ECOLOGICAL AND SOCIOECONOMIC STUDIES OF FARM FORESTRY BIODIVERSITY AT TIMERGARA LOWER DIR, PAKISTAN

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Abstract **-** The aim of the study was to evaluate ecological and socioeconomic status of farm forestry biodiversity of Tehsil Timergara Dir Lower were carried out. The data regarding the research was collected through semi structure questionnaire. 150 respondents were interviewed. Out of 100 villages 15 villages were selected in each site 10 quadrates were laid in the area. Each quadrate was 10 m×10 m. 15 communities were established in selected sites each community was properly named after establishing. Farm forestry can uplifts the economy and standard of life of the masses it is a source of income for some people. Farm forestry can educate the people about their ecological and environmental problems. It was concluded that the overall condition of the farm forestry system is satisfactory in study area. 86% farmers of the area claimed that the farm forestry system fulfils their socioeconomic needs and the farm forestry trend is adopted by the local people as a profession day by day. Majority of respondents responded that economy is raised because of farm forestry. The present research has provided useful data related to existing agroforestry systems and their improvement in study area and also the impacts of agroforestry system on socioeconomic conditions of local community. The farm forestry supports the local community in the form of timber, fuel wood, fruits and fodder. The total income from the farm forestry products were Rs. 2,247,000 and revenue generated from dairy products were Rs. 1,043,000. Soil samples of selected sites were tested in laboratory for determining their edaphic factors. The highest pH is 7.7, EC 0.40 dsm^{-1}, N 0.048 mg kg^{-1}, P41.1 mg kg^{-1}, K120 mg kg^{-1}, and organic matter are 0.96 %.

Index Terms **-** Agroforestry, ecology, edaphic factors, Farm forestry, pH, EC, Organic matter, timber, fuel wood, fodder, communities' Tehsil Timergara.

INTRODUCTION

District Dir Lower was founded in 1996 after bifurcation of former District Dir covering an area of 1585 km^2. It can be located from 71°31/ to 72°14/ E longitudes and from 34°37/ to 35°07/ N latitudes. The population of Dir Lower is 14, 35,971 having 906 people per km^2. Dir Lower consists of seven Tehsils *viz.* Timergara, Khal, Balambat, Adenzai, Lal Qilla, Sammar Bagh and Munda. Timergara is the head quarter of Dir Lower [1]. Tehsil Timergara lies on the east side of River Panjkora with an altitude of 823 m. The population of Town is 43,774 according to the survey report of 2017. The topography of area consists of mountains, hills and plains. Vegetation of the area is divided into sub-tropical, dry temperate and a short range of alpine types. This is due to the diversity in altitude, precipitation and temperature. In December average minimum temperature is 5.2 ^{0}C and average maximum temperature in July is 35.8 ^{0}C at Timergara. Average rainfall at Dir Lower is 431 mm [2]. Nearly about 50% in the research area is used for agriculture, the thick wild forest areas are surrounded by the pines and oaks trees. Wheat, maize and rice are amongst the cereals crops and vegetables like onion, tomatoes and gourds are the prominent cultivation of the research area. Some fruits like plums, apples, peaches and persimmons are also present in prominent number [1].

All the trees on the farm land which were managed to produce profitable products like charcoal, timber, oil or carbon credits were included in farm forestry. The commercial management of native forests were also included in farm forestry which was a vast land use system. With the help of which the combination of woody trees in farm and rangelands were combined for generating income as well as for the social and economic and environmental benefits this extended and managed social, financial and ecological advantages [3].

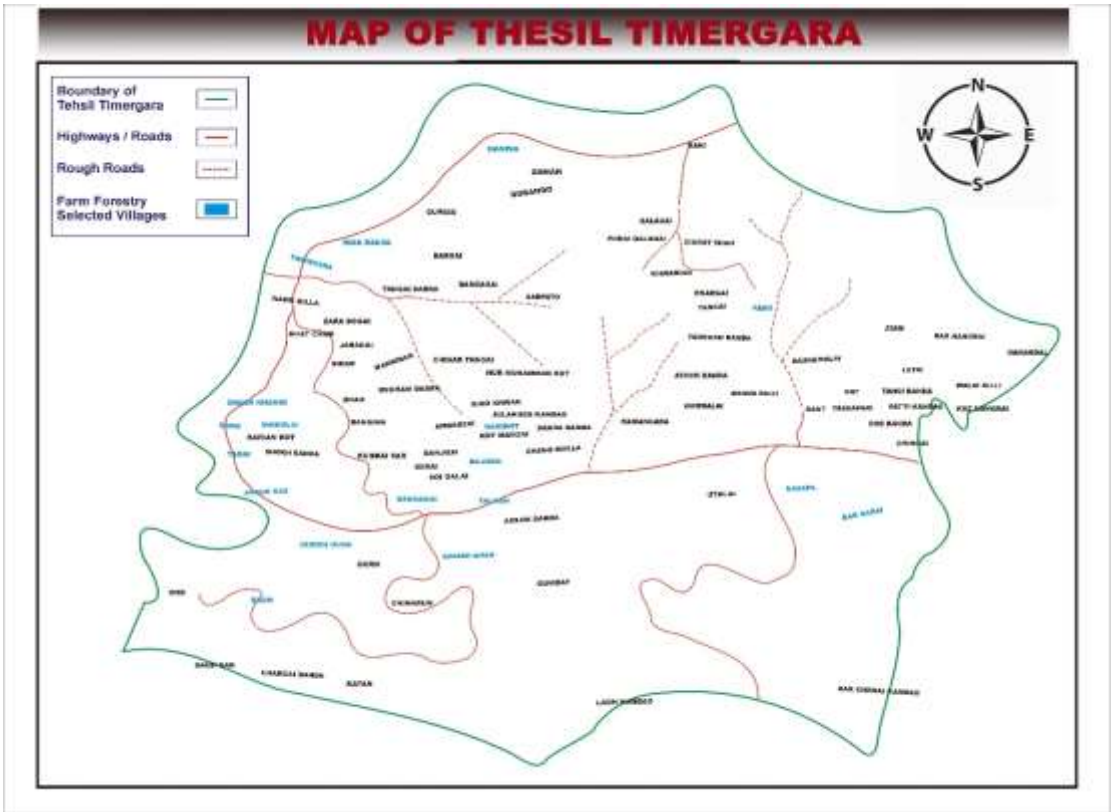


Fig. 1. Map of study area showing the sampling sites of Tehsil Timergara

The importance of farm forestry as income uplifting plan was emphasize in most developing countries by the higher poverty rate. It was estimated that 90% people were poor and living in the rural areas in Africa. Fundamentally depend on farms as a source of income [4-5]. In developing countries the farm forestry plays a vital role in raising the life standard of poor masses and eradication of poverty [6]. Traditional agroforestry system and modern agroforestry system are more adopted to modern farming practices. Trees contribute to economic development has a crucial role in watershed protection, conservation of biodiversity and betterment of the environmental quality [7]. Pakistan has less forestry resources and has one of the less forest ranges in the world [8]. The forest cover is unable to fulfil the growing demand for wood and wood based products. This is alarming for a country which has the 7th most populous in the world and fourth in Asia with an annual population growth rate of 2.1% [1]. Trees contribute through their vital role in the watersheds protection, enhancement of biodiversity, improvement of environment and income generation [9]. In Khyber Pakhtunkhwa the development trends of agroforestry system can be improved by sustainable management system, which will ensure proper land use. Resultantly, the livelihood of Khyber Pakhtunkhwa people has considerably improved [10]. According to a study the research area consists of low forest cover with soil texture ranging from sandy clay loam to loam and is sensitive to erosion. It is evident that Pakistan forest policy, related legislations and development plans always emphasize on rising plantation and encouraging forestation activities. But in past the increase in tree cover was carried out without considering Environmental Impact Assessment (EIA) and livelihood opportunities for the local farmers [11].

The ideal forest cover is 25% of the total land worldwide in developed countries. Unfortunately, Pakistan lagging behind this and has only 4.5% forest cover. Recently launched billion tree Afforestation project (BTAP) has raised the forest cover, but it will take time to become successful. Population growth rate in Pakistan is very high and since its inception about 100 million of population has been increased. According to the recent survey 2017 Pakistan is on 7th number among global warming affected countries. Due to less forest cover other issues like carbon sequestration has also been raised. In the near future it will become a challenging task to be managed. The present research area came under dry temperate and subtropical forest. Major portion of the area is barren so farm forestry can be carried out. Sustainable management of farm forestry is expected to increase income of the peoples, provide timber, shade for plants and animals, control soil erosion and environmental pollution [12].

MATERIALS AND METHOD

Field Survey and collection of farm forestry species

Field survey was carried out during 2018-2021 from the months of January to April each year in 15 villages of the research area including Osakai, Sarai Bala and Nagri, Nasafa, Kamangara and Ajjo, Sarai Payen and Ziarat Talash, Bajawro, Dherai, Bandagai, Bagh Dushkhel, Shago Kas Trai, Saddo, Timergara, Khungi, Shekolai and Mian

Banda. Various farm forestry species growing in the area were collected, pressed and identified at the Herbarium of Department of Botany, University of Peshawar (PUP) by the help of authentic literature *i.e.,* [13-14-15]. The farm forestry growers, local peoples and farmers were interviewed personally. Ten respondents were interviewed at each village total numbers of respondent were 150 in 15 villages.

Sampling techniques for farm forestry studies

Proportionate sampling procedure was adopted for data collection. First different areas of the research area were selected according to farm forestry practices. Then from these area sampling were carried out at 15 villages and data was collected from the farmers and other local peoples of the selected villages regarding research study. One community per village was established and 10 quadrates were sampled at each site measuring 10 m×10 m calculated by the following formula with the help of available literature [16-17].

$$\text{Density} = \frac{\text{No. of individuals of a species}}{\text{Total number of quadrats}}$$

$$\text{Frequency} = \frac{\text{No. of quadrats in which a species was present}}{\text{Total number of quadrats applied}} \times 100$$

$$\text{Cover} = \frac{\%\text{Cover of a species}}{\text{Total cover of all species}}$$

For density and cover mid points values will be used. After calculating density, frequency and cover the relative density, relative frequency and relative cover was calculated by using the following formulae.

$$\text{RD} = \frac{\text{Density of a species}}{\text{Total densities of all species}} \times 100$$

$$\text{RC} = \frac{\text{Cover of a species}}{\text{Total cover of all species}} \times 100$$

$$\text{RF} = \frac{\text{Frequency of a species}}{\text{Total frequencies of all species}} \times 100$$

Based on RD, RF and RC the importance value index (IVI) was calculated by using the following formula.

$$\text{IVI} = \frac{\text{RD} + \text{RF} + \text{RC}}{3}$$

Accordingly one community was established and named after sampling 10 quadrates in each selected village.

RESULTS AND DISCUSSION

Socioeconomic studies

The education of a person influences the development of character and also broadens his level of acceptance or receptivity to new idea on improves farming and agro forestry techniques. Literate farmers can make best use of their resource than illiterate farmers. In sample area 80 % males were found educated out of total literate and 20% female were educated. Overall the literacy rate was 34% while the literacy rate for rural areas of Pakistan is 28. 3%. The advanced literacy rate in the study area than literacy rate for rural show that people are well aware of important of education and are trying their best to educate their children. Although the literacy rate of the study area was 34% however, the higher proportion to literate respondents were having education only up to the primary level and belonged to comparatively younger age group. The average family size of the sample population was 11 persons out of them 60% were males and 40% were females Fig-2, 3). In study area total 150 respondents were interviewed. Respondents were made as group on the basis of age. 30 respondents were from 20-30 age groups, 5 respondents were from 30-40 age groups, 30 respondents were from 40-50 age groups, 35 respondents were from 50-60 age group and remaining 50 respondents were from 60-70 age group. 135 (90%) respondents were of the view that the current situation of the existing agroforestry practices is good and 15 (10%) respondents said that the condition of current agroforestry system is bad (Fig 4, 5).

Majority 69 (46%) of respondents were interested in agroforestry practices for the source of income, because they were generated extra revenue from agroforestry systems. 51 (34%) respondents were interested in agroforestry systems as a source of fuel wood, because most the members of farmers families were more in numbers and they could not afford the burden of fuel wood from market. Whereas 30 (20%) were interested in agroforestry practices as a source of fodder because they were fulfilling the forage requirements for livestock's from the species of agroforestry. Data analysis showed that, out of 150 (100 %) majority 93 (62 %) of the respondents preferred margin of field, 39 (26 %) preferred strip plantation and remaining respondents with frequency of 18 (12%) preferred side composite plantation. According to this survey showed that 100% respondents with number of 150 respondents responded that the current the trend of plantation with crops increasing day by day because growing trees were more beneficial than separate crops on farm lands (Fig-6). The following different trees species were planted. *Populus alba* L., *Olea ferruginea* Royle, *Eucalyptus camaldulensis* Dehnh., *Ailanthus althesemia* (Mill.) Swingle, *Robinia pseudocacia* L., *Dodonaea viscosa* (L.) Jacq, *Melia azedarach* L., *Salix alba* L., *Pinus roxburghii* Sargent, *Prunus armeniaca* L., *Diospyros kaki* L., *Prunus persica* L. and *Prunus communis* L. (Table-1).

Table 1. Types of trees planted in these lands.

S. No.	Scientific names	English names
1.	*Populus alba* L.	Poplar
2.	*Olea ferruginea* Royle	Olea
3.	*Eucalyptus camaldulensis* Dehnh.	Eucalyptus
4.	*Ailanthus altissima* (Mill.) Swingle	Bakian
5.	*Robinia pseudocacia* L.	Kikar
6.	*Dodonaea viscosa* (L.) Jacq	Dodonaea
7.	*Melia azedarach* L.	Melia
8.	*Salix alba* L.	Willow
9.	*Pinus roxburghii* Sargent	Chir Pine
10.	*Prunus armeniaca* L.	Apricot
11.	*Diospyros kaki* L.	Persimmon
12.	*Prunus persica* L.	Peach
13.	*Prunus communis* L.	Plum

Out of 150 (100%) 129 (86%) respondents were satisfied from farm forestry systems on their lands because farmers were getting more profits from a land at the same time *i.e.*, forage for their livestock, crops production and fuel wood from the trees grown on these lands and remaining 21 (14 %) were not satisfied from such practices because they have their views that their need were not fulfilling by farm forestry practices. According to survey 62% respondents with a frequency of 93 believed that owners were commonly benefitted and rest 48% with a frequency of 57 believed that tenant were benefitted (Fig-8, 9). The result showed that 90 % respondents with a frequency of 135 were satisfied for the production of timber from agroforestry systems and rest of 10% respondents with a frequency of 15 were not satisfied for the production of timber from farm forestry systems. Also the result showed that 74% with a frequency of 111 respondents were satisfied for the production of fuel wood from agroforestry systems. And remaining 26 % with a frequency of 39 respondents were not satisfied for the production of fuel wood from agroforestry systems (Fig-10).The result showed that 90% respondents with a frequency of 135 responded that they were selling timber from agroforestry and remaining 10 % respondents with a frequency of 15 responded that they were not selling timber from agroforestry. The result also showed that three forms of products were using for sale *i.e.*, trees, pole and sleepers/stacks. 64% respondents with a frequency of 96 responded that they were selling such products in trees form and 20 % respondents with a frequency of 30 responded that they were sailing products in pole form, rest of 16% respondents with a frequency of 24 responded that they were selling products in stacks/sleeper's form (Fig-11).

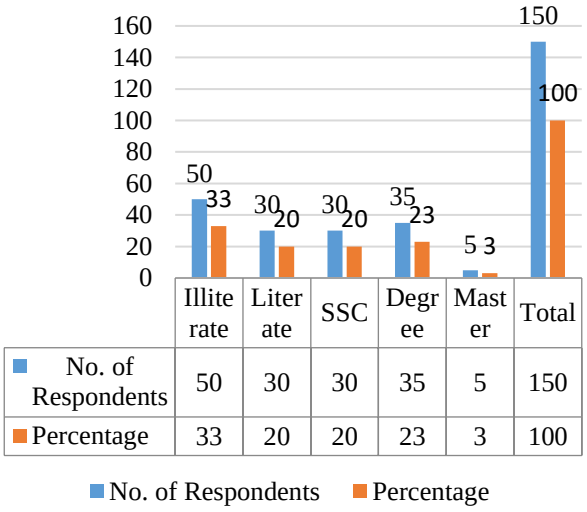
According to data analysis 30% respondents with a frequency of 45 responded that market was accessible for selling of several agroforestry products and rest of 70 % respondents with a frequency of 105 responded that there was no appropriate market for selling of various products. 26% respondents with a frequency of 39 responded that various products were sold in market, 54% of respondents with a frequency of 91 responded that various products were bought by local buyers and rest of 20 % of respondents with a frequency of 30 responded that various products were purchased by industries traders (Fig-12). According to survey that there are four types of fruity trees chosen by the respondents in research area *i.e.*, persimmon, peach, apricot, and plum. 58% respondents with a frequency of 87 responded that they were planting peach trees, 18% respondents with a frequency of 27 responded that they were planting persimmons trees, 14% respondents with a frequency of 21 responded that they were planting plums trees and remaining of the 10% respondents with a frequency of 15 responded that they were planting apricots trees on their lands (Fig-13). According to data analysis 100% respondents with a frequency of 150 responded that they were selling fruits from agroforestry. And the result shows that annual revenue generates in PKR from these fruity trees were grouped in four categories *i.e.*, up to Rs. 100,000/-, Rs. 100,000-199000/-, Rs. 200,000-299,000/-, and Rs. 300,000-399,000/-. Result showed that 26% respondents with a frequency of 39 responded that they were generating up to Rs. 100,000/-, 42% respondents with a frequency of 63 responded that they were generating Rs. 100,000-199000/-, 18% respondents with a frequency of 27 responded that they generating Rs. 200,000-299,000/- and rest of 14% respondents with a frequency of 21 responded that they generating Rs. 300000-399,000/- annually from fruiting trees (Fig-14).

According to questionnaire survey 34% respondents with a frequency of 51 responded that they were keeping 1-2 number of cows, 48% respondents with a frequency of 72 responded that they were keeping 3-4 number of cows, and rest of 18% respondents with a frequency of 27 responded that they were keeping 5-6 number of cows. Further Results showed that 66% respondents with a frequency of 99 responded that they were keeping 1-2 number of buffalos, 22% respondents with a frequency of 33 responded that they were keeping 3-4 number of buffalos, and rest of 12% respondents with a frequency of 18 responded that they were keeping 5-6 number of buffalos and also the showed that 54% respondents with a frequency of 81 responded that they were keeping 1-2 number of goats, 26% of respondents with a frequency of 39 responded that they were keeping 3-4 number of goats, and rest of 20% of respondents with a frequency of 30 responded that they were keeping 5-6 number of goats and sheep's (Fig-15).

The revenue got annually from the livestock products in rupees were categorized in three groups *i.e.*, meat, dairy products and dung cakes/manure. The results showed that annual income is generated in rupees from dairy products divided into three income groups *i.e.*, up to Rs. 150,000/-, Rs. 150,000-300,000/-, Rs. 300,000-450,000/-. Result showed that 32% respondents with a frequency of 48 responded that they were generating up to Rs. 150,000/-, 46% respondents with a frequency of 69 responded that they are generating Rs. 150,000- 300,000/-, and rest of 22% respondents with a frequency of 33 responded that they are generating Rs. 300,000-450,000/-. The results showed that annual revenue generated in rupees from meat are categorized in three groups *i.e.*, up to Rs. 99,000/-, Rs. 100,000-199,000/-, Rs. 200,000-299,000/-. Result showed that 58% of respondents with a frequency of 87 responded that they were generating up to Rs. 99,000/-, 24% respondents with a frequency of 36 responded that they were generating Rs. 100,000-199,000/-, and rest of 18% respondents with a frequency of 27 responded that they were generating Rs. 200,000-299,000/-. Results showed that annual revenue generate in rupees from dung cakes/manure were categorized in three groups *i.e.*, up to Rs. 100,000/-, Rs. 100,000-200,000/-, Rs. 200,000-300,000/-. Result showed that 62% respondents with a frequency of 93 responded that they were generating up to Rs. 100,000/-, 24% respondents with a frequency of 36 responded that they were generating Rs. 100,000-200,000/-, and rest of 14% respondents with a frequency of 49 responded that they were generating Rs. 200,000-300,000/- (Fig-16).

It is noted that 86% respondents accepted that supplemental food gotten from agroforestry and 14% accepted that supplemental food could not provide to livestock the by agroforestry practices (Table 4.18). 66 % respondents present their view that agroforestry knowledge came to us by ancestors, 12 % from media, 14 % and 8 % from NGO, s and Forest department respectively. According to survey the view of the respondents for the improvements of farm forestry system were that 50% respondent's view about farm forestry system improvement were by government facilitation. 20% respondents showed farm forestry system could be improved by awareness and 16% and 14% said that this system could be improved by development of irrigation facilities and providing of suitable market facilities respectively. The respondent's percentage *i.e.*, 6%, 29%, 11%, 4% showed that government can enhance and improve the farm forestry system through advance machinery, irrigation system, fertilizers and seed and at last plant nurseries provision respectively (Fig-17, 18, 19).

Fig. 2. Education level of the respondent



	Illiterate	Literate	SSC	Degree	Master	Total
No. of Respondents	50	30	30	35	5	150
Percentage	33	20	20	23	3	100

Fig. 3. Family size

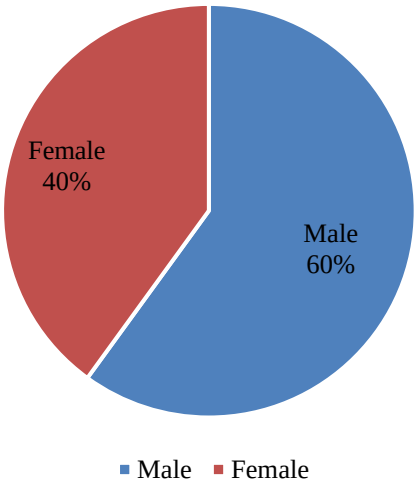


Fig. 4. Age group of respondents

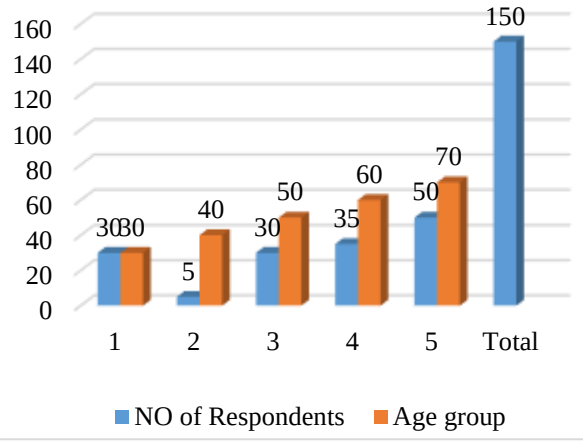


Fig. 5. Condition of the existing agroforestry system

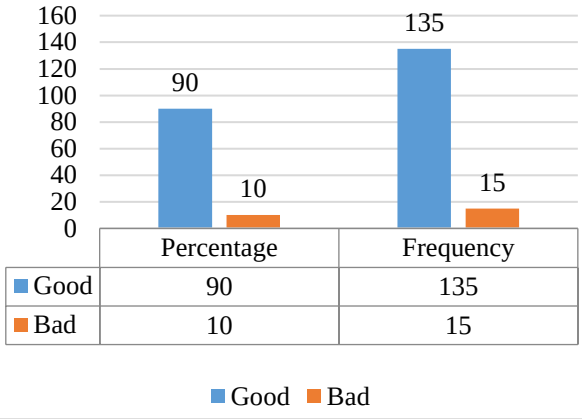


Fig. 6. Prefered location for trees plantation in fields

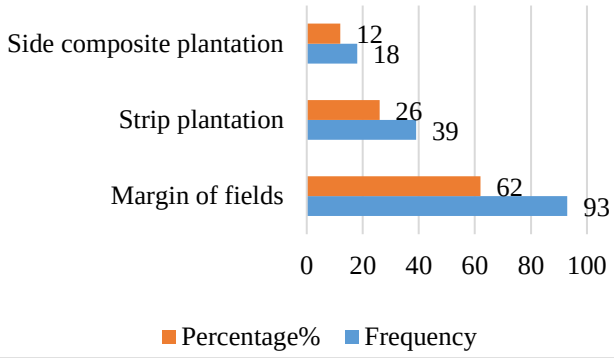


Fig. 7. Current situation of agroforestry in study area

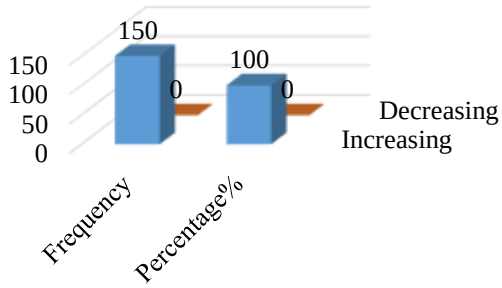


Fig. 8. Satisfiction from agroforestry system

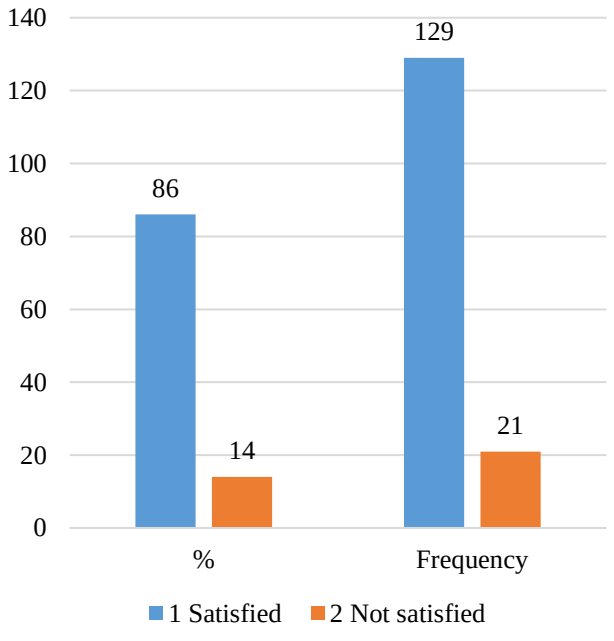


Fig. 9. Who is mostly benifited

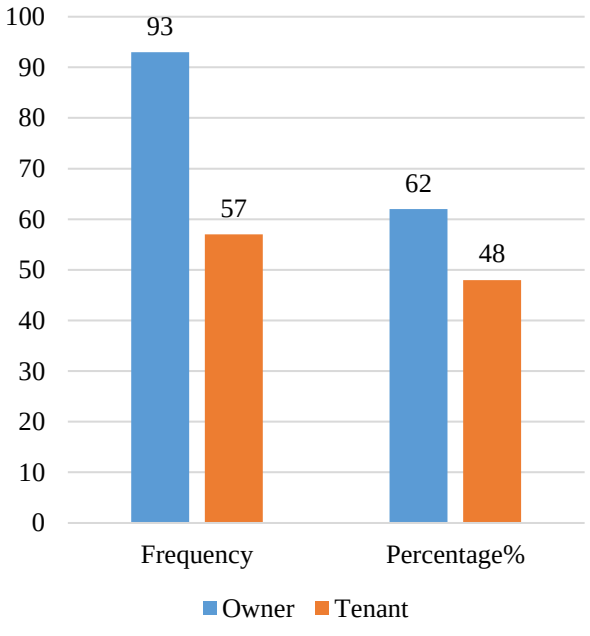


Fig. 10. Satisfiction from timber and fuel wood

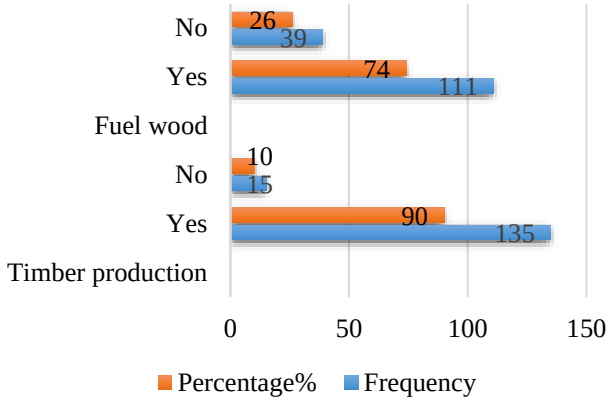
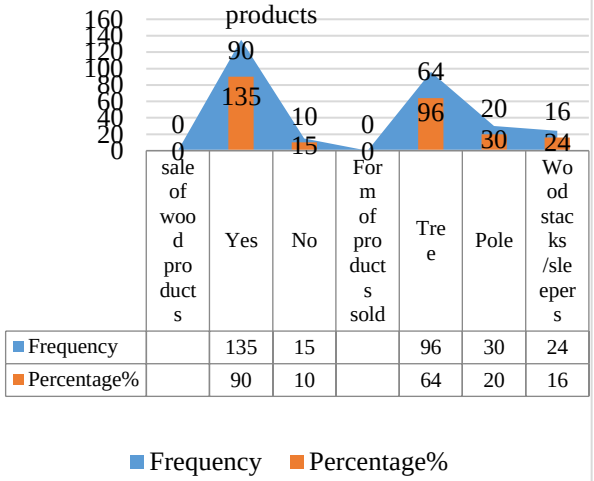
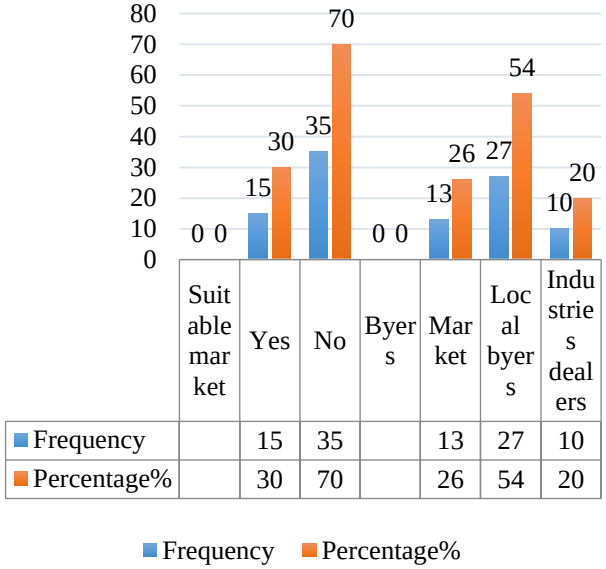


Fig. 11. Sale of wood products and form of products



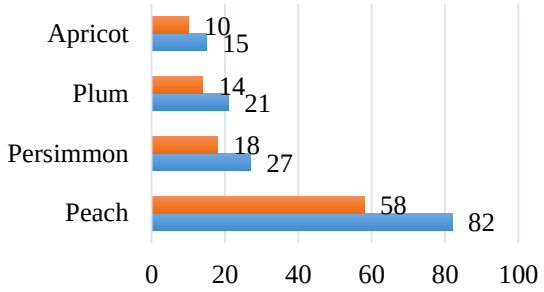
	sale of wood products	Yes	No	Form of products sold	Tree	Pole	Wood stacks /sleepers
Frequency		135	15		96	30	24
Percentage%		90	10		64	20	16

Fig. 12. Suitable markets and buyers for agroforestry products



	Suitable market	Yes	No	Byers	Market	Local byers	Industries dealers
Frequency		15	35		13	27	10
Percentage%		30	70		26	54	20

Fig. 13. Types of fruit plants prefered on farm lands



	Peach	Persimmon	Plum	Apricot
Percentage%	58	18	14	10
Frequency	82	27	21	15

Fig. 14. Sale and revenue generated from fruit plants

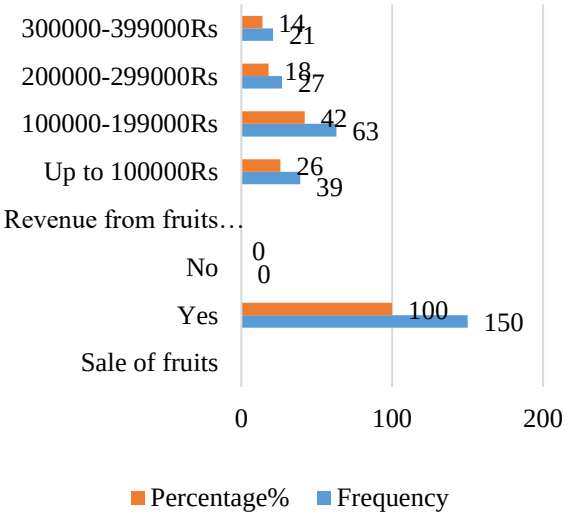


Fig. 15. Livestocks

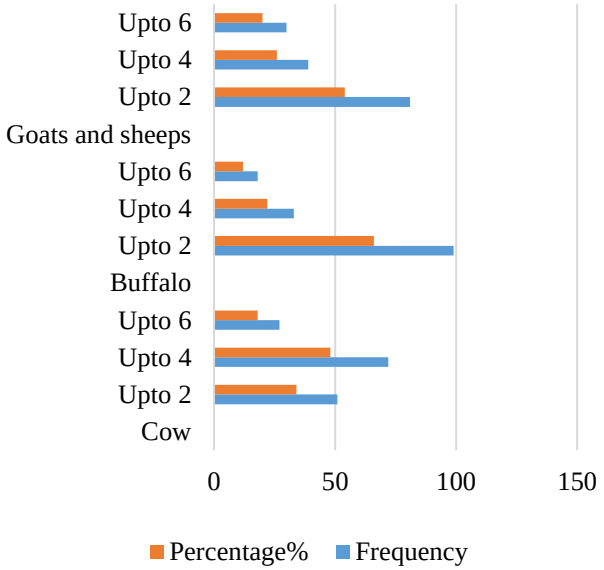


Fig. 16. Annual reveneue from livestock products

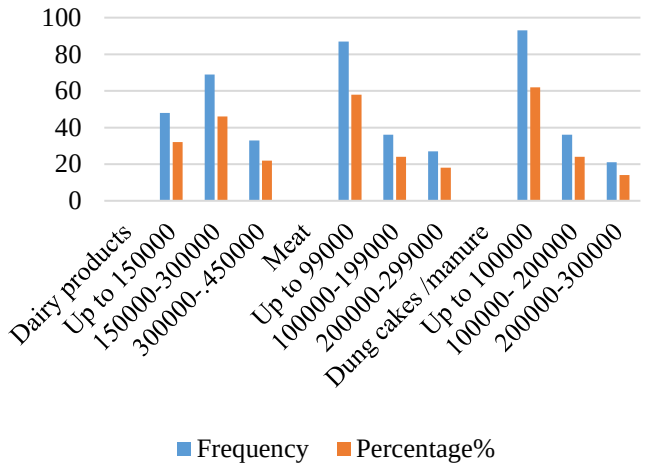


Fig. 17. Improvement of agroforestry system

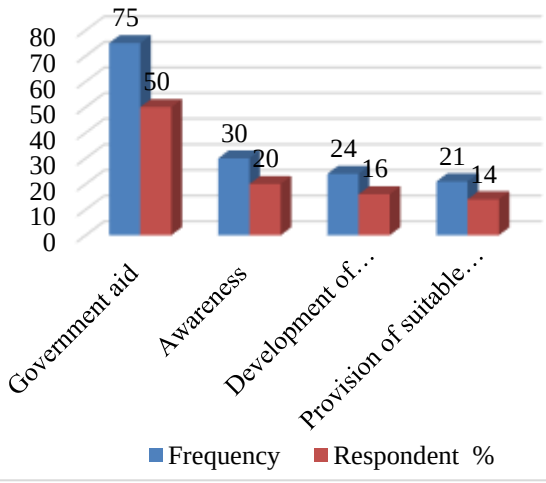


Fig. 18. Concept of agroforestry

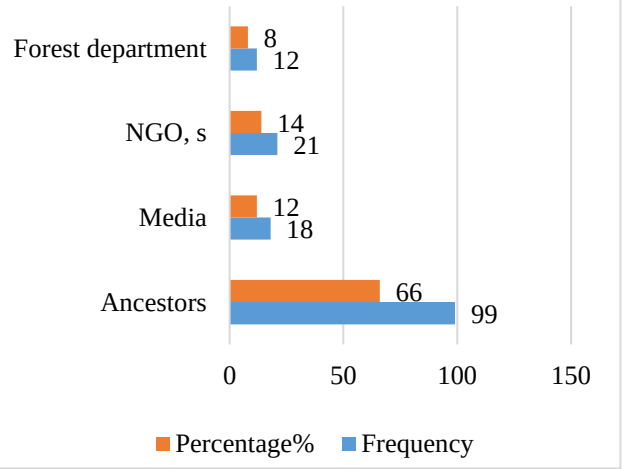
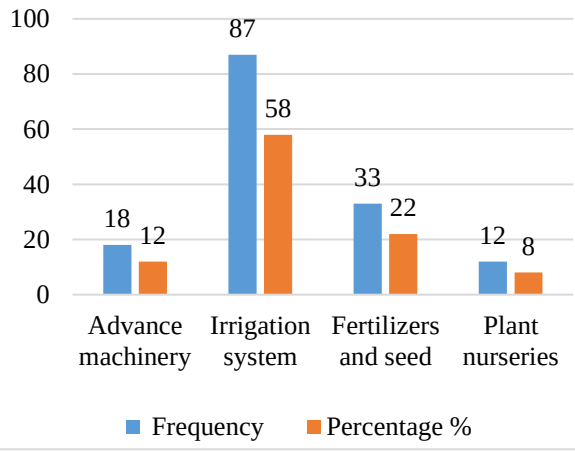


Fig. 19. Govt. Initatives for agroforestry practices



Phytosociological study of farm forestry species

The following communities were established during the present study.

1. ***Populus-Ailanthus-Eucalyptus*** **community at Osakai**

This community was represented by 5 species. The leading species were *Populus alba* L. IVI 104.1, *Ailanthus altissima* (Mill.) Swingle 80.7 and *Eucalyptus camaldulensis* Dehnh. IVI 59.09. *Robinia pseudocacia* L. was the only associated species with IVI value 56.03.

2. ***Populus-Eucalyptus-Dodonaea*** **Community at Sarai Bala and Nagrai**

This community was represented by 4 species. The leading species were *Populus alba* L. IVI 106.83, *Eucalyptus camaldulensis* Dehnh. IVI80.41 and *Dodonaea viscosa* (L.) Jacq. IVI 70.29. *Robinia pseudocacia* L. was the only associated species with IVI value 56.03.

3. ***Dodonaea-Eucalyptus-Olea*** **community at Nasafa**

This community was represented by 4 species. The leading species were *Dodonaea viscosa* (L.) Jacq IVI 170.93, *Eucalyptus camaldulensis* Dehnh. IVI 86.19 and *Olea ferruginea* Royle IVI 44.96. *Pinus roxburghii* Sargent was the only associated species with IVI value 56.03.

4. ***Morus-Juglans-Acacia*** **community at Kamangara and Ajjo**

This community was represented by 4 species. The leading species were *Morus alba* L. IVI 144.87, *Juglans regia* L. IVI 73.38 and *Acacia modesta* Wall. IVI 44.96. *Robinia pseudoacacia* L. was the only associated species with IVI value 56.03.

5. ***Robinia-Ailanthus-Acacia*** **community at Ziarat and Amlook Dara**

This community was represented by 4 species. The leading species were *Robinia pseudoacacia* L. IVI 94.81, *Ailanthus altissima* (Mill.) Swingle IVI 75.95 and *Acacia modesta* Wall. IVI 71.87, *Melia azedarach* L. was the only associated species with IVI value 56.03.

6. *Salix-Dodonaea-Morus* community at Bajawro and Barikot

This community was represented by 5 species. The leading species were *Salix alba* L. IVI 89.22, *Dodonaea viscosa* (L.) Jacq IVI 60.29 and *Morus alba* L. IVI 59.07. *Melia azedarach* L. was the only associated species with IVI value 47.96.

7. *Dodonaea-Juglans-Ailanthus* community at Bandagai and Shamshi khan

This community was represented by 5 species. The leading species were *Dodonaea viscosa* (L.) Jacq IVI 96.69, *Juglans regia* L. IVI 63.37 and *Ailanthus altissima* (Mill.) Swingle IVI 57.81. *Morus alba* L. was the only associated species with IVI value 39.66.

8. *Salix-Eucalyptus-Pinus* community at Bagh Dushkhel and Goro

This community was represented by 5 species. The leading species were *Salix alba* L. IVI 98.99, *Eucalyptus camaldulensis* Dehnh. IVI 96.81 and *Pinus roxburghii* Sargent IVI 41.02. *Dodonaea viscosa* (L.) Jacq was the only associated species with IVI value 26.05.

9. *Ailanthus-Eucalyptus-Dodonaea* community at Dherai

This community was represented by 5 species. The leading species were *Ailanthus altissima* (Mill.) Swingle IVI 85.79, *Eucalyptus camaldulensis* Dehnh. IVI 81.26 and *Dodonaea viscosa* (L.) Jacq IVI 56.68. *Melia azedarach* L. was the only associated species with IVI value 25.74.

10. *Populus-Salix-Dodonaea* community at Shago Kas and Trai

This community was represented by 4 species. The leading species were *Populus alba* L. IVI 100.89, *Salix alba* L. IVI 81.06 and *Dodonaea viscosa* (L.) Jacq IVI 74.97. *Robinia pseudoacacia* L. was the only associated species with IVI value 43.02.

11. *Salix-Ailanthus-Dodonaea* community at Sado

This community was represented by 4 species. The leading species were *Salix alba* L. IVI 81.83, *Ailanthus altissima* (Mill.) Swingle IVI 80.11 and *Dodonaea viscosa* (L.) Jacq IVI 74.03. *Eucalyptus camaldulensis* Dehnh. was the only associated species with IVI value 63.98.

12. *Salix-Populus-Eucalyptus* community at Timergara

This community was represented by 4 species. The leading species were *Salix alba* L. IVI 108.66, *Populus alba* L. IVI 93.1 and *Eucalyptus camaldulensis* Dehnh. IVI 50.26. *Morus alba* L. was the only associated species with IVI value 47.93.

13. *Salix-Populus-Eucalyptus* community at Khungi and Patio Dara

This community was represented by 4 species. The leading species were *Salix alba* L. IVI 118.49, *Populus alba* L. IVI 91.93 and *Eucalyptus camaldulensis* Dehnh. IVI 52.24. *Pinus roxburghii* Sargent was the only associated species with IVI value 36.98.

14. *Salix-Eucalyptus-Morus* community at Shekolai

This community was represented by 5 species. The leading species were *Salix alba* L. IVI 73.29, *Eucalyptus camaldulensis* Dehnh. IVI 71.15 and *Morus alba* L. IVI 63.48. *Ailanthus altissima* (Mill.) Swingle was the only associated species with IVI value 47.61.

15. *Ailanthus-Morus-Dodonaea* community at Mian Banda

This community was represented by 5 species. The leading species were *Ailanthus altissima* (Mill.) Swingle IVI 76.84, *Morus alba* L. IVI 69.04 and *Dodonaea viscosa* (L.) Jacq IVI 65.59. *Juglans regia* L. was the only associated species with IVI value 33.03.

Table 2. Phytosociological study of farm forestry species

S. No.	Name of Community	Species IVI	IVI
1.	*Populus-Ailanthus-Eucalyptus* community at Osakai	*Populus alba* L.	104.1
		Ailanthus altissima (Mill.) Swingle	80.7
		Eucalyptus camaldulensis Dehnh.	59.09
2.	*Populus- Eucalyptus- Dodonaea* Community at Sarai Bala and Nagrai	*Populus alba* L.	106.83
		Eucalyptus camaldulensis Dehnh.	80.41
		Dodonaea viscosa (L.) Jacq.	70.29
3.	*Dodonaea- Eucalyptus- Olea* community at Nasafa	*Dodonaea viscosa* (L.) Jacq	170.93
		Eucalyptus camaldulensis Dehnh.	86.19
		Olea ferruginea Royle	44.96
4.	*Morus-Juglan-Acacia* community at Kamangara and Ajjo	*Morus alba* L.	144.87
		Juglans regia L.	73.38
		Acacia modesta Wall.	44.96
5.	*Robinia- Ailanthus- Acacia* community at Ziarat and Amlook Dara	*Robinia pseudoacacia* L.	94.81
		Ailanthus altissima (Mill.) Swingle	75.95
		Acacia modesta Wall.	71.87
6.	*Sallix- Dodonaea- Morus* community at Bajawro	*Salix alba* L.	89.22

	and Barikot	*Dodonaea viscosa* (L.) Jacq	60.29
		Morus alba L.	59.07
7.	*Dodonaea- Juglans-Ailanthus* community at Bandagai and Shamshi Khan	*Dodonaea viscosa* (L.) Jacq	96.69
		Juglans regia L.	63.37
		Ailanthus altissima (Mill.) Swingle	57.81
8.	*Salix- Eucalyptus- Pinus* community at Bagh Dushkhel and Goro	*Salix alba* L.	98.99
		Eucalyptus camaldulensis Dehnh.	96.81
		Pinus roxburghii Sargent	41.02
9.	*Ailanthus- Eucalyptus- Dodonaea* community at Dherai	*Ailanthus altissima* (Mill.) Swingle	85.79
		Eucalyptus camaldulensis Dehnh.	81.26
		Dodonaea viscosa (L.) Jacq	56.68
10.	*Populus- Salix- Dodonaea* community at Shago Kas and Trai	*Populus alba* L.	100.89
		Salix alba L.	81.06
		Dodonaea viscosa (L.) Jacq	74.97
11.	*Salix- Ailanthus- Dodonaea* community at Sado	*Salix alba* L.	81.83
		Ailanthus altissima (Mill.) Swingle	80.11
		Dodonaea viscosa (L.) Jacq	74.03
12.	*Salix- Populus- Eucalyptus* community at Timergara	*Salix alba* L.	108.66
		Populus alba L.	93.1
		Eucalyptus camaldulensis Dehnh.	50.26
13.	*Salix- Populus- Eucalyptus* community at Khungi and patio Dara	*Salix alba* L.	118.49
		Populus alba L.	91.93
		Eucalyptus camaldulensis Dehnh.	52.24
14.	*Salix- Eucalyptus- Morus* community at Shekolai	*Salix alba* L.	73.29
		Eucalyptus camaldulensis Dehnh.	71.15
		Morus alba L.	63.48
15.	*Ailanthus- Morus- Dodonaea* community at Mian Banda	*Ailanthus altissima* (Mill.) Swingle	76.84
		Morus alba L.	69.04
		Dodonaea viscosa (L.) Jacq	65.59

Physico-chemical analysis

The physico-chemical properties of established communities were determined for the soil texture, textural class, pH, EC, N, P, K, TSS, $CaCo_3$ and organic matter. The results revel that most of the soil pH was neutral the highest (pH 7.7) for the Bajawro village, While the lowest (pH of 7.1) for the Saddo village. The EC was recorded from (0.40dsm^{-1}) to (0.18 dsm^{-1}) highest EC was recorded for the village Bagh Dushkhel and lowest EC was for the village Shago Kas which was optimum for the growth of plants. The total soluble salts (TSS) was recorded for the village Bagh Dushkhel (0.128 %) and the lowest TSS (0.061 %) were of the villages Nasafa, Dherai, Kamangara and Mian Banda. The highest calcium carbonates (10.0 %) was recorded of the village Ziarat Talash, while the lowest $CaCo_3$ (6.50 %) was for the village Saddo. The organic matter (0.96 %) was recorded for the village Shekolai while lowest (0.62 %) for the village Bajawro. The Nitrogen contents was recorded from (0.048 mg kg^{-1}) for the village Shekolai to (0.031 mg kg^{-1}) for the village Bajawro. The highest Phosphorus (41.1 mg kg^{-1}) was recorded for the village Timergara while lowest Phosphorus contents (0.2 mg kg^{-1}) was recorded for the village Shekolai. The highest Potassium (120 mg kg^{-1}) were recorded for the villages Khungi, Kamangara and Shekolai while the lowest Potassium (80 mg kg^{-1}) were recorded for the villages Saddo and Timergara and Textural classes from the research area were sandy loam, loam and sandy clay loam (Table 3).

CONCLUSIONS

It was concluded that the area has a great potential for Farm Forestry practices. The farmers/growers were inclined towards Farm Forestry practices and 90 % people agreed to Farm Forestry practices. The study area has rich ecological diversity and various Farm Forestry species were growing at different sites. It was observed that the farmers/growers are mainly belong to poor families and they support their livelihood through Farm Forestry practices. The Farm Forestry practices provide revenue to the local farmers/growers. The livestock in the study area is supported by Farm Forestry species. Some fruit plants *i.e., Prunus armeniaca* L., *Diospyros kaki* L., *Prunus persica* L. and *Prunus communis* L. are also a source of income. There is a potential of using these Farm Forestry species for various purposes.

Table 3. The Physico-chemical analysis of soil of the established communities

S#	Village names	Soil texture							pH 1:5	E.C 1:5 dS m^{-1}	N	P	K
		Clay	Silt	Sand	Textural class	TSS	$CaCo_3$	Organic matter			mg kg^{-1}		
		%				%							
1	Bagh Dushkhel and Goro	29	12	59	Sandy loam	0.128	7.0	0.86	7.6	0.40	0.043	5.7	100
2	Sarai Bala and Nagrai	19	26	55	Sandy loam	0.098	7.50	0.72	7.4	0.28	0.036	1.4	80
3	Khungi	11	32	57	Sandy loam	0.080	8.75	0.82	7.4	0.25	0.041	2.2	120
4	Osakai and Warsak	27	20	45	Loam	0.077	8.50	0.79	7.3	0.24	0.039	0.5	95
5	Ziarat and Amlook Dara	19	30	51	Loam	0.064	10.0	0.69	7.4	0.20	0.034	1.7	100
6	Nasafa	31	16	53	Sandy clay loam	0.061	8.50	0.79	7.5	0.19	0.039	0.2	110
7	Bandagai	15	32	53	Sandy loam	0.077	7.50	0.86	7.5	0.24	0.043	0.8	90
8	Dherai and Bangi	11	40	49	Loam	0.061	8.75	0.93	7.6	0.19	0.046	1.7	100
9	Kamangara and Ajjo	17	42	41	Loam	0.061	10.0	0.79	7.5	0.19	0.039	6.5	120
10	Shekolai	13	20	64	Sandy loam	0.067	8.25	0.96	7.4	0.21	0.048	0.2	120
11	Mian banda and Danwa	11	28	44	Loam	0.061	8.50	0.82	7.5	0.19	0.041	2.0	80
12	Saddo	15	28	57	Sandy loam	0.064	6.50	0.86	7.1	0.20	0.041	8.5	95
13	Timergara	11	36	53	Sandy loam	0.064	8.75	0.93	7.3	0.20	0.046	41.1	110
14	Shagokas and Trai	9	32	59	Sandy loam	0.058	6.75	0.69	7.6	0.18	0.034	0.2	100
15	Bajawro and Barikot	11	38	51	Loam	0.064	8.25	0.62	7.7	0.20	0.031	2.5	110

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