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Volume, Biomass and Carbon content of Agroforestry Systems of Chikhli, South Gujarat, India

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1. Introduction

AF systems provide higher income, multiple produces and environmental security along with wood and Non-wood forest produces among the farmers; moreover, tree and shrub species components help in sequestering more carbon. Therefore, in the era of climate change, conversion of monocropping into Agroforestry practices provide varieties of benefits to the grower and also help in maintaining local environment. In Gujarat, many farming communities have already started Agroforestry practices with varieties of tree as main component and agricultural crops, vegetables, medicinal, aromatic and spice plants, flowering plants as intercrops. In order to assess the tree components in terms of its growth, biomass, carbon contents in the different agroforestry systems, a survey was undertaken in different villages of Chikhli taluka, Navsari district of South Gujarat and prevailing agroforestry systems were documented and tree growth parameters were recorded for estimating biomass and carbon content.

2. Material and methods

In the present study, total five different villages of Chikhli taluka were selected during 2021. Various crop/tree components growing in the 10 different farms (small land holdings) were recorded. Tree biometric parameters such as height, DBH, mid diameter and crown characteristics were recorded. Further, tree volume, biomass and carbon content of tree components of selected AF Systems were estimated following standard formula.

3. Results and discussion

In the present study total seven crops *viz.,* Rice (*Oryza sativa* L.), Sugarcane (*Saccharum officinarum* L.), Turmeric (*Curcuma longa* L.), Yam (*Dioscorea alata* L.), Elephant fruit yam (*Amorphophallus paeoniifolius* L.), Taro (*Colocasia esculenta* L.), Okra (*Abelmoschus esculentus* L.Moench) and three tree species *viz.,* Teak (*Tectona grandis* L. f.), Mango (*Mangifera indica* L.), Sapota (*Manilcara zapota* (L). P. Royen) were recorded among 10 different AF systems studied during June to Sept. 2021.

Table 1. Tree volume, biomass and carbon yield in different AF systems

Sr. no.	AF System	Numbers of trees in AF system	Approximate farm area (m^2)	Volume (m^3) Based on total trees	Biomass per hectare (ton)	Carbon yield per hectare (ton)
1	Teak + Mango + Rice	56	3456	4.88	8.78	3.93
2	Teak + Sugarcane	16	1360	6.11	27.91	12.50
3	Teak + Mango + Turmeric + Yam	32	1762	4.91	16.23	7.23
4	Mango + Turmeric	13	1320	2.34	9.16	4.00
5	Mango + Teak + Sugarcane	29	2784	13.82	25.20	11.01
6	Mango + Elephant fruit yam	15	2044	1.19	2.81	1.23
7	Mango + Taro	10	1650	1.10	3.20	1.40
8	Mango + Okra	10	658	0.65	4.77	2.08
9	Sapota +Elephant fruit yam	10	5791	1.04	0.95	0.42
10	Sapota + Turmeric	5	2184	0.38	0.92	0.41

Since south Gujarat is hub for horticultural crops, famers are growing mainly mango and sapota as prominent crop and in the available space, they use to grow different economical crops as intercrop based on the season. Biometric study shows that yield and biomass depend upon the number of trees present, age of the tree (DBH and Height) and other inter-cultural practices. Based on total number of trees available in the respective farm, tree volume, biomass and carbon content were estimated and presented in Table 1. Among 10 AF systems, Mango + Teak + Sugarcane AF system resulted in higher tree volume (13.82 m^3 total tree basis), where in the case of biomass and carbon content, highest recorded in Teak + Sugarcane (27.91 tons ha^{-1} and 12.50 tons ha^{-1} respectively) and they were lower in Sapota + Turmeric AF system (volume calculated on total tree basis = 0.38 m^3, biomass of 0.92 ton ha^{-1} and carbon yield of 0.41 ton ha^{-1}). Study shows that small farmers can derive minimum of 0.09 to 0.41 tons carbon ha^{-1} from AF systems.