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Integrated Soil Productiveness and Management Practices in Case of Hiruy Abarageay Kebele, South Gondar Zone Administrative

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Abstract

Soil fertility degradation is a change or converts to all aspects of the natural environment by human actions. Objective of the study was to assess integrated soil fertility management practice. Method and material applied in order to achieve the intended objectives questionnaires, observation and interview were used. The primary data were obtained from sample respondent, while the secondary data were analyzed by using descriptive statistical tool and will presented by using statistical analysis. Result of the study, following, crop rotation, manure application, and soil bund were traditional soil fertility management practice in the study area whereas integrated soil fertility management practice are soil conservation structure, inorganic fertilizer applied with organic fertilizer, use improved germplasm and organic fertilizer these are consist under modern practice about 90% use together one to another. The major challenges that impediment farmers from the practicing soil fertility management practices in the study area are shortage of crop residues for fodder, animal dung for fuel, age of farmers and household size. The challenge that were assessed socioeconomic, therefore there must be other in detail study regarding technological and institutional challenges of soil fertility manage. Generally, soil fertility decline is the seriously problem in our country, primary and secondary data gathering method are pillar for this research paper writing, traditional and modernize techniques of soil fertility management and improvement are essenicial mechanisms in our study area.

Keywords: Integrated soil fertility; Soil conservation; Land degradation; Fertility management improvement

Introduction

Soil fertility degradation is an alteration to all aspects of the natural (biophysical) environment by human actions leading to determinant effects on the vegetation, soil, landform, water and ecosystems [1]. Soil fertility decline is the environmental challenge that threatens agricultural productivity and livelihood of the million of rural household in Ethiopia [2].

The cause of soil degradation in Ethiopia are cultivated on steep and fragile soil within inadequate investment in soil conservation or vegetation cover, erratic and erosive rainfall patterns, decline use of follow liming cycling of the dung and crop residues to the soil [3]. Soil fertility depletion has been severely intensified by anthropogenic factor such as land use or land cover change, Overgrazing, over cultivation, farming of fragile steep slopes and inappropriate soil fertility management practices [3].

Due to strong association that exists between land use and soil properties, land use change from natural ecosystem to agricultural landscape is one of the major human induced factor that threatens soil nutrient contents in Ethiopia agricultural intensification involves high input application for replenish soil fertility specially the use of inorganic fertilizer [4]. Continued use of inorganic fertilizer has not only altered the PH soil, soil structure and texture, but also disrupted the niches for micro and mesofuana which are essential for nutrient cycling. The removal of vegetation cover or burning plant residues are practiced under traditional system of crop production, farmers use crop rotation, application of inorganic fertilizer with sources to maintain soil fertility. Soil fauna play an important role of transforming the quality of soil by regulating the structure and the functioning of microbial communities shedding and digesting organic matter [5]. Of course, conservation agricultural is conceived within a boarder environmental management issues than that of ISFM; and it's prioritize minimum or non-soil tillage, permanent organic soil cover, diversified crop association and rotation [6].

In modern farmers derived practice use of fertilizer micro dosing, surface mulching, efficient organic fertilizer management, crop- livestock integration, water harvesting and addressing the problem of nutrient depletion are the common specific feature of conservation agriculture and integrated soil fertility management. One of the major constraints to crop production faced by smallholder farmers is the inadequate supply of nutrient. Farmers are either entirely abandoning the traditional practice of using natural follow to restore soil fertility or able to leave land for long enough for it to be effective. The use of mineral fertilizer is declining as they are increasingly beyond the means of most small - farmers erosion and sever runoff are further depeting the existing soil nutrient reserves, low and dealing performance of the agricultural self or in Hiruy Abarageay due to continued land degradation decline of soil fertility, widespread failure to make sufficient soil fertility replenishment in order to sustain the quality of the farmland, low and poor distributed rainfall, poor resource endowment, lack of or poor institution that continued for long period, endemic crop and livestock disease [7].

In Hiruy Abarageay kebele soil degradation, depleting of soil nutrient and soil acidification are the capital issues that rising low productivity and poverty. In Abarageay Keble in farta woreda which experience sever soil erosion. Due to this reason the researcher will intended to assess integrated soil fertility management practice which can manage the problems of Soil erosion in the study area.

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The objectives

The study was to assess integrated soil fertility management practices in Hiruy Abarageay Keble.

- To evaluate traditional Soil fertility management practice.
- To assess the challenge of soil fertility management practice.

Research Methodology

Description of study area

Location: The study area is found south Gonder zone in Amhara region, at Farta woreda 4.6 km far from Debre Tabor town and 110 km far from Bahirdar as well as 671 km away from Addis Ababa. It is one of the 24 Keble in Farta Woreda which is bordered or surrounded by in the east Wawa Magera Keble, in the west DebreTabor town or DebreTabor University, in the north limado kebele, and in the south Kanat Keble. The altitude and slope range of the study area is 2233-2761 m above the main sea level and 11°C 000'000" latitude as well as 38°C 000'000"longitude respectively (Figure 1).

Climate: According to simplified traditional agro- climate system which considers alone temperature, altitude, and precipitation, the study area lies within Dega (temprate) eighty five percent and fifteen percent woinadega (tropical), the climate conditions generally humid except some seasonal situation. The temperature of the study site is range from 11°C to 22°C for wet season and dry season respectively. The average annual rainfall of study area is 1200-1400 mm as per the Abaragay Administrative Office in 2010.

Soil type: Concerning Hiruy Abarabaragay Kebele there are four main type of soil, namely 29% red soil, 1.5% black soil, 8.5% gray soil, 61% brown soil. Mostly the land structure gentle, however, some areas of Abaragay kebele is undulating and slope area. The most dominant soil reaction in the study area is silting [1].

Land use and land cover: The survey of the data show that the study area covered 3489.813 ha. The agricultural land in this keeled is 2052.15 ha, which have livestock in the study area were ox, cow, horse and sheep. That type of farming system the major sources of income through which farmers work to enhance their living standard. Generally, the socio-economy of the society in the study area is dominated by agricultural production system. The land use covers different activity such as crop land, grazing land, and land forest. As shown in the above Table 1, 62.99% ha of land were covered by agricultural crop, 15.76% of were covered by forest land and the remaining one is 21.25% ha of land covered by grazing land. The above forest cover study area is made of by human planted forest specially eucalyptus forest and some of natural forest.

Population: The total population of the study area is 8365. Out of these 4015 are males, 4350 females and 1673 are households as per the Abaragay Administrative Office in 2010.

Site selection

Abaragay Keble would be selected degraded land for restore or

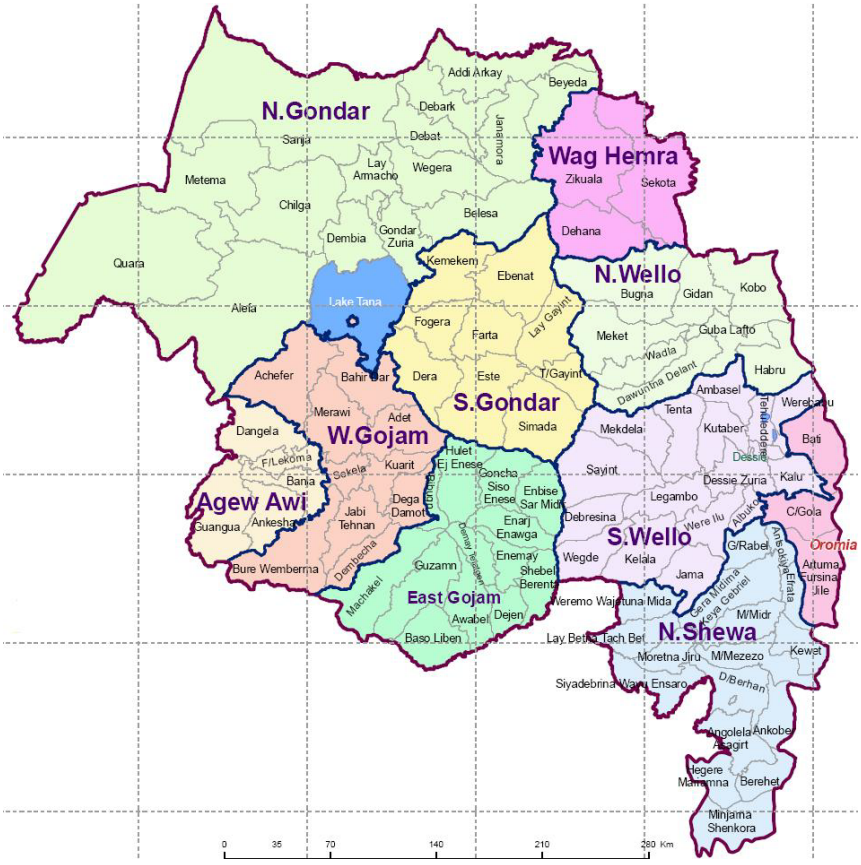

Figure 1: The map of Amhara region and location of our study area in Farta Woreda.

rehabilitate the forest cover and fertile soil by apply integrated soil fertility management measures.

Data type and source: In order to achieve the intended objectives, the data for the study were collected from both primary and secondary data source. The primary data were collected from sample respondent through questionnaires, interview and direct observation. However, secondary data were gathered and obtained from different published and unpublished material such as (books, journals, internet services) and (official statistics, report papers) respectively.

Sampling technique and sample size: The selected study area has 1673 HHs; however, it is difficult to take all household due to time and financial constraints. The researcher have taken 5% of total household that is 40 sample household were selected. To avoid biases the researchers have used simple random sampling technique.

Slovin Formula:

$$n = \frac{N}{1 + N(E)^2}$$

Where: n = sample size

N = total number of household

e=level of significance

n = 1673/1+1673 (0.05)2, n=1673/1+1673(0.0025),

n=1673/5.1825=323

The above formula shows that the actual sample size for this study is 323, but as mentioned in the above statement due to time and financial constraint, we reduce the sample size into 40 respondents. Proportional sample size based on the household is essential to determine the number of respondent from six sub district place in study area.

Data analysis

The collected data from primary and secondary data sources were analyzed by used to descriptive statistical way and the result were concluded and summarized by using percentage, mean, and rank. The results were shown in table, graphic representation.

Results and Discussion

Household characteristics of the respondents

As shown in the above Table 2, 45% of the respondent were male and 55% of the respondent were female, this were leads to male people had important for traditional soil fertility management. Since mostly male work in the field, but female mostly work in the domestic, 42.5% of respondent were occurred in the age of 31-38 and 20% of the respondent were found the age of 8 since people in the age of 31-38 were better for the traditional soil fertility management due to having traditional knowledge and 52.5% of the respondent were married and 25% of the respondent were divorce these was indicated that people highly important for traditional soil fertility management. Since working cooperation, but divorces were less available due to shortage

Type of land use and land cover	Land cover in ha	Percentage (%)
Crop cultivation	2051.15	62.99
Forest coverage	513.21	15.76
Grazing land	691.95	21.25
Total	3256.32	100

Table 1: Type of land use and land cover in study site.

Variables		Frequency	%
Sex	Male	18	45
	Female	22	55
	Total	40	100
Age	25-30	8	20
	31-38	17	4 2 . 5
	>38	15	37.5
	Total	40	100
Marital status	Married	21	52.5
	Divorced	10	25
	Widowed	6	15
	Single	3	7.5
	Total	40	100

Table 2: Age, sex and marital status of respondent.

Level of education	Frequency	%
Illiterate	28	70
Literate	12	30
Total	40	100

Table 3: Education level of the respondent.

of labor these management activities was labor intensive. As shown in Table 3, 70% of the respondent was illiterate and 30% of the respondents were literate and these literate people had indigenous knowledge for traditional soil fertility management and improvement of soil fertility a aimed to maximizing productivity of their own farmland. As mentioned in the Table 4 [3] 70% of the respondents have 4-7 family size. This indicates that these respondents have better performance in applying soil fertility management practices since there is division of labor in the family members in study area. As attempted to display in the Table 5 of the respondents have agriculture-based income source. This indicates that they participate in the soil fertility management better than whose income source is trade and daily labor and traders.

Traditional soil fertility management practice in study area

Fallowing: Fallowing is traditional soil fertility management practices being practiced in the study area. During the interview farmers said that for us fallowing was a practice we use majorly in the earliest time. But now a day, due to the rising population it not practiced the number of farmers for year. As result, shortage of land is the major constraints of fallowing (Table 6).

Crop rotation: Crop rotation is an important strategy for soil fertility improvement. During focus group discussion farmers said that for us fallowing is no longer possible they rotate crops on their field away from their homestead which rectified very little manure. Land size and value of crops influences farmers' choice of crop rotation. The major crop rotated in the study area, Wheat, Barley, Potato, Bean and sometime tiff. According to farmers response crop rotation has dual benefit to reduced weed and improve crop yield. Farmers with large size rotate crop major than farmers with small farm size.

Tillage practices: Farmers in Hiruy Abaragay Keble use Oxen and Horse to pull traditional plough. The frequency of plough differs according to the soil type. Farmers said that it is difficult to plough heavy soil like verity soil especially during the first tillage after harvest. The field is plough within an average four times tiff but only once for bean. Each phases of tillage have name " winter tillage" was performed during dry times for the purpose of incorporate manure crop residues and for expose weed.

Family size	Frequency	%
1-3	10	25
4-7	28	70
8	2	5
Total	40	100

Table 4: Family size of the respondent.

Income source	Frequency	%
Agriculture	34	85
Daily labor	2	5
Trade	4	10
Total	40	100

Table 5: Income source of the respondent.

Type of practice	Extent/adopters	%
Fallowing	-	-
Crop rotation	28	70
Tillage practice	40	100
Manure application	36	90
Soil/stone bund	30	75

Table 6: Traditional soil fertility management practice in study area.

Manure application: In traditional farming system manure and other organic nutrient sources to maintain soil fertility. Manure is important practices in Hiruy Abaragay farmers apply manure around homestead. According to farmers manure increase weed because the amount of manure is not known. Most animal manure consist of feces, common forms animal manure include farm yard manure (FYM) or farm slurry (liquid manure) also contain plant material.

Soil bund: Soil bund is an embankment made of cut off water before reaching the run off to the farm land. During field observation the structure is constructed in each field of farm land and it is deeply dug in sloppy areas and shallowly dug in flat areas of study area.

Modern soil fertility management practices

Inorganic fertilizer: Although farmers used traditional soil fertility management practices, they also give high value for inorganic fertilizer. They said that the amount of fertilizer applied per hectare is increasing through time because the land is getting lost its fertility since it is repeatedly ploughed. According to farmers now 100 kg/ha dap and 100 kg/ ha urea used for wheat production previously 50 kg/ha dap and 25 kg/ha urea used for barley production. It is practiced about 40 sample respondents, it can be said that as it practiced by all farmers (Table 7).

Fanyajuu: During the field observation fanyajuu is constructed by putting the dug soil up hill in very sloppy area of study area. Farmers in study area ploughing these structures as they feed these structures create difficult to plough the land. There, long-impact commonly used (SWC) technique fanyjuu terracing. The establishment of SWC structure in this erosion-prone land escape related in the recovery of SOM level.

Terrace: Terrace is a piece of sloped plan that has been cut into series of successively receding that flat surfaces. During data analysis terracing is made by putting the dug soil downhill in less flat area in study area. This structure made around February each year initiated by the Keble agricultural expert. As mentioned in the Figure 2 below the farmland conserved and managed by terracing activity, so the soil cannot be easily eroded or excavate by different factor of erosion. According to the response of the respondent, land give good amount of crop yield compared to unprotected agricultural land.

Organic fertilizer (manure): During the data analysis, animal manure is comprised of three sources such as cattle, and poultry manure and bio slurry. Bio slurry is a bi-product from biogas production, often used as organic manure sources by farmers. In relation to the soil fertility management practices, 25 respondents reported using manure.

Compost: Although an organic source of manure, compost manure is considered modern practices because many farmers reported using it for less than two decades in their cropping system since being promoted by extension agent. Almost all farmers have used compost on their field and acknowledge its effectiveness in improving soil fertility, but many had abandoned its use. 23 respondents were still using the practice. Efforts to continue using it were threatened by its high labor intensiveness, long preparation time and competing demand on scarce of materials. As we attempted to understanding and displays below in the Figure 2, the soil fertility decline rehabilitates or restore by applied prepared compost for a targeted to maximize crop land productivity.

Challenge of integrated soil fertility management practices

Use of crop residues for fodder and animal manure for fuel: Farmers use crop residue for different activity to precede is removed the land become bare and exposed for soil erosion, various erosion agents such as water and wind erosion. So, the soil fertility to become decline, in this case less amount of agricultural crop yield produces in the year (Table 8).

Age of farmers: Despite its role in accumulation of experiences and having deeper knowledge of the field, age of farmers as the challenge of integrated soil fertility management was mentioned by 57.5% have troubles with practicing soil fertility management on their field. Older farmers could not make soil conservation as they require hard work which could not be accomplished by aged farmers. On the other hand,

Type of practice	Frequency	%
Inorganic fertilizer	5	12.5
Fanyajuu	38	95
Terracing	39	97.5
Organic fertilizer	25	62.5
Compost	23	57.5

Table 7: Modern soil fertility management practices and their extent.

Figure 2: Compost applied farmland.

Figure 3: The number of respondents working on their own farm land.

Challenge	Severity	%
Use of crop residue for fodder and Animal dung for fuel	35	87.5o
Household size	25	62.5
Age of farmer	23	57.5

Table 8: Challenge of integrated soil fertility management practices in the Study area obtained from the respondent.

aged farmers practice less labor demanding technologies such as crop rotation and contour ploughing this practice reflects that aged farmers are practicing short staying structures in their cultivation fields.

Household size: In the study area, farmers who have large household size, but elder require additional labor to maintain soil fertility. To this end, some farmers in the study area pay for labor when they face shortage of labor. During the interview, farmers said that shortage of work force, especially for construction structure will immediately force farmers to shift their decision toward implementation of less labor demanding soil fertility management measures. As shown below in Figure 3, most of the household live in study area are older people, in this case they needed further finance and labor to improve and enrichment of soil fertility as well as reduce soil degradation.

Conclusion

The physical structure-oriented soil conservation strategy could not adequately address the problem of soil fertility decline. The objective of the study was to assess soil fertility management practices in case of Hiruy Abaragay kebele. Specifically, the study is aimed to assess the challenges of integrated soil fertility management practices being practice in study area. Traditional soil fertility management practice in study area were following, crop rotation, tillage practice, manure application and soil bund, inorganic fertilizer, fanyajuu, and terracing of moon structure, newly introduce soil fertility practices, use of crop residue for fodder and animal manure for fuel, age of farmers and household size were challenges that constraints farmer to use integrated soil fertility management practices. Both primary and secondary data collection mechanism play a great role to got accurate and relevant information from respondent in the study area. In the study area we were used significant data analysis system is descriptive statistics generalized by percentage, mean and rank. The most relevant to and well known ISFM practices applied on the agricultural farmlands are organic fertilizers, inorganic fertilizers, germplasm, agronomic system, mechanical or physical soil fertility conservation and amendment techniques.

Recommendations

Based on the assessment made and result obtained the following suggestion are forwarded

- The practice of integrated soil fertility management by older farmers is slow progress. Therefore, there must be creating cooreporation among the farmers.
- Farmers are ploughing farmland and they are used conservation structure. So concerned experts for the target of aware the farmers about managed and improved of soil fertility
- For sustainability integrated soil fertility management techniques farmers should be voluntary to do free community participation not only food consumption (cash for work).
- Farmers live in the study area didn't have a deep awareness and knowledge on various integrated soil fertility management mechanisms, therefore concerned additional bodies who have a good skill and knowledge about the techniques of ISFM helped and aware to them.
- There must be technical and material support from the governmental and non-governmental organization including from input seedling farm equipment.
- The biological soil fertility management were relatively less practiced, but many agreed that biological conservation and enrichment techniques provides many significances than physical management methods such as increasing soil fertility by adding crop residues material, nitrogen fixation bacteria takes place plants, animal fences rather than used to fodder for animal and fuel for domestic purpose.

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