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Financial Analysis of Fruit Tree Based Agroforestry Practice in Hadero Tunto Zuria Woreda, Kembata Tembaro Zone, South Ethiopia

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Abstract
Shortage of land and farmer's switching from agroforestry practice to expand monocropping is the main problem in the study area. This study was carried out to evaluate the profitability of fruit tree based agroforestry practice against monocropping. The study employed both participatory research methods (focus group discussions, Key informant interviews, and flied observations) and household survey for data collection and used both descriptive statistics and financial analysis. The result shows that fruit tree based agroforestry system in the study area is omnipresent. The financial analysis indicated that fruit tree based agroforestry practice is not only more profitable than monocropping system but also less sensitive for changes in price, output and discount rate. In general, the fruit tree based agroforestry practice is superior for both its economic and environmental benefits as well as its less sensitive features to external factors than monocropping system. Therefore, the government and other responsible bodies should give due attention to help smallholder farmers in order to use agroforestry land use for sustainability of smallholder agriculture that has been constrained by soil nutrient depletion, skyrocketing price of fertilizer and climate variability. Above all, it is the land use system recommendable in the area, where the problem of land shortage is very pressing.
Key words: Benefits, cost benefit analysis, Smallholders, sensitivity analysis,

1. INTRODUCTION

Agriculture is the back bone of Ethiopian economy. That is, about eighty percent (80%) of the country's population is employed in agricultural activity (CSA, 2007). Even if the agriculture is the backbone of Ethiopia's economy, yet the sector is being characterized by low productivity due to rapid population growth, subsequent increase in human needs, lack of appropriate technologies, lack of capital for intensification technique and others (Pender, 1999).

As the population continues to grow rapidly and available land suitable for agriculture is shrinking, the gap between supply and demand for agricultural land continues to expand and lead to severe land use conflicts between crop production and forestry. As a result, clearance of forest land for agricultural and other needs has been severe. Currently, deforestation is imposing diverse environmental problems such as soil erosion, decline in the productivity of the land and increases food insecurity, which subsequently lead to socio economic problems (Kang and Akinnifesi 2000; Pech and Sunada, 2008). This situation, therefore, calls for a farming system that increases synergy between natural resources management and productivity to minimize the problem of deforestation (Deacon, 1994; SLUF, 2006).

Thus, agroforestry land use is a land use system with this dual purpose of increasing natural resources management and improving productivity of land (Beetz, 2002; Pech and Sunada, 2008). Above all, agroforestry land use systems is an appropriate land use alternative in situations of land shortage and reputed as a potential solution for curbing the problem of declining rural agricultural productivity and land degradation (Jiregna, 1998; Evan, 2011).

Today agro forestry it has become a land use believed to promote both productivity and environmental objectives and receiving increasing attention as a sustainable land management option in the world because of its ecological, economic, and social attributes (SLUF 2006). The other advantage that receives world's attention is the fact that it can reduce the risks associated with agricultural production due to the various components of the system that are differentially affected by risk and making the system more sustainable (Martin and Sherman,1992). Also agroforestry systems make maximum use of the land and every part of the land is considered suitable for useful plants (Motis, 2007). Fruit tree based agroforestry system consists of "tall" fruit trees irregularly dispersed throughout croplands and pastures. It is highly popular among resource limited producers worldwide due to its relatively pre-production phase of fruit trees, high market value of their products and the contribution of fruits to household dietary needs (Daniel, 1998; Bellow, 2004). As a result, it can provide a more diverse farm income and reduce food insecurity. Fruit trees based agroforestry system has great roles to play in livelihood of the farming community because of its multiple benefits. Some of the benefits are income generation, food, fuel, construction material, fodder and shading for shade loving crops like coffee and amenity value. These multiple benefits of the system make it more desirable than other land use (CITATION).

Nevertheless, agroforestry is a not a sole land use practice by smallholder farmers. Rather, it is one of the land uses the households practice. In such situation comparisons of the land uses so as to allocate the fixed resources to best alternative uses is very important. To compare the desirability of different land uses it is better to analysis cost and benefit of each land use. Since different land uses practiced by individual households involve different levels of benefits and costs, it is important to identify which land use practices better serve to improve the livelihood of rural households. Besides, in order to formulate strategic interventions by responsible bodies that enhance productivity and sustainable land uses, it is vital to know how profitability and other competing goals affect farmers' land use decisions (Rasul and Thapa, 2006). This requires detailed information about costs and benefits and analysis of the financial profitability of each alternative land use practices.

In Hadero Tunto Zuria woreda of Kembata Tembaro zone, South Ethiopia agroforestry land use has been a dominant practice for long time. Currently, there are two parallel developments in the agroforestry land use in the woreda. On one hand, farmers are expanding the agroforestry by incorporating non-traditional fruit crops such as mango and avocado. On the other hand, even though agroforestry practice is the dominant practice in study area; some farmers are switching from agroforestry practice to expanding monocropping especially, ginger production which is the major cash crop in the study area. Indeed, the agroforestry is a farming practice has been praised in the study area, recently for its ability to relax the problem due to inability to follow extensification as an option, and also to remove the side effect due to intensification of agriculture. With this background, this study was designed to identify the components of agroforestry practices, investigate to what extent the fruit tree based agroforestry is practiced in the area and evaluate the financial profitability of fruit tree based agroforestry practices against monocropping system in the study area.

2. RESEARCH METHODOLOGY

This study was carried out in Hadero Tunto Zuria woreda, Kembata Tembaro Zone, South Nations, Nationalities and Peoples Region State (SNNPRS), Ethiopia the worada is located 343km south of the national capital, Addis Ababa and 151km south west of Hawassa, the capital of SNNPRS. Astronomically, it is situated between 7^0 7'30'' and 7^0 19' 30''N latitude and from 37^0 34' 30'' and 37^0 43'30'' longitude. Hadaro Tunto Zuria Worada is bordered by Wolayta Zone in the south, Kacha Bira woreda in the east, Hadiya Zone in the north and Tembaro woreda in the west. The altitude of the woreda ranges from 1300m and 2600m a.s.l. The Worada has three distinct agro-climatic zones, Kolla (1%), Weynadega (87%), which was the dominant agro-climatic zone and Dega (12%). The mean annual rainfall ranges from 800mm - 1200mm and with mean annual temperature of 18^oC-32^oC. It also has a bimodal rainfall distribution such as "Belg", which is a short rain season that extends from March to May and "Kermit" season, which is a long rainy season thatlasts between June and August, (Anonymous, 2012).

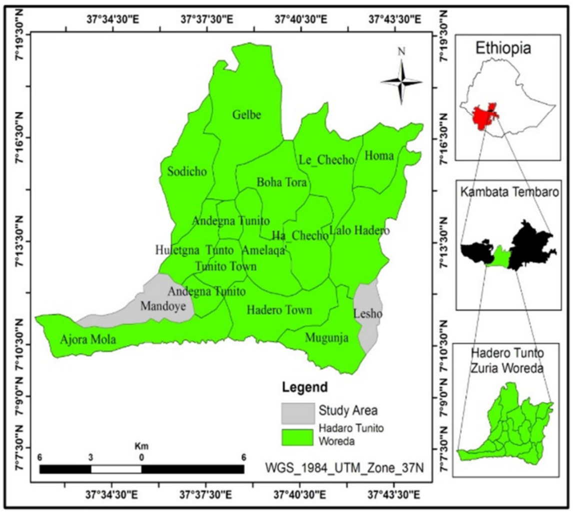

Figure 1.Map of the study area

2.1. Study site and sample size selection

This study employed multistage sampling techniques for the selection of the households to be interviewed. In the first stage, the study worada was selected purposively based on the presence of fruit-tree based agroforestry practices. In the second stage, from the woreda, two Kebeles (Mandoye and Lesho) were selected also purposively based on the presence of fruit production after discussion with the woreda agricultural office experts.

In the third stage, sample households were selected by following simple random sampling techniques (SRS). SRS is the simplest form of probability sampling in which each population element has a known and equal chance of being to be selected. Hence a total of 182 households were interviewed for this study.

2.2. Data Sources and Collection Methods

In this study both primary and secondary data were used. Primary data were collected through a household survey, focus group discussions, and field observation methods. Secondary data like the number of households in each kebele and socio-economic information were obtained from the agricultural office of Hadero Tunto Zuria woreda.

2.2.1. Focused Group Discussions

Two focused group discussions, one men group and one women group, were conducted and five persons were involved in each group discussion from each sampled kebele on different issues such as benefits, labour requirement by each component, life span, maturity age of each component of practices and others.

2.2.2. Key informant interview

Key informant interviews were also held with experts and representatives of the community who have better understanding about the agricultural system in the area in general and fruit tree based agroforestry system in particular. The experts considered for this interview were experts of agriculture and natural resources both at Worada and district levels. Community representatives considered were leader of the Kebele council and members of the community who have good knowledge about the area and the agricultural activities in the area.

2.2.3. Household survey

Lists of all household heads of the selected kebeles were collected from the kebele administration and development agents. One hundred eighty two (182) representative household heads from listed household heads in the selected kebeles were selected based on simple random sampling technique. Then four enumerators with Diploma qualifications were selected, trained and assigned to each kebele for data collection. Regular monitoring was conducted by the researcher while enumerators were interviewing the respondents and daily evaluation of the filled questionnaires was undertaken throughout the data collection processes.

2.3. Methods of Data Analysis

2.3.1. Financial analysis

To decide on continuity of any investment, it is important to check its financial and economic viability. Financial analysis is the evaluation of costs and benefits which occur in the future. A typical investment has a pattern of cost and benefits. It has an important role to play in informing decisions at different levels of investment. The financial analysis should define financial viability, and hence project or programme financial sustainability. To assess economic and financial viability a range of tools and methods can be used. Some of these were cost benefit analysis, cost effectiveness analysis and sensitivity analysis. In this paper cost benefit analysis and sensitivity analysis were used to compare the financial profitability of the agroforestry practice against monocropping system (Sekar and Karunakaran, 1992; Idassi, 2012).

I. Cost benefit analysis (CBA)

Farmers are often concerned about the costs and benefits of a farming system to reach a conclusion whether or not to adopt the system continuously. So, the profitability analysis of the fruit tree based agroforestry practice against monoculture was carried out based on the cost benefit analysis. Cost benefit analysis was used to access the present and future costs and benefits of project. This involves the use of discounted cash flow (Khadka*, 2010)*. Three standard measures were used in the cost benefit analysis such as NPV, BCR & AEV. These were common indicators used to analysis and measure the financial performance and feasibility of agroforestry system (Wahl *et al*., 2009; Godsey, 2010).

Data was collected on the cost factors for the production and total benefit from selling the output was entered into a Microsoft office Excel-sheet 2007 to sum up the discounted costs and benefits for thirty years. This data then built the foundation for the calculation of three economic indicators: NPV, BCR and AEV.

Net present value (NPV): it is an aggregated value used in whole life cycle analysis to measure the resultant financial and economic benefit of a good or service when all costs and benefits are taken into consideration (Gittinger, 1984; Casey, 2001).

$$NPV = \sum_{i=1}^{t} \frac{Bt}{(1+r)^t} - \sum_{i=0}^{t} \frac{Ct}{(1+r)^t} \qquad PV>0,$$

The benefit-cost ratio (BCR[1]): benefit cost ratio is the relative measure of benefits obtained per dollar spent. It compares the discounted benefits to discounted costs (Cowdin, 2008: Godsey, 2008).

Annual equivalent value (AEV): The annual equivalent value is an estimate of a level of income stream that would have the same net present value as the actual income streams (Kurtt, 1982; Godsey, 2010). The AEV calculates an annuity (or an annual net payment) that would give the equivalent net present value at the same discount rate. The equation used in the NPV calculation assumes varying cash flows for each year. Whereas, the AEV equation assumes that the cash flow is the same in each year; that is,

$$\mathrm{NPV} = cashflow \left\{\sum_{t=1}^{n} \left(\frac{1}{(1+i)^t}\right)\right\}$$

(Godsey, 2008). Therefore, the equation can be modified as follows

$$\mathbf{Cashflow} = \frac{\mathbf{NPV}}{\sum_{t=1}^{n} \frac{1}{(1+r)^t}}$$

Cash flow is the annual equivalent value that is being calculated. The annuity discount factor of the equation simplified as follows:

$$\sum_{t=1}^{n} \frac{1}{(1+r)^t} = \frac{1}{r} - \frac{1}{r(1+r)^t}$$

Where t=1, 2 … 30
r=discounting rate
NPV= net present value

Assumptions which were undertaken during financial analysis**:**

I. The value of land is the same and does not change over time for both practices
II. The tax amount is constant over time.
III. The opportunity cost of labour used in the case of family labour cost, was 30 ETB/Labour
IV. The interest rate is 6%, based on current minimum saving interest rate of NBE (IMF, 2012).
V. The time horizon was 30 years.

II. Sensitivity analysis

In cost benefit analysis, it is often assumed that even after measuring all benefits and cost and establishing a ranking of the alternatives, the benefit cost analysis is not complete. Due to the uncertainties the benefit cost analysis the decision makers want to know more than the results using one set of conditions, specifically they want to know if the recommendation would change if one or more of inputs to the benefit cost analysis varied (Sekar and Karunakaran,1992). The calculation of NPV, BCR and AEV is based on estimated cost and benefit of project which is subject to varying degree of uncertainty and risk. Sensitivity analysis is a technique whereby a viability of project tested against possible variation in the size and time of estimated cost and benefits (Desai, 1997). It is also a way of analyzing the effect of change in inputs or the outcome of the alternatives land uses, in this case agroforestry and monocropping land use systems (Pannell, 1997).

Sensitivity analysis was conducted for the change in the selling prices of output, change in opportunity cost of labour (wage) and change in discount rate. The yields of annual crops and fruit trees dispose to the weather, calamities, pests and diseases. The risks of output losses due to these reasons are considered by a sensitivity analysis of decrease in yields. Sensitivity analysis is the study of how the uncertainty in the output of a model can be allocated to different sources of uncertainty in the model input. It is prerequisite for model building in investment (Breierova and Choudhari, 2001).

There are several different ways of undertaking sensitivity analysis: - one-way sensitivity analysis and multiway sensitivity analysis. One-way sensitivity analysis is way of examining the impact of the change of one value or inputs in the model. One-way sensitivity analysis is useful in indicating the impact of one parameter varying in the model. Multiway sensitivity analysis examines the impact of the change of two or more key parameters (for example, input price and interest rate change), in the model. This way was used to examine worth and best case in this study (Pannell, 1997; Matthew, 2009).

3. RESULTS AND DISCUSSION

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[1] $$BCR = \sum_{i=1}^{t} \frac{Bt}{(1+r)^t} \Big/ \sum_{i=0}^{t} \frac{Ct}{(1+r)^t}, \quad BCR>1$$

Where t=1, 2 … 30
r=discounting rate
B_t= total revenue earned from sale of the outputs in year t
C_t=total cost incurred from the different activities at the time of production in year t.

3.1. Components of Fruit Tree Based Agroforestry practice

The focused group discussion, and field observation show that the agroforestry practice in the study area was dominated by perennial crops, such as avocado, banana, mango, coffee and enset, and annual crops such as maize, sorghum, sweet potato and taro. The commonly planted agroforestry trees include *Graveillia Robusta* and *Cordia Africana*.

The maturity age, life span and rotation age of different trees in the agroforestry system is not the same. The estimated maturity age[1], life span[2] and the productivity of some fruit tree in the agroforestry practice were listed in table1 below. The mango and avocado start giving fruits after six to seven years of planting. In this regard, coffee and enset give fruit after four and three years of plantation respectively. However, banana gives the fruit after seven month.

The economic contribution of fruit tree based agroforestry system directly related with their maturity age and their life span. They start to contribute on household's income directly after their maturity and they contribute more on their middle life age, i.e. at their middle age their output is higher than the young age and the old age.

The component trees in the agroforestry system are also known for their additional benefits. These additional benefits are irrespective of its maturity age. For example, banana, enset, and avocado leaves and stem serve as fodder for livestock in dry season.

Table1.Maturity age, life span & productivity of tree in FTBAFP

Components of FTBAFS	Maturity age	Life span	Average annual yield/tree(bunch
Banana	7month	4 year	7zelela/ bunch
Avocado	7 year	30year	5qt/tree
Mango	6 year	25year	3qt/tree
Coffee	4 year	34 year	0.5qt/t
Enset	3 year	4 year	1horseback/tree

Source: own survey and FGD

3.2. Comparison of the financial profitability of Agroforestry and Monocropping Systems

In this section the financial profitability of agroforestry and monocropping system is discussed. Fruit tree based agroforestry practices has long-term environmental and economic benefits such as soil conservation, carbon sequestration, and biodiversity protection, contribution of fuel wood, fodder, cash generation, agricultural sustainability and others. During the survey the respondents put forward the different reasons why they manage the agroforestry practice. The main reason they mentioned were, provision of fruits, provision of fuel wood, protection of farm land, provision of animal fodder, and provision of shade. Additionally according to FGD there are benefits enjoyed by farmers, due to use of agroforestry practice such as improvement of family income, increase availability of food varieties and improvement of soil fertility.

In densely populated area like Hadero Tunto Zuria district the role of agroforestry practice in supplying woody products for various uses is enormous. According to FGD the households get forest products from agroforestry land use. The farmers in study area depend on the agroforestry system for fuel wood, fodder, construction materials, timber, fruit and other uses. Since there are no public forest or large scale forest plantations in the area to use for fuel wood fuel wood, agroforestry practices has become the only sources to get fuel wood and other forest products. Besides supplying fuel woods, the agroforestry practice is the major source for livestock feeding. Farmers use different parts of the fruit and other trees of the agroforestry components such as stems, leaves and root for livestock feed. Especially in the study area as winter is a season with severe scarcity of livestock feeding, the agroforestry components such as banana and Enset are most important source of fodder in winter in the study area.

3.2.1. To evaluate Financial Performance between agroforestry and monocropping system

Different performance evaluators' indicators such as NPV, BCR and AEV were used in this paper. In this performance evaluation, the benefits and costs of different land uses were discounted in to present value as the benefits occurring in the future are worth less than the same level of benefits that occur now. Similarly, costs occurring in the future are less burdensome than the same level of costs that occur now.

[1] The maturity age in this study means the age at which the trees start to give output.

[2] life span in this paper means the age at which the productivity of tree start decline but not mean its production already cease. In this age the trees still give the output but the quality and quantity of output declines negatively

Table 2. Comparison of agroforestry and monocropping land uses for their financial performance (ETB)

Financial performance indicator	Fruitvtree based agroforestry land use	Mono crop land uses		
		ginger	Maze+sweet potato	teff+ taro
NPV	273,983.09	117,591.58	60159.47	69148.32ETB
BCR	7.22	2.92	2.88	2.64
AEV	28,122.50	8542.90	4570.52	5023.55

Source: own survey

The result in table 2 shows that the NPV of fruit-tree based agroforestry practice (273,983 ETB) was found to be about two times higher than the NPV of ginger (117,591.58 ETB), five times higher than the NPV of the sequential monocropping of maize with sweet potato (60159.47ETB), and four times higher than NPV of taro with teff sequential monocropping (69148.32 ETB). The result indicates that agroforestry practice has better financial performance than monocropping system. This may be due to the existence of multiple components of agroforestry practice with multiple benefits.

In terms of the benefit cost ration (BCR) criteria the result also shows difference in the financial performance of the two land uses. According to the BCR, the land use with higher Benefit cost ratio is more profitable than land use with lower ratio. In this study, the benefit cost ratio of fruit-tree based agroforestry practice, ginger, maize with sweat potato and teff with taro sequential monocropping was 7.22ETB, 2.92ETB, and 2.88 ETB and 2.64 ETB respectively. From this fruit-tree based agroforestry practice has higher BCR than other monocropping land uses. This implies that fruit-tree based agroforestry practice has more profitable land use than monocropping system. This is also may be due the existence of higher cost of production for monocropping than agroforestry practice and the existence of multiple benefits in the agroforestry practice.

Similarly, the annual equivalent value (AEV) for the fruit-tree based agroforestry practice indicates that the expected annual income of the fruit-tree based agroforestry practice is 28,122.50ETB per annum, whereas the AEV for ginger monocropping is 8542.90ETB per annum, AEV for the sequential monocropping of sweat potato with maize is 4570.52 ETB per annum, and AEV for the sequential monocropping of taro with teff is 5023.55ETB per annum. Therefore, the AEV result also confirmed that the fruit-tree based agroforestry practice has the potential to generate the highest expected annual income throughout the life of the project than monocropping system (Table 2).

In all the above listed performance indicators, agroforestry land use is more profitable land use than monocropping land use. This finding is consistent with the study conducted in the Middle Nepal by Neupane and Thapa (2001) that indicated the BCR for the improved agroforestry based farming system was considerably higher than that of the conventional system. Similarly, Rasul and Thapa (2006) in their studies on the degraded agricultural lands of Chittagong Hill Tracts of Bangladesh revealed that economic returns from agroforestry practice were greater than shifting cultivation. A study conducted in the Northern Bangladesh by Rahman *et al.* (2007) also showed that the NPV of multi-strata agroforestry practice was five times higher than the NPV of traditional monoculture. Another study carried out in southern Africa by Franzel (2004) revealed that agroforestry practice generate a NPV of US$388 per hectare, which is six times higher than the net benefit obtained in conventional maize fallow systems. Ajayi *et al.* (2009) confirmed that the net benefit of agroforestry practices is 44 to 58% superior to non fertilized continuous maize production practice). In Ethiopia study by Getahun (2012) at wondogenet reveal that agroforestry practice has higher AEV than monocropping system.

3.2.2. Sensitivity Analysis (SA)

As both agroforestry and monocropping systems are farming practices that depended on both natural and social systems, their performance may be liable to change due to these external factors. Thus, sensitivity analysis (SA) was carried out to evaluate the performance of the two systems (agroforestry practice and monocropping s) for change in some key variables, such as increase/decrease in price of output, increase/decrease in wage increase/decrease in yield and increase/decrease in discount rate. Farmer's net benefit decline if the opportunity cost of labour use and discount rate increases and price of output and quantity of output decrease. The opposite will happen if the opportunity cost of labour use and discount rate decrease, the change of wage is not significantly affect sensitivity due to its lower wage (W), and price of output and amount of output produced increase. In this study, therefore, SA is conducted for the decrease/ increase in the selling prices of output, increase/decrease of opportunity cost of labour, and increase/ decrease in discount rate. The yields of annual crops and fruit trees are prone to the weather, calamities, pests and diseases. The risks of output losses due to these reasons are considered by a sensitivity analysis of decrease in yields. Although it is not common, there is also situation that yield of annual crops and fruit trees increase more than a usually condition. Therefore, SA was also conducted for the increase in output of monocropping and agroforestry practice.

Table 3. Sensitivity analysis for change in the key variables

Description	Ginger	Maize+ sweet potato	Teff +taro	FTBAFP
	NPV change %	NPV change%	NPV change %	NPV change%
*Price decrease (*10%)	-27.95	-30.19	-36.81	-23.52
*Price increase (*10%)	13.21	5.69	2.87	3.85
*Wage increase (*10%)	2.21	1.44	1.52	1.61
*Wage decrease (*10%)	2.22	1.44	1.47	1.56
*R increase (*10%)	-10.93	-10.93	-10.93	-4.06
*R decrease (*10%)	10.46	10.46	10.46	5.84
Yield increase *(*10%)	13.21	13.28	13.86	10.93
Yield decrease *(*10%)	-17.95	-18.09	-19.18	-13.99
Best scenario	23.75	23.31	23.85	12.07
Worth scenario	34.32	33.26	34.61	15.93

The result in table 3 shows that the decrease in price for each land use has negative impact on NPV of respective land use, but the magnitude of change on NPV was not the same in each land use. On the contrary, the increase in output price has positive impact on NPV; still the magnitude of change is different between the two land uses (monocropping and agroforestry practice). For 10% increase/decrease of output price the NPV of ginger, Maize +sweet potato, and teff+ taro sequential monocropping systems increase/decrease by 13.21%/ 27.95%, 5.69%/ 30.19% and 2.87% / 36.81% respectively. But NPV of FTBAFP system increases/decreases by 3.85%/23.52%. This indicates that the magnitude of change in agroforestry and monocropping system for increase/decrease of price by 10% is different. In all the cases there is more change in monocropping system than the fruit based agro-forestry system. From this we can understand that for the increase/ decrease of output price agroforestry practice is less sensitive than monocropping system.

The other variable is the change in output of both agroforestry practice and monocropping system. For 10% increase/decrease of outputs of respective land uses, the NPV of ginger, Maize +sweet potato, and teff+ taro sequential monocropping system will increase/decrease by 13.21%/ 17.95%, and 13.28%/18.09% and 13.86%/19.18% respectively, but NPV of FTBAFP will increase/decrease by 10.93%/13.99 % (Table, 3). The result indicates that there is positive /negative impact on NPV of respective land use for increase /decrease of output respectively even if the magnitude of change is different. This also shows that agroforestry practice is less sensitive than monocropping system for increase /decrease of output.

The above two variables, output price and output of respective land use are important variables that affect revenue of farmer. The revenue can increase if and only if one of these variables increases.. If the price or yield of agroforestry practice and monocropping system decreases the revenue of respective land use will decrease, but the percentage of change in its NPV is not the same between two practices. The result shows thatmonocropping system is more sensitive than fruit based agroforestry practices for an increase or decrease in the magnitude of important variables. This is because, there are diversified components in agroforestry practice but in the case of monocropping there is no diversification of components and benefits. This is consistent with finding of Pham (1999**)** who studied the Socio-Economic Analysis of Shifting Cultivation versus agroforestry system in the upper stream of lower Mekong watershed in Daklak Province that revealed that agroforestry system is less sensitive to the change in prices of perennial crops and fruit trees. Similarly, the study conducted in Wondo Genet by Getahun (2012) revealed that agroforestry practice is less sensitive than monocropping system for change of price and output.

The other key variable that was used to analyze the sensitivity of NPV of two land system is increase/decrease of wage. The increase /decrease of wage affect both land use practices negatively/ positively respectively. For 10% increase in labour wage the NPV of ginger, maize +sweet potato, teff+ taro sequential monocropping and FTBAFP will change by 2.21%/2.22%, 1.44%/1.44%, 1.52%/1.47%, and 1.61%/1.56% respectively (table, 3). From this we can understand that ginger and FTBAFP are more sensitive than other two land uses. This may be due to the use of large number of labour by ginger and agroforestry practice. According to FGD ginger and agroforestry are more labour intensive than other monocropping system. Due to this the labour cost of these two land use is high and they are more sensitive for change of this cost. This is consistent with study of Getahun (2012) who revealed that agroforestry practice is more sensitive for wage change than monocropping system.

The result shows that the increase/decrease of interest rate has negative/positive impact on two land uses (agroforestry and monocropping), although the magnitude of change is different between the two land uses. The increase in interest rate by 10% reduces NPV of ginger, maize +sweet potato, teff+ taro and FTBAFP by 10.93%, 10.93%, 10.93%, and 4.06% respectively and decrease of interest rate by 10% imposes positive change on NPV of ginger, maize +sweet potato, teff+ taro and FTBAFP by 10.46%, 10.46%, 10.46%, and 5.84% respectively. From this result we can see that the magnitude of change on NPV of monocropping is higher than agroforestry practice's NPV change, which implies agroforestry is less sensitive than monocropping system for change of interest rate. This may be because the maximum benefit from FTBAFP would be obtained after long years, but in the case of monocropping harvest period was very short and the change of interest rate will have direct impact and make it more sensitive than agroforestry practice. This is similar with finding of Yeshimebet (2011) who studied on economic evaluation of Coffee-Enset-based agroforestry practice in Yirgachefe *woreda*, Ethiopia and revealed that agroforestry is less sensitive for increase of discounting rate. Similarly, the study by Getahun (2012) at Wondo Genet supports this finding. When concluding the sensitivity analysis, the result revealed that agroforestry practice is less sensitive than monocropping system for both worth scenario (increase of opportunity cost of labour, increase of interest rate and decrease of price and output simultaneously) and best scenario (decrease of opportunity cost of labour, decrease of interest rate, and, increase of price and output simultaneously). This may associated with its diversified components and benefits

4. CONCLUSION AND RECOMMENDATIONS

4.1. Conclusion

This study was conducted at Hadero Tunto Zuria woreda to identify components of agroforestry practice and to analyze the financial profitability of two land uses (agroforestry versus monocropping system) in study area. The result shows that agroforestry practices in the study are majorly dominated by fruit trees and enset. Whereas, the monocropping system is mainly characterized by ginger and two sequential crops such as maize +sweet potato and teff+taro sequential monocropping system were analyzed.

The result of financial analysis showed that the fruit tree based agroforestry practice is more profitable land use than monocropping land use system. The net present value of the fruit tree based agroforestry practice is two times higher than net present value of ginger monocropping, and four times higher than the net present value of maize +sweet potato sequential monocropping system.

The sensitivity analysis showed that the fruit-tree based agroforestry practice is less sensitive for change in price, and change in yield than monocropping system. And also fruit-tree based agroforestry practice is less sensitive than monocropping system for change in discount rate. However, agroforestry practice and ginger production are more sensitive than maize+ sweet potato and teff+taro sequential cropping system for change in wage of labour.

The result shows that the land size allocated for agroforestry practice is less than land allocated for monocropping system despite the fruit based agroforestry system is more productive and less sensitive than that of monocropping.

4.2. Recommendations

There is threat in the sustainability of agroforestry practice in the area because of the switch to ginger production which is major cash crop in the area. Even if the ginger is major cash crop in the study area, its production is not sustainable because it it is open for risk due to disease. Based on the findings of this study, the following policy and further research directions are recommended

- The financial evaluation has showed that fruit-tree based agroforestry practice is economically more profitable than monocropping systems namely ginger, maize +sweet potato and teff +taro sequential monocropping. Even if fruit-tree based agroforestry practice is more profitable than monocropping system, some farmers are engaged in production of monocropping especially, ginger production because of its short maturity age and they were switching from agroforestry practice to ginger production. As the monocropping system is liable for risk, it would be better to provide improved varieties of agroforestry tree with short maturity age in order to make farmers not switch from agroforestry practice and make agroforestry practice to serve the economic and environmental development goals.
- As lands for grazing in the study area are progressively shrinking from time to time diversification of the livelihoods of households using livestock can be possible if agroforestry practice is continued in the area.
- Since only the marketable benefits were evaluated in this study, further study is needed to estimate the total economic value of the agroforestry practice including the non -marketed benefits (environmental functions) served by the practice.

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