

PROJECT INFORMATION

Potential of plantation-based systems in generating carbon credit through biochar production and application in the West Coast region of India

PROJECT OVERVIEW

Funding Agency	Department of Agriculture and Farmers Welfare, New Delhi (RKVY)
Total Outlay	117.00 lakh
Duration	2 years (Oct 2024 to Sept 2026)
Single / Multi-Institutional	Single
Principal Investigator	Dr. Uthappa, A.R.
Co-Investigators	Gopal Mahajan, Sujeet Desai, Bappa Das and Bommayasamy N

RATIONALE

Traditional *Kulagar* plantation systems of the West Coast generate substantial quantities of coconut, arecanut and other plant residues, much of which remains underutilized or is disposed of through burning or dumping. Converting this biomass into stable biochar offers a dual benefit of managing agricultural waste and enhancing soil quality while increasing long-term soil carbon sequestration. However, the potential of biochar-based carbon sequestration and its conversion into verifiable carbon credits for farmers remains insufficiently demonstrated under coastal conditions. The project therefore aims to develop and evaluate a practical biochar production and application system in *Kulagars*, quantify carbon sequestration, and establish the basis for carbon-credit generation and additional income opportunities for farmers.

RESEARCH GAPS

- Limited quantification of biomass availability: Insufficient data on the quantity and seasonal availability of coconut, arecanut and other plantation residues suitable for biochar production in *Kulagar* systems.
- Site-specific biochar performance: Limited information on the optimum production and application conditions and the effects of biochar on soil properties, crop productivity and soil carbon under lateritic coastal soils.
- Carbon sequestration potential: Lack of reliable field-based estimates of stable carbon retained in biochar and soil under plantation-based systems.

- Carbon-credit feasibility: Limited evidence on the quantification, monitoring, reporting and verification (MRV) requirements for converting biochar-based carbon sequestration into verifiable carbon credits for smallholder farmers.
- Economic viability: Inadequate assessment of the cost-effectiveness, farmer-level benefits and income potential of decentralized biochar production and carbon-credit generation.
- Scalable production model: Lack of a validated, low-cost and locally adaptable biochar production and utilization model that can be replicated across coastal plantation systems. There is a need to integrate biomass utilization, biochar production, soil carbon sequestration, soil-health improvement and carbon-credit generation into a scientifically validated and economically feasible model for *Kulagar*-based plantation systems.
- Weak linkage between production and markets: There is limited integration of species selection, site suitability, cultivation, economics and market demand into a unified framework for promoting bamboo cultivation in Goa.

OBJECTIVES

- To explore the feasibility of production of biochar from biomass and application of it for soil and non soil application for sequestering carbon.
- To develop a project to realize carbon credits from biochar production and utilization in the coastal region.

ACTIVITIES

Objective 1:

- Selection and characterization of *Kulagar* sites and assessment of available coconut, arecanut and other plantation biomass.
- Installation and operation of low-cost pyrolysis units for conversion of plantation biomass into biochar.
- Quantification and characterization of biochar, including yield and carbon content.
- Application of biochar to selected plantation soils and monitoring of changes in soil properties, soil carbon and crop performance.
- Estimation of carbon sequestration through biomass conversion, biochar production and soil carbon storage. • Compilation, statistical analysis, interpretation and reporting of results.

Objective 2:

- Quantification of biomass contribution and biochar production at individual farmer/*Kulagar* level.
- Development of a carbon accounting and monitoring, reporting and verification (MRV) framework for biochar-based carbon sequestration.
- Assessment of carbon-credit potential from biochar production and soil application.
- Evaluation of the economic feasibility and potential additional income to farmers through carbon credits.

- Preparation of carbon-credit project documentation and implementation framework in accordance with applicable carbon-market requirements.
- Development of guidelines and a scalable model for biochar-based carbon sequestration in coastal plantation systems.

EXPERIMENTAL DETAILS

Treatment:	NA
Fertilizer Doses	NA
Variety	NA
Replications:	NA
Observations:	Biomass and Biochar • Biomass availability ($\text{kg ha}^{-1} \text{ year}^{-1}$) • Type and quantity of biomass utilized • Biochar production ($\text{kg ha}^{-1} \text{ year}^{-1}$) • Biochar yield (%) • Biochar carbon content (%) Soil and Crop • Soil pH • Soil organic carbon (%) • Available N, P and K • Soil moisture and water-holding capacity • Soil carbon stock (Mg C ha^{-1}) • Crop/plant growth and yield Carbon and Economics • Carbon sequestered through biochar (Mg C ha^{-1}) • Estimated carbon credits ($\text{t CO}_2\text{e}$) • Cost of biochar production and application • Potential income from carbon credits Farmer and Socio-economic Details • Farmer name/ID and location • Landholding and area under <i>Kulagar</i> • Major crops/tree species grown • Quantity of biomass generated and utilized • Existing biomass management practices • Farmer awareness of biochar and carbon credits • Willingness to adopt biochar technology • Labour and production costs • Farmer's perceived benefits and constraints
GPS Coordinates:	Existing <i>Kulagar</i> in Ponda taluka of Goa will be used as sites for the study (Keri & Priol village)

EXPECTED OUTPUT

- Validated biochar production and application technology for efficient conversion of *Kulagar* plantation biomass into biochar, with quantified biochar yield, quality and carbon sequestration potential.
- Carbon-credit generation framework including carbon accounting/MRV methodology and farmer-level assessment for biochar-based carbon sequestration.

EXPECTED OUTCOME

- Improved soil health and carbon sequestration through recycling of plantation biomass as biochar.
- Additional income opportunities for farmers through sustainable biomass utilization and participation in biochar-based carbon-credit programmes.

FIELD INFORMATION

When the field was developed:	NA
What are crops being cultivated season-wise:	NA
Soil type:	NA
Soil pH, EC, OC:	NA
Soil depth:	NA
Soil NPK and Micronutrient status:	NA
Common pests and diseases:	NA