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Status of the Traditional Agriculture in the Local Region

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ABSTRACT

This study aimed to identify various plant species used in the agricultural fields of Kolli Hills to enhance soil fertility and manage pest attacks, where Malayali tribal communities continue to practice organic farming by utilizing surrounding bioresources. Notably, eighteen tree species from 13 families have been identified in the surrounding forests and utilized in the agricultural fields of Kolli Hills. Out of the 18 species, 15 were utilized for fertilizer purposes which enhance the nutrient availability and support sustainable agricultural practices. Across fourteen panchayats youngsters lose interest in using local bio resources. At the panchayat level, the tribal men and women above the age of 50 showed greater levels of awareness and utilization compared to younger individuals. However, among panchayats, Alathurnadu, Peraikkarainadu Gundurnadu, and Chithurnadu continued to remain traditional. Panchayats Thinnanurnadu Devanurnadu, Thirupulinadu, and Edappulinadu were found in the transition from traditional to modern, and panchayats Ariyurnadu, Bailnadu, Gundurnadu, Selurnadu, Valapurnadu and Valavanthinadu were found to be under total transformation based on interest showed by elders and youngsters of Kolli Hills.

Keywords: *Traditional, Agriculture, Bioresources, Fertilizer*

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INTRODUCTION

The knowledge can originate from scientific and traditional sources (Altieri, 2004). In particular, traditional knowledge is often regarded as a cumulative body of practices, beliefs, and understanding, developed through adaptive processes and spread across generations via cultural means (Kamatchi & Parvathi, 2020). Traditional medicine, widely practiced globally, depends heavily on locally available plant species and plant-based products, drawing a rich repository of conventional wisdom (Kala, 2017). Biodiversity inventories, crucial for guiding local-scale conservation planning, are still underutilized, especially in tropical countries where technical capacity is often constrained (Shao *et al.,* 2024). Forests in India have been extensively cleared for large-scale hydroelectric projects, industrial development, urbanization, agricultural expansion, and so on. Primary forests, specifically those in the Western Ghats and Eastern Ghats of peninsular India, are rapidly disappearing due to anthropogenic activities, often being replaced by less desirable species or undergoing shifts in land use (Ramachandra *et al.,* 2017).

Kolli Hills is a part of Eastern Ghats located in Namakkal district of Tamil Nadu, India (11° 10' 54"- 11° 30' 00" N latitude and 78° 15' 00"- 78° 30' 00" E longitude) bordered by Trichy and Salem district of Tamil Nadu in the northeast and southwest respectively. The topmost portion of the hill is highly undulating, cut by a network of streams most of which are semi-perennial or seasonal flowing in all directions but mostly to an Eastern and South Eastern direction finally drains into the Aiyur River (Jayakumar *et al.,* 2000). Among the different landscapes in which agriculture is practiced by tribal communities of Kolli Hills major attention was given to valley land agriculture, where starting from land preparation to post-harvest storage was indigenously practiced with the support of surrounding forest tree biomass (Keerthika *et al.,* 2024). Due to its inaccessible mountain ranges the mechanization and modern agriculture practices are yet to take over. Given the ongoing global reduction in agricultural land due to urbanization along with the increasing prevalence of large-scale monocropping practices,

adequate soil fertility replenishment during or before crop cultivation is highly essential before or during crop cultivation to ensure successful harvests (Watanabe *et al*., 2024; Uma & Kumar, 2025).

Today, agriculture increasingly depends on the application of chemical fertilizers and pesticides to improve crop yield and quality (Tudi *et al.,* 2021). Fertilizers and pesticides are generally classified into chemical, organic, and bio-based categories, each with its unique properties and effects on soil fertility and overall crop management practices (Baweja *et al.,* 2020; Ali *et al.,* 2025). The distinctiveness of traditional agriculture lies in its environmentally benign characteristics, such as both environmental and economic feasibility and widespread public acceptance (Patil, 2022; Prajapati *et al.,* 2025). It maintains productivity by effectively utilizing locally available resources and develops site-specific agricultural practices that are well-suited to regional climatic conditions, as well as spatial and sequential diversities (Dongmo & Tamesse, 2023; Kumar *et al.,* 2025).

However, it has to be noted that animal husbandry only a negligible percentage exists hence for fertilization and other agriculture practices these tribal communities were dependent on forest biomass (Gohain *et al.,* 2021). It is also noted that such knowledge and use are also decreasing due to slow and gradual penetration of modern agriculture like mechanization, and the use of synthetic fertilizers, pesticides, and weedicides (Revathi *et al.,* 2016; El-Ramady *et al.,* 2022). To address this gap, the present study aims to assess the use of tree diversity in 14 major regions of Kolli hills of the Eastern Ghats, India to trace existing knowledge on agriculture practices utilizing the trees and their present status amongst the older and younger generation.

MATERIALS AND METHODS

Study area

The study area of the present research, Kolli Hills block, is a part of Eastern Ghats located at an altitude of 1200 meters MSL in Namakkal District, Tamil Nadu covering an area of 280 sq.km **(Figure 1)** The block Kolli Hills comprises of fourteen Panchayats including Alathurnadu, Riyurnadu, Bailnadu, Chithurnadu, Devanurnadu, Edappulinadu, Gundaninadu, Gundurnadu, Peraikkarinadu, Selurnadu, Thinnanurnadu, Thiruppulinadu, Valappurnadu, Valavanthinadu. Similar to other regions globally, these mountain ranges are occupied by tribal communities commonly known as the Malayali tribe. These mountains are covered by moist evergreen forests which are cleared by the tribal communities surrounding the valley for their agriculture practices. People in all four panchayats of Kolli Hills have close relationships with their surrounding forest which built their culture and agriculture. In the present paper, such relationship of these people in their agriculture especially for their fertilizer, pest, and insect control is being studied.

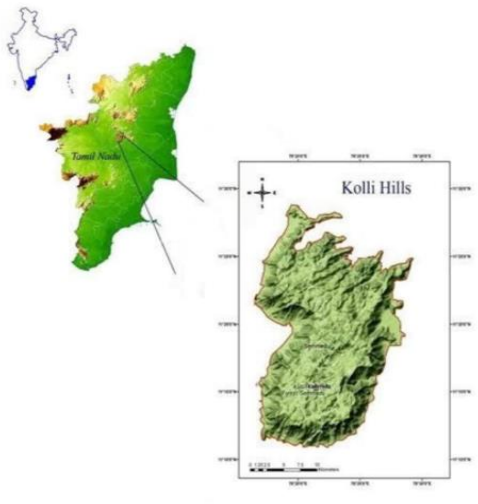

Figure 1. Location map of study area indicating sample collection points.

Data collection

The present study was conducted by intensive field trips during 2023-2024 with an initial reconnaissance survey to understand their mode of interaction. Following by reconnaissance survey a detailed survey was conducted in fourteen panchayats using a structured questionnaire. 140 informants including males and females of different age groups, elders above 50 years of age, and youngsters of 25 years of age were interrogated. Plant species were collected in either flowering or fruiting stages. Data were recorded along with the Vernacular name, Uses, etc. The collected plant species were identified with the help of taxonomists and also using the Flora of the Presidency of Madras and Flora of Tamil Nadu (Silambarasan *et al*., 2023). These specimens were poisoned by using Mercuric chloride with alcohol, pressed, and herbarium specimens prepared according to the standard methods (Maden, 2006). The recorded data were tabulated using Microsoft Excel and processed data were subjected to statistical analysis with instant statistical software.

Malayali tribe

This study was carried out among the Malayali tribes residing in the Kolli Hills and aims to explore the plants used in conventional agricultural practices. The Malayali tribe is one of the 36 scheduled tribes in Tamil Nadu (Fiodorova *et al*., 2022; Silambarasan *et al*., 2023), comprising approximately 54% of the total scheduled tribe population. Members of the Malayali tribe possess extensive knowledge of medicinal plants, which they use to treat ailments such as coughs, colds, fevers, headaches, poisonous bites, and other common health issues. Additionally, the Malayali people continue to supplement their diet by foraging for roots and tubers from nearby forest areas. The core population of the Malayali tribe is primarily concentrated in the Kolli Hills (Israel, 2020; Marian *et al*., 2024).

RESULTS AND DISCUSSION

The present study was conducted with an initial reconnaissance survey among the Malayali tribes to understand their mode of interaction inhabiting Kolli Hills. The findings from the survey

revealed that forests serve as the primary source of biomass, which sustains agricultural production and productivity in the region (Jolly, 2022). The Malayali tribal community uses forest resources for agriculture practices right from land preparation, manure, pest and insect control, and also during post-harvest management of cultivated crops. Forest tree biomass has served as a crucial nutrient source for agricultural practices, playing a key role in enhancing soil fertility for centuries (Singh *et al*., 2021; Dipalma *et al*., 2022). The study revealed that 18 different tree species belonging to 13 families were used in the agriculture of Kolli Hills across fourteen panchayats by the tribal community for fertilizer, pest attack, insect infestation, and storage pest prevention **(Table 1)**.

Table 1. Kolli Hills Tree species used in agriculture practice

S/N	Vernacular Name	Scientific Name	Family	Common Name	Uses
1	Allan Maram	*Memecylon umbellatum* Burm.f	Myrtaceae	Ironwood	Fertilizer and firewood
2	Anai	*Clausena dentata* (Willd.) Hook.f. ex Benth.	Rutaceae	Horsewood	Pesticides, insecticides, and fertilizer,
3	Irali/ Mariachi	*Ficus virens*Aiton	Moraceae	White fig	Fodder, fertilizer
4	Irumbuli	*Diospyros ferrea* (Willd.) Bakh.	Ebenaceae	Sea Ebony	Fertilizer
5	Konnai/Sarakonnai	*Cassia fistula* L.	Fabaceae	Golden shower tree	Fertilizer Agricultural tools Firewood
6	Malai vaembu	*Melia azedarach* L.	Meliaceae	Chinaberry tree	Fertilizer and firewood
7	Mallai Savukku	*Grevillea robusta* A.Cunn. *ex* R. Br	Proteaceae	Silver Oak	Timber, Shade trees, and Firewood
8	Mayilaadi	*Vitex altissima* L.f.	Lamiaceae	Peacock Chaste tree	Pesticides, insecticides, fertilizer, Fodder plant, and Firewood
9	Navaal	*Syzygium cumini* (L.)	Myrtaceae	Black plum	Fertilizer and pesticide
10	Nekkini	Psydrax dicoccos Gaertn.	Rubiaceae	Butuland cathium	Wood carving, Firewood, and fertilizer
11	Oduvan	*Cleistanthus collinus* (Roxb.) Benth. *ex*Hook.f.	Euphorbiaceae	Toxic Gooseberry	Fertilizer, Poisonous, insect repellent in
12	Oosi illai Maram	*Pinus roxburghii* Sarg.	Pinaceae	Pine Tree	Turpentine, Construction, Wood tars
13	Panai	*Cipadessa baccifera* (Roxb. *ex*-Roth) Miq	Meliaceae	Ranabili	Pesticides, insecticides, and fertilizer,
14	Purasa Maram	*Chloroxylon swietenia* DC.	Rutaceae	East Indian satinwood	Pesticide, fertilizer, and agricultural tools
15	Thyla Maram	*Eucalyptus propinqua* H. Deane & Maiden	Myrtaceae	Gre gum	Poles. Timber and Railway sleeper.
16	Valluku Maram	*Cordia obliqua*B.Heyne *ex* DC	Boraginaceae	Clammy cherry	Fertilizer
17	Poovarasu	*Thespesia populnea* (L.) Sol. *ex*-Correa	Malvaceae	Portia tree	Fodder
18	Villari	*Dodonaea viscosa* (L.)	Sapindaceae	Broadleaf hopbush	Pesticide and fertilizer

The diversity of trees plays a vital role in the overall biodiversity of rainforests, as trees supply essential resources and habitat structure for nearly all other rainforest species (Bolay *et al*., 2024; Najeeb *et al.,* 2025; Rengarajan *et al.,* 2025). Tree species inventories carried out in defined study sites, along with assessments in minimum diameter classes, serve as reliable tools for indicating the diversity level of a study site (García-Alvarado *et al.,* 2001; Dhanasekar *et al*., 2022; Makhoahle & Gaseitsiwe, 2022; Pisano *et al*., 2023). Myrtaceae is the most predominant family which contains 3 species (16 %) followed by Ebenaceae, Meliaceae, and Rutaceae (2 species each) (11.11 %) and families such as Boraginaceae, Fabaceae, Lamiaceae, Malvaceae, Moraceae, Pinaceae, Proteaceae, Rubiaceae, and Sapindaceae are represented by single species (5.56 %) **(Table 1, Figure 2)**.

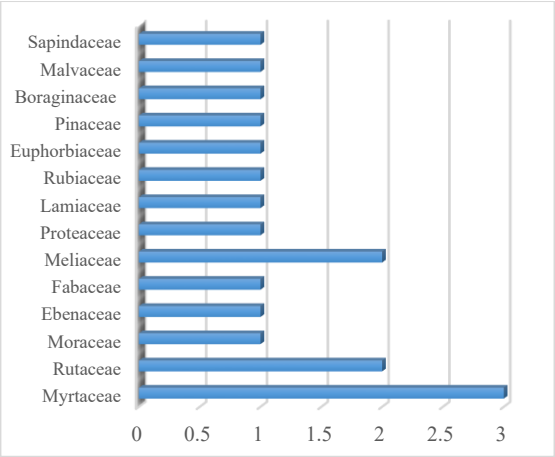

Figure 2. Dominant family representation among the agroforestry tree species in Kolli Hills.

Among the different families of tree species, Myrtaceae is the dominant family used by tribes of Kolli Hills as green foliar nutrition for agricultural soil. Studies have shown that these tree species are rich in potassium, followed by calcium, magnesium, sodium, and phosphorus which are very essential apart from carbon and nitrogen (Bulusu & Cleary, 2023;

Hashemi, 2025). Other economically significant plant families commonly utilized include Ebenaceae, Meliaceae, and Rutaceae. Research has shown that tree species from these families contribute to soil fertility enhancement through the processes of carbon and nitrogen mineralization (Malcangi *et al*., 2023; Singh *et al.,* 2015). This research was carried out on the knowledge and utilization of agroforestry trees among the Kolli Hills tribal community interview revealed that 75.12 % of both tribal men and women aged above 50 were aware of trees used for the agroforestry compared to only 54.33 % amongst the 25-year age group. However, no significant difference was observed in the knowledge regarding different trees within these age groups **(Table 2)**.

Table 2. Existing knowledge and use of different Agroforestry trees among Kolli Hills tribal communities (%).

S/N	Scientific name	Age				P Value	F Value
		Above 50		Above 25			
1	*Memecylon umbellatum* Burm.f	70.71	12.14	47.86	19.29	0.0009	2.525
2	*Clausena dentata* (Willd.) Hook.f. *ex* Benth.	77.14	17.25	57.86	11.88	0.0020	2.108
3	*Ficus virens* Aiton	75.71	9.61	54.29	10.89	< 0.0001	1.287
4	*Diospyros ferrea* (Willd.) Bakh.	75.00	10.44	55.00	16.05	0.0006	2.363
5	*Cassia fistula* L.	75.00	9.67	55.71	14.53	0.0003	2.258
6	*Melia azedarach* L.	73.57	11.93	51.43	17.91	0.0007	2.254
7	*Grevillea robusta* A.Cunn. ex R. Br	77.86	13.01	56.43	14.47	0.0003	1.237
8	*Vitex altissima* L.f.	74.29	8.77	53.57	17.37	0.0005	3.923
9	*Syzygium cumini* (L.)	77.14	8.01	52.14	13.11	< 0.0001	2.679
10	*Psydrax dicoccos* Gaertn	72.86	11.82	50.71	17.74	0.0006	2.253
11	*Cleistanthus collinus* (Roxb.) Benth.*ex* Hook.	72.14	10.32	55.71	16.04	0.0034	2.416
12	*Pinus roxburghii* Sarg.	75.00	8.77	52.86	13.83	< 0.0001	2.487
13	*Cipadessa baccifera* (Roxb. *ex*-Roth) Miq	81.43	14.81	62.14	13.69	0.0014	1.170
14	*Chloroxylon swietenia DC.*	74.29	13.91	55.00	15.06	0.0016	1.176
15	*Eucalyptus propinqua* H.Deane & Maiden	73.57	13.91	52.14	15.78	0.0008	1.287
16	*Cordia obliqua*B.Heyne *ex* DC	79.29	13.54	53.57	13.36	< 0.0001	1.027
17	*Thespesia populnea* (L.) Sol. *ex*Correa	72.86	12.51	56.43	14.99	0.0041	1.436
18	*Dodonaea viscosa* (L.)	74.29	11.27	55.00	18.29	0.0024	2.634

Among various categories of farmers, old-aged farmers exhibited significantly higher levels of knowledge about conservation agriculture compared to other categories at a 5% level. This can be attributed to the fact that some of the conservation agriculture practices like crop rotation were part of traditional Indian agriculture (Chichongue *et al.,* 2020). Since a majority of the farmers in the study were older, their deep-rooted knowledge of traditional agricultural practices likely contributed to their higher understanding of CA (AlHussain *et al*., 2022; Hashemi, 2025). At the panchayat level, a significant trend emerged, revealing that tribal men and women above the age of 50 showed greater levels of awareness and utilization compared to their younger individuals, particularly those aged 25. Among the 50+ age group, the topmost levels of awareness were observed in Alathurnadu and Peraikkarinadu (88.33 %), followed by Gundaninadu (87.78 %) and Chithurnadu (86.67 %) **(Table 3, Figures 3 and 4)**.

Table 3. Existing knowledge and use of Agroforestry trees among different panchayats in Kolli Hills tribal communities (%).

Panchayats	Age				P Value	F Value
	Above 50		Above 25			
Alathurnadu	88.33	6.86	73.33	9.24	< 0.0001	1.814
Ariyurnadu	67.78	7.52	47.22	7.32	< 0.0001	1.055
Bailnadu	68.89	7.58	41.11	8.32	< 0.0001	1.205
Chithurnadu	86.67	8.08	72.22	9.70	< 0.0001	1.441
Devanurnadu	74.44	8.26	52.78	9.22	< 0.0001	1.246
Edappulinadu	70.00	8.32	51.11	8.40	< 0.0001	1.019
Gundaninadu	87.78	8.08	72.22	9.43	< 0.0001	1.362
Gundurnadu	67.22	8.40	40.00	7.52	< 0.0001	1.248
Peraikkarinadu	88.33	6.18	75.00	9.85	< 0.0001	2.540
Selurnadu	66.67	8.26	42.78	7.67	< 0.0001	1.160
Thinnanurnadu	76.67	7.67	56.67	6.86	< 0.0001	1.250
Thiruppulinadu	74.44	8.78	52.22	7.84	< 0.0001	1.254

Valappurnadu	67.78	9.85	41.67	7.32	< 0.0001	1.811
Valavanthinadu	66.67	10.03	42.22	5.94	< 0.0001	2.851

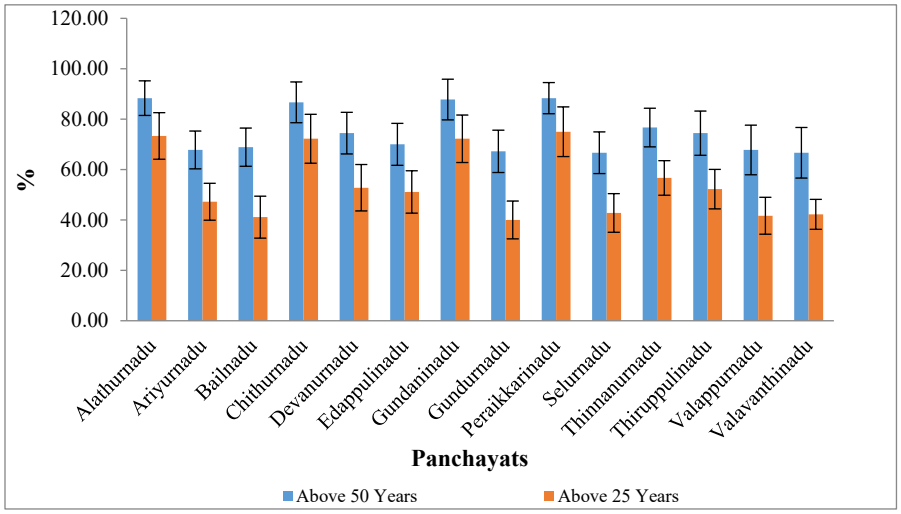

Figure 3. Existing knowledge and use of Agroforestry trees among different panchayats in Kolli Hills tribal communities.

Conversely, in the 25-year-old age group, Peraikkarinadu again initiated with an awareness rate of 75.00 %, followed by Alathurnadu (73.33 %), and Chithurnadu and Gundaninadu, both at 72.22 % **(Table 3, Figure 3)**. Raja *et al.* (2023) had earlier reported similar views among older-aged farmers, who form the majority (50%), followed closely by middle-aged farmers (28.9%). Young farmers make up only 21.1%, which shows that the majority of youth are not attracted to farming. These findings suggest a trend where older individuals are more informed and occupied, possibly due to accumulated experience or targeted interventions, with regional differences further emphasizing the variable effectiveness of local efforts. The study revealed that the highest median knowledge and utilization of agroforestry trees among tribal men and women was found in Thinnanurnadu for the 50+ age group, with a value of 76.67 %, followed by Thirupulinadu and Devanurnadu (74.44 % each), and Edapulinadu (70.00 %) **(Table 3, Figures 3 and 4)**.

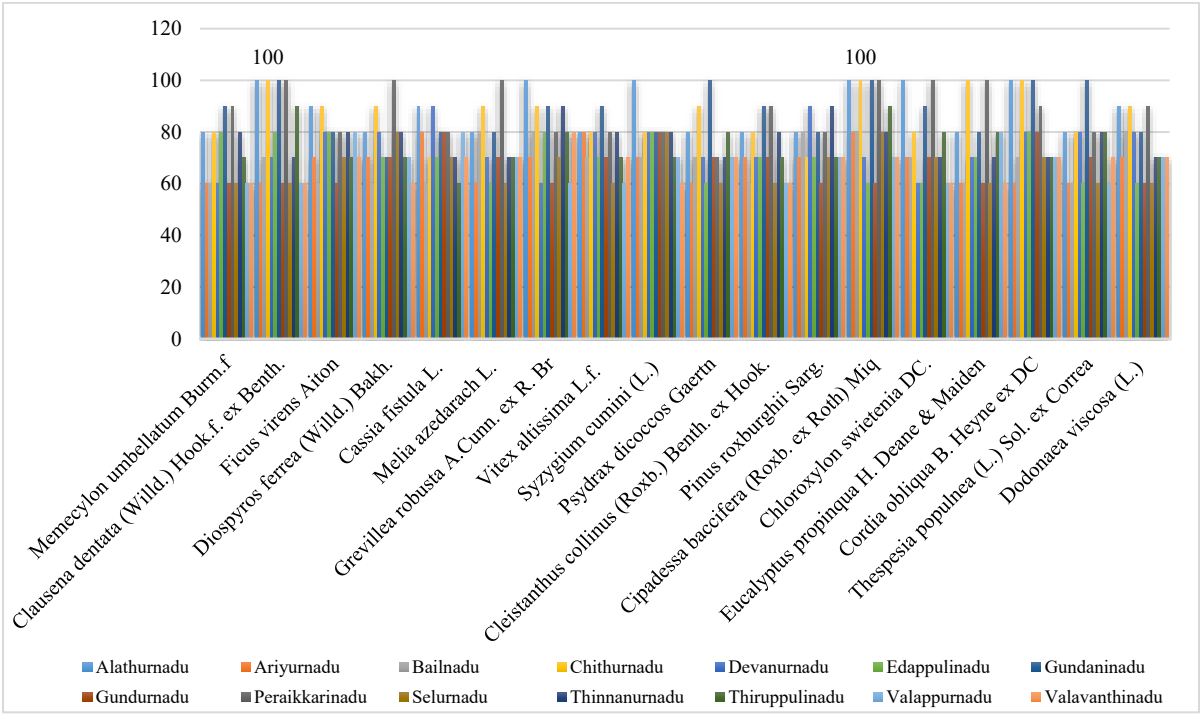

Figure 4. Existing knowledge and use of different Agroforestry trees among people above 50 years of age in different panchayats of Kolli Hills tribal communities.

For the 25-year-old age group, Thinnanurnadu again exhibited the highest level of awareness (56.67 %), followed by Devanurnadu (52.78 %), Thirupulinadu (52.22 %), and Edapulinadu (51.11 %) **(Table 3, Figures 4 and 5)**. Conversely, the lowest levels of agroforestry knowledge among the 50-year age group were reported in Valavanthinadu and Selurnadu, each at 66.67 %, followed by Gundurnadu (67.22 %), Ariyurnadu (67.78%), Valappurnadu (67.47%), and Bailnadu (68.89%) **(Table 3, Figures 4 and 5)**. Among the 25-year age group, the lowest awareness was found in Gundurnadu (40.00%), followed by Bailnadu (41.11 %), Valappurnadu (41.67 %), Valavanthinadu (42.22 %), Selurnadu (42.78 %), and Ariyurnadu (47.22 %) **(Table 3, Figures 4 and 5)**.

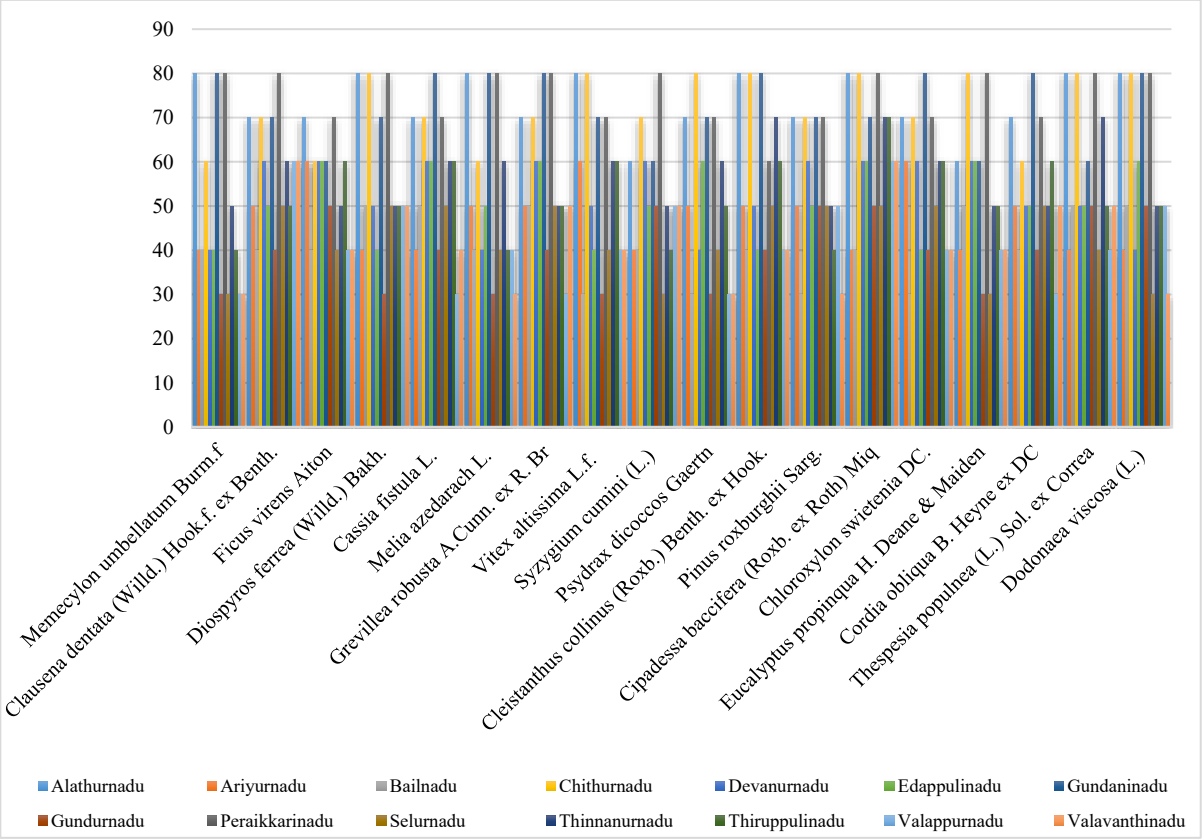

Figure 5. Existing knowledge and use of different Agroforestry trees among people above 25 years of age in different panchayats of Kolli Hills tribal communities.

Respondents recognized four main uses for the 18 woody perennials, with 15 species mainly used as fertilizers, except for *Eucalyptus propinqua* H. Deane & Maiden *Pinus roxburghii* Sarg., and *Grevillea robusta* A. Cunn. *Ex* R. Br. According to Bilkis and Rafah (2016) and (Maneea *et al*., 2024) traditional knowledge, including practices such as seed saving, food preservation, and the use of ecologically-based fertilizers and pesticides, plays a vital role in the success of community-driven, local agricultural systems. Pesticides and firewood, both of which are used, each have six species associated with them (Fernandes *et al*., 2022; Virgin *et al.,* 2022; Shaheen *et al*., 2023). The botanical pesticides are usually prepared using different methods, such as processing plant materials into powders or dust, extracting resins, or creating liquid formulations, with leaves being a primary source. Species used for agriculture tools include *Cassia fistula* L. and *Chloroxylon swietenia* DC. Three species, *Ficus virens* Aiton*, Vitex altissima* L.f, and *Thespesia populnea* (L.) Sol. *Ex* Correa. are used as fodders. The natives collect these leaves and feed their dairy animals in addition to the available concentrate mixture (Raj *et al.,* 2018; Graefen *et al*., 2023; Kalaimurgan *et al.,* 2024; Ravoori *et al*., 2024). A single species was utilized for wood carving, poles shade trees, etc. The present research was conducted to analyze the status of such changes, as these findings underscore the significant role that diverse tree species play in supporting sustainable agricultural practices within the region, of Kolli Hills.

CONCLUSION

The investigation of the traditional agriculture survey shows a total of 18 tree species in our study site. These tree species offer significant multifunctional value, contributing to fertilizer usage, pest control, wood carving, timber production, shade provision, and fodder. These 18 different plants fall into 13 different families in which Myrtaceae, Ebenaceae, Meliaceae, and Rutaceae were dominant. To effectively extend these practices to other regions, it is essential to conduct field trials in collaboration with farmers. Their active involvement will help validate the advantages of these systems across diverse environmental and socioeconomic conditions. A gradual loss of

interest can be observed among the traditional Malayali tribal communities across the fourteen panchayats of Kolli Hills, primarily due to the declining engagement of younger generations in indigenous practices and cultural traditions.

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