

Characteristics and Management of Gomma Woreda Smallholder Coffee Farms in Southwest Ethiopia

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Abstract

In Ethiopia, coffee is a major source of income for the country and the coffee growers, whose livelihood is entirely dependent on coffee, plus not only exports but also remarkable consumption of coffee by the local community. Despite this, the management of coffee farms for smallholders is very poor at Gomma woreda, southwest Ethiopia. As a result, the objectives of this study were to assess and provide information on the management of the status and characteristics of coffee farms for smallholders in Gomma Woreda for sustainable coffee production. According to the current study, accordingly, the topography of coffee farms in the study area is within the range of sloping to moderately steep slopes. Also, the result indicated that farmers were simply expecting the benefits of shade trees and the nutrient recycling capacity of soil without soil nutrient management on coffee farms, which is why coffee farms did not give sufficient productivity. Because all of the sampled farms were more than 19 years old, concerned organizations should distribute improved coffee seedlings to smallholder coffee farmers to increase coffee productivity. The major problems in the study area of smallholder coffee farms were the effect of continued cultivation without soil fertility intervention, nutrient mining as a result of harvested products, no application of mineral fertilizer, organic fertilizer, or lime, and coffee cultivation on a steep slope without soil conservation measures.

Keywords: coffee, slope, smallholder

INTRODUCTION

Ethiopia's most significant and essential export is coffee, which contributes 60% of its export revenue, 10% of the country's overall agricultural output, and 5% of its GDP (Girma, 2011). Despite its importance, the national average coffee yield is only 0.67 t ha⁻¹ (CSA, 2017). This is significantly lower than Brazil's average output of roughly 1.5 t ha⁻¹ (Abu, 2016). This coffee yield gap is attributed to a number of factors, including declining soil fertility, poor agronomic practices, limited input use, insufficient technology generation, a lack of credit facilities, and poor seed quality, all of which severely limit the productivity of the country's smallholder coffee farmers (Taye, 2010).

Land degradation and soil nutrient depletion have become serious threats to agricultural productivity in sub-Saharan Africa. In Ethiopia, a decline in soil fertility is the major challenge to increasing crop production (Alemu et al., 2016), and the depletion rates of macronutrients N, P, and K were 122, 13, and 82 kg ha⁻¹ year⁻¹ in Ethiopia, respectively (Amare et al., 2005). According to IFPRI (2010) and Kehali et al. (2017), this is a result of the removal of organic

matter, biomass, and animal manure from farm plots, the limited application of mineral and organic fertilizers, macro- and micronutrient depletion, soil acidity, and topsoil erosion.

According to Anon (1999), there are four types of coffee production systems in Ethiopia: forest coffee (10%), semi-forest coffee (35%), garden coffee (50%), and plantation coffee (5%). Climate factors, type of soil, mulching, farm management methods, crop production methods, etc. are among the prominent factors that affect the growth and development of plants, including coffee. In Ethiopia, coffee is a major source of income for the country and the coffee growers, whose livelihood is entirely dependent on coffee, plus not only exports but also remarkable consumption of coffee by the local community. However, the management of coffee farms for smallholders is very poor at Gomma Woreda, southwest Ethiopia. Hence, to assess the management status of coffee farms for smallholders in the study sites for sustainable coffee production.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted to know how smallholder farmers (excluding other coffee farming systems) in the Gomma district, Jimma zone of the Oromia national state, located in the mid-altitude sub-humid zone of Southwestern Ethiopia. Gomma district is located 397 km southwest of the capital Addis Ababa and 50 km away from Jimma town. The topography of the study area ranges from gently sloping to hilly lands with ridges and valleys in between. The altitudinal range of the district is between 1387 to 2870 m. a.s.l. (IPMS, 2007). The Gomma district has a bimodal rainfall distribution, with an annual rainfall average of 1534 mm. In Figure 1, the mean maximum and lowest air temperatures are 28.7 °C and 11.9 °C, respectively. The rainy season lasts from March to April, with the main rainy season lasting from June to October.

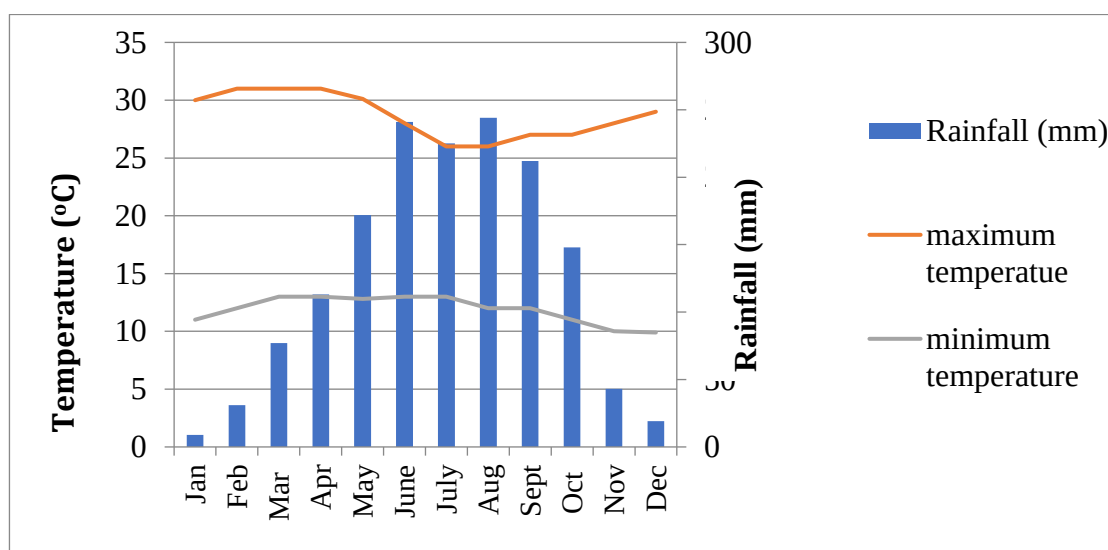


Figure 1: Mean monthly minimum and maximum temperatures (°C) and mean monthly total rainfall (mm) of the study area.

Source: ENMA (1997–2016).

Field Survey and Site Selection

Gomma was purposefully chosen from among Jimma Zone's potential coffee production potential districts. As a result, ten (10) smallholder coffee farms were purposefully chosen to collect preliminary information for further investigation. Primary and secondary data were collected as planned. Temperatures and rainfall were taken from the Ethiopian National Meteorological Agency (ENMA).

Statistical Data Analysis

Descriptive statistics such as mean, minimum and maximum were employed for the study. For data analysis, Statistical Package for Social Science version 16 (SPSS) was used.

RESULTS AND DISCUSSION

Topography

The investigation of topography is one of the most important factors in cultivating coffee. Accordingly, the survey results of topographic variations, as presented in Table 2, depicted that the slope of coffee farms varied from 6 to 30% with a mean value of 14.3%. Based on the survey results, out of the sampled coffee-growing farms, approximately 40% were recorded to stretch out on sloping (5–10%), 30% on strongly sloping (10–15%), and 30% on a moderately steep slope (15–30%), respectively. This present result corroborates the IPMS (2007) report that the Gomma district varies from gently sloping to hilly lands with ridges and valleys. However, as the present result indicated, traditional farming methods were still carried out at the study site, so no soil conservation actions were taken (Table 1). For that reason, slope steepness and traditional practices may contribute to topsoil erosion, low yield, and nutrient depletion in the upper positions and gradually transfer to the lower positions.

Altitude

To grow coffee, understanding the variation of altitudes is one of the essential points to be considered. Thus, the altitudes of sampled coffee farms varied from 1523 to 2020 m.a.s.l. with a mean of 1768.6 (Appendix Table 2); all of these farms were within ranges considered optimal for coffee production. According to survey results, therefore, the sampled farms were found to be mid-highland (1500–2300 m.a.s.l.) in agroecology. This result is supported by IPMS (2007) report that Gomma district was characterized by mid-highland (88%), high land (8%), and low land (4%), respectively.

Soil Management Practices

About soil management practices of a sampled coffee farm in the Gomma district, data are presented in Table 1. Similarly, survey results indicate that, out of sampled coffee farms ($n=10$), all farmers only did not use chemical and organic fertilization, but also lime was not applied to the coffee farms of sampled sites. In addition, none of the farms used any soil conservation practices in the study sites (Table 1). This result implies the farmers only depend on the capacity of the soil and the recycling of plant materials to supply nutrients to the coffee soils. The results from the present study are consistent with the findings by Kehali et al. (2017) who reported application of organic manures was only restricted to home gardens. In the same way, Fanuel et al. (2016) also found that chemical fertilizer was not applied to coffee soils, while FYD, which was below recommended rate was applied to coffee. Moreover, the Findings of Bahilu et

al. (2016) indicated farmers only apply their compost and crop residue in nearby farms to their homes in southwestern Ethiopia. The survey conducted by Abebe et al. (2017) in districts of the Jimma zone depicted that very few respondents applied compost; while none of the respondents applied lime for soil amendments.

The causes farmers were not used agricultural inputs, i.e., fertilizers, organic manures, and lime because they perceive that the cost of inorganic fertilizers is high-priced, the productivity is changeable, and transporting organic manures required large family size (Bahilu et al., 2016; Abebe et al., 2017). Therefore, this resulted in low coffee productivity and depletion of soil plant nutrients.

Table 1. Soil management practices and weeds management practices

Coffee farms	Soil conservation practices		Input used			Weed management	Local soil name
	Intercropping		Chemical fertilizer	Organic fertilizer	Lime		
1	No	No	None	None	None	Slashing	<i>Biyyoo gurraacha</i> (black)
2	No	No	None	None	None	Slashing	<i>Biyyoo diimaa</i> (red)
3	No	No	None	None	None	Slashing	<i>Biyyoo diimaa</i> (red)
4	No	No	None	None	None	Slashing	<i>Biyyoo diimaa</i> (red)
5	No	No	None	None	None	Slashing	<i>Biyyoo diimaa</i> (red)
6	No	No	None	None	None	Slashing	<i>Biyyoo diimaa</i> (red)
7	No	No	None	None	None	Slashing	<i>Biyyoo gurraacha</i> (black)
8	No	No	None	None	None	Slashing	<i>Biyyoo diimaa</i> (red)
9	No	No	None	None	None	Slashing	<i>Biyyoo diimaa</i> (red)
10	No	No	None	None	None	Slashing	<i>Biyyoo diimaa</i> (red)

Source: survey result (2019)

Weed Control Methods

This study was conducted to know how smallholder farmers (excluding other coffee farming systems) Gomma district manages their coffee farms from weeds. And also the survey result showed that the slashing method (100%) is a common practice for weed management in coffee farms of study sites (Table 1). This result is in agreement with the findings of Techale et al. (2013) who reported that most of the respondents used slashing mechanisms (83.33%), whereas (13.33%) of the respondents used chemicals to control weed and the remaining (3.33%) of respondents used both chemical and slashing methods in Gomma district, southwest Ethiopia.

Coffee Age

The coffee age of the farms studied ranged from 20 to 50 years (Table 2). This finding reveals that smallholder farmers in the Gomma district have had old coffee trees for more than 19 years. This finding was supported by Techale et al. (2013), who discovered that in the Gomma district, Jimma zone, the majority of respondents (83.33%) owned old coffee trees (> 20 years), whereas 6.67% owned coffee trees less than twenty years, and 10% had both. However, the current study differed from Techale et al. (2013) in that it only included smallholder farmers from coffee farms. In addition, Taye (2010) reported that poor agronomic practices, limited use

of inputs, and poor seed quality, in turn critically hamper the productivity of smallholder coffee farmers in the country. Following that, the problems identified by Techale et al. (2013) revealed that the coffee age was ranked first among surveyed coffee farms in the Gomma district. As a result, the present study found that low yields can be linked to the coffee age, a lack of organic and inorganic fertilizers, and a lack of soil conservation measures.

According to the Production Guide for Coffee (2012), reports indicate that coffee productivity continues up to 15–20 years of age. However, coffee trees in the research area were seen to have been passed down from generation to generation without replacement and to have been retained for an extended length of time. Age is thought to have a negative impact on coffee output. As a result, to address this issue, concerned organizations should distribute improved coffee seedlings, other coffee managements such as: stumping, pruning to smallholder farmers to increase coffee productivity.

Farmers' Estimation Coffee Yield

In Table 2, the study found that farmers' estimates of coffee yield ranged from 0.22 to 0.68 t ha⁻¹. With regard to this, the mean coffee yield was 0.41 t ha⁻¹, which is below the national average yield. The decrease in coffee yield can be attributed to coffee age, landscape positions, and the lack of use of external input, i.e., mineral and organic fertilization, and lime in the study area.

Table 2. Altitudes, slope, coffee age and yield estimation of sampling sites

Coffee farms	Altitude (m.a.s.l)	Slope (%)	Topography	coffee age(year)	Yield estimation (t ha ⁻¹)
1	1523	7	S	25	0.29
2	1589	14	SS	20	0.25
3	1862	20	MSS	22	0.41
4	1686	6	S	20	0.68
5	1995	30	MSS	50	0.42
6	2020	28	MSS	20	0.3
7	2006	11	SS	30	0.67
8	1636	7	S	40	0.22
9	1652	12	SS	50	0.45
10	1717	8	S	50	0.41
Mean	1768.6	14.3		32.7	0.41
Minimum	1523	6		20	0.22
Maximum	2020	30		50	0.68

Where S= sloping, SS= Strongly Sloping, MSS= moderately steep slope.

Source: survey result (2019)

Similarly, different slope positions, low soil plant nutrients, continuous cultivation, and insufficient fertilizer and manure application resulted in lower crop yield estimates than the national average (Fanuel et al., 2016). This present study suggests that low yields resulted from the continuous cultivation of coffee, irrespective of lime and fertilizer applications (Table 1).

According to Cyamweshi et al. (2014), lime treatment resulted in a 2.3 t ha⁻¹ higher coffee cherry yield than unlimed treatment, which is a significant difference. Moreover, Ababayehu et al. (2011) reported that low productivity is characterized by poor integrated soil nutrient management, inefficient use of locally available resources, inadequate soil conservation practices, and a high cost of chemical fertilizers in southwestern Ethiopia.

CONCLUSION

Generally, the present study showed the topography of coffee farms is within the range of sloping to moderately steep slope. The results clearly indicated that farmers were only expecting the advantages of shade trees and the nutrient recycling capacity of soil without soil nutrient management on coffee farms, and thus coffee farms did not provide sufficient productivity. Because all of the sampled farms were more than 19 years old, concerned organizations should distribute improved coffee seedlings to smallholder coffee farmers in order to increase coffee productivity.

The impact of continuous cultivation without soil fertility intervention, nutrient mining due to harvested products, no application of mineral fertilizer, organic fertilizer, and lime, coffee age, and coffee cultivation practiced on a steep slope without soil conservation measures were the major problems in the study area.

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