**Understanding the Adoption Dynamics and Impact of TNAU Coconut Tonic: A Study Among Coconut Farmers in Tamil Nadu, India**

**Abstract**

**Background:** In an effort to enhance productivity and address micronutrient deficiencies in coconut palms, the Tamil Nadu Agricultural University (TNAU) introduced the Coconut Tonic, a nutrient-rich formulation applied through root feeding. This tonic contains essential macro and micronutrients that aim to improve the overall health and yield of coconut palms.

**Aim**: To understand the adoption dynamics and impact of TNAU coconut tonic among coconut farmers

**Methodology:** The study adoptedanEx-post facto research design. The sample consisted of Coconut growers in the western zone (Coimbatore, Tirupur and Erode) of Tamil Nadu**.** A well-structured Interview schedule was developed and applied as a data collection tool to 100 sample.

**Results:** This study, conducted in the western zone of Tamil Nadu, explores the underlying reasons for non-adoption, identifies constraints faced by users, and proposes actionable recommendations to improve uptake. Among the surveyed farmers, 26% had not adopted the TNAU coconut tonic despite being aware of it. Key reasons cited included lack of technical knowledge (35%), high cost (27%), unavailability of the product (27%), and doubts about its effectiveness (8%). Additionally, existing users reported several usage constraints, including irregular product availability, inadequate guidance on dosage and application, labour scarcity, and initial costs. These issues hinder consistent and effective application, especially among small and marginal farmers. To address these gaps, the study recommends strengthening local supply chains, conducting field-level demonstrations, offering financial incentives, and promoting collective action through Farmer Producer Organisations (FPOs).

**Conclusion**: Furthermore, the involvement of trained rural youth and Self-Help Groups (SHGs) in application support could enhance farmer confidence and ensure proper use.

**Key words**: TNAU Coconut tonic, adoption, impact, western zone.

**Introduction**

Coconut (*Cocos nucifera* L.) is one of the most important plantation crops globally, with an annual production of approximately 62 million metric tonnes. Coconut is a gift of nature and is cultivated worldwide because of its multiple uses. Based on the morphological characteristics of the coconut tree, when coconut is grown as a monocrop, land use efficiency is very low (Nuwarapaksha et al., 2022; Dissanayaka et al., 2022; Heroweti et al., 2023). The leading producers include Indonesia (17 million tonnes), the Philippines (14.8 million tonnes), and India (14.7 million tonnes), placing India third in global production. In India, coconut is cultivated across 2.1 million hectares, mainly in Kerala, Tamil Nadu, Karnataka, and Andhra Pradesh, with Kerala alone accounting for nearly 31% of the country’s output. The coconut sector contributes over ₹12,000 crore to the Indian economy annually and supports the livelihoods of more than 10 million people. India has produced 16.9 billion nuts from a planted area of approximately 1.89 million hectares. India is also the most productive coconut-producing country in the world in terms of productivity. (Muthumani & Sathuragiri,2022). Among the many value-added products, coconut tonic—extracted from tender coconut water or inflorescence sap—holds immense promise due to its rich nutrient profile. In a coconut system, nutrient replacement demands increase faster than uptake and loss, and because the root surface for absorption is limited, it is critical to keep nutrient supply at a level of modest extravagant consumption (Karthickraja et al., 2023). Containing high levels of potassium (250 mg/100 ml), magnesium, and antioxidants, it serves not only as a natural health drink but also as an effective bio-stimulant in agriculture. Research by the Central Plantation Crops Research Institute (CPCRI) has shown that the use of coconut tonic can increase crop yields by 10–20% and significantly improve tolerance to drought, salinity, and heat stress. With rising global interest in organic and climate-resilient farming, the market for coconut tonic and related products is expected to reach USD 8 billion by 2030, reflecting its growing significance in both nutrition and sustainable agriculture.

**Importance of Coconut Tonic**

Coconut tonic, derived primarily from tender coconut water or the sap of the coconut inflorescence, has emerged as a natural elixir both for human health and plant wellness. Rich in essential nutrients like potassium, calcium, magnesium, amino acids, and antioxidants, it is widely consumed as a hydrating drink that supports heart health, boosts energy, and aids digestion. Beyond human consumption, coconut tonic is gaining popularity in agriculture as a plant bio-stimulant. It helps improve seed germination, root development, and stress tolerance in crops, especially under drought or saline conditions. By enhancing plant vigour and nutrient uptake, coconut tonic contributes to sustainable farming practices and aligns with the goals of eco-friendly agriculture.

Coconut cultivation plays a vital role in the agricultural economy of Tamil Nadu, with Coimbatore district being one of the major coconut-growing regions. In an effort to enhance productivity and address micronutrient deficiencies in coconut palms, the Tamil Nadu Agricultural University (TNAU) introduced the Coconut Tonic, a nutrient-rich formulation applied through root feeding. This tonic contains essential macro and micronutrients that aim to improve the overall health and yield of coconut palms.

Despite the proven scientific benefits of the tonic, its adoption among farmers has been inconsistent. Understanding the constraints faced and the benefits perceived by the farmers is essential to enhance uptake and improve coconut farming practices. This study was undertaken to assess both aspects among coconut growers in the Coimbatore district.

**Methodology**

Ex-post facto research design was employed for this study. Primary data were collected from 100 randomly selected coconut farmers from Aliyar and Pollachi blocks of Coimbatore, Kangeyam and Dharapuram of Tirupur and Gobichettipalayam and Perundurai of Erode district who had either adopted or were merely aware of the TNAU Coconut Tonic.

The data were gathered using a structured interview schedule. The questionnaire covered demographic information, awareness levels, adoption status, constraints experienced during usage and perceived agronomic and economic benefits. Percentage analysis was used to interpret and present the findings.

**Results and Discussion**

**Awareness of Coconut Tonic**

Out of the 100 respondents surveyed, a significant majority, 82%, reported being aware of TNAU Coconut Tonic, while 18% stated they had no prior knowledge of the product.

Among the 82 farmers who were aware of coconut tonic, the sources through which they learned about it were as follows: (n=82)

**Table 1: List of sources that create awareness among farmers about coconut tonic**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl.No.** | **Source** | **No. of Respondents** | **Per cent (%)** |
| 1 | Government extension programs | 33 | 40 |
| 2 | Fellow farmers | 25 | 30 |
| 3 | Input dealers | 13 | 16 |
| 4 | Social media / Internet | 8 | 10 |
| 5 | Others (TV, Agri exhibitions) | 3 | 4 |

Awareness plays a crucial role in the adoption of agricultural innovations like coconut tonic. In the present study, a significant 82% of the farmers were aware of the TNAU Coconut Tonic, highlighting the impact of awareness campaigns and information dissemination. Government extension programs emerged as the most prominent source of awareness, accounting for 40% of responses. Fellow farmers as peer influence also played a major role, with 30% of farmers reporting fellow farmers as their source, supporting Rogers’ (2003) diffusion theory, which notes the importance of interpersonal communication in technology spread. Input dealers, while commercial in nature, contributed to awareness among 16% of the respondents, and the retailers often act as informal extension agents. It aligns with the report of Manasa *et al*. (2023) that the success of farming activities largely depends on the timely and efficient delivery of agro services, particularly those provided by input dealers.



**Fig 1: Graph indicating sources of Agricultural Information among Respondents**

Although traditional media and events like exhibitions had a limited contribution (4%), they still serve as complementary tools in creating awareness. Collectively, these findings underscore the multifaceted nature of information flow in rural settings and highlight the importance of integrating multiple channels to reach a wider farming audience. Awareness dearth and accessibility were limiting TNAU’s coconut tonic use. Recently, the product was included in the digital marketing platform *viz..*,tnauagricart of TNAU**.** (Rathinavel *et al*.,2024)

**Adoption Status**

Among the 82 farmers who were aware of the tonic:

* 56 farmers (68%) had adopted it in their fields.
* 26 farmers (32%) had not adopted the tonic despite being aware of it.

**Reasons for Non-Adoption**

The 26 farmers who had not adopted the tonic despite being aware of it cited the following reasons: (n=26)

**Table 2: Reasons for non-adoption of coconut tonic among farmers**

|  |  |  |  |
| --- | --- | --- | --- |
| **Sl.No** | **Reasons for Non-Adoption** | **No. of Respondents** | **Per cent (%)** |
| 1 | Lack of technical knowledge | 9 | 35 |
| 2 | High cost | 7 | 27 |
| 3 | Unavailability of the product | 7 | 27 |
| 4 | Doubts about effectiveness | 3 | 11 |

Among the 26 farmers who were aware of the coconut tonic but chose not to adopt it, several key reasons were identified. The predominant barrier, cited by 35% of respondents, was a lack of technical knowledge regarding the proper usage and benefits of the tonic. Additionally, 27% of farmers pointed to the high cost of the product as a significant constraint, while an equal percentage (27%) reported difficulty in accessing or the unavailability of the tonic in local markets. Around 11% of the respondents remained doubtful about the coconut tonic’s effectiveness, which made them hesitant to adopt it.

These findings highlight the need for targeted awareness programs, cost-reduction strategies, and improved distribution networks to enhance adoption rates among coconut farmers.

**Constraints faced by coconut farmers**

A wide range of constraints was reported by the respondents, as summarised in the table below:

**Table 3: List of constraints faced by coconut farmers in adopting coconut tonic.**

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Constraints** | **Per cent (%)\*** |
| 1 | Limited availability in local markets | 75 |
| 2 | Lack of technical knowledge about usage  | 66 |
| 3 | Shortage of skilled labour for root feeding | 62 |
| 4 | High cost of tonic and materials | 58 |
| 5 | Low absorption in waterlogged areas | 40 |
| 6 | Labour migration and rising wage rates | 39 |

\*Multiple responses

A major constraint was the limited availability of the tonic (75%), with most farmers unaware of digital purchase options like the TNAU Agri Cart. This aligns with the findings of Karthickraja *et al*.,(2023), who suggested that the government take necessary steps to establish additional sales centres to overcome this constraint.

**Figure 2: Graph indicating the list of constraints faced by coconut farmers in adopting coconut tonic**.

Lack of technical knowledge (66%) and skilled labour (62%) were other key barriers, indicating difficulty in root identification and correct application. Despite the known benefits of coconut tonic in enhancing nut setting and improving yield, several constraints hinder its widespread usage among coconut farmers. A key limitation is the lack of awareness and technical knowledge among farmers regarding its appropriate application and dosage.

Economic factors such as the high cost of the tonic (58%) and associated labour expenses discouraged adoption among smallholders. Biophysical and soil-related, challenges, such as reduced root absorption in waterlogged soils, were reported by 40% of the respondents

Addressing these issues through effective awareness campaigns, farmer training, improved supply chain systems, and subsidies could significantly boost the adoption of coconut tonic technology.

**Perceived Benefits of Coconut Tonic**

Farmers who successfully adopted the tonic reported several benefits, both agronomic and economic:

**Table 4: List of perceived benefits after adopting the coconut tonic**

|  |  |  |
| --- | --- | --- |
| **Sl.No** | **Perceived Benefits** | **Per cent (%) \*** |
| 1 | Increase in nut yield per tree | 78 |
| 2 | Reduction in button shedding | 71 |
| 3 | Improved greenness and vigour of leaves | 70 |
| 4 | Enhanced pest and disease resistance | 60 |
| 5 | Correction of micronutrient deficiencies | 59 |
| 6 | Better root activity and nutrient uptake | 57 |
| 7 | Increased copra and oil yield | 52 |
| 8 | Cost-effective in the long term | 51 |

\*Multiple responses

A review of farmers' perceptions reveals that the application of coconut tonic is associated with a wide range of agronomic benefits. The most widely reported advantage is an increase in nut yield per tree, cited by 78% of respondents, indicating its direct impact on productivity. The application of coconut tonic has gained considerable attention among coconut cultivators due to its perceived ability to enhance nut production, palm health, and overall productivity.

This is closely followed by a reduction in button shedding (71%) and improved greenness and vigour of leaves (70%), both of which are indicators of improved plant health. Additionally, enhanced resistance to pests and diseases (60%) and the correction of micronutrient deficiencies (59%) suggest the tonic’s potential role in plant defence and nutrition. Improvements in root activity and nutrient uptake (57%) further support these claims, while 52% of users noted an increase in copra and oil yield, indicating economic benefits. The results are well aligned with the study of Kalarani *et al.,* 2008, who have reported that the root feeding of TNAU coconut tonic showed its supremacy in increasing yield gradually from 8612 nuts to 9830 nuts/year/acre after adoption of coconut tonic over a period of years. Fifty-one per cent of the respondents viewed it as economically viable in the long term, reflecting their confidence in its sustained financial benefits. The study of Kalarani *et al.,* (2008) highlighted that the marginal benefit-cost ratio steadily improved from 1:2.49 to 1:3.04 over time.

**Figure 3: Graph indicating the perceived benefits after adopting coconut tonic**

The study highlights a dual narrative around the adoption of TNAU Coconut Tonic among coconut growers in Coimbatore. On one hand, the tonic delivers remarkable benefits in terms of yield improvement, plant health, and economic gains. On the other hand, several constraints—especially related to accessibility, lack of training, labour shortages, and cost—pose serious challenges to widespread adoption.

These benefits make coconut tonic a promising input, particularly in traditional coconut-growing regions where soil fertility issues and declining yields are major concerns.

**Conclusion**:

To enhance the adoption of coconut tonic among coconut growers, a multifaceted strategy is essential. First, strengthening local distribution networks is crucial to ensure the tonic is readily available in rural and remote areas, minimising delays and increasing timely access for farmers. Accessibility must be complemented by hands-on field-level training and demonstrations, which are vital for building farmers' confidence and competence in proper application techniques.

Many farmers are hesitant to adopt new inputs due to a lack of familiarity, and practical exposure can significantly bridge this gap. In addition, financial support mechanisms, such as subsidies or incentives, are particularly important for marginal and small-scale farmers who may find the initial investment burdensome. Collective approaches, such as promoting the role of Farmer Producer Organisations (FPOs), can facilitate bulk procurement and shared services, thereby reducing per-unit costs and enhancing bargaining power.

Furthermore, the deployment of trained rural youth or Self-Help Group (SHG) members as professional service providers can ensure correct and consistent application, while also generating rural employment. These coordinated efforts can significantly improve the reach, affordability, and proper utilisation of coconut tonic, ultimately contributing to better crop productivity and farmer well-being.

Several researchers have emphasised the importance of promoting coconut tonic use among farmers to boost coconut productivity and sustainability. By addressing the key barriers and leveraging the tonic’s proven benefits, TNAU Coconut Tonic can become a sustainable and scalable solution for improving coconut productivity in Tamil Nadu.

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**References**

Kalarani M, Raja D, Janaki P. Popularization of TNAU Coconut Tonic and its impact. Agriculture Update 2008;4(1/2): 36-40.

Manasa K, Jirli B, Srishailam B, Ravi G. A critical study on availability of agricultural inputs with the agri input dealers of Nagarkarnool and Wanaparthy districts of Telangana State, India. Asian J Agric. Ext Econ Sociol. 2023;41(3):61-68.

Rathinavel S, A Surendrakumar, R Kavitha1, Sanjeevi and B Suthakar, Key challenges faced in coconut farming across Coimbatore and Tirupur districts, Tamil Nadu,Volume 7; Issue 9; September 2024; 896-901

Rogers, E. M. (2003). Diffusion of innovations (5th ed.). Free Press.

Nuwarapaksha, T. D., Udumann, S. S., Dissanayaka, D. M. N. S., Dissanayake, D. K. R. P. L., & Atapattu, A. J. (2022). Coconut based multiple cropping systems: An analytical review in Sri Lankan coconut cultivations. Circular Agricultural Systems, 2(1), 1-7.

Dissanayaka, D. M. N. S., Nuwarapaksha, T. D., Udumann, S. S., Dissanayake, D. K. R. P. L., & Atapattu, A. J. (2022). A sustainable way of increasing productivity of coconut cultivation using cover crops: A review. Circular Agricultural Systems, 2(1), 1-9.

Karthickraja, M., Premavathi, R., Vanetha, K. P., Senthil, A., & Selvi, R. G. (2023). Problems Encountered by Coconut Growers by Adopting TNAU Coconut Tonic and their Perceived Benefits. Int. J. Environ. Clim. Change, 13(9), 3591-3598.

Heroweti, J., Wibowo, D. N., Ulya, A. N., & Linda, D. (2023). Physical Stability Test Hair Tonic Combination Cinnamon (Cinnamomum burmanii) Essential Oil and VCO (Virgin Coconut Oil) With Cycling Test Method and Irritation Test On The Rabbit. Jurnal Farmasi Sains Dan Praktis, 72-82.

Muthumani, K., & Sathuragiri, V. (2022). A study on coconut cultivation practices and satisfaction among the farmers in Theni district. World Wide Journal of Multidisciplinary Research and Development, 8(05), 88-93.