Coffee Production Potentials and Constraints In Darolebu Wereda of West Hararghe Zone

Anteneh Netsere
Solomon Endrise
Ashenafi Ayano
Berehanu Megersa

Research Report 84

የኢትዮጵያ የግብርና ምርምር ኢንስቲ_CALLBACK ቃት
Ethiopian Institute of Agricultural Research
Coffee Production Potentials
and
Constraints
in
Darolebu Wereda
of
West Hararghe Zone

©EIAR, 2010

Copyediting: Tedla Pascal
Page Design: Tedla Pascal
Printing: Abesolom Kassa
Binding and collation: Abesolom Kassa, Miftah Argeta, and Meseret Kebede
Distribution: Solomon Tsega and Tigist Beshir
Bibliographic input to WAICENT (FAO): Tigist Beshir
## Contents

**Introduction** ................................................................................................................. 2

**Description of the Study Area** .................................................................................. 4  
  Topography .................................................................................................................. 4  
  Rainfall and temperature ......................................................................................... 4  
  Soil Properties ............................................................................................................. 4  
  Demographics ............................................................................................................... 5  

**Methodology** ............................................................................................................. 6  
  Survey procedure, data collection and analysis ....................................................... 6  
  Soil analysis ................................................................................................................. 7  

**Survey Findings** ..................................................................................................... 8  
  Coffee varieties and cropping systems .................................................................... 8  
    Varieties .................................................................................................................... 8  
    Cropping systems .................................................................................................... 11  
  Coffee husbandry ...................................................................................................... 12  
    Seed preparation and nursery management ....................................................... 12  
  Field management .................................................................................................... 14  
    Holing and on-field planting ................................................................................ 14  
    Shading ................................................................................................................... 15  
    Stumping and pruning ........................................................................................... 15  
    Soil fertility management ...................................................................................... 15  
    Cultivation and mulching ....................................................................................... 16  
    Soil and moisture conservation ........................................................................... 16  
    Weed control methods ......................................................................................... 17  
  Diseases and insects ................................................................................................ 18  
    Diseases .................................................................................................................. 18  
    Insects .................................................................................................................... 19  
  Harvesting and processing ....................................................................................... 20  
  Marketing .................................................................................................................... 20  
  Production constraints .............................................................................................. 21  

**Conclusion** ............................................................................................................... 22  

**References** ............................................................................................................. 23
List of Figures

Table 1. Physical and chemical properties of soil samples collected from Serero and Gudisse PAs.................................................................5
Table 2. Coffee varieties planted/grown in the farmers’ field in the surveyed areas .........................................................................................9
Table 3. Major weed species in coffee fields of the study area ...................18
Table 4. Principal farmers’ problems, and suggested potential solutions.........21
Introduction

Coffee production and management in Ethiopia vary with regions and their environmental conditions, which, in turn, govern the farming systems of a given area. Identification of such practices and traditional knowledge of the coffee culture has importance for farmers, researchers and policy makers. In view of this, diagnostic survey was conducted on coffee-based farming systems of Darolebu Wereda, West Hararghe Zone of the Oromiya Region, with the objectives to characterize and document farmers’ traditional knowledge of coffee varieties, nursery and field management practices, method of harvesting and processing, and marketing conditions. It was also attempted to identify major constraints in the process. This document will help identify and prioritize major coffee production constraints, and proposes appropriate technologies that could improve coffee productivity of the area.
Description of the Study Area

Topography

Serero and Gudisse have an altitude of 1800 and 1750 meters. The PAs are characterized by rolling hilly mountains and gentle to steep slopes with rugged topography. Thus, the soils are vulnerable to erosion and land degradation, unless properly used using traditional farmers’ knowledge and/or improved natural resource management technologies.

Rainfall and temperature

The area experiences a bimodal pattern of rainfall with peaks in April to May and July to September. It receives 1045 mm of rainfall per annum and has average minimum and maximum air temperatures of 13.0 and 27.6 °C, respectively. November, December, January and February are the drier months in which the monthly rainfall is below 30 mm. January to March is warm with an average maximum temperature of 26.7 °C.

Crop production is practiced in both Meher and Belg seasons, though the majority of the crops are produced in the former because of unreliability and small amount of the rains in the latter season. Land preparation for most rain fed crops starts when residual soil moisture is obtained during the small shower in the dry season.

Soil Properties

The soils at the study area are Vertic Luvisols, Phaeozems, Eutric Cambisols and Nitosols (Paulos, 1994). The physical and chemical properties of the soils are shown in Table 2. The soil at the PAs is sandy clay and sandy clay loam, and has a strong acidic reaction with a pH of 5.2 and 4.2 for Serero and Gudisse, respectively. It has low
total N, organic carbon and available P (Table 1). These indicate that the soil has low fertility with regard to crop production. Thus, it needs to be amended with organic and/or inorganic sources of fertilizers to sustain the natural resource and the livelihoods of people in the area.

**Table 1. Physical and chemical properties of soil samples collected from Serero and Gudisse PAs**

<table>
<thead>
<tr>
<th>Physicochemical properties</th>
<th>Peasant Association</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Serero</td>
</tr>
<tr>
<td>Texture</td>
<td>Sandy clay</td>
</tr>
<tr>
<td>pH (1:2.5 H₂O)</td>
<td>5.2</td>
</tr>
<tr>
<td>Total N (%)</td>
<td>0.2</td>
</tr>
<tr>
<td>Available P (ppm)</td>
<td>2.5</td>
</tr>
<tr>
<td>Organic carbon (%)</td>
<td>1.1</td>
</tr>
<tr>
<td>Organic matter (%)</td>
<td>1.9</td>
</tr>
</tbody>
</table>

**Demographics**

Darolebu is one of the 180 weredas of the Oromia Regional State found in the West Hararghe Zone. It is bordering Shebelle River which separates it from the Bale Zone in the south, Arsi Zone in the west, Guba Koricha in northwest, Habro Wereda in the north, and Boke Wereda in the east (Figure 1).

According to the 2005 report of the Central Statistical Agency (CSA), the wereda has an estimated population of 155,644, of which 75,300 are males and 80,344 are females; and 8.58% of the population lives in urban areas, which is less than the zone average of 9.6%. With an estimated area of 4,388.91 km², Darolebu has an estimated population density of 35.5 people per km², which is less than the zone average, 101.8 per km².
Methodology

Survey procedure, data collection and analysis

A survey was conducted in January 2009 in Darolebu Wereda, representing the major coffee producing wereda of West Hararghe Zone of the Oromiya Region (Figure 1). The area is known for its high cup quality Harar coffee brand, which fetches premium prices in the world market.

A team of researchers consisting of an agronomist, a plant breeder, a soil scientist and an extension expert from the Jimma Research Center (JRC) participated in the survey. The team discussed with experts and development agents (DAs) of the wereda’s Agricultural and Rural Development Office on the objectives of the survey, and selected two peasant associations (PAs), namely Serero and Gudisse, based on their production potential, their accessibility and representativeness of the farming system. From each PA, 15 farmers were selected to represent innovative, late adopters and those who are skeptical of agricultural technologies. The selected farmers were interviewed using structured questionnaires for their knowledge of coffee varieties, nursery and field management practices, coffee harvesting and processing, markets and marketing systems and some relevant information about the farming systems of the study sites. Besides, coffee production constraints in the selected PAs were assessed by questioning 15 selected farmers, and 15 wereda experts and DAs.

The team observed the farming system through transect walk. It also visited the selected farmers’ field in each PA, and had an overview of the existing cropping system, vegetation cover and associated farm elements. Other quantitative secondary data were also collected from the Agricultural and Rural Development Office of the study wereda, the respective DAs in each PA, JRC and National Metrological Service Office. The data were analyzed using Statistical Product and Service Solutions (SPSS).
Soil analysis

Six to seven soil samples were collected at 0 – 20 cm depth from randomly selected coffee farms in each of the selected PA, and then bulked to get one sample from a PA. The bulked samples were air-dried and ground to pass through a 2 mm sieve, and physicochemical properties of the soil, i.e. texture, soil reaction (pH), total nitrogen (N), available phosphorus (P), exchangeable potassium (K) and organic carbon (OC), were analyzed in the laboratory at JRC.

Texture of the soil was determined using hydrometer as described by Day (1965). The pH was measured using a glass electrode meter on a 1:2.5 soil water suspension (Page, 1982). Total N was determined by Kjeldahl method (Bremner and Mulvaney, 1982). Available P was extracted by the Olsen and Sommers method (1982). Exchangeable K was extracted by the calcium-phosphate-acid methods (Thomas, 1982). Organic matter content was calculated by multiplying OC by 1.724 (Brady and Weil, 2002).

Figure 1. Darolebu Wereda and study area in West Hararghe Zone.
Survey Findings

Coffee varieties and cropping systems

Varieties
The nationally released coffee berry disease (CBD) resistant selections originated from southwestern Ethiopia fail to adapt in both East and West Hararghe coffee growing zones. Consequently, farmers in the study areas still depend on the heterogeneous local land race cultivars, which are known by different vernacular names. There are seven locally known agro-types, which have distinct difference in morphology, yield, CBD resistance and agronomic characteristics (Table 2). The names are derived from the name of the first collector or introducer, or the area of collection, or the agronomic characteristics of each coffee type.

Farmers grow three or more local varieties in their individual orchards based on their tolerance to moisture stress, resistance to diseases and pests. Accordingly, for the low altitude areas, where CBD prevalence is low, but high temperature and shortage of moisture is a problem, they grow more adapted land races, such as Shimbure. However, in the CBD prone areas, they grow less susceptible cultivars such as Buna Kela, Shimbure and Buna Guracha although such cultivars are known to be inferior in terms of their productivity and quality attributes. However, all the respondents are very interested to plant high-yield, diseases resistant and drought tolerant and adaptable improved coffee varieties, if any. In this regard, the varieties that are in pipeline or the final stage of verification at Mechara and Micheta will satisfy the high demand for such varieties by coffee growers.
Table 2. Coffee varieties planted/grown in the farmers’ field in the surveyed areas

<table>
<thead>
<tr>
<th>Local name</th>
<th>Yield character</th>
<th>Growth character</th>
<th>Leaf character</th>
<th>Fruit character</th>
<th>Diseases and stress condition</th>
<th>Other characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cherchero</td>
<td>Medium, irregular</td>
<td>Medium, vigorous, open, thin and long branch</td>
<td>Bronze tip</td>
<td>Small and round</td>
<td>Medium resistant to CBD, prone to water stress</td>
<td>Two types, “Guda and Tina”</td>
</tr>
<tr>
<td>Buna Guracha</td>
<td>Poor, irregular</td>
<td>Medium, vigorous, open, long internode</td>
<td>Green tip</td>
<td>Large and long dark red</td>
<td>Susceptible to blight, resistant to CBD</td>
<td>Ripe fruits easily picked</td>
</tr>
<tr>
<td>Goma</td>
<td>High</td>
<td>Medium internode and vigorous, open</td>
<td>Narrow and short, bronze tip</td>
<td>Small and round, light red</td>
<td>-</td>
<td>Preferred for yield and fragrance</td>
</tr>
<tr>
<td>Shimbure</td>
<td>Good</td>
<td>Good vigorous, compact</td>
<td>Bronze tip, narrow, long</td>
<td>Small and round, dark red</td>
<td>Resistant to CBD</td>
<td>Two types, “Gebaba and Dera”</td>
</tr>
<tr>
<td>Buna Kubania</td>
<td>Poor, irregular</td>
<td>Poor vaguer, open, medium internode</td>
<td>Bronze tip, small, poor retention</td>
<td>Small and round, dark red</td>
<td>Susceptible to branch die back</td>
<td>High sucker initiation</td>
</tr>
<tr>
<td>Abadiro</td>
<td>Very high, irregular</td>
<td>Vigorous, open, thin and long branch</td>
<td>Bronze tip, broad long, thin and leather</td>
<td>Small and round, light red</td>
<td>Susceptible to CBD</td>
<td>-</td>
</tr>
<tr>
<td>Buna-Kela</td>
<td>Very high, irregular</td>
<td>Medium, vigorous, compact</td>
<td>Bronze tip, narrow, long, dark green</td>
<td>Large and round, dark red</td>
<td>Highly resistant to CBD</td>
<td>-</td>
</tr>
</tbody>
</table>
Cropping systems
All the surveyed area is cultivated, with the average holding ranging between 0.2 and 0.5 ha. Crops grown are divided into major and complementary crops. The major crops are coffee, Chat, sorghum, maize and teff. These crops are said to be major in terms of land allocation or area coverage and farmers’ dependency for cash source and food. Haricot bean, millet, flax, sesame, sweet potato, groundnuts, chickpea and various horticultural crops are complementary crops.

Coffee and chat are the predominant cash crops in the area. Chat provides income throughout the year, while coffee provides a large sum of income once a year, which is used to purchase materials for shelter and household furniture making, and for covering expense of social occasions like weeding.

Farmers in the area grow a variety of crops to overcome risks, such as crop failure, crop loss due to erratic rainfall. In addition to this, shortage of land and labor also forces the farmers to grow many crops simultaneously on pieces of land. Hence, the major advantage of growing many crops simultaneously is to maintain a steady food supply for the family, secure cash for the purchase of farm inputs and other family needs.

Intercropping the major or complimentary crops is the most common cropping pattern practiced by coffee producing farmers. Some farmers also practice double cropping of maize with teff, haricot bean, maize and sweet potato in coffee fields. They grow the intercrops either in rows using the recommended spacing for the crops or broadcast between rows of coffee trees.
Coffee husbandry

Seed preparation and nursery management

The majority of the respondent farmers raise their own coffee seedlings. They get coffee seeds either from the Agricultural and Rural Development Office or from their own seed orchard. Farmers practice two methods of seed preparation: (1) collect ripe red cherries of local coffee types and dry them with their two seeds under shade; or (2) remove the pulp from the collected cherries by hand and dry the parchment seed under shade usually in their backyards. Farmers keep the dried cherry and the parchment seed under room temperature on clean ground in well-ventilated container until sowing.

Farmers do not produce polythene-grown seedlings because of its unavailability and associated costs. The major reasons that limit farmers not to grow coffee seedlings using polythene are:

- polythene is not available in the local market around the study area;
- preparing the media and filling the pots with the media demands large amount of labor, and
- polythene-grown seedlings require frequent watering, which is not practical in the study area mainly due to unreliable amount and erratic distribution of the rainfall, and the inaccessibility of underground water, rivers and springs to many farmers.

Farmers raise seedlings in fine seedbeds. First they prepare a seedbed of about 1 meter width and 5 - 10 m length by digging a trench of 20 - 30 cm depth, and later they incorporate the trench with a mixture of plant debris (chopped plant leaves and young stems of *Erythrina*, and maize and sorghum stock), and topsoil. The seedbed is elevated on the trench with a mixture of fine soil and manure and/or compost with varying amount (10 – 12 kg/bed). In addition, when they prepare seedbed they also bury plant debris around or between the beds. This practice helps supply moisture for the seedlings by releasing water slowly from the buried plant parts and it also increases the level of soil organic matter after decomposition.
Farmers practice two methods of seed sowing. They use either dried cherry with its seeds (*Jenfel*) or parchment seed. The *Jenfel* is sown in the nursery bed by drilling with no space between *Jenfel* within rows and 15 and 20 cm between rows. Similarly, the parchment seeds are sown at a distance of 10 and 15 cm within and between rows to a depth of 2 to 3 cm with the grooved side of the seed downward. In both methods, sowing is accomplished in April.

After sowing, the nursery beds are heavily mulched with grasses or tree leaves, or with chopped maize or sorghum stover of approximately 5 cm thickness. At the same time, overhead shades of approximately 60 cm height above the ground are constructed and all sides of the bed are covered with heavy grass pads or plant stems and leaves to minimize evapotranspiration. Seeds are left under this condition with no supplementary watering until germination. After germination, the mulch is removed from the germinated seeds, but maintained between the rows. Seedlings are cultivated by breaking the soils into fine tilth to cover soil cracks, a practice known as soil mulch, which is also useful to conserve soil moisture.

Seedlings are left without supplementary watering until field planting, unless severe plant wilting, which often occurs at a time of extreme dry weather, is noticed. It takes 12 to 14 months until field transplanting takes place after nursery sowing up. The planting operation is completed between April and July.

Farmers believe that seedlings obtained from such dry nursery are tolerant to adverse situations and their subsequent field performance is superior to seedlings produced by the improved technologies.
Field management

Holing and on-field planting
Before marking the land for holing and refilling, bench terraces are constructed on all kind of slopes following the contour of the land and a convenient square or rectangular individual ridge, locally known as Katara, is built for coffee seedling (Figure 3).

A 1 m wide and 1 m deep or 1 m wide and 50 to 60 cm deep holes are dug regardless of the growth nature of the coffee varieties. Holes are refilled layer by layer with young Erythrina stem or with plants having fibrous stems, top soil and manure and/or compost with varying amount, mostly ranging between one and three shovels. The holes are refilled up to the surface of the soil but below ridges. Usually, holing is done from February to April, and refilling is done in April.

Unlike most coffee producing regions of the country that use recommended spacing, farmers in the area plant coffee at wider spacings of 2 and 3 m between plants, and 3.5 and 4 m between rows (Figure 3). Planting is usually done 3 to 5 cm deeper than the normal nursery soil level of the seedling (collar level).

Planting coffee trees at wider spacing has the following advantages:

- allows farmers to intercrop their coffee with perennial and/or annual crops and so utilize resources in their limited holdings more intensively and efficiently;
- avoids competition for moisture and nutrients;
- makes weeding easy, and
- allows aeration and, hence, reduces the incidence of diseases and insect pests.

After planting, coffee trees are left to grow free with one central vertical stem. Suckers are removed to strengthen the tree and to use their leaves for making a drink boiled with milk, locally called Hoja, or served alone as Kuti.
Shading
Farmers in Serero PA grow coffee without shade in an open field. Consequently, biannual bearing habit and overbearing dieback are common problems. Besides, the wide spacing between trees, and the absence of shade increase the risk of soil erosion. Although the interviewed farmers are aware of their contribution to coffee husbandry, they do not grow shade trees with coffee. This is mainly because they believe that shade trees compete with coffee and other intercropped crops for the limited soil moisture. Besides, shade trees occupy spaces, which could have been used for growing other crops. On the other hand, farmers in Gudisse PA plant coffee trees under naturally established shade trees. The most commonly used shade trees, in decreasing order of farmers preference are Korch/Gorgo/Wolensu (Erythrina burana), Gerbi-Adi and Gerbi-Guracha (Acacia spp.), and Wanza (Cordia africana). Farmers responded that they have chosen these shade trees for their ability to boost coffee yield, ameliorate soil fertility and provide feed to livestock.

Stumping and pruning
Sixty-four respondents from Gudisse and all respondents from Serero PAs practice stumping to change the cycle of unproductive old coffee trees. It is done in January after crop harvest. Old coffee trees are stumped at 0.40 to 1.00 m height. The number of bearing heads left on stumped coffee trees varies from 3 to 4. Farmers leave these verticals to grow free. Most farmers practice handling and desuckering, and remove dead branches when the need arises. However, few farmers remove dead branches while they harvest coffee cherry, usually from September to January.

Soil fertility management
The high cost, scarcity and timely unavailability of inorganic fertilizers and the absence of credit system force farmers not to apply mineral fertilizers to their coffee trees. Instead, they depend more on organic fertilizer sources, such as farmyard manure and/or compost, to fertilize their coffee field. Depending on its availability, farmers
apply 1 to 10 kg of farmyard manure and/or compost per tree in April and June.

Some farmers believe that if a coffee field sufficiently manured once, it can nourish the plant for two to three consecutive years compared to commercial fertilizers, which need yearly application. In the absence of enough amounts of organic sources and abundance of competition from other crops intercropped with coffee, farmers manure their fields every year.

**Cultivation and mulching**

Farmers commonly practice digging and hoeing or harrowing using spade and hoe 2 to 3 times per annum in September, April and July depending on the growth of weeds, moisture conditions and labor availability. This destroys weeds, facilitates water infiltration and aeration, reduce the adverse effect of soil cracking, enhance the capillary movement of soil moisture, and create catchments around each coffee tree for water harvesting during the rainy seasons.

Farmers use soil mulch by plowing the land to fine tilth and covering it with soil dust at the end of the rainy season (usually in October) and the beginning of the rainy months, mostly in May. Soil mulch is applied more frequently than organic mulch materials to prevent evaporation from the soil. This is mainly caused by shortage of organic mulch materials in the area. These techniques of long lasting moisture conservation indicate the traditional and innovative capability of the Hararghe farmers.

**Soil and moisture conservation**

The area is known for its short annual rainfall, which leads to moisture stress during crop growing periods. The problem is more pronounced when the rainfall comes late and stops early or at times of uneven distribution. Rugged topography of the area, which exposes the land to soil erosion, aggravates the problem. Farmers have adopted cultural practices aimed at reducing moisture loss through run off. Farmers employ a technique called *Katara*, which is similar to ridging. They construct the ridge in April or June, if it is
for the first time, and renew it in March or April. They also apply soil mulch in the months of October and May whereby soil cracks are regularly covered with soil dust to reduce evaporation and conserve soil moisture. These traditional land preparation methods effectively conserve soil and moisture in the farm and around each individual coffee tree.

**Weed control methods**
Grassy and broadleaf weeds are the major weeds in the coffee fields (Table 3). *Cypres* spp., *Cynodon* spp. and *Digitaria* spp. are some of the grassy weeds which require much labor for control. In general, coffee fields are kept free of weeds throughout the year using the following cultural practices:

- digging, hoeing or plowing between rows of coffee trees (if the field is to be intercropped) in March or April, June and September;
- digging out the weeds manually using a locally made tool known as Dengora, and
- pulling out weeds by hand between and within rows of coffee trees.

Farmers weed their coffee farm by the above methods using family labor or Guza, community labor. However, slashing, which is the most common weed control method in other coffee growing areas, is not implemented in the study area. Similarly, farmers do not use herbicide because it is not affordable for them. Thus, improved and affordable technologies should be generated for effective control of the weeds.
Table 3. Major weed species in coffee fields of the study area

<table>
<thead>
<tr>
<th>Scientific name</th>
<th>Common name</th>
<th>Type of weed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parthenium hysterophorus</td>
<td>Congress weed</td>
<td>Broadleaf</td>
</tr>
<tr>
<td>Tagetus minute</td>
<td>Mexican marigold</td>
<td>Broadleaf</td>
</tr>
<tr>
<td>Amaranthus spp.</td>
<td>Pigweed</td>
<td>Broadleaf</td>
</tr>
<tr>
<td>Striga spp.</td>
<td>Witch weed</td>
<td>Broadleaf</td>
</tr>
<tr>
<td>Commelina spp.</td>
<td>Water grass</td>
<td>Broadleaf</td>
</tr>
<tr>
<td>Guizotia scabra</td>
<td>Tufo (Afan Oromina)</td>
<td>Broadleaf</td>
</tr>
<tr>
<td>Bidens pilosa</td>
<td>Black jack</td>
<td>Broadleaf</td>
</tr>
<tr>
<td>Galinsoga parviflora</td>
<td>Gallant soldier</td>
<td>Broadleaf</td>
</tr>
<tr>
<td>Lanthana spp.</td>
<td>-</td>
<td>Broadleaf</td>
</tr>
<tr>
<td>Cynodon spp.</td>
<td>Bermuda grass</td>
<td>Grass</td>
</tr>
<tr>
<td>Eleusine indica</td>
<td>Wild finger millet</td>
<td>Grass</td>
</tr>
<tr>
<td>Cyopus spp</td>
<td>Nut sedges</td>
<td>Grass</td>
</tr>
<tr>
<td>Digitaria spp.</td>
<td>Couch grass</td>
<td>Grass</td>
</tr>
</tbody>
</table>

Diseases and insects

Diseases
Coffee in the study area has been increasingly threatened by CBD followed by coffee leaf rust (CLR) and branch dieback. CBD is more sever in medium to high altitudes, while CLR is a problem in lower altitudes. During prolonged dry seasons, the coffee trees become more susceptible to rust. Farmers believe that the problem have been aggravated by the absence of locally screened coffee types resistant to the disease, and lack of improved cultural control method to CLR.

However, farmers have some traditional knowledge and experience to control the diseases. These include planting coffee seedlings in deeper and wider hole to attain well established trees capable of absorbing ground water so as to make the tree less susceptible to the diseases; planting coffee trees under shade to reduce transpiration and make them less stressed (not to be easily attacked by the diseases); application of farmyard manure and/or compost. Frequent cleaning and burning of fallen leaves, fruits and other plant debris and screening of local coffee lines relatively resistant to the diseases are some of disease control measures practiced by farmers. Although
the use of resistant land race cultivars effectively controls the diseases, it should be supported by research findings. The current land race development program run at Mechara by JRC and Mechara Research Center is in line with the farmers’ effort.

**Insects**

Ants, termites, antestia, thrips, leaf miner and stem borer are the major pests attacking the crop. The coffee trees become more susceptible to the pest when there is a prolonged dry season during production years.

Coffee growers apply different traditional management practices, such as adding ash around coffee trees, flooding or burning or digging mound, and killing the larva manually by inserting stick into a hole burrow by insect, for the control of ant, termite and stem borer. But such traditional control methods may not be adequate for effective control. Local pest resisting materials and control methods should be investigated by research so as to provide the farmers with efficient and economical pest control methods.
Harvesting and processing

Coffee trees flower from January to April. However, the main flowering occurs in April. Harvesting is mainly done in the months of October to December, and rarely, early maturing local cultivars are harvested in September. Farmers collect red cherries from trees, and those fallen down by wind, animals and rain. They do not allow the cherries to dry while they are on the trees. The cherries collected from the trees and from the ground are sun-dried separately on clean ground or on a canvas laid on the ground. Farmers store the dried cherry in jute sack (sisal bag) in their house until taken to the market.

Marketing

Coffee is some times sold by women in pieces on market days and is mainly meant for covering minor expenses, but large quantities are sold by household heads to coffee collectors or wholesalers. If the coffee farmers are not in need of money, they store the dried cherry up to one year to attain a better price.

Premium price is not paid for good quality harvest and drying procedure. This discourages farmers not to harvest and process their coffee with great care. This signals that, if the trend continues unabated, it is very likely that the genetic basis of the typical Moka flavor of Harar Coffee will face irreversible quality deterioration. Furthermore, farmers claimed that they could not get fair share that would cover the cost of production. As a result, most farmers tend to shift their labor land to Chat. If this condition is not reverted, both the culture and coffee germplasm of the area will be lost in a short life span.
Coffee Production Potentials and Constraints in Darolebu Wereda

**Production constraints**

Farmers in the survey area have experienced several major problems caused by natural and social factors and/or policy related issues. However, they have their own strategies to overcome the problems. The major problems, farmers’ strategies launched against the problems, and suggested solutions are listed in Table 4.

**Table 4. Principal farmers’ problems, and suggested potential solutions**

<table>
<thead>
<tr>
<th>Major problems</th>
<th>Suggested solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extended drought and moisture stress</td>
<td>Developing drought tolerant varieties; developing improved soil and moisture conservation technologies that effectively conserve moisture, screening early maturing crop varieties; developing crop varieties compatible to the rainfall pattern of the area; strengthening the existing soil and water conservation activities; launching afforestation program and promote farmers to adopt water harvesting technologies;</td>
</tr>
<tr>
<td>Diseases (CBD, rust) and insect pests</td>
<td>Developing integrated pest management options that have long lasting solutions for the control of the disease(s); screening and evaluating local land races for diseases and insect pests, and drought resistant and good quality; developing improved cultural and chemical control methods and screening natural enemies that effectively control the diseases;</td>
</tr>
<tr>
<td>Shortage of arable land</td>
<td>Generating information on the right amount of fertilizers to be applied at sowing (planting) and subsequent periods; promoting the inclusion of agro forestry practice into the farming system and assessing appropriate combinations of crop for double, multiple and relay cropping and intercropping;</td>
</tr>
<tr>
<td>Overbearing dieback</td>
<td>Promoting planting of recommended shade trees in coffee farms in the appropriate level;</td>
</tr>
<tr>
<td>Soil fertility degradation</td>
<td>Introducing adaptable cover crops that improve soil fertility and serve as livestock feed; promoting the use of organic mulch; selecting or adopting appropriate soil conservation techniques; identifying multipurpose trees and shrubs suitable for the area to overcome problems of soil fertility, erosion, feed and wood shortages;</td>
</tr>
<tr>
<td>Absence of training</td>
<td>Conducting education campaign through public media; training on management and post harvesting activities should be organized by Mechara Research Center in collaboration with concerned research centers and be delivered to farmers, DAs and expertise; disseminating information using different mechanisms, such as leaflets and posters, on coffee production, processing and marketing to farmers, DAs and experts; building research capacity at Mechara Research Center; establishing strong relationship with farmers’ training centers (FTC) in different villages so as to raise the farmers' knowledge, attitude and practices of using improved technologies; establishing on-farm and station demonstration fields;</td>
</tr>
<tr>
<td>Labor shortage</td>
<td>Developing improved and profitable technologies for different crops; using modern agricultural technologies such as herbicides; screening efficient herbicides and screening and planting crop varieties that mature at different times;</td>
</tr>
</tbody>
</table>
Conclusion

Farmers in the study area rely on their traditional husbandry knowledge in crop production. Dry nursery seedling production should be studied in depth to investigate the scientific reasons for the success. Attempts should be made to investigate if dry nursery practice can be improved to produce large amounts of healthy and strong seedlings with the introduction of some improved technologies.

Coffee pricing should give due emphasis to quality so that farmers would be encouraged to produce quality coffee. This will improve and maintain the quality, productivity and sustainability of coffee production in the area. To achieve this, interactive, more rigorous and timely intervention is needed by the government as well as by non-governmental organizations.

Drought, unreliable and uneven rainfall distribution, diseases and insect pests, soil fertility degradation, shortage of arable land, shortage of labor, food and feed shortage, low price for coffee, absence of credit and saving institutions, lack of training on coffee production and processing are some of the principal production constraints in the study areas. Farmers’ alleviate these problems and ensure sustainable food supply for their own family by using local varieties and husbandry practices. Researches and development interventions focusing on these aspects should be done to complement the local varieties and farmers’ traditional knowledge.
References


