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ASSESSMENT OF SHADE TREES AND SOCIO-ECONOMIC CONDITION OF THE TEA WORKERS: A CASE STUDY OF TEA ESTATE AROUND BANDERDEWA FOREST RANGE

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Abstract

The shade trees is an integral part of the tea cultivation that played a crucial role in its management. The common shade trees found in tea estate around Banderdewa forest range, Arunachal Pradesh are *Melia azedarach* L., *Albizia procera* (Roxb.) Benth. and *Albizia lebbeck* (L.) Benth. The fabaceae is the dominant family. The highest basal area is found in *Albizia procera* (13.5 sq.m per ha) and the highest number of trees per ha is found in *Melia azedarach* (140 trees per ha). The average crown density of the shade tree is 40.41%. The socio economic condition of tea labourer is fully depend upon the tea estate. The labour force in tea estate are consists of migrant labourer and they have good ethnobotanical knowledge on medicinal plants.

Keywords: Tea estate, Shade tree

INTRODUCTION

Tea (*Camellia sinensis* L.) cultivation is one of the sustainable land use system, which is considered as an important agroforestry system and it is mostly done at commercial level (Chundawat and Gautam, 1993). In tea cultivation, tree component is an integral component, which not only provides better microclimates for the better growth of quality tea leaves but also provides many environmental goods and services viz., fuel wood, fodder, soil and water conservation, etc. (FAO, 2010). It also helps in meeting the goal of national forest policy 1988 in attaining 33.3% of the geographical area of the country under the forest and tree cover.

Tea plant is traditionally grown under the shade condition as they are shade loving plant. In practice, shade tree used in tea cultivation are of two types viz., permanent shade tree and temporary shade tree. The rotation period of the permanent shade tree is relatively higher than temporary shade tree. Whereas the rotational period of temporary shade tree is as low as 4 to 5 years (Sana 1989). The shade trees provides 50% to 70% of diffused solar insolation to the tea cultivation area (Sana, 1989). It results in improves in the quality of the tea leaves due to increased in the concentration of amino acid with lowers content of catechin in the plant (Ku *et al*., 2010) and it also inhibits the concentration of flavonoid (Wang *et al*., 2012). The amino acid improves the sweetness whereas catechin provides astringency effect. However, excessive UV light (Agati and Tattini, 2010) and drought condition (Winkel-Chirley, 2002 results in increased in the flavonoid content.

Initially, *Albizia chinensis* was used as a shade tree in tea cultivation area in North east India. Nowadays, the most popular shade trees used in tea estate are *Albizia odoratissima, A. moluccana, A. chinensis, Acacia pruinosa, A. decurrens, Dalbergia sp., Erythrina indica,*

Grevillea robusta, Gliricidia sepium, etc. (Barua 2007).

Generally, tea grows at fairly high relative humidity that range from 67% to 85%, maximum temperature (27.1^0 C to 28.6^{0}C), minimum temperature (9.3 ^{0}C to 20.4 ^{0}C) (Rashid, 1985) and the marginal annual rainfall must be 1270 mm (Sana, 1989). At present, tea cultivation is considered as a good source of revenue earning and tea production in India was estimated to be 1,208.66 million Kg in 2015 (Tea Board of India, 2016). It is also considered as a main source of income for million of tea workers in the tea garden.

Tea cultivation in one of the important agroforestry system well known in Northeast India, which was started in 19th century. However, tea cultivation in Arunachal Pradesh has recently started. The present study emphasised on documentation of the shade tree used in tea estate and the socio-economic condition of the tea labourers.

MATERIAL AND METHODS

Rony tea estate is situated at Kharsingsa, which is located 4 km away from Banderdewa, Papumpare district of Arunachal Pradesh. It is located at latitude 27˚08'21" N, Longitude 93˚45'55" S, with an elevation of 308 ft above msl. It was established in 1999 and the total area of tea estate is 8 ha.

The study of shade tree in tea cultivation area was done through quadrate method wherein 10 × 10 m^2 quadrate size was used to assess the shade trees w.r.t basal area and density of trees per ha through random sampling. The socio-economic study has been done through personal interview with the respondents through standardized questionnaire. The study was done for five months from January to May, 2012.

RESULTS

The shade tree of tea estate

The major shade tree species found in Ronyi tea estate are *Melia azedarach, Albizia procera* and *Albizia lebbeck.* Fabaceae is the dominant family. The shade trees not only provides shade to tea plants but also helps in replenishing nitrogen loss and controls insect pest due to bio pesticide properties of the tree (Table 1).

Table 1: Shade trees in the tea garden and their other uses

Name of tree	Family	Uses
Albizia procera	Fabaceae	Shade tree, nitrogen fixing and fuel wood
Albizia lebbek	Fabaceae	Shade tree, nitrogen fixing and fuel wood
Melia azedarach	Meliaceae	Shade trees, bio pesticide, fuel wood, etc.

Girth, tree density, basal area and crown density

The highest average girth (GBH) (OB) is found in the *Albizia procera*, which is about 4.15 m, followed by *Melia azedarach* (3.21 m) and *Albizia* lebbeck (1.02 m). The highest basal area is found in *Albizia procera* (13.5 m^2), followed by *Melia azedarach* and *Albizia lebbeck*. Whereas the highest number of trees per ha is found in *Melia azedarach* (140 trees per ha), followed by *Albizia procera, a*nd *Albizia lebbeck* (Table 2).

Table 2: GBH (OB) and basal area of shade trees

Name of tree	Average GBH (m)	Basal area sq. m per ha	Nos. of trees per ha
Albizia procera	4.15	13.5	120
Melia azedarach	3.21	8.8	140
Albizia lebbek	1.02	1.65	20

The crown density in the tea estate varies from 31% to 43%. The average crown density of the tea estate is 40.41%. (Table 3).

Table 3: Crop composition and crown density

Crop composition	Crown density
Albizia procera, Albizia lebbek	31.25%
Melia azedarach	41.6%
Albizia procera, Melia azedarach	41.6%
Albizia procera, Melia azedarach, Albizia lebbek	41.6%
Albizia procera, Melia azedarach	43.75%
Average:	**40.41%**

Socio-cultural aspects of tea workers

The average family size of the tea estate worker is 8. Most of the tea workers are Christian (70%), followed by Hindu (20%) and others (10%). The literacy rate of tea workers is 45%. About 60% of the labourer lives in joint family (Figure no. 1). Most of the tea workers are from Assam, which is 87% and rest of them are from Jharkhand and Arunachal.

Socio-economic aspects

The income of the tea workers are range from Rs. 3000 to 3300 per month. About 60% of tea workers involved in the bamboo plantation, livestock rearing (50%), farming (30%), fishery (20%), etc. About 80% of the tea labourer collect fuel wood from various sources viz., reserve forest, tea estate and secondary forest near the riverbank. About 30% of the labourers have access to LPG facilities. (Figure no. 2).

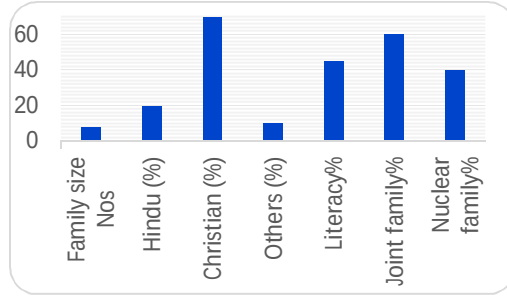

Fig. 1: Socio-cultural aspects of the three Tea gardens

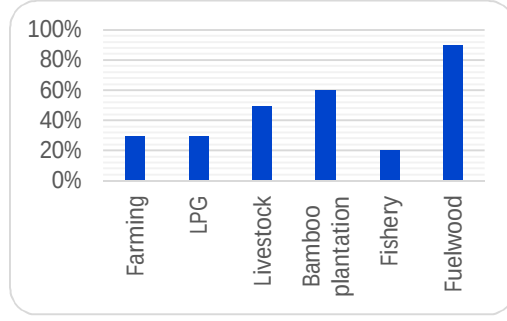

Fig. 2: Socio-economic conditions of the tea estates workers

The requirement of fuelwood per household per day is about 15 kg. However, the surplus fuelwood are sold in market @ Rs. 30 per bundle. The common fuelwood species are *Albizia* spp., *Gmelina arborea, Melia azedarach, Terminalia sp., Erythrina sp.*, etc.

Ethno botanical aspects

The tea workers have good knowledge about medicinal plants, which are generally used for curing common diseases viz., fever, hypertension, fever, wounds, etc. The plants used are *Ocimum tenuiflorum*, *Ageratum*

conyzoides, *Melia azedarach*, etc. (Table 4). These plants are generally sourced from the forest and home garden.

Table 4: Ethnobotanical knowledge of tea tribes

Botanical name	Family	Uses	Part use
Ageratum conyzoides (L.) L	Compositae	Wound	Leaf
Melia azedarach L.	Meliaceae	Skin diseases	Leaf
Ocimum tenuiflorum L.	Lamiaceae	Cough & Cold	Leaf, Stem
Clerodendron glandulosum Lindl.	Lamiaceae	Hypertension	Leaf
Curcuma longa L.	Zingiberaceae	Fracture, Fever	Rhizome

CONCLUSION

The dominant shade tree of studied tea estate is *Melia azedarach*, followed by *Albizia procera* and *Albizia lebbeck*. The shade trees provide partial shade to the tea plants, which is important for improving the quality of tealeaf. The average crown density of the tea estate is 40.41%. The highest basal area is found in *Albizia procera* (13.5 sq.m per ha) and the highest number of trees per ha is found in *Melia azedarach* (140 trees per ha). The socio economic condition of tea labourer is depend upon the tea estate and they also have good knowledge on utilisation of plants in common health care. To ensure sustainable development in tea cultivation in Arunachal Pradesh more emphasise should be given on utilised wasteland in tea cultivation instead of using farmland and forestland, organic tea cultivation and utilisation of bio-pesticide.

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