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Diversity of traditional agroforestry practices, challenges and opportunities of Rajnandgaon district of Chhattisgarh

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Abstract
The study on "Diversity of Traditional Agroforestry practices, Challenges and Opportunities of Rajnandgaon District of Chhattisgarh" was carried out during 2020-2021 in Rajnandgaon district of Chhattisgarh to characterize the structure and diversity of traditional agroforestry practices prevailing in the study area of Rajnandgaon and to identify the opportunities and challenges for promoting scientific agroforestry in rural areas to boost overall farm productivity and additional income. The major tree species recorded in Rajnandgaon District of Chhattisgarh are *Acacia nilotica, Aegle marmelos, Annona squamosa, Azadirachta indica, Bambusa vulgaris, Butea monosperma, Emblica officinalis, Mangifera indica, Millettia pinnata, Pithecellobium dulce, Terminalia catappa, Syzygium cumini, Tamarindus indica, Tectona grandis, Terminalia arjuna, Ziziphus mouritiana Carica papaya* and *Citrus limon*. The common shrubs species recorded are *Cascabela thevetia, Corissa caranda, Carica papaya, Gossypium spp, Hibiscus rosa, Moringa oleifera, Murraya koenigii, Musa paradisica, Ocimum sanctum, Psidium guajava, Punica granatum* and *Rosa indica* whereas the herbaceous plants recorded are *Abelmoschus esculentus, Allium cepa, Amaranthus tricolor, Catharonthus roseus, Amorphophallus paeoniifolius, Brassica oleraceae, Brassica rapa, Capsicum annuum, Colocasia esculenta, Corchonus olitorius, Curcuma longa, Raphanus sativus, Solanum lycopersicum, Solanum melongena, Spinacia oleracea, Zea Mays* and *Zingiber officinale*. In all three blocks, firewood was the highest anticipated benefit, followed by timber. Fibber, feed, medicine, increased revenue, and shading impacts were negligible in contrast to the other products. Medium-sized farmers benefited most from agroforestry since it provided them with fuel, followed by wood products, food, and fodder. Over all, scientific agroforestry was seen differently by different sorts of farmers.

Keywords: Agroforestry practices, traditional agroforestry practices, diversity, challenges and opportunities

Introduction
Traditional agroforestry not only acts as an important part in food security and poverty alleviation, but also adds to the improvement of the climate and socio-culture in a local region. There is ample scope and opportunity for improving the traditional practices by scientific interventions for enhancing the productivity and economic benefits to farmers. The amount of land under agroforestry in India and the rest of the world is a contentious question. The number of trees varies from one per hectare (arid area of Rajasthan) to 200 per hectare (Kerala's Home gardens), and there is no specific method for estimating them. Interestingly, there is immense diversity in agroforestry systems within the country. The structural complexity, species diversity, productive and protective attributes, as well as socio-economic aspects, all differ greatly among the systems. It can range from seemingly simple forms of shifting cultivation to complex home-gardens: from sparse stands of trees on farmlands (e.g. *Prosopis cineraria* (Khejri) tree in arid regions of Western India to high-density complex multi-storied Multitier systems of humid lowlands: from systems in which trees play primarily a "service" function (e.g. shelter belts) to systems in which they proliferate (e.g. intercropping with plantation crops).
Growing of multipurpose trees along with agricultural crops through agroforestry has been considered as a panacea for maladies of intensive agriculture (Uthappa *et al*., 2015) [11].

The multipurpose tree species like Babul (*Acacia nilotica),* Subabul *(Leucaena leucocephala),* Arjun *(Terminalia arjuna),* Sissoo *(Dalbergia sissoo),* Mangium *(Acacia mangium),* Neem *(Azadirachta indica),* Mango *(Mangifera indica),* Aonla *(Emblica officinalis),* Guava *(Psidium guajava),* Ber *(Ziziphus mauritiana),* Char *(Buchnania lanzan),* Saja *(Terminalia tomentosa),* and Palas *(Butea monosperma)* are traditionally practiced by farming communities in Chhattisgarh plains. These trees are existing on the bunds of farmers for the use of various purposes as either NTFPs, agriculture equipment's, fuel wood tree and fodder tree.

Materials and Methods

The study was conducted in Rajnandgaon district of Chhattisgarh. The Rajnandgaon is located in the western part of the state of Chhattisgarh, between the latitudes of 20°70 - 22°29 North latitude and the longitudes of 80°23 - 81°29 East. Rajnandgaon has an area of 8,222 square kilometers, with more than 11.90 percent of that covered in forest (around 978.87 square kilometers). Total forest area under Rajnandgaon District is 2695.91 sq. km. comparising Rajnandgaon Forest Division, Khairagarh Forest division and Panabaras Project Division. The study conducted in Rajnandgaon district of Chhattisgarh. Site was selected during March 2021 there are total nine blocks in Rajnandgaon district in which namely three blocks were selected Rajnandgaon, Chhuikhadan and Mohala. The study site is selected in such a manner that the heterogeneity of district covered properly. Three villages were selected randomly from each block, thus the total (3X3=9) 9 villages were selected for this investigation. The vegetation analysis was carried out through 10 quadrates each for Tree, Shrub and herb respectively 10x10M, 5x5M and 1x1M. The income of the farmers was calculated like agriculture, Job, Labor work and other enterprises for calculation of their livelihood. The data collected on the basis of questionnaire developed to collect the primary data and secondary data for further analysis. Height of the trees and shrubs measured by measuring pole and herbs by graduated scale. The vegetation data quantitatively analysed for abundance, density and frequency (Curtis and McIntosh 1950). The importance value index (IVI) for the tree species was determined as the sum of the relative frequency, relative density and relative dominance (Curtis 1959). Diversity indices *viz*., Shannon-wiener index (Shannon and weaver, 1963) and Concentration of dominance-Simpson's Index (Simpson, 1949) measured.

Statistical analysis: Purposive sampling. vegetation data will be collected from farmer's field.

A view of data taken for Tree, shrub and herb species present in study sites

Result and Discussion

The study from three blocks in total 9 villages each block three villages *viz*., Rajnandgaon Block (Sukuldaihan (V1), Dhaba (V2) Farhad (V3)) Chhuikhadan Block (Atariya (V4), Ghirgholi (V5), Jangalpur (V6)), and Mohla Block (Hiddar (V7), Kunjamtola (V8), Majiyapar (V9)).

The structure and diversity of traditional agroforestry practices prevailing in the study area of Rajnandgaon.

1. Phytosociological structure of vegetation of small and large tree species at Rajnandgaon block of Rajnandgaon District (CG) (Village Sukuldaihan, Dhaba and Farhad)

Acacia nilotica, Aegle marmelos, Annona squamosa, Azadirachta indica, Bambusa vulgaris, Butea monosperma, Carica papaya, Citrus limon, Millettia pinnata, Syzygium

cumini, Tectona grandis, Terminalia Arjuna, Moringa oleifera, Psidium guajava and Ziziphus mouritiana are the tree species recorded in the Rajnandgaon block. Highest number of individual species per hectare recorded is *Carica papaya* (200 per ha). The tree species *Citrus limon and Carica papaya* were found in majority of the quadrates each in 100 quadrates per ha. The highest frequency and the relative frequency of 0.1579 and 15.79 per ha respectively was recorded in *Citrus limon and Carica papaya*. The *Carica papaya* also recorded significantly higher density of 6.67 per ha and the relative density of 21.0524 per ha. The higher abundance of 1.94737 per ha and the relative abundance of 129.825 per ha is recorded in the tree species *Acacia nilotica.* The IVI values varied from 68.4211 (*Butea monosperma*) to 201.579 (*Aegle marmelos*) (Table 1& Fig.1)

Table 1: Phytosociological structure of vegetation of small and large tree species at Rajnandgaon block of Rajnandgaon District (CG) (Village Sukuldaihan, Dhaba and Farhad)

Species	Family	Frequency (/ha)	Ab. (/ha)	Density (/ha)	RAb. (/ha)	RF (/ha)	RD (/ha)	IVI
Acacia nilotica	Fabaceae	0.100	4.111	1.947	10.000	12.982	129.825	152.807
Aegle marmelos	Rutaceae	0.005	0.333	3.000	0.526	1.053	200.000	201.579
Annona squamosa	Annonaceae	0.047	1.444	1.444	4.737	4.561	96.296	105.595
Azadirachta indica	Meliaceae	0.111	3.000	1.286	11.053	9.474	85.714	106.241
Citrus limon	Rutaceae	0.158	4.444	1.333	15.790	14.035	88.889	118.713
Butea monospera	Fabaceae	0.011	0.222	1.000	1.053	0.702	66.667	68.421
Millettia pinnata	Fabaceae	0.037	1.111	1.429	3.684	3.509	95.238	102.431
Syzygium cumini	Myrtaceae	0.011	0.333	1.500	1.053	1.053	100.000	102.105
Tectona grandis	Lamiaceae	0.011	0.333	1.500	1.053	1.053	100.000	102.105
Terminalia arjuna	Combretacee	0.047	1.333	1.333	4.737	4.210	88.889	97.836
Ziziphus mouritiana	Rhamnaceae	0.058	1.778	1.455	5.790	5.614	96.970	108.373
Moringa oleifera	Fabaceae	0.116	2.667	1.091	11.579	8.421	72.727	92.727
Crica papaya	Caricaceae	0.158	6.667	2.000	15.790	21.052	133.333	170.175
Psidium guajava	Myrtaceae	0.132	3.889	1.400	13.158	12.281	93.333	118.772
Total		1.000	31.667	1.500	100.000	100.000	100.000	300.00

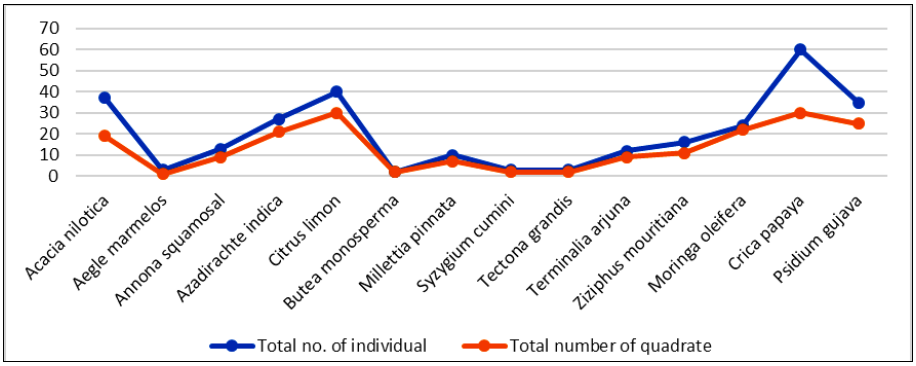

Fig 1: Phytosociological structure of vegetation of small and large tree species at Rajnandgaon block

In case of Rajnandgaon block, the dominating tree species was *Carica papaya*, shrub was *Solanum lycopersicum* and the herb was *Curcuma longa.* The co dominating tree species is *Citrus limon*, shrub was *Solanum melongena* and herb was *Colocasia esculenta*. The receive tree species was *Butea monosperma*, shrub was *Gossypium spp* and herb was *Bambusa vulgaris* (Table.2)

Table 2: Plant species dominancy of small and large tree, shrub and herbs species of Rajnandgaon block of Rajnandgaon District (CG)

	Species	Family	Frequency	Density	Ab.	RF	RD	RAb.	IVI
Tree species									
Dominating	*Crica papaya*	Caricaceae	0.158	6.667	2.000	15.790	21.052	133.333	17.01
Co dominating	*Citrus limon*	Rutaceae	0.158	4.444	1.333	15.790	14.035	88.889	11.87
Receive	*Butea monosperma*	Fabaceae	0.011	0.222	1.000	1.053	0.702	66.667	6.84
Shrub species									
Dominating	*Solanum Lycopersicum*	Solonaceae	0.125	46.667	4.200	12.500	27.344	25.481	65.32
Co dominating	*Solanum melongena*	Solonaceae	0.130	31.111	2.692	13.000	18.229	16.334	47.56
Receive	*Gossypium spp*	Malvaceae	0.050	5.333	1.200	5.000	3.125	7.280	15.40
Herb species									
Dominating	*Curcuma longa*	Zingiberaceae	0.088	1866.667	8.000	8.750	18.301	12.103	39.15
Co dominating	*Colocasia esculenta*	Araceae	0.113	1688.889	5.630	11.250	16.558	8.517	36.32
Receive	*Bambusa vulgaris*	Poaceae	0.004	44.444	4.000	0.417	0.436	6.051	6.90

3. Phytosociological structure of vegetation at Chhuikhadan block of Rajnandgaon District (CG)

Acacia nilotica, Annona squamosa, Azadiracta indica, Citrus limon, Mangifera indica, Millettia pinnata, Syzygium cumini, Tamarindus indica, Tectona grandis, Terminalia arjuna, Ziziphus maurtitiana, Moringa oleifera and Psidium guajava are

the tree species recorded in the Chhuikhadan block. Highest number of individual species per hectare recorded is *Citrus limon* (163.33 /ha). The tree species *Citrus limon* found in majority of the quadrates of 90 quadrates per ha. The highest frequency and the relative frequency of 0.18 and 18 /ha respectively was recorded in *Citrus limon* and also recorded significantly higher density of 5.44 per ha and the relative density of 23.67 /ha. The higher abundance of 1.81 /ha and the relative abundance of 9.54 /ha is recorded in the tree species *Citrus limon.* The IVI values varied from 6.40 (*Mangifera indica*) to 32.50 (*Terminalia arjuna*) (Table 3 & Fig 3)

Table 3: Phytosociological structure of vegetation of small and large tree species at Chhuikhadan block (Village- Atariya, Ghirgholi and Jangalpur) of Rajnandgaon District (CG)

Species	Family	Frequency (/ha)	Ab. (/ha)	Density (/ha)	RAb. (/ha)	RF (/ha)	RD (/ha)	IVI
Acacia nilotica	Fabaceae	0.090	1.890	1.310	8.670	8.210	6.870	23.750
Annona squamosa	Annonaceae	0.010	0.330	1.500	1.330	1.450	7.880	10.660
Azadiracta indica	Meliaceae	0.110	1.780	1.000	10.670	7.730	5.250	23.650
Citrus limon	Rutaceae	0.180	5.440	1.810	18.000	23.670	9.540	51.210
Mangifera indica	Anacardiaceae	0.010	0.110	1.000	0.670	0.480	5.250	6.400
Millettia pinnata	Fabaceae	0.020	0.330	1.000	2.000	1.450	5.250	8.700
Syzygium cumini	Myrtaceae	0.070	1.220	1.100	6.670	5.310	5.780	17.760
Tamarindus indica	Fabaceae	0.030	0.780	1.750	2.670	3.380	9.200	15.240
Tectona grandis	Lamiaceae	0.020	0.560	1.670	2.000	2.420	8.760	13.170
Terminalia arjuna	Combretaceae	0.100	3.000	1.800	10.000	13.040	9.460	32.500
Ziziphus maurtitiana	Rhamnaceae	0.030	0.670	1.500	2.670	2.900	7.880	13.450
Moringa oleifera	Fabaceae	0.060	1.110	1.110	6.000	4.830	5.840	16.670
Psidium guajava	Myrtaceae	0.190	3.560	1.140	18.670	15.460	6.010	40.130
Carica papaya	Caricaceae	0.100	2.220	1.330	10.000	9.660	7.010	26.670
Total		1.000	23.000	19.030	100.000	100.000	99.980	300.00

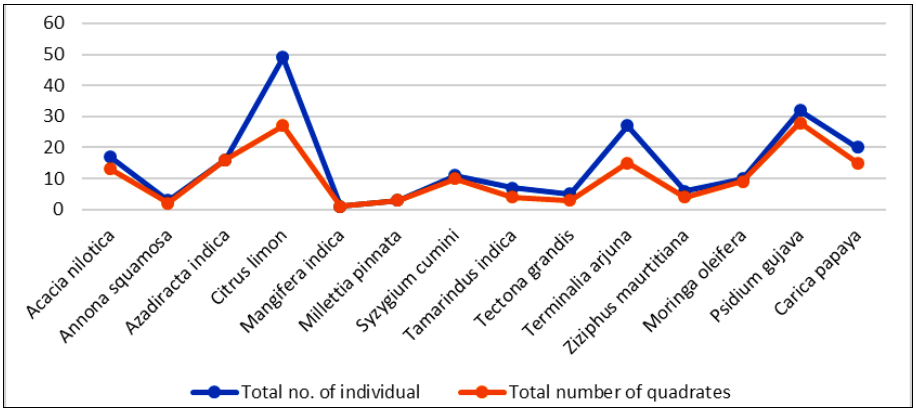

Fig 3: Phytosociological structure of vegetation of small and large tree species at Chhuikhadan block of Rajnandgaon District (CG)

In case of Chhuikhadan block, the dominating tree species was *Citrus limon*, shrub was *Solanum lycopersicum* and the herb was *Curcuma longa.* The co dominating tree species was *Terminalia arjuna*, shrub was *Carissa caranda* and herb was *Colocasia esculenta.* The receive tree species was *Mangifera indica*, shrub was *Rosa indica* and herb was *Bambusa vulgaris* (Table 4).

Table 4: Plant species dominancy of small and large tree, shrub and herbs species of Chhuikhadan Block of Rajnandgaon District (CG)

	Species	Family	Frequency	Density	Ab.	RF	RD	RAb.	IVI
Tree species									
Dominating	*Citrus limon*	Rutaceae	0.180	5.440	1.810	18.000	23.670	9.540	51.21
Co dominating	*Terminalia arjuna*	Combretaceae	0.100	3.000	1.800	10.000	13.040	9.460	32.50
Receive	*Mangifera indica*	Anacardiaceae	0.010	0.110	1.000	0.670	0.480	5.250	6.40
Shrub species									
Dominating	*Solanum lycopersicum*	Solonaceae	0.130	36.440	4.100	12.990	32.540	32.330	77.86
Co dominating	*Carissa caranda*	Apocynaceae	0.190	20.890	1.620	18.830	18.650	12.780	50.26
Receive	*Rosa indica*	Rosaceae	0.060	4.890	1.100	6.490	4.370	8.680	19.53
Herb species									
Dominating	*Curcuma longa*	Zingiberaceae	0.100	2277.780	7.070	10.210	19.730	12.230	42.18
Co dominating	*Colocasia esculenta*	Araceae	0.100	2144.440	6.890	9.860	18.580	11.930	40.36
Receive	*Bambusa vulgaris*	Poaceae	0.000	22.220	2.000	0.350	0.190	3.460	4.01

5. Phytosociological structure of vegetation at Mohala block of Rajnandgaon District (CG)

Acacia nilotica, Annona squamosa, Azadirachta indica, Butea monosperma, Emblica officinalis, Millettia pinnata, Pithecellobium dulce, Terminalia catappa, Syzygium cumini, Tamarindus indica, Tectona grandis, Terminalia arjuna,

Ziziphus mauritiana, Citrus limon, Carica papaya, Psidium guajava and *Moringa oleifera* are the tree species recorded in the Mohla block. Highest number of individual species per hectare recorded is *Carica papaya* (190 /ha). The tree species *Citrus limon and Psidium guajava* were found in majority of the quadrates each in 93.33 quadrates /ha. The highest frequency and the relative frequency of 0.167 and 16.667 per ha respectively was recorded in *Syzygium cumini*. Carica papaya also recorded significantly higher density of 6.633 per ha and the relative density of 18.750 /ha. The higher abundance of 2.9 per ha and the relative abundance of 10.657 /ha is recorded in the tree species *Annona squamosa.* The IVI values varied from 4.559 (*Pithecellobium dulce* and *Terminalia catappa*) to 42.399 (*Carica papaya*) (Table 5 & Fig 5).

Table 5: Phytosociological structure of vegetation of small and large tree species at Mohala block of Rajnandgaon District (C.G) (Village-Hiddar, Kunjamtola and Majiyapar)

Species	Family	Frequency (/ha)	Ab. (/ha)	Density (/ha)	RAb. (/ha)	RF (/ha)	RD (/ha)	IVI
Acacia nilotica	Fabaceae	0.056	1.333	1.200	5.556	3.947	4.410	13.913
Annona squamosa	Annonaceae	0.056	3.222	2.900	5.556	9.539	10.657	25.752
Azadirachta indica	Meliaceae	0.039	1.222	1.571	3.889	3.618	5.775	13.282
Butea monosperma	Fabaceae	0.022	1.222	2.750	2.222	3.618	10.106	15.946
Emblica officinalis	Phyllanthaceae	0.006	0.111	1.000	0.556	0.329	3.675	4.559
Millettia pinnata	Fabaceae	0.044	1.556	1.750	4.444	4.605	6.431	15.481
Pithecellobium dulce	Legumes	0.006	0.111	1.000	0.556	0.329	3.675	4.559
Terminalia catappa	Combretaceae	0.006	0.111	1.000	0.556	0.329	3.675	4.559
Syzygium cumini	Myrtaceae	0.017	0.444	1.333	1.667	1.316	4.900	7.882
Tamarindus indica	Fabaceae	0.011	0.222	1.000	1.111	0.658	3.675	5.444
Tectona grandis	Lamiaceae	0.028	0.889	1.600	2.778	2.632	5.880	11.289
Terminalia arjuna	Combretaceae	0.056	2.111	1.900	5.556	6.250	6.982	18.788
Ziziphus mauritiana	Rhamnaceae	0.039	1.444	1.857	3.889	4.276	6.825	14.990
Citrus limon	Rutaceae	0.156	4.556	1.464	15.556	13.487	5.381	34.423
Carica papaya	Caricaceae	0.167	6.333	1.900	16.667	18.750	6.982	42.399
Psidium guajava	Myrtaceae	0.156	5.556	1.786	15.556	16.447	6.562	38.565
Moringa oleifera	Fabaceae	0.139	3.333	1.200	13.889	9.868	4.410	28.167
Total		1.000	33.778	27.212	100.000	99.999	100.000	300.000

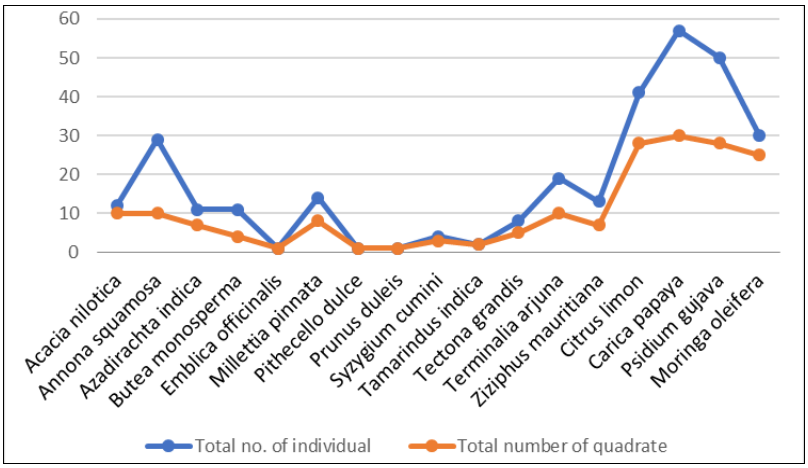

Fig 5: Phytosociological structure of vegetation of small and large tree species at Mohala block of Rajnandgaon District (CG)

In case of Mohla block, the dominating tree species was *Carica papaya*, shrub was *Solanum lycopersicum* and the herb was *Colocasia esculenta*. The co dominating tree species was *Psidium guajava*, shrub was *Carissa caranda* and herb was *Abelmoschus esculentus.* The receive tree species was *Pithecellobium dulce, Terminalia catappa* and *Emblica officinalis*, shrub was *Gossypium spp* and herb was *Amaranthus sylvestris* (Table 6).

Table 6: Plant species dominancy of small and large tree, shrub and herbs species of Mohala Block of Rajnandgaon District (CG)

	Species	Family	Frequency	Density	Ab.	RF	RD	RAb.	IVI
Tree species									
Dominating	*Carica papaya*	Caricaceae	0.167	6.333	1.900	16.667	18.750	6.982	42.39
Co dominating	*Psidium guajava*	Myrtaceae	0.156	5.556	1.786	15.556	16.447	6.562	38.56
Receive	*Pithecellobium dulce*	Legumes	0.006	0.111	1.000	0.556	0.329	3.675	4.55
	Terminalia catappa	Combretaceae	0.006	0.111	1.000	0.556	0.329	3.675	4.55
	Emblica officinalis	Phyllanthaceae	0.006	0.111	1.000	0.556	0.329	3.675	4.55
Shrub species									
Dominating	*Solanum lycopersicum*	Solonaceae	0.127	84.444	6.786	12.727	42.035	35.854	90.61
Co dominating	*Hibiscus rosa*	Malvaceae	0.132	20.889	1.621	13.182	10.398	8.563	32.14
Receive	*Gossypium spp*	Malvaceae	0.036	4.889	1.375	3.636	2.434	7.265	13.33

Herb species									
Dominating	*Colocasia esculenta*	Araceae	0.118	1766.667	5.300	11.811	16.667	9.278	42.81
Co dominating	*Abelmoschus esculentus*	Malvacea	0.114	1466.667	4.552	11.417	13.836	7.968	37.75
Receive	*Amaranthus sylvestris*	Amaranthceae	0.067	188.889	1.000	6.693	1.782	1.751	9.23

Agroforestry systems that are well-designed will increase production, preserve biodiversity, and boost farm revenue in the long run. Despite the fact that almost all farmer groups have traditionally used one or more agroforestry methods. They want to keep the natural-grown trees, but they don't want to add additional multifunctional trees to the spatial and temporal mixes. Only a few farmers have expressed an interest in using scientific agroforestry methods on their farms. According to a study, farmers favour agroforestry systems. The prevailing agroforestry practices observed in Rajnandgaon, Chhuikhadan and Mohala block are presented below. Persual of data indicated that the present agroforestry practices based on tree species and agricultural crop components were broadly grouped into following structures.

1. Agri-silviculture System
2. Multitier system System
3. Silvi-pasture System

The percent respondents of farmers on adoption of scientific Agro-forestry systems are presented in Table 7. The results reveal in case of Rajnandgaon that 60.47% of marginal, 92.31% of small farmers, 71.43% of medium farmers followed Agro-silviculture. 27.91% of marginal farmers, 46.15% of small farmers and 78.57% had Multitier system. 74.42% of marginal, 76.92% of small and 85.71% of medium farmers had horticultural crops along with the agricultural crops. In case of Chhuikhadan that 81.82% of marginal, 50% of small farmers, 71.43% of medium farmers followed Agri-silviculture. 90.91% of marginal farmers, 94.44% of small farmers and 92.86% had Multitier system. 72.73% of marginal, 44.44% of small and 71.43% of medium farmers had horticultural crops along with the agricultural crops. In case of Mohala that 33.33% of marginal, 92.86% of small farmers, 90.91% of medium farmers followed Agri-silviculture. 66.67% of marginal farmers and 72.73% had Multitier system. 7.14% of small and 100% of medium farmers had horticultural crops along with the agricultural crops. The large farmers from all three blocks had all three systems.

Table 7: Percent respondents of farmers on adoption of scientific agroforestry systems

	Marginal farmers	Small farmers	Medium farmers	Large farmers
Rajnandgaon				
Agri-silviculture	60.47	92.31	71.43	100.00
Multitier system	27.91	46.15	78.57	100.00
Agri horticulture	74.42	76.92	85.71	100.00
Chhuikhadan				
Agri- silviculture	81.82	50.00	71.43	40.00
Multitier system	90.91	94.44	92.86	100.00
Agri horticulture	72.73	44.44	71.43	100.00
Mohala				
Agri silviculture	33.33	92.86	90.91	100.00
Multitier system	66.67	0.00	72.73	100.00
Agri horticulture	0.00	7.14	100.00	100.00

Conclusion

As a result, it can be inferred that there may be a significant opportunity to expand existing agroforestry using appropriate agroforestry techniques in order to maximize farmer income. The present study also clearly indicated that agroforestry is the way of life of farmers in Rajnandgaon District.The restrictions can be solved by enacting farmer-friendly legislation and recognizing agroforestry as a sustainable agricultural method from an environmental and ecological point of view. For nationalized timber, the felling and transit laws must be changed. The institutional structures that have been put in place to ensure that the anticipated economic advantages are realized. Farmers that adopt agroforestry will be rewarded for ecosystem services as well as other indirect advantages. Technical assistance should be provided, as well as high-quality planting materials at competitive prices. A governmental authority/Board may be established to address the concerns of agroforestry producers and reach an acceptable resolution. The plans should be written to promote agroforestry aggressively in order to protect the interests of both local and global populations while also assuring long-term productivity. Therefore, there is need to promote the tree-based IFS model in this district to play a significant role to increase the farmers income with these enterprises.

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