Towards Viksit Bharat@2047
Technological Innovations and Policy Options for Eastern Region

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Towards Viksit Bharat@2047: Technological Innovations and Policy Options for Eastern Region

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Carbon Stock Quantification Models for Important Fruit Trees of Eastern India

Period of Development: 2018 - 2021

Developers:

SK Naik, BP Bhatt, S Maurya, PK Sarkar, Bikash Das, AK Singh

Background:

Sequestering carbon through tree-based systems is considered as an attractive economic opportunity for carbon trading. Majority of Indian population is dependent on agriculture, so that fruit tree-based systems provide a long-term strategy to increase the amount of carbon along with food crops. Understanding the carbon storage potential of fruit trees, will likely provide additional value to farmers' livelihood in poverty alleviation in carbon market schemes like REDD+. The biomass estimation of individual trees or orchard is important for the valuation of the amount of CO_2 that is sequestered from the atmosphere as well as changes in the carbon stock.

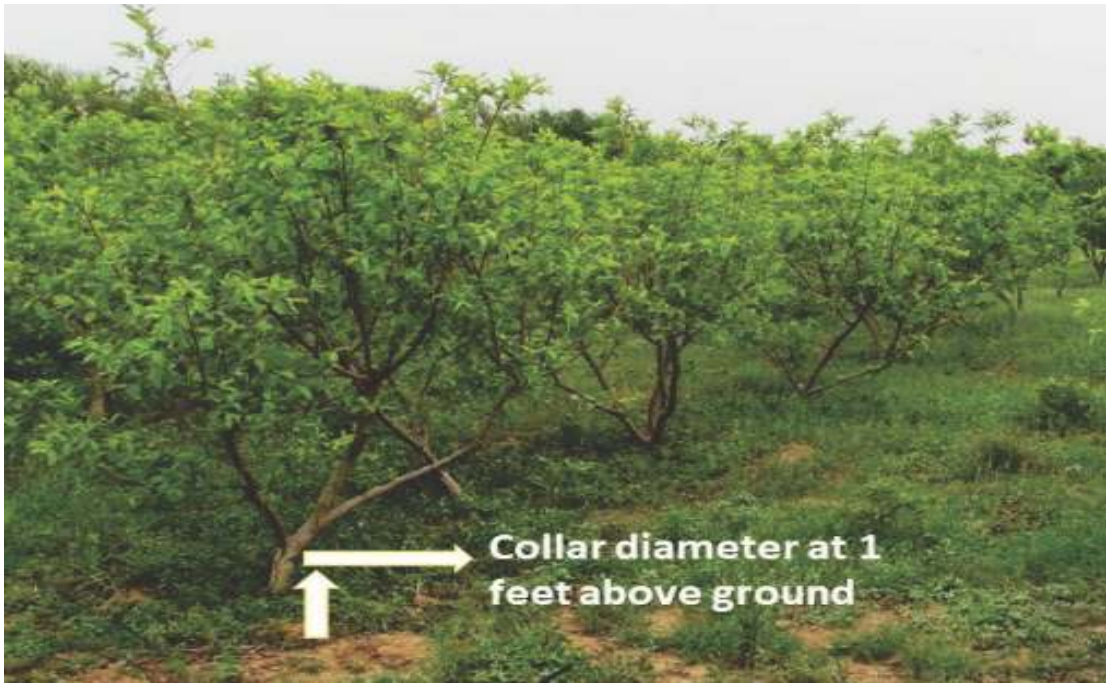
Description of the technology:

Guava orchards under rainfed conditions in a hot and sub-humid climate contribute significantly to atmospheric CO, sequestration while mitigating emissions from deforestation. A model was developed to estimate biomass carbon stock in *Psidium guajava* orchards, aiding in understanding carbon dynamics and optimizing orchard management for enhanced sequestration and carbon credit earnings.The study assessed above-ground biomass (AGB) and below-ground biomass (BGB) in a 1 ha orchard with 275 guava trees (2–10 years old) spaced at 6 m × 6 m. Trees were categorized into five age classes (2, 4, 6, 8, and 10 years), with collar diameter measured at 30 cm above ground. Root biomass was excavated from a 1.5 m soil volume per tree, and tree components (roots, bole, branches, leaves) were separated to estimate dry weight using the fresh-to-dry weight ratio. Carbon stocks were determined by multiplying biomass with average carbon content. Component-wise biomass carbon stock (kg/plant) and collar diameter (cm) were analyzed using nine predictive models—linear, allometric, logistic, Gompertz, Richard's, negative exponential, monomolecular, Mitcherlich, and Weibull—to establish functional relationships. Richard's equation was identified as the most suitable model for estimating dry biomass and carbon stock using collar diameter as an independent variable. The validity of the developed models is within the collar diameter range of guava orchards considered during sampling, because they do not include other sources of variation. The present developed model for estimation of biomass carbon stock will help in better understanding of C stocks and dynamics in P. guajava orchards and can be used in orchard management activities to enhance C sequestration while earning significant C credits.

Impact:

Understanding the carbon sequestration potential of fruit trees will provide additional benefits to farmers by earning additional income terms of selling carbon credits. The farmers' in the non-forest area having fruit orchard will be benefitted from this model. The

present developed model will be helpful for developing suitable policy to the government for designing state plan in minimizing the GHG emission.



Collar diameter measurement for carbon stock

Commercial potential:

The technology can be Consultancy services provider/ licensed/outsourced to State Agricultural Department, National Horticulture Mission, RKVY, NGOs and stakeholders engaged in efficient nutrient management in Orchards.

Agro-ecoregions suitability:

Hill and plateau regions of Jharkhand

Reference:

Naik SK, Sarkar PK, Das B, Singh AK, Bhatt BP. 2021. Biomass production and carbon stock in Psidium guajava orchards under hot and sub-humid climate. *Current Science (00113891), 120*(10): 1627-1635.