



Financial viability of citronella (*Cymbopogon winterianus*) as rejuvenation crop during tea rehabilitation

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Abstract

Small tea growers in Assam face a critical income gap of 7 years during tea rehabilitation, threatening their economic sustainability. This study examines citronella (*Cymbopogon winterianus*) cultivation as a rehabilitation crop to bridge this income gap. Primary field data from small tea growers of Assam combined with secondary sources were analyzed to assess financial viability. Results indicate that integrating citronella upon tea uprooting immediately offsets conventional replantation deficits, generating a net cash flow of INR 82,530/acre by the end of the first year. The transition model demonstrates a Net Present Value of INR 240,051 at 12 percent discount rate, Benefit-Cost Ratio of 1.7, Citronella yields 2,250 kg/acre/cut with 4 cuts annually under favorable conditions, generating gross revenue of INR 108,000/acre at INR 12/kg price. Gross income in 15 Years is 15 Lacs, Total cost that includes the capital costs are 8 lacs resulting in Net income of 6 Lacs along with old tea bushes being replaced by new and healthy bushes. The Tea Board of India recognizes citronella as a rehabilitation crop during plantation rehabilitations. This dual-cropping strategy addresses the research gap of income stabilization during gestation periods of tea, providing STGs with continuous cash flow while new tea bushes mature.

Keywords: Income gap, Rehabilitation Crop, Small Tea Growers, Tea Replantation

Introduction

Tea (*Camellia sinensis* L.) cultivation in Assam represents the backbone of India's tea industry, with the state contributing 56.11 percent of national production from 282.10 thousand hectares (Das et al., 2020). Small Tea Growers (STGs), defined by the Tea Board of India as farmers cultivating up to 10.12 hectares without a processing facility, have emerged as a transformative force in the sector, contributing over 52 percent of Assam's total tea production and supporting more than 2,00,000 farming families (Basu & Banerjee, 2022). The concept of small-scale tea cultivation in Assam was largely unheard of until 1975, with farmers beginning to adopt it on a large scale during the mid-1990s when prevailing market prices made it an

attractive livelihood (Bordoloi et al., 2022). This transition was often a shift from pre-existing livelihoods as per the respondents in Tinsukia District, the STGs had previously cultivated sugarcane and citronella grass before converting their land to tea, reflecting the broader agrarian flexibility that drove STGs expansion across upper Assam. Despite this substantial contribution, STGs face multifaceted challenges including fluctuating market prices, high input costs, limited bargaining power, and most critically, income loss during plantation renewal cycles (Bordoloi et al., 2022; Sharma, 2019).

Tea cultivation area in Assam stood at 230,363 hectares in 1990 and expanded to 266,512 hectares by 2000, with the incremental area largely

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attributable to the legalization and rapid proliferation of small-scale cultivation following policy liberalization (Tea Board of India, 2001). At the all-India level, total area under tea grew from 416,269 hectares in 1990 to 504,366 hectares by 2000, with STG expansion accounting for a significant share of this growth (Tea Board of India, 2001). Since tea bushes planted in the 1990s will reach their 40-year economic threshold between 2030 and 2035, and given that the most rapid phase of STG establishment occurred precisely within that decade, Assam is approaching a concentrated wave of replantation need (Kamau, 2008). Assuming a conservative renewal cycle in which even 10 percent of the old plantation's require uprooting per year from 2030 onwards, this translates to thousands of hectares annually entering the rehabilitation phase in Assam alone. The financial implications of this impending transition, without an income-bridging mechanism, are severe for resource-constrained STGs who lack the savings to withstand a 7-year income void (Bordoloi *et al.*, 2022; Pratap Bhuyan, 2004).

Tea (*Camellia sinensis*) is a long-duration perennial plantation crop capable of remaining in production for up to 100 years under well-managed conditions (Kamau, 2008). However, the economically productive phase of a tea bush is considerably shorter. Research consistently identifies that peak yields are attained between 20 and 40 years after planting, beyond which productivity declines to levels where plantations become degraded and economically unviable (Kamau, 2008; Dutta *et al.*, 2012). Plantations exceeding 40 years exhibit more than 25 percent gaps, fail to respond to nitrogen fertilisation, and do not recover meaningfully from rejuvenation pruning (Kamau, 2008). This age-related yield deterioration has been corroborated specifically for Northeast India, where section-level regression analysis across Assam tea estates confirmed a significant negative linear effect of age on yield, with production peaks clearly falling between the 20 to 40 year age of tea bushes (Dutta *et al.*, 2012). The effective economic age of a tea bush is therefore 40 years, beyond which uprooting and replanting with improved clonal cultivars becomes the most

cost-effective intervention (Kamau, 2008; Dutta *et al.*, 2012). The uprooting and replantation process creates an income gap of 7 years before new plantations reaches commercial production levels. For resource constrained STGs with limited savings and no alternative income sources, this extended period without revenue forces many to abandon replantation altogether or fall into debt

The Tea Board of India formally recognizes six crops for use as rehabilitation intercrops during tea plantation renewal: Guatemala grass (*Tripsacum laxum*), Pusa Giant Hybrid Napier (*Pennisetum purpureum*), Citronella grass (*Cymbopogon winterianus*), Crotalaria (*Crotalaria anagyroides*), Teprosia (*Tephrosia candida*), and Sesbania (*Sesbania rostrata*) (Tea Board of India, 2026). Among these, Crotalaria, Teprosia, and Sesbania function exclusively as green manure crops, offering soil enrichment but no marketable income for the grower. Guatemala grass and Napier grass, while productive as fodder crops, have limited commercial reach in Assam's tea belt and do not generate a tradeable value-added product. Citronella grass (*Cymbopogon winterianus* Jowitt), a perennial aromatic grass of the family Poaceae, stands apart as the only Tea Board-approved rehabilitation crop that generates a commercially traded essential oil with established domestic and export markets (Katiyar *et al.*, 2011; Camacho *et al.*, 2015). The selection of citronella in this study is further grounded in its agronomic familiarity to the respondent farmers primary data confirms that STGs in Tinsukia District previously cultivated citronella before transitioning to tea reducing the knowledge and adoption barrier. Additionally, the North Eastern Development Finance Corporation Limited (NEDFi), under a North Eastern Council (NEC) initiative, has published a dedicated Package of Practice for citronella cultivation in the region and provides farm economics guidelines, indicating institutional readiness for scaling the crop in Northeast India (NEDFi, 2023).

The agronomic suitability of Assam's tea-growing landscape for citronella cultivation further strengthens the case for this rehabilitation model. Citronella grass thrives in well-drained, slightly acidic soils with pH ranging from 5.0 to 7.0,

requires annual rainfall of 1,500 to 2,500 mm, and performs best at temperatures between 18°C and 29°C with high sunshine hours (Katiyar *et al.*, 2011; Das *et al.*, 2020). These conditions are nearly identical to the agro-climatic requirements of tea cultivation in Assam's plains and sub-Himalayan foothills, meaning that any area currently under tea in the state is, in principle, agronomically suited for citronella during the rehabilitation phase. This universality of terrain suitability is a critical advantage: unlike specialized intercropping models that require specific micro-climatic conditions, the tea-citronella transition model can be applied across the full geographic extent of Assam's STG sector. Market access is progressively being addressed through FPO-led distillation units supported by NEDFi in upper Assam, which provide collection and processing infrastructure particularly relevant to Tinsukia and adjoining districts where this study is situated (NEDFi, 2023). The global citronella oil market, valued at USD 126.80 million in 2023 and projected to grow at a 5.5 percent CAGR through 2032, provides a stable demand environment for STGs entering this market (GM Insights, 2023).

While studies have examined the economics of tea cultivation (Das *et al.*, 2020; Sharma, 2019; Kiruthiga & Damodaran, 2016) and citronella as a standalone crop (Camacho *et al.*, 2015; Katiyar *et al.*, 2011), there is a critical research gap regarding the systematic financial analysis of citronella as a rehabilitation crop specifically designed to bridge STG income loss during replantation periods. Previous work on STG farming systems confirms income diversification improves livelihood resilience (Bordoloi *et al.*, 2022), yet no study has modelled the complete 15-year financial trajectory of a tea-citronella transition from the perspective of a resource-constrained STG facing an imminent replantation cycle. This study addresses that gap through three objectives. The first objective is to assess the financial viability of citronella cultivation as a rehabilitation crop during tea replantation cycles. The second objective is to analyze the cost-benefit ratios of the integrated tea-citronella transition model over a 15-year horizon. The third objective is to provide evidence-based recommendations for policy interventions that support STG rehabilitation strategies at scale in Assam.

Materials and Methods

Study Area

This study focused on Tinsukia District, Assam a high-density STG area facing acute plantation aging challenges using purposive sampling of 20 STGs and 10 citronella farmers. The tea farmers have started their plantation in 1998. Primary data combined field surveys, direct observations, interviews using questionnaires and Excel-based financial modelling of 15-year horizon. Secondary sources included Tea Board statistics and publications, NEDFi Package of Practice, Assam and North Bengal tea economics, and regional citronella studies. The citronella farmers operated within Tinsukia District, sharing identical agro-climatic, soil, and market conditions.

Financial Analysis Framework

The financial viability assessment employed standard agricultural project evaluation techniques:

Net Present Value (NPV):

$$NPV = \sum_{t=0}^n \frac{B_t - C_t}{(1 + r)^t}$$

where B_t = benefits in year t , C_t = costs in year t , r = discount rate (12 percent), n = analysis period (13 years).

Benefit-Cost Ratio (BCR):

$$BCR = \frac{\left(\sum_{t=0}^n \frac{B_t}{(1 + r)^t} \right)}{\left(\sum_{t=0}^n \frac{C_t}{(1 + r)^t} \right)}$$

where B_t = benefits in year t , C_t = costs in year t , r = discount rate (12 percent), n = analysis period (13 years)

Results and Discussion

Integration of citronella as a rehabilitation crop during tea replantation substantially improves the short- and medium-term cash-flow profile of small tea growers (STGs) in Tinsukia District, Assam, compared with any other rehabilitation crops. The transition model demonstrates that citronella can

convert a 7-year income void into a financially viable and agronomically compatible rehabilitation pathway for ageing smallholder tea plantations.

Cost and revenue parameters of the transition model

Table 1. Citronella and Tea cultivation parameters

Parameter	Value
Citronella Grass Price (Rs/kg)	12
Citronella Yield per acre per cut (kg)	2,250
Citronella Slip cost (Rs/slip)	3.00
Required Slips per acre	11,241
Citronella Establishment cost (Rs/acre)	63,723
Cuts per year	4
Senile Tea Income (Year 0)	1,10,000
Annual Decline rate of Senile Tea	15%
Estimated Tea Uprooting cost	30,000
New tea establishment Costs	1,29,000
Mature tea operating Costs	65,000
Peak Production Income from Tea	1,01,032

The model is calibrated using field-derived and institutionally validated parameters for both

citronella and tea (Table 1). Citronella is assumed to yield 2,250 kg of fresh biomass per acre per cut, with four cuts annually and a farm-gate price of ₹12 per kg, giving gross annual revenue of ₹108,000 per acre at full production. Establishment costs including 11,241 slips per acre at ₹3 per slip plus land preparation and planting total ₹63,723 per acre, consistent with NEDFi's package of practices for Java-type varieties such as Mandakini, Manjusha and Jorhat-2.

For tea, senile stands earn ₹110,000 per acre in Year –2 with an annual yield decline of 15 percent, capturing the documented productivity deterioration beyond 40 years of economic life in North-East India. Uprooting costs are taken as ₹30,000 per acre and new clonal tea establishment costs as ₹129,000 per acre, while mature tea operating costs are assumed at ₹65,000 per acre, yielding peak tea income of about ₹101,032 to ₹110,000 per acre under full bearing. These parameters provide a realistic baseline for assessing citronella-assisted rehabilitation under current market and technological conditions in upper Assam.

Table 2. Phases of integrated tea-citronella transition model

15 Year Period	Phase	Tea Income	Cit Income
Yr -2	Senile Tea (declining)	₹ 1,10,000	₹0
Yr -1	Senile Tea (declining)	₹ 93,500	₹0
Yr 0	Tea Uprooted (August) and Citronella Planted	₹ 79,475	₹0
Yr 0.1	Citronella Year 1	₹0	₹84,000
Yr0.2	Citronella (Cit.) Year 2	₹0	₹1,08,000
Yr 1	Citronella 4 cuts; new tea planted	₹0	₹1,08,000
Yr 2	Citronella full (4 cuts); young tea Yr1	₹0	₹1,08,000
Yr 3	Citronella full (4 cuts); young tea Yr2	₹0	₹1,08,000
Yr 4	Citronella 50% boundary (3 cuts); tea Yr3	₹82,356	₹40,500
Yr 5	Citronella 30% perimeter (2 cuts); tea Yr4	₹85,896	₹16,200
Yr 6	Citronella 20% boundary (2 cuts); tea Yr5	₹90,384	₹10,800
Yr 7	Citronella 10% perimeter (1 cut); tea Yr6	₹82,356	₹2,700
Yr 8	Mature Tea Yr 7	₹94,908	₹0
Yr 9	Mature Tea Yr 8	₹1,03,032	₹0
Yr 10	Peak Tea Yr 9	₹ 1,10,000	₹0

Phased income trajectory and cash-flow stabilisation

The integrated tea–citronella transition follows four phases over 15 years (Years –2 to 10): senile tea decline, full citronella dominance, progressive citronella retention on boundaries, and a return to mature tea monoculture (Table 2). In Years –2 and –1, senile tea still provides positive but declining net incomes, reflecting typical late-life STG performance.

The critical inflection occurs in Year 0, when old tea is uprooted (August) and citronella is planted. This generates a one-time net deficit of ₹16,082 because uprooting and establishment costs exceed the final senile tea income in Year 0a. Within six months, however, the first citronella harvest in Year 0.1 delivers net income of ₹58,530, fully offsetting the initial deficit and preventing the prolonged negative cashflows characteristic of conventional replantation. From Year 0.2 onwards, full citronella stands generate net income of about ₹82,530 per acre per year, providing a robust income bridge while new tea is established.

In Years 2 and 3, citronella remains at full scale and young tea begins to enter the system, producing modest but positive net cashflows of around ₹20,790 per acre per year despite ongoing establishment and maintenance costs. Citronella thus functions as an income stabiliser across the early gestation period of young tea, eliminating the multi-year zero-income phase faced by STGs under conventional practice.

Transition to mature tea

From Year 4, citronella is deliberately withdrawn as tea canopy increases, coverage is reduced to 50 percent in Year 4, 30 percent in Year 5, 20 percent in Year 6 and 10 percent in Year 7, and removed entirely by Year 8 when tea reaches maturity. This sequence reflects both agronomic requirements intercrops must recede as tea canopy closes and the grower's need to retain some oil-grass cashflow while tea productivity ramps up.

Throughout this transition, annual net incomes remain positive, typically between ₹19,136 and

₹48,031 per acre, with citronella and tea providing complementary revenue streams (Table 2). Even when citronella is confined to a narrow perimeter strip in Year 7, net income remains above levels expected under conventional replanting during the same stage. From Years 8 to 10, tea stands fully mature and citronella is phased out; net incomes of ₹29,625, ₹37,317 and ₹43,790 per acre are achieved, with Year 10 performance clearly exceeding the pre-rehabilitation senile baseline of ₹28,229 in Year –1.

Financial viability indicators

Table 3. Summary Financial Indicators for Tea-Citronella Transition Model

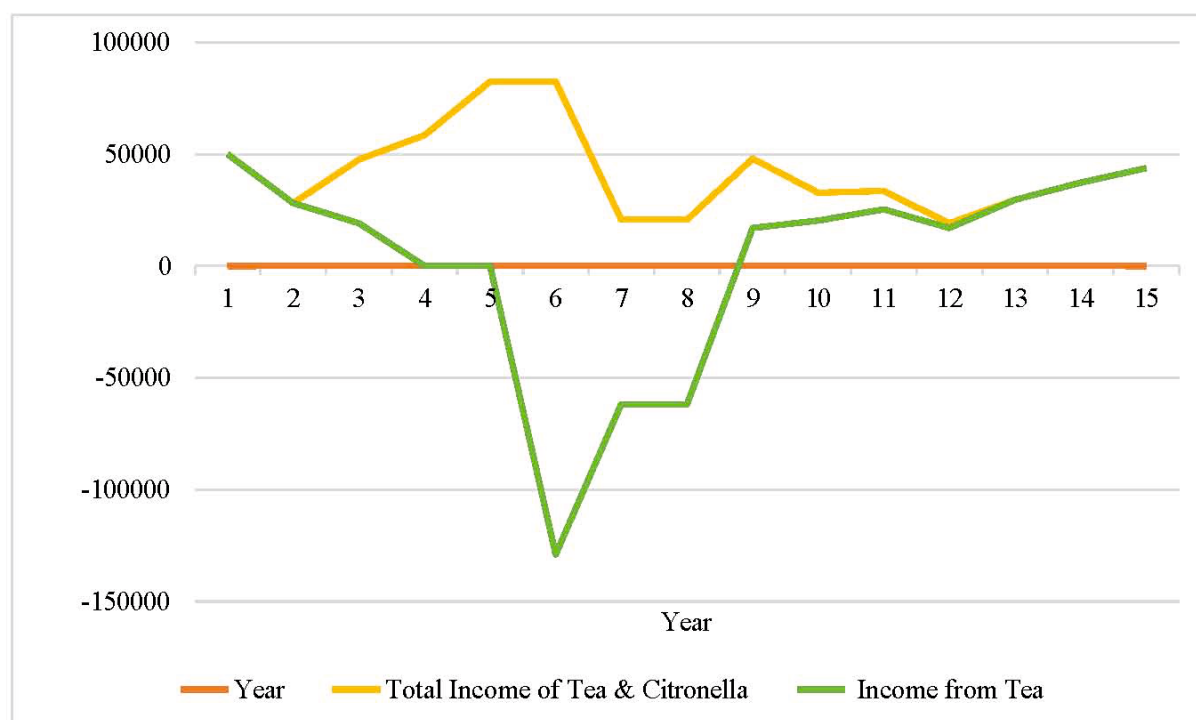
Financial Indicator	Value (Rs. /acre)
Net Present Value (NPV) at 12%	2,40,051
Benefit-Cost Ratio (BCR)	1.7
Total Gross Income (15 years)	15,18,107
Total Costs (15 years)	8,82,789
Net Profit (15 years)	6,35,319
10-Year Cumulative Net Income	3,35,087

Over the full horizon, the integrated system generates total gross income of ₹1,518,107 per acre against total costs of ₹882,789, yielding cumulative net profit of ₹635,319 (Table 3). At a 12 percent discount rate, the Net Present Value (NPV) is ₹240,051 per acre, confirming that returns exceed the opportunity cost of capital, while the Benefit–Cost Ratio (BCR) of 1.7 indicates that each rupee invested yields ₹1.70 in present value terms. Payback is achieved by Year 2, which is unusually rapid for a perennial plantation investment and particularly significant for resource-constrained STGs.

By Year 10, cumulative net income from the tea–citronella model reaches ₹335,087 per acre compared with about ₹165,000 under conventional replantation, implying a 103-percent advantage in 10-year net returns (Table 4). These indicators show that a properly designed rehabilitation intercrop can fundamentally shift the economics of tea replantation in favour of smallholders.

Table 4. Complete 15-Year Cashflow Trajectory (INR /acre)

Year	Phase	Income from tea cultivation	Income from citronella	Total Income	Total Costs	Net Cashflow
-2	Senile tea declining	110,000	0	110,000	60,000	50,000
-1	Senile tea declining	93,500	0	93,500	65,271	28,229
0a	Tea uprooted, cit. planted	79,475	0	79,475	95,557	-16,082
0.1	Citronella Year 1 (first cut)	0	84,000	84,000	25,470	58,530
0.2	Citronella Year 2 (4 cuts)	0	108,000	108,000	25,470	82,530
1	Citronella full + tea replanting	0	108,000	108,000	154,470	-46,470
2	Citronella full + young tea Yr1	0	108,000	108,000	87,210	20,790
3	Citronella full + young tea Yr2	0	108,000	108,000	87,210	20,790
4	50% Citronella + tea Yr3	82,356	40,500	122,856	74,825	48,031
5	30% Citronella + tea Yr4	85,896	16,200	102,096	69,329	32,768
6	20% Citronella + tea Yr5	90,384	10,800	101,184	67,572	33,612
7	10% Citronella + tea Yr6	82,356	2,700	85,056	65,920	19,136
8	Mature tea Yr7	94,908	0	94,908	65,283	29,625
9	Mature tea Yr8	103,032	0	103,032	65,715	37,317
10	Peak tea Yr9	110,000	0	110,000	66,210	43,790
TOTAL		1,012,382	586,200	1,518,107	882,789	635,319

**Fig 1. Comparative financial performance (INR/acre) of tea and citronella**

Comparison of Citronella and Other Rehabilitation Crops

Plantation of any other rehabilitation crops requires upfront spending of roughly ₹30,000 per acre on uprooting and ₹129,000 per acre on establishment, while yielding no marketable income for about seven years until commercial bearing. Field evidence from Tinsukia indicates that this remains the default STG strategy, mainly due to limited awareness of Tea Board-approved rehabilitation options, following the agronomic practices of nearby large tea estates, and weak extension support.

In this baseline scenario, Years 0–1 alone produce an accumulated deficit of about ₹198,000 per acre, often forcing growers into distress borrowing or abandonment of replantation. In contrast, the citronella-integrated model generates positive cashflow of approximately ₹78,508 per acre over the same period, representing a 140-percent reversal of the deficit profile (Figure 1). Additional gains in Years 2–3 (net income of about ₹41,580 versus continued deficits under conventional practice) allow growers to maintain input use and labour payments without resorting to high-cost informal credit. The integrated system therefore addresses both liquidity and solvency constraints by smoothing annual cashflows, limiting debt exposure and preserving the capacity to manage young tea effectively.

Agronomic compatibility and institutional readiness

Citronella's agro-climatic requirements are well-drained slightly acidic soils (pH 5.0–7.0), annual rainfall of 1,500–2,500 mm and temperatures of 18–29 °C with good sunshine closely match those of tea in Assam's plains and sub-Himalayan foothills, implying broad suitability of existing STG lands for citronella during rehabilitation. The Tea Board of India lists citronella among its approved rehabilitation crops, and unlike the green-manure or fodder alternatives, citronella generates a tradable essential oil with established domestic and export demand. NEDFi's dedicated package of practices and farm-economics guidelines, along with emerging FPO-led distillation units in upper Assam, indicate

institutional readiness to scale citronella alongside STG replanting programmes.

However, diffusion barriers remain: awareness of citronella as a rehabilitation option is low, establishment costs and labour demands can be daunting without tailored credit or subsidies, and marketing still hinges on access to nearby distillation units and reliable buyers.

Citronella intercropping transforms tea replantation from a prolonged financial shock into a managed, income-generating transition, delivering an NPV of ₹240,051 per acre and a BCR of 1.7 while maintaining continuous or near-continuous positive cashflows throughout the rehabilitation period. By bridging the 7-year income gap through rapid and sustained citronella returns peaking near ₹82,530 per acre per year. The model directly addresses a central vulnerability in STG livelihood systems and fills a key gap in rehabilitation policy design. Scaling this tea–citronella transition through targeted replantation subsidies, decentralized nurseries and FPO-led distillation and marketing infrastructure could generate substantial cumulative gains even if adopted on a modest share of Assam's ageing STG area. In effect, citronella-based rehabilitation recasts replantation from a high-risk, debt-inducing decision into a viable, income-securing investment in the long-term sustainability and competitiveness of the small tea sector in North-East India.

Conflict of Interest Declaration

The author declares no conflict of interest. This research received no external funding and has no financial or personal relationships that influenced the study.

Ethics Statement

This study used anonymized primary data from small tea growers with verbal informed consent. No human or animal subjects were involved, and all analyses followed standard agricultural research ethics.

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References

- Adhikari, K. B., Regmi, P. P., Gautam, D. M., Thapa, R. B., & Joshi, G. R. (2017). Value chain analysis of orthodox tea: Evidence from Ilam district of Nepal. *Journal of Agriculture and Forestry University*, *1*, 61–68.
- Basu, U., & Banerjee, K. (2022). Scope of collective bargaining process in the small tea garden: A study with special reference to Jalpaiguri district of West Bengal. *Advancement in Management and Technology*, *2*(4), 17–25.
- Bordoloi, S. K., Deka, M., Bhuyan, R. P., Gogoi, A. S., Phukon, S. K., Sonowal, S., Tanti, N., & Hussain, T. (2022). Livelihood analysis of small tea growers by analysing their farming systems and resource utilization in Jorhat district. *International Journal of Plant & Soil Science*, *34*(8), 81–91.
- Camacho, S. C., Carandang, A. P., Camacho, L. D., Gevaa, D. T., Carandang, M. G., Lorida, R. E., & Bandian, M. N. P. (2015). Economic potential of small-scale citronella (*Cymbopogon winterianus*) production in the Philippines. *Philippine Journal of Crop Science*, *40*(3), 73–81.
- Dutta, R., Stein, A., Smaling, E. M. A., Bhagat, R. M., & Hazarika, M. (2012). Modelling and quantifying tea productivity in Northeast India. *Two and a Bud*, *59*(2), 56–63.
- GM Insights. (2023, August 22). *Citronella oil market size and share: Growth forecast 2024–2032*. GM Insights. <https://www.gminsights.com/industry-analysis/citronella-oil-market>
- Ghosh, A., Das, L., Pal, P. K., Sarkar, A., & Nain, M. S. (2017). Perspectives of small-scale tea growing system (STGS): A study of North Bengal areas in India. *Indian Journal of Extension Education*, *53*(4), 52–56.
- Kamau, D. M. (2008). *Productivity and resource use in ageing tea plantations* [Doctoral dissertation, Wageningen University]. Wageningen University & Research. <https://edepot.wur.nl/121950>
- Katiyar, R., Gupta, S., & Yadav, K. R. (2011, May 22). *Cymbopogon winterianus: An important species for essential Java citronella oil and medicinal value*. In *National Conference on Forest Biodiversity: Earth's Living Treasure*.
- Kiruthiga, D., & Damodaran, K. (2016). Economics of tea cultivation in the Nilgiris district. *International Journal of Agricultural and Rural Economic Research*, *4*, 16–21.
- North Eastern Development Finance Corporation Limited. (2023). *Package of practice: Citronella cultivation*. North Eastern Council (NEC).
- North Eastern Development Finance Corporation Limited. (2023). *Farm economics of citronella cultivation: Package of practice guidelines*. North Eastern Council (NEC).
- Panda, S., Ghosh, A., Das, L., Modak, S., Mondal, S., Pal, P. K., & Nain, M. S. (2022). Economics of small tea farming system (STFS): An in-depth study of North Bengal, India. *Indian Journal of Extension Education*, *58*(1), 63–67.
- Pratap Bhuyan, R. (2004). *Economic analysis of green leaf production: The case of small tea growers of Assam* [Doctoral dissertation]. Assam Agricultural University.
- Sharma, S. K. (2019). Cost benefit analysis of small tea growers in Padumani Development Block of Golaghat district of Assam. *International Journal of Advanced Scientific Research and Management*, *4*(5), 259–262.
- Tea Board of India. (2001). *Tea statistics 2000–01*. Ministry of Commerce and Industry, Government of India. https://www.teaboard.gov.in/pdf/Tea_Statistics_2000_01_pdf8891.pdf
- Tea Board of India. (2026). *List of approved planting materials and soil testing laboratories*. Ministry of Commerce and Industry, Government of India. https://www.teaboard.gov.in/pdf/LIST_OF_APPROVED_PLANTING_MATERIALS_AND_SOIL_TESTING_LABORATORIES_pdf5072.pdf