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Financial Analysis of Eucalyptus Woodlot in Comparison with Selected Cereal Crops, the Case of Gombora District in Hadiya Zone, Central Ethiopia

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Abstract

Farming systems can be integrated to create the best possible combination for a better financial benefit when taking into account the available resources; based on the potential benefits of the farm products and costs associated with the production processes. The purpose of this study was to estimate the household financial profitability of eucalyptus woodlots and selected cereal crops. Ninety-six households were selected through random sampling method. Both primary and secondary data were used. For data analysis, SPSS (Statistical Package for Social Sciences) was employed. As a measure of profitability, Net Present Value (NPV), Benefit Cost Ratio (BCR), and Internal Rate of Return (IRR) studies were utilized. The result indicated that farming was their primary source of income for the farmers' in the study area. The result showed that 81.25% of the respondents believed that growing Eucalyptus woodlots had beneficial effects on the economic position of the owner. Only 18.75% of the responders mentioned the detrimental effects of the eucalyptus woodlot. The majority of respondents (64.6%) strongly agreed that they had interest towards establishing eucalyptus woodlots. The NPV analysis demonstrated that profitability of cereal crops being 1.94 times more profitable than Eucalyptus woodlots. At a 10% interest rate, the BCR for both farming methods was greater than unity. For the households, investing in cereal crops over 169% interest rate resulted in losses that may reach 566% in the case of woodlot. As a result, combining the two farming methods can increase financial return.

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Introduction

Long, evergreen Eucalyptus trees belong to the Myrtaceae family and are the species that have been introduced to foreign countries the most (Rassaeifar *et al.*, 2013). It is a genus with more than 500 species, making it the most widely planted genus of trees worldwide (FAO, 2011). Despite being an Australian native, eucalyptus trees are now widely and successfully planted in countries like India, South Africa, Zimbabwe, Kenya, Uganda, and Tanzania (Kilimo, 2011). Currently, more than 100 different species of eucalyptus are planted in Africa, with roughly 55 of them being grown in Ethiopia and 70 of them being found in Kenya (Oballa *et al.,* 2005). The genus was first discovered in Ethiopia in 1894/95, under the rule of Emperor Menilek II (1868–1907) (Breitenbach, 1961; Dominique, 2010). Ethiopia has the largest area of eucalyptus plantations in east Africa (FAO, 2011), with over 120 eucalyptus tree species (Wassie, 2019); of the different species, *Eucalyptus globules* and *Eucalyptus camaldulensis* are the most common eucalyptus tree species. Species of the genus Eucalyptus (common name Eucalyptus) are widely planted all across Ethiopia including on large areas of land previously allocated to food production (Liang *et al.*, 2016).

In many parts of Ethiopia the Eucalyptus species provide wood sources for rural livelihoods such as building materials, poles, lumber, fuel, charcoal, posts, and farm implements, respectively (Mekonnen, 2007). In addition, most Ethiopian households grew and planted eucalyptus trees because of their flexibility, quick growth, and lack of taste for livestock, as well as the fact that they may sell the wood-derived products they make for a high profit (Dessie, *et al*, 2019).

Ethiopia's economy is dependent on agriculture, which accounts for 40 percent of the GDP, 80 percent of exports, and an estimated 75 percent of the country's workforce (USAID, 2020). In Ethiopia, cereals, pulses and oilseeds, are the grain crops that occupy almost 86.8 percent of the total area cultivated (12.9 million hectares) and constituted the major food crops, source of income at household level and a contributor for the country's foreign currency earnings, among others. Within the category of grain crops, cereals are the major food crops both in terms of the area they are planted and volume of production obtained. In the production season of 2020/2021, 81.2 percent of the area planted was under cereals and the total grain production reached to 341.8 million quintals, of which cereal production accounted for 302 million quintals. They are produced in larger volume compared with other crops because they are the principal staple crops (CSA, 2021).

The government of Ethiopia targeted to increase the total annual quantity of crop production in all production systems from 543 million quintals to 925 million quintals in 2030. However, crop productivity varies greatly from place to place, depending on amounts and quality of inputs applied, change in farming practices, amounts and price of fertilizer used, quality of seed varieties, weather, technology and use of irrigation (CSA, 2021; Merga and Haji, 2019). Farmers determine their land use selections based on the potential benefits of the farm products and costs related to the production processes. Undertaking financial cash flows in the farming practice of eucalyptus woodlot and crop agriculture system can assist farmers in making land use decisions (Eshetu *et al.*, 2018). Croplands are currently being converted into eucalypt woodlots as a result of farmers' increased interest in eucalypt farm forestry (Dereje *et al.,* 2012). According to Tadele *et al.,* (2014), Eucalyptus plantation forestry has played and is still playing a key role in enhancing rural populations' quality of life, lowering poverty, and relieving pressure from remaining natural forests in Ethiopia's highlands. However, the uncontrolled expansion of eucalyptus on productive farmlands has raised great concern, particularly as eucalypts are claimed to have detrimental effects on soil productivity (Forrester *et al.,* 2006; Jiregna, 2006).
In the Hadiya zone of southern Ethiopia, cereal crops like wheat, maize, "teff", sorghum, and barley are the core sources of food and cash income for the farmers.

But smallholder farmers respond to decreasing access to and declining agricultural productivity by increasing eucalyptus woodlots. Household in the Hadiya zone in general and in the study area in particular expands Eucalyptus woodlots for different reasons like; fast growth, less labour cost, high fertilizer cost crop, less willingness to do agriculture yearly, rural to urban migration, remittance from other countries and increasing demand of eucalyptus woodlot due increasing illegal urban expansion. In the study area of Gombora district, smallholder farmers have been using red eucalyptus woodlots as an important cash source, even by replacing their farmland with commonly grown main food crops, without considering the cost-benefit analysis of expanding eucalyptus and cereal crops. However, there is no empirical data on the costs and benefits of eucalyptus and crop agriculture production, especially cereal crops, in the study area. Hence, comparing the financial benefits of Eucalyptus woodlot and crop agriculture with major cereal crops such as wheat, "teff", maize, and barely can help to make analysts and policymakers the right and sound decisions to select farm practices. Therefore, this study aims to assess the local farmers' knowledge and attitudes towards growing eucalyptus and compare the financial benefits of the two farming practices.

Methods and materials

Description of the Study Area

The study was conducted in Gombora district, Hadiya Zone, and Southern Nations, Nationalities, and Peoples Regional State (SNNPRS). It is situated around 27 kilometres from Hosanna, the Hadiya zone's capital city, and about 259 kilometres south of Addis Ababa. Geographically, it is located between 37° 35′ and 37° 40′ East longitudes and 7° 33′ and 7° 37′ North latitudes (Fig 1).

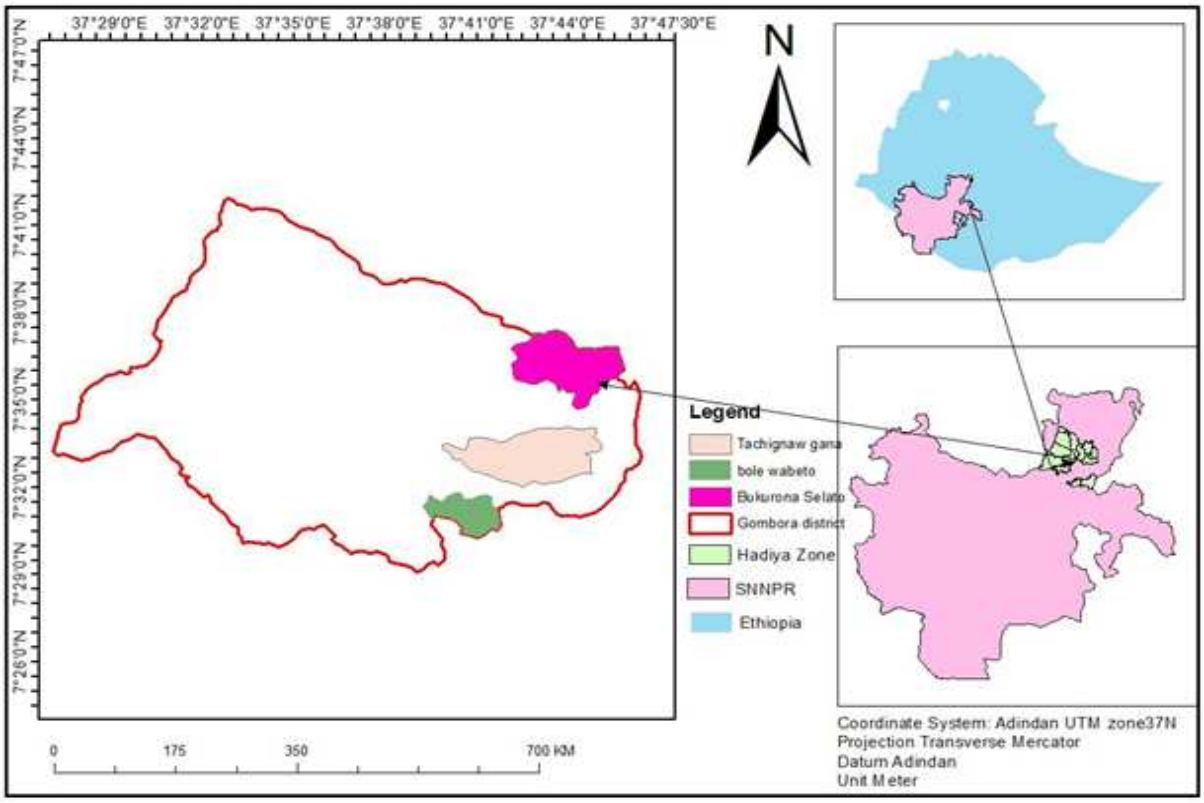

Fig. 1. Map of the study area.

The district has total land area coverage of 48,352.5 ha, which is comprised of 23 rural and 5 urban kebels. Flat and relatively gentle lands at low altitude and some mountainous lands at upper altitude make up the study area's topography. The altitude varies from 1400 meters to 2400 meters above sea level. The study area has a bimodal rainfall distribution where the main rainy season starts in June and continues up

to the end of September "Meher" rains and the short rainy season occurs from January to April "Belg" rains. The mean annual precipitation and temperature vary between 1800 and 2200mm and a mean annual temperature of 15–25°C (GWFEDO, 2020). A total projected population for 2016 is based on the 2007 census of 110,877, with 55,533 males and 55,344 females (CSA, 2017). The livelihood of the people in the area is mainly rain-fed subsistence mixed crop and livestock production associated with trees grown either in woodlots or in farm plots, and some kebeles use irrigation for agricultural activities. The most common cultivated cereal crops in the study sites include "teff", wheat, maize, barley, and beans, and cash crops like "enset", chat coffee, and fruits such as banana, papaya, avocado, and mango are cultivated for household consumption and income generation (GWARDO, 2020).

Sampling Techniques and Sample Size Determination

This study was conducted in Gombora district of the Hadiya zone, southern Ethiopia. Two-stage sampling procedures were used. In the first stage, four kebeles (Bukurona selato, Tachignaw gana, Bole wabeto) from Gombora were selected purposively. The basis for selection was the intensive expansion of eucalyptus woodlots on agricultural land. In the second stage, the sample household heads for interview were selected by using simple random sampling techniques. The total households within the selected kebele's are 2219.

The total sample size was determined from the given population size based on the formula developed by Yamane (1967). According to the formula, 96 households were selected from the four kebeles. The number of households included in the sample from each kebele was based on the proportion of households in each kebele.

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

$$n = \frac{2219}{1+2219(0.1)^2} = 96$$

Where, n" is sample size to be computed, "N" is Target population (total household size) in the study area and "e" is the level of precision. The minimum level of precision is acceptable at 10%.

Data Collection

Both primary and secondary data were used for this study. Secondary sources of data were used for this study, including published and unpublished materials. Field observations, key informant interviews, focus group discussions, household surveys, and market assessments were used to collect primary data. Household survey was used to collect socioeconomic characteristics and attitudes towards eucalyptus plantation as well as gather important market information about two farming practices.

Semi-structured interview was used for active households in the study area, those who have general knowledge about the farming practice of both eucalyptus and cereal crops and development agents of the kebele. The focus group discussion had been held finally after key informant interview and the household survey completed.

The most integral part of the data collection which rigorously touched is both the cost and benefit streams of each cereal crops and Eucalyptus woodlots. Model farmers and experts from different backgrounds (like, Agriculture, forest and environment, natural resource management and trade office) that have relatively better information about two farming system within the community of the district have been gathered for a day long consultative discussions. The discussion has been done in each kebele which comprised five up to eight members. A total of four focus group discussions were held to collect cost and benefit of each cereal crops per hectare and eucalyptus woodlots per hectare.

Data on the price of eucalyptus poles, split wood, and bundles of fuel wood pieces were acquired from the marketplaces in Habicho, Boshoana, and Hossana. Market data for the main cereal crops was also gathered from Gombora district trade and market development office. Selected cereal crops were included in the data set "teff", maize, wheat, and

sorghum). The quantity produced was measured in a number of local units before being translated to a standard measurement (kilogram). Using average local market level unit prices obtained during the survey years, the quantity of production in kilograms was converted into monetary values in Ethiopian Birr (ETB). In the 2019/20 production year, physical data on cereal crops per hectare such as "teff", maize, wheat, and sorghum, as well as eucalyptus woodlot per hectare production procedures, costs and yield, usage of physical inputs, sale amount of produce, and selling prices, was collected. The labour cost was calculated using opportunity cost, which assumes that someone works as a day laborer for neighboring flower fields, incurring no additional costs for the farmers because they do not utilize transportation or other items to get to work.Most Ethiopian households planted and produced Eucalyptus trees due to its adaptability, fast growth, and earn high income from sale of Eucalyptus wood product for different purposes like construction, firewood, timber and charcoal (Dessie, 2019). According to Zerga and Berta (2016), the majority of these trees are also exploited for construction purposes during the lumbering age (after 15 years). The eucalyptus tree, on the other hand, is employed in construction at various stages (3 to 4 years- small poles, 5 to 6 years- medium poles, 7 to 8 years- big poles and greater than 9 years- logs). People in the study area primarily grow eucalyptus trees for construction purposes. 6 years of construction pole and 3 coppice rotation production were used for this investigation because production declines after the third coppice. The coppice reaches harvest in the fourth year after the first seedling is harvested.

Data analysis

Statistical Package for Social Science (SPSS) Version 25 for both descriptive and financial profit indicators were used to analyze the collected data. Descriptive statistical tools such as frequencies, means, standard deviation and percentages were used to present the socio-economic and demographic variables and attitudes towards growing eucalyptus. Moreover, Microsoft Excel software tools and financial profit indicators like net present value, internal rate of return and cost benefit analysis were used to analyze feasibility of the two farming practices.

Financial analysis

The feasibility of investments and decisions has been based on financial indicators. These indicators are Net Present Value (NPV), Benefit Cost Ratio (BCR) and Internal Rate of Return (IRR). The NPV determines the net returns of the production system by discounting the streams of benefits and costs back to the establishment year using appropriate discount rate over the lifetime. The farming practice with higher NPV had been taken as a better option than with lower NPV. According to Mmopelwa (2006), NPV is given by the following formula:

$$NPV = \sum_{t=0}^{n} \frac{Bt - Ct}{(1+r)^t} > 0 \quad (2)$$

Where; NPV= Net Present Value, B_t= Benefit flows at time t, Ct=Cost of production at time t, r= discount rate and t= time.

The BCR is used to compare the discounted benefits to discounted costs. The farming practice with higher BCR was taken as a better option and it is computed by (Rahman and Kholilullah, 2017) below.

$$BCR = \frac{\sum_{t=0}^{n} \frac{Bt}{(1+r)^t}}{\sum_{t=0}^{n} \frac{Ct}{(1+r)^t}} > 1 \quad (3)$$

$$IRR = \sum_{t=0}^{n} \frac{Bt - Ct}{(1+r)^t} = 0$$

The expected profitability of an investment is the rate of return which provides enough income to cover the inputs' opportunity cost. A cereal crop agriculture practice is considered financially attractive if the IRR is higher than the opportunity cost (Florio *et al.*, 2018). The Outputs (costs and benefits) have to be discounted to take care of the time value of money. The cost and benefits of the two farming practices were discounted using the equation 4.

$$P_v = \sum_{t=1}^{T} \frac{V_t}{(1+r)^t} \quad (4)$$

Where P_v is the present value of streams of benefits or costs, T is the time horizon and r is the discount rate. There has been significant discussion around the

correct social discount rate because small changes in its value have large impacts on the welfare of future generations (Chiabai ". 2011). A discount rate of 10% was assumed based on the recent minimum lending interest rate for long-term, which was provided by the Development Bank of Ethiopia (DBE) to farmers' association (MoFEC, 2016). The values in the calculation are based on the current input and output set constant throughout for 18 years of cash flow analysis.

Sensitivity analysis

We are living in an uncertain world and just like other businesses; investments on crop agriculture and expansion of eucalyptus are not risk free. They are subject to change in line with other changing situations (ecological and economic). Therefore, the costs and benefit streams of farming practices are subject to changes in economic variables like market prices of products and discount rates and prices. They are also affected by ecological variables like precipitation, tenure insecurity, diseases and tree growth rates. It is difficult to predict the future input and output prices, yields and discount rates due to lack of data or information. Hence, a sensitivity analysis was carried to show the effect of the change in these key variables on the NPV. In the process of the adoption of new farming practices; farmers are not only concerned about costs and benefits but also associated risks. Moreover, the farm households may attach high value to present income and discount the future income at a higher rate. To do the sensitivity analysis of the farming systems on smallholder farms, two assumptions was considered. These assumptions are: (i) increasing the discount rate by 10%, 20%, and 30% keeping other key variables constant and (ii) Increase or decrease the price of the product by 10% keeping other variables constant.

Results and discussion

General Socioeconomic Information

From the total sampled respondents, majority of the respondents about 82.5% were male and 17.5% were female (Fig 2). The large number of males compared to females could be due to the fact that most of the heads of households are men, and they are the ones that own land. Also, females do not have a high contribution to farming rather than home work.

Table 1. Socio-economic characteristics of respondents.

Variables	Description	Mean	Std. dev.	Min.	Max.
Age	Age of the respondents	43.39	10.123	24	66
Education	Education level of household	6.1	3.622	0	13
Family size	Total family size	5.75	2.43	2	11
Land size	Total owned land	1.307	.5637	0.25	3
Eucalyptus land	Total land covered by Eucalyptus	0.56	0.56	0	2
Income	Total annual income	16,021.22	1243.68	6835	50,000

The average ages of the respondents were 43.68 with minimum and maximum 24 and 66 respectively. The average educational levels of the respondents were 6.1 with minimum of zero (not attend formal education) and maximum of 10+3.

The average family size was 5.75 with minimum and maximum of 2 and 11 respectively. The average annual income of the respondents was about 16,021.22 Ethiopian birr. Majority of the respondents had land, and average land size owned by a household is 1.307ha where the minimum and maximum land size owned by the household is 0.25 and 3ha, respectively. The average land size covered by eucalyptus woodlots was 0.56ha (Table 1).

People's Knowledge and Their Attitudes towards Growing Eucalyptus

Majority of the respondents 74(77.1%) had Eucalyptus woodlot in the study area. The respondents who have the ownership of eucalyptus woodlots, has also indicated the place of eucalyptus plantation, out of

eucalyptus ownership farmers, a considerable percentage 39(52.7%) were used to grow Eucalyptus in their farmlands and the respondents who, used to grow eucalyptus on farmland boundary and degraded land (a land that is not suitable for crop farm) were 21(28.4%) and 14(18.9%) respectively (Table 2). Focus group discussion and key informant interview has reason out for the fast expansion of eucalyptus woodlot on farmlands were urban to rural migration, better income from eucalyptus rather than other crops, low labour force required, remittance, high cost of crop farm and high fertilizer costs.

Table 2. Eucalyptus woodlot ownership and their place of plantation.

Variables	Description	Frequency	Percentage
Ownership	Yes	74	77.1
	No	22	22.9
	Total	96	100
Place of plantation	Farmland	39	52.7
	Farmland boundary	21	28.4
	Degraded land	14	18.9
	Total	74	100

From the total sampled respondents about 72(75%) were chooses to grow Eucalyptus woodlot and 24(25%) of the respondents were not preferred to grow. As a result, most of the respondents 78(81.25%) noted that Eucalyptus had positive impacts. When the local people were responded about the positive impacts of Eucalyptus, what first came into their mind was the economic benefit that they got from Eucalyptus woodlot, like, livelihood improvement and diversification to meet household wood demand and generating cash income through the sale of Eucalyptus wood products, such as construction materials, like pole, "Mager", "Weraj" and fuel wood which is similar with (Tadesse and Tafere, 2017).

They stated that local people had the preference to plant more Eucalyptus in Meja watershed, central Ethiopia. This is the reason why most of the respondents noted that Eucalyptus had positive impacts.

Table 3. Financial and sensitivity analysis towards interest rate.

Interest rate	Crops/woodlot	Benefits	Costs	NPV	BCR
10%	"Teff "	644,220.92	224,657.18	419,563.7	2.87
	Wheat	654,780.24	214,507.93	440,270.3	3.05
	Maize	661,238.85	231,044.03	430,194.9	2.86
	Sorghum	428,523.78	159,148.40	269,375.4	2.7
	Eucalyptus woodlots	235,977.90	35,408.177	200,569.73	6.67
20%	"Teff "	377,997.903	139,601.77	238,396.13	2.7
	Wheat	384,193.6	133,105.3	251,088.3	2.88
	Maize	387,983.21	144,389.9	243,593.3	2.7
	Sorghum	251,437.18	994,19.94	152,017.23	2.5
	Eucalyptus woodlots	107,584.678	300,55.745	775,28.931	3.58
30%	"Teff "	259,505	101,183.8	158,321.2	2.56
	Wheat	263,758.5	96,352.17	167,406.33	2.7
	Maize	266,360.16	105,185.42	161,174.7	2.5
	Sorghum	172,617.9	72,400.4	100,217.5	2.38
	Eucalyptus woodlots	57,495.915	27,517.935	29,977.98	2.09

In contrast, most of the respondents 89(92.7%) noted that there was a difference in crop due to the presence of Eucalyptus woodlot in nearby area in the study area (Fig 3). When the respondents were asked about their knowledge on "the difference in crop due to Eucalyptus woodlot in the nearby area," they were thinking about the adverse ecological impacts of Eucalyptus, for example, reduction of crop especially when Eucalyptus is planted around farm boundaries or on grazing lands.

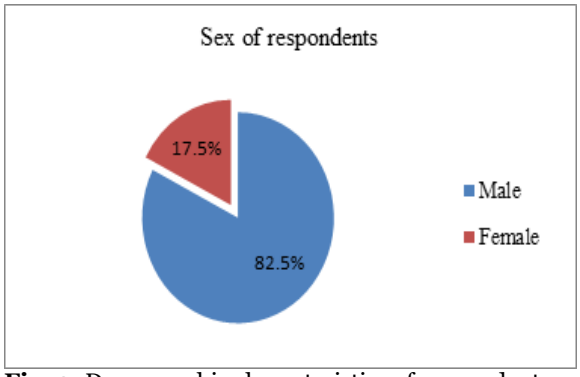

Fig. 2. Demographic characteristics of respondents.

According to the respondents, the adverse ecological impacts of Eucalyptus may include a decline in soil fertility through acidification and competition, reduction in forage availability due to allopathic effect, and a decline in the availability of groundwater. Also out sampled respondents 65(67.7%) were known that they had past knowledge about Eucalyptus woodlot. Hence, the largest proportion of the respondents had strongly agreed to have a positive attitude towards growing Eucalyptus woodlot in the study area (Fig 3). Hence, the largest proportion 62(64.6%) of the respondents had strongly agreed to have a positive attitude towards growing Eucalyptus woodlot in the study area (Fig 4).

The respondents are asked to state the reason/ purpose of growing eucalyptus woodlots, out of respondents 55(57.3%) were used to grow for sale of poles (Locally said "Quami", "Woraj", "Mager" and "Teshgagari") and 16(16.7%), 12(12.5%) and 13(13.5%) were for construction of own house, sale of firewood and household fire wood (Fig 5).

In the study area majority of the respondents were used grow eucalyptus of sale of poles; the reason might be high demand of eucalyptus for construction of house especially in urban area and seeking high economic return than other crops. Similar study was reported by (Belay and Abriham, 2016).

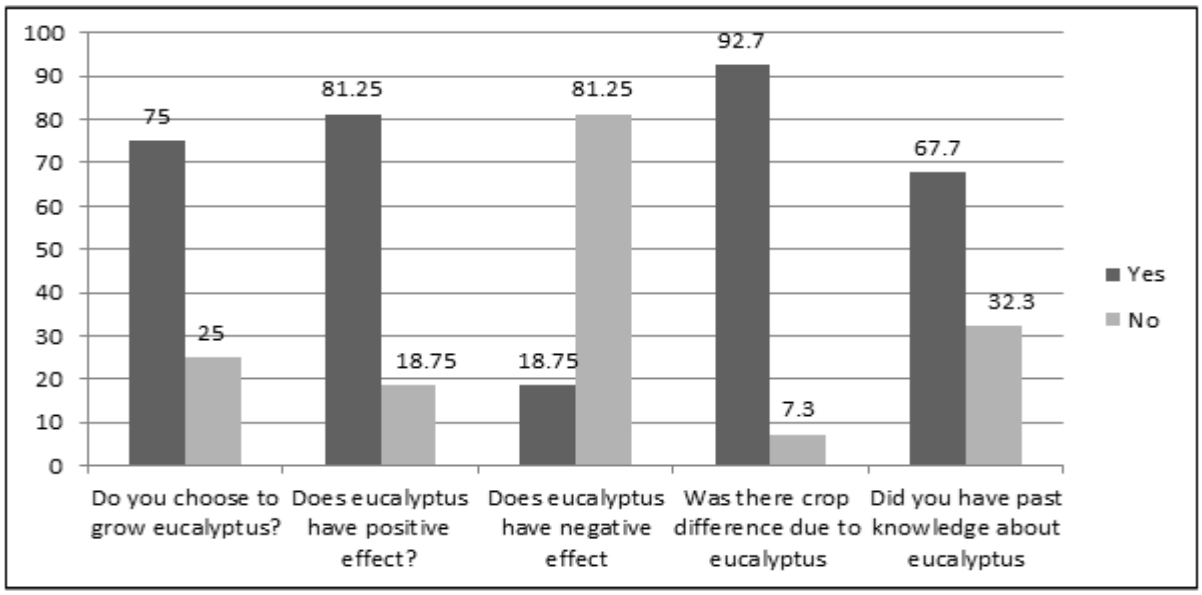

Fig. 3. People's knowledge towards growing eucalyptus.

Financial and sensitivity analysis

In order to compare the financial benefit of the farming system the financial profit indicators like; NPV, BCR and IRR were analyzed to show the best alternative farming practice for the study area. The NPV, BCR, and IRR of the farming practices were

calculated using the analysis method indicated in methods and materials. The result shows that all farming practices are a good investment for the households rewarding with a positive NPV.

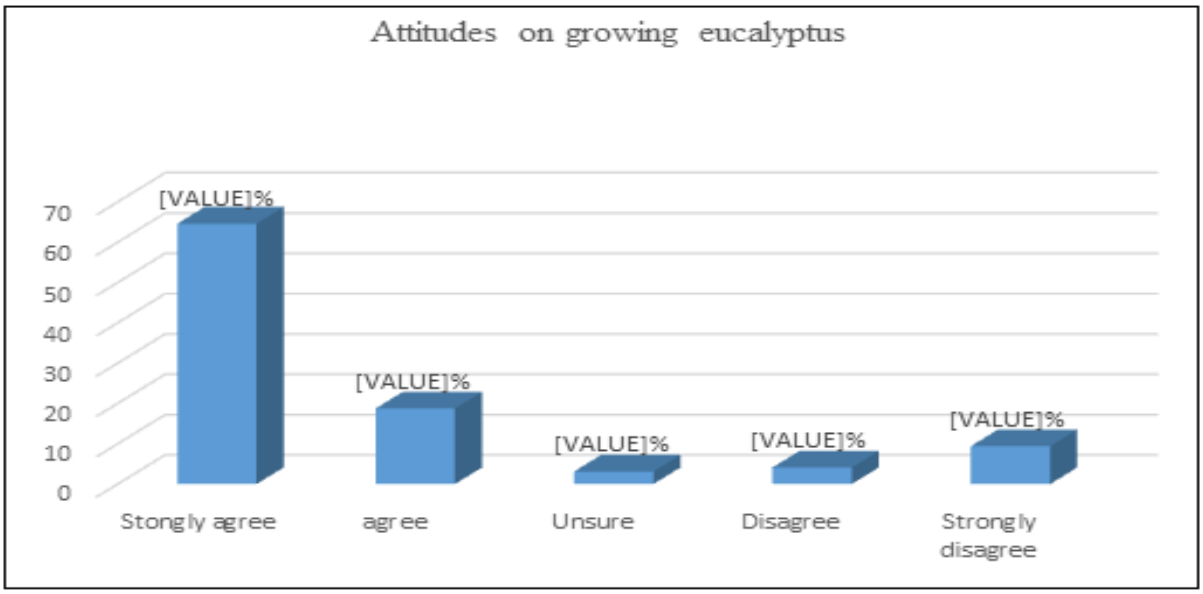

Fig. 4. People's attitudes towards growing Eucalyptus.

The calculated NPV for major cereals like "teff", wheat, maize and sorghum per hectare were 419,563.7, 440,270.3, 430,194.9 and 269,375.4 respectively. Were as, the calculated NPV for eucalyptus woodlots were 200,569.73. The NPV revealed that "teff", wheat, maize and sorghum have higher profit gain of 2 times, 2.2 times, 2.15 times and 1.34 times that of eucalyptus woodlots, respectively.

BCR of cereals like "teff", wheat, maize and sorghum are 2.87, 3.05, 2.86 and 2.7 while eucalyptus woodlot assembles BCR of 6.67 per hectare of production.

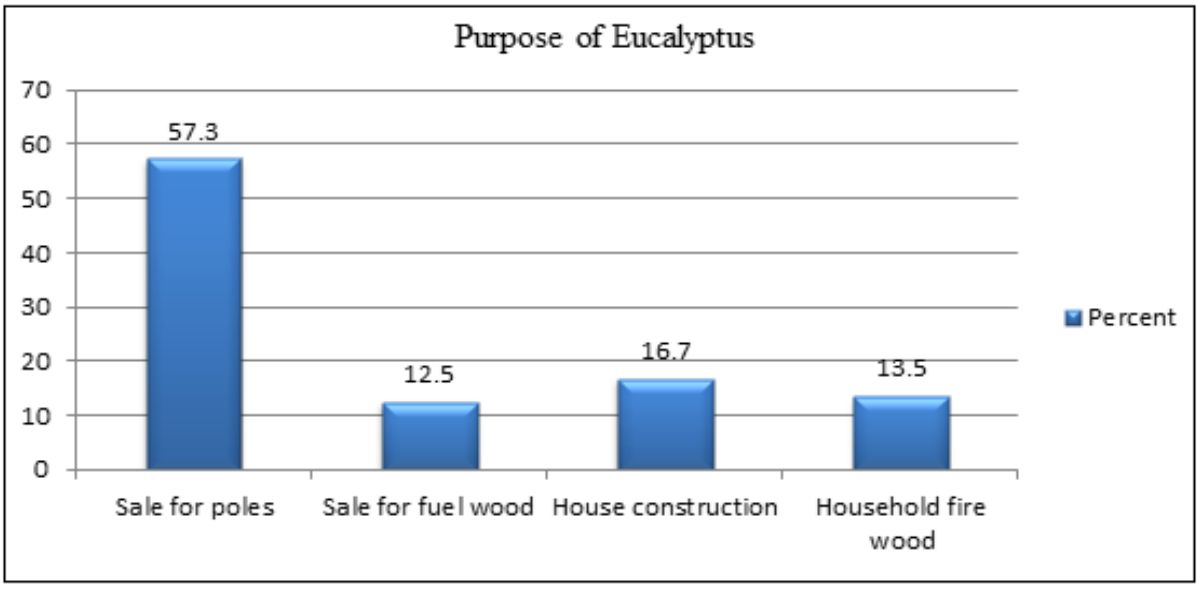

Fig. 5. Purpose of planting eucalyptus woodlot.

IRR is 187% for "teff", 205% for wheat, 186% for maize, 169% for sorghum and 566% for eucalyptus woodlot. This shows that all farming practices have BCR of greater than unity at 10% interest rate. Investing cereals and eucalyptus woodlots above mentioned interest rate is a loss for the household.

The decision of the households upon selecting beneficiary farming practice upon their farmland mainly depends on the benefit reward and the essentiality of the products for the household needs. The detailed NPV and BCR calculation considering the sensitivity of the farming practice towards different interest rate is computed and presented in (Table 3).

Though the profit of farming practices decreases with increasing interest rate, both eucalyptus woodlot and cereal crops are not sensitive to the interest rate of the investment. Change in interest rate for financial analysis does not change the status of the NPV; they are all positive. Comparably, cereal crops are more sensitive than eucalyptus woodlot. This is due to the annual cost incurred for cereal crops are higher than eucalyptus woodlot despite periodical profit reward of the woodlot.

Conclusion

Fast growth, high income contribution, high crop farming costs, and high fertilizer costs of cereals encourage rural households to quickly expand their Eucalyptus woodlots. In contrast to other land use types in the research area, analysis also showed that more than half of the households assigned a significant portion of their farmlands to Eucalyptus woodlots. This is so because eucalyptus is the most commercially significant tree species planted in rural households' woodlots. According to findings of this study, the majority of respondents strongly agreed that they had a favorable attitude toward the growth of eucalyptus woodlot in the study area.

The financial analysis of the two farming systems, Eucalyptus woodlot and agricultural crops (cereal crops), was undertaken to compare the profitability. Major cereal crops in the study area like "Teff", wheat, maize, and sorghum were analyzed separately. In the various patterns, both farming practices contribute significantly to household income. Farming cereal crops has more cash flows every year whereas, eucalyptus woodlots contribute to the income periodically and much more is used for households' wood consumption. Compared to the two farming practices, selected agricultural crops (cereal crops) per unit area is more financially rewarding than eucalyptus woodlot in the short term. Though there is a better profit in cereal crops, the sensitivity towards input and output makes the Eucalyptus woodlot more interesting for long-term benefit and less sensitive to interest rate and price. Integrating the two farming practices can maximize the financial profit, and this is possible with the available land size of the households.

Based on the findings of this study, the following recommendations were put forward:

Controlling the negative effects of eucalyptus woodlot on the environment requires educating awareness among farmers and other stakeholders and encouraging extension education regarding the selection of suitable land for eucalyptus woodlots, site selection, and planting space.

Providing awareness training on farmer's attitudes is important to understand and identify benefit and costs of two farming practices.

Improving access to agricultural equipment and other related facilities like small-scale irrigation activities and water harvesting to boost productivity should be a policy direction so that eucalyptus planting will be discouraged.

Allocation of proportional land for both farming system for cereal crops and eucalyptus woodlots is more profitable.

Implementing land use policies is crucial for identifying suitable land for suitable crops as well as for forests and trees.

The government and those who care about agriculture should pay close attention to stabilizing fertilizer prices and may even consider introducing or increasing its present level of fertilizer subsidies in order to minimize eucalyptus planting.

Data availability statement

The datasets presented in this article are not readily available because Ethical clearance given may not permit sharing of datasets with a third party. Requests to access the datasets may be directed to. yohannesh2005@gmail.com

Ethics statement

The studies involving human participants were reviewed and approved by College of Agriculture Ethics Review Committee, Wachemo University. The participants provided their written informed consent to participate in this study.

Author contributions

Yohannes Horamo (YH) and Shiferaw Teshale (ST): project conception. YH and ST: draft and final manuscript. YH: manuscript quality control and supervision. ST: data collection and analysis. Both authors contributed to the article and approved the submitted version.

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