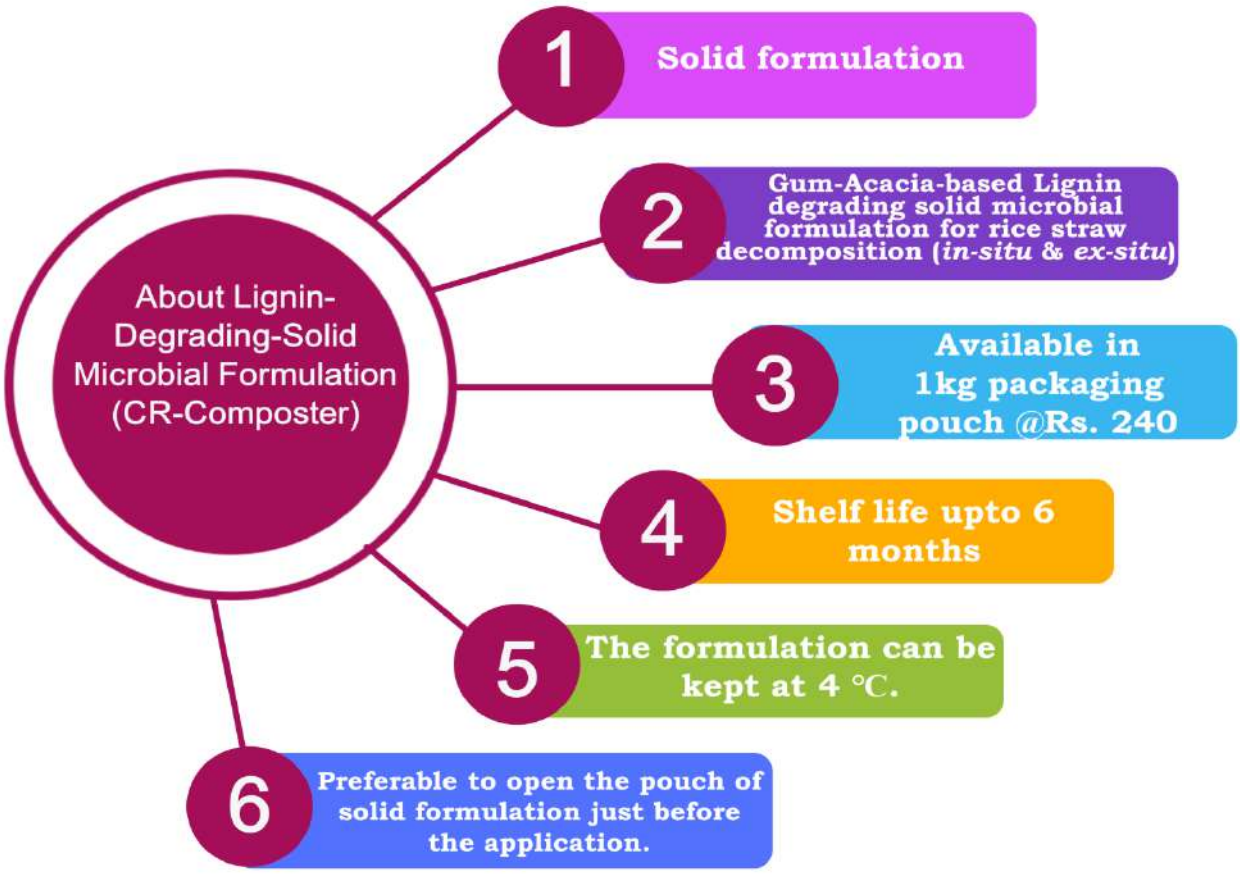
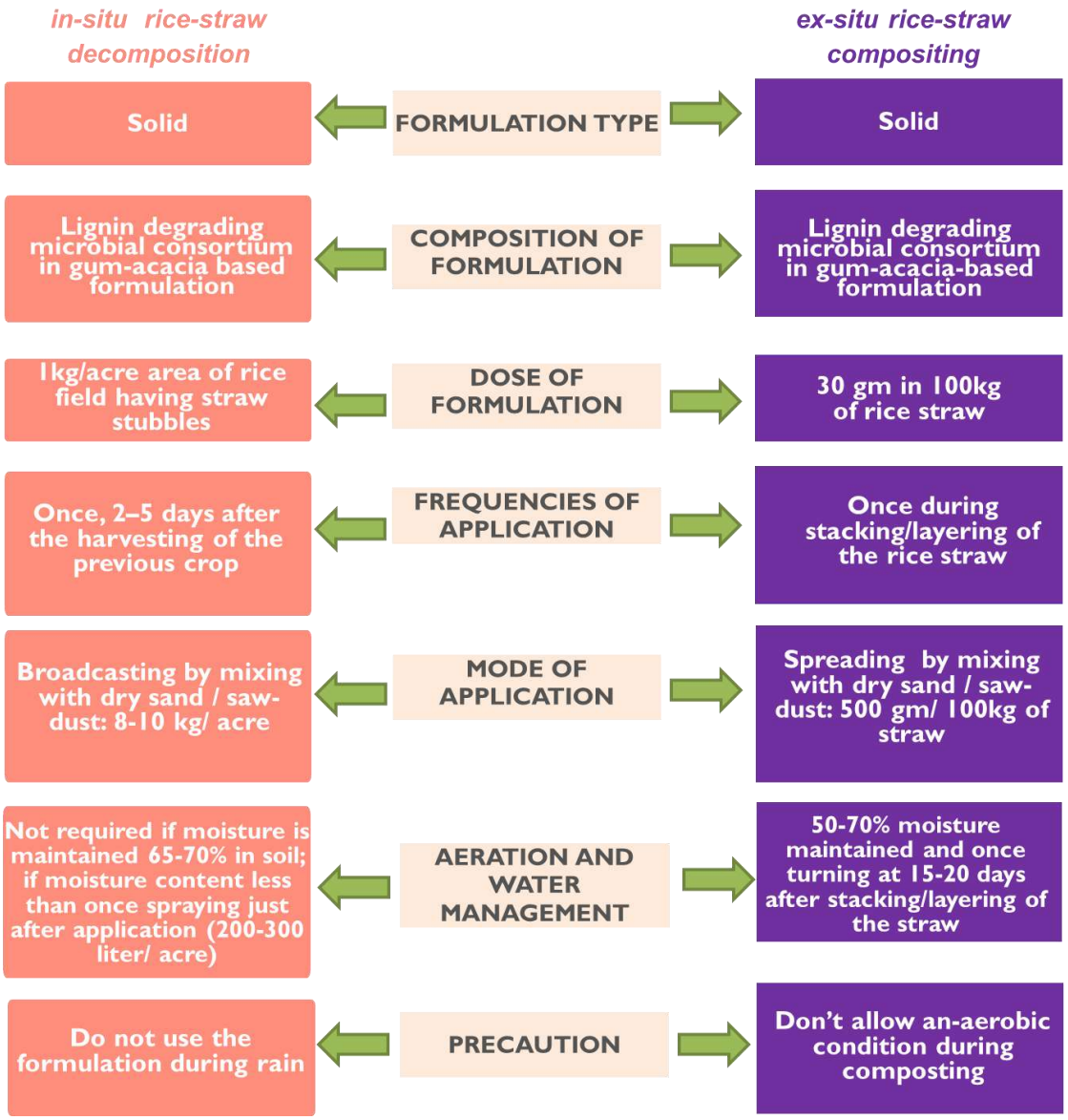
Prologue

Rice straw burning causes significant environmental challenges in north-western India, particularly in Punjab and Haryana. However, it is rapidly spreading in eastern and southern India. Around 50-60 million tonnes of rice straw is produced annually among which 10-18 million tonnes are burnt on the field. Specifically in Odisha, West Bengal, Andra Pradesh, and Tamil Nadu 1-2, 2-3, 2.5-3.5, and 4-5 million tonnes of straw is reported to burn in open field respectively, due to a lack of economically viable options for its utilization (Ananyaa Mohanty and V. Suresh Babu., 2022; Govardhan et al., 2023). However, a few bio-decomposers provide some alternatives by converting rice straw into compost, but their large-scale utilization is limited due to site-specific requirements, soil conditions (moisture and temperature), cropping pattern, and farmer choice. We provide an eco-friendly alternative for both *in-situ* and *ex-situ* decomposition of straw in eastern India. In this context, microbes with higher lignin-degrading potential sourced from natural environments were used for formulation. This bulletin presents the technological details and the protocol for using efficient lignin-degrading solid microbial (*Bacillus* cereus.: MN784664 + *Penicillium* sp.: MK855473) formulation for both *in-situ* and *ex-situ* rice straw decomposition in a shorter time frame in eco-friendly manner.



Protocol for Lignin-Degrading-Solid-Microbial Formulation application for *in-situ* and *ex-situ* rice straw decomposition



Benefits of this technology

1. *In-Situ* Decomposition
   Crop Yield: 5.07–5.23 t ha^{-1} as compared to RDF: 5.50-5.65 t ha^{-1}
   Decomposition Time: 32-35 days
   Fertilizer demand: 25% less nitrogen fertilizer demand for the next crop
   Soil Health Benefits:
   - Enhances soil enzymatic activity.
   - Increase of Soil organic carbon content (SOC): 18-26% over 5 years and improving long-term soil fertility.
2. *Ex-Situ Composting*
   Composting time: 30-35 days
   Final rice straw compost C/N Ratio: 18.8–20.0%
   Compost Quality:
   - C: 20-25%, N:1.2-1.5%, P: 0.5-0.9% K: 1-2%; Bulk Density: 400–600 kg/m^3 Moisture content: 35–45%
3. Validation: *In-situ:* Validated at the CRRI farm field over a period of five years.
   Ex-situ: Validated at the CRRI compost tank and by EcoGrow Solutions SHG group at Dhenkanal, Odisha.

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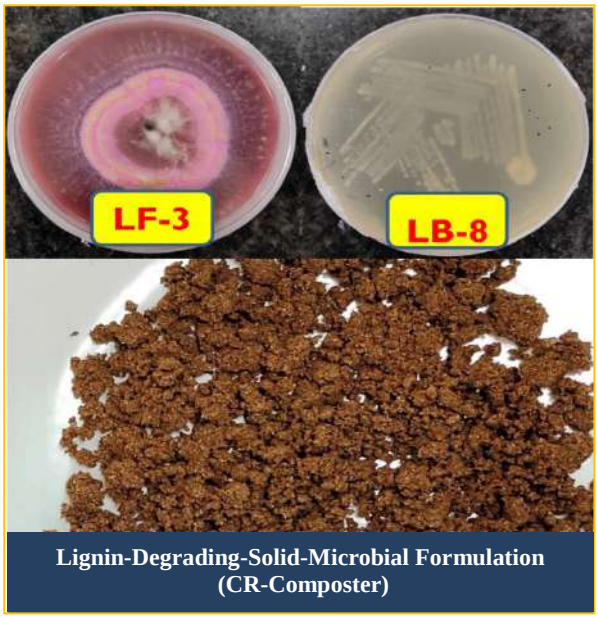

Lignin-Degrading-Solid-Microbial Formulation (CR-Composter)

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