Finger Millet Production in the Amhara Region of Ethiopia

Research Report No 1

Amhara Regional Agricultural Research Institute  Collaborative Crop Research Program
Finger Millet Production in the Amhara Region of Ethiopia

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Abbreviations

AARC  Adet Agricultural Research Center
ABW  African bollworm
ARARI  Amhara Regional Agricultural Research Institute
BOFED  Bureau of Finance and Economic Development
ANRS  Amhara National Regional State
CACC  Central Agricultural Census Commission
CSA  Central Statistical Authority
DAP  Di-ammonium phosphate
PA  Peasant association
PRA  Participatory rural appraisal
SNNP  Southern Nations Nationalities and Peoples
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Introduction

Finger millet (*Eleusine coracana*) is a small seeded cereal grown in low rainfall areas of the semi-arid tropics and subtropics of the world under rain fed conditions. It is a hardy crop capable of providing reasonable grain yield under circumstances where other crops give negligible yield. Finger millet is a staple food crop in drought-prone areas of the world and often considered as a component of food security strategies.

In Africa, finger millet is grown by small-scale farmers often intercropped with other cereals, legumes or vegetables. It is an important staple food in East and Central Africa where it serves as a subsistence and food security crop. It is also important for its nutritive and cultural value, especially in traditional low-input cereal based farming systems (Huse et al. 1980). In Eastern Africa, it is produced in Ethiopia, Uganda, Kenya, Tanzania, Rwanda, Burundi, Democratic Republic of Congo, Sudan and Somalia (Oduori, 2005).

In Ethiopia, finger millet is grown mainly as a sole crop in rotation with other annual crops, preferably legumes. The crop is produced in Tigray, Amhara, Oromiya, Benishangul-Gumuz, Southern Nations and Nationalities and Peoples (SNNP), and Gambela regional states.

In the Amhara National Regional State finger millet is grown in all administrative zones except North Shewa. The Amhara region accounts for more than half of the total area and production of finger millet in the country. For instance, in 2003 cropping season finger millet was produced on 0.3 million ha with an average yield of 800 kg per ha. In terms of area coverage, North Gonder, West Gojam, and Awi Zones are the largest whereas North Welo, Awi and South Gonder Zones rank highest in productivity (Table 1).
Table 1. Area and production in the study areas in 2004/05

<table>
<thead>
<tr>
<th>Crop type</th>
<th>West Gojam</th>
<th>South Gonder</th>
<th>Awi</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Area (million ha)</td>
<td>Production (million tons)</td>
<td>Area (million ha)</td>
</tr>
<tr>
<td>Cereals</td>
<td>0.50</td>
<td>0.57</td>
<td>0.33</td>
</tr>
<tr>
<td>Finger millet</td>
<td>0.06</td>
<td>0.05</td>
<td>0.02</td>
</tr>
</tbody>
</table>


Finger millet is considered to be a low risk crop in the mid and lowland areas of the country where rainfall is erratic and total precipitation is low. Finger millet also grows well on marginal lands compared to other cereals. The crop can be grown on a wide range of soils but does well on fertile sandy soils.

Finger millet grain has high nutritional value and often consumed in the form of porridge, bread, local beverages (*areki* and *tela*), and enjera. The straw is used as forage for animals, thatching, and weaving. Despite its importance and significance, finger millet production practices, the challenges farmers are facing, opportunities of finger millet production; marketing, and utilization were not systematically assessed and documented. Therefore, this baseline study was conducted in major finger millet production areas of the Amhara Regional State with the following objectives:

- To understand and document smallholder farmers’ finger millet production practices; and
- To assess technical, social and policy factors limiting finger millet production, marketing and utilization with a view to establish a framework for future research and development of the crop.
Methodology

Survey Procedures

The study was conducted in West Gojam, South Gonder and Awi Zones of the Amhara Regional National State (ARNS) of Ethiopia by a multidisciplinary team of experts drawn from plant breeding, crop protection, agronomy and physiology, food science and research and extension.

The study began by reviewing relevant secondary data and literature followed by a reconnaissance survey to identify major finger millet producing zones and weredas. Accordingly, three major finger millet growing zones namely West Gojam, South Gonder and Awi administrative zones were selected based on area coverage and production volume. Following the identification of the three zones, two weredas from West Gojam and one wereda from each of South Gonder and Awi zones were selected for intensive study. Again from each wereda, 2-3 peasant associations were purposefully selected with the assistance of extension experts from the respective wereda agricultural development offices.

Primary data and information were collected using participatory rural appraisal (PRA) techniques including personal interviewes of male and female headed households, key informants and group discussion involving farmers of different age groups, sex and wealth status. For this purpose a checklist and a semi structured questionnaire were employed to guide the the discussions with farmers and key informants. Depending on the sheer size and population of the PA in question, 15-42 farmers from each of the identified peasant associations were involved in the discussions. On the whole, information was collected form 328 farmers from 11 peasant associations of which 25 were women farmers. Farmers were allowed to discuss and share their views freely (Table 2).
Table 2. General information characterizing some of the peasant associations included in the study

<table>
<thead>
<tr>
<th></th>
<th>Mecha</th>
<th>Ambo Mesk</th>
<th>Wonchit</th>
<th>Qorata</th>
<th>Gedam Geregera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abiyot Fana</td>
<td>41</td>
<td>22</td>
<td>20</td>
<td>43</td>
<td>30</td>
</tr>
<tr>
<td>Area (ha)</td>
<td>2729</td>
<td>2394</td>
<td>N.A</td>
<td>N.A</td>
<td>2775</td>
</tr>
<tr>
<td>Altitude (m a.s.l)</td>
<td>N.A</td>
<td>1980</td>
<td>N.A</td>
<td>N.A</td>
<td>N.A</td>
</tr>
<tr>
<td>Soils (%)</td>
<td>Red (82), Brown (15), black (3)</td>
<td>Red (97), Black (3)</td>
<td>Red</td>
<td>Red</td>
<td>Red (90), black (10)</td>
</tr>
<tr>
<td>Landscape (%)</td>
<td>Plain (85), Undulating (8), Swamp (3), Gorge (3), Hilly (1)</td>
<td>Plain (98), Gorge (2)</td>
<td>N.A</td>
<td>N.A</td>
<td>Plain (65), Undulating (25), Hilly (10)</td>
</tr>
<tr>
<td>Number of streams</td>
<td>8</td>
<td>N.A</td>
<td>N.A</td>
<td>N.A</td>
<td>7</td>
</tr>
</tbody>
</table>

Note: N.A= Not available

The Study Areas

The study was conducted in representative locations of West Gojam, South Gonder and Awi Zones of the Amhara Regional National State (ARNS) of Ethiopia (Fig 1). The Amhara region is located 9°20'–14°0' N and 36°20'–40°20' accounting for 16% of the total area of the 1.1 million km² and 25% of the estimated 75 million inhabitants of Ethiopia.

The altitude of the Amhara region ranges from 500 to 4620 m at the peak of Ras Dashen. The region is traditionally classified into three major agricultural climatic zones, namely dega (above 2300 m), weina dega (1500-2300 m), and kola (below 1500 m). The region receives annual rainfall ranging from 300 mm in the extremely dry areas of the east to 2000 mm in the western part. The temperature of the region varies between 7.5°C to 37°C. The study area is characterized by one effective rainy season extending from June to September followed by a long dry season with intermittent showers in April and May. While crop production is restricted in the wet season, the intermittent showers are crucial for land preparation.
The region has four drainage basins namely the Blue Nile, Tekeze, Awash and Danakil. Lake Tana, the largest lake of Ethiopia and the third largest in Africa, is located at the heart of the region.

With a combined area of 22.5 thousand km², the study zones of West Gojam, South Gonder and Awi zones support 2.6, 2.2 and 1.0 million inhabitants, respectively. About 70% to 85% of the study area ranges in altitude from 1500-2500 m.a.s.l, which is dominated by red soils.

The land use pattern of the three zones vary widely (Table 3). While a significant portion of west Gojam constitutes wet land and plantation forest, much of south Gonder is cultivated followed by shrubs. In Awi
zone, natural forest and wet land make up much of the land use (Table 3).

Table 3. Land cover/land use pattern of the study zones (%)

<table>
<thead>
<tr>
<th>Land use type</th>
<th>West Gojam</th>
<th>South Gonder</th>
<th>Awi</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afro alpine</td>
<td>0.0</td>
<td>4.4</td>
<td>0.0</td>
</tr>
<tr>
<td>Cultivated land</td>
<td>11.3</td>
<td>12.8</td>
<td>6.9</td>
</tr>
<tr>
<td>Grass land</td>
<td>8.2</td>
<td>7.9</td>
<td>4.4</td>
</tr>
<tr>
<td>Natural forest</td>
<td>3.4</td>
<td>0.2</td>
<td>35.0</td>
</tr>
<tr>
<td>Plantation forest</td>
<td>16.5</td>
<td>3.2</td>
<td>6.8</td>
</tr>
<tr>
<td>Wood land</td>
<td>8.5</td>
<td>1.2</td>
<td>11.1</td>
</tr>
<tr>
<td>Shrub land</td>
<td>2.6</td>
<td>9.6</td>
<td>4.0</td>
</tr>
<tr>
<td>Wet land</td>
<td>33.2</td>
<td>3.6</td>
<td>17.3</td>
</tr>
<tr>
<td>Others</td>
<td>2.1</td>
<td>6.8</td>
<td>0.7</td>
</tr>
</tbody>
</table>


Production, Marketing and Utilization

Crops grown
Finger millet is the principal crop in all the study weredas followed by either maize or noug (Guizotia abyssinica). Minor crops include barley grown either on residual moisture or during the main rainy season, tef, grass pea, hot pepper, lupine, mustard, wheat, faba bean, chickpea, groundnut, haricot bean and field pea. The composition of the minor crops vary greatly with time and space.

Finger millet is mainly grown on relatively fertile red soils (Nitosols) in rotation with other crops. The precursor crops in order of preference are maize, noug, barley, and tef.
Production
At a national level, in the 1998/99 crop season, about 8 million hectares of land were devoted to crop production from which 8.6 million tons of grain were harvested. Of this, finger millet constituted 5.6% of the area and 4.4% of the produce. In the 2004/05 crop season, the area devoted to crop production increased to 17.2 million ha from which 21.7 million tons of grain was harvested (Table 4). The share of finger millet, however, declined to 1.7% and to 1.4% in terms of area and production, respectively. Similarly, both finger millet area and production have declined in most of the study areas due to the expansion of maize and increased incidence of diseases (mainly head blast) and insect pests (grass hoppers and shoot fly). Furthermore, poor soil fertility, continuous cultivation, land scarcity and weed infestation have all contributed to the low productivity of finger millet.

Recently, in Mecha wereda, besides the expansion of maize due to its high productivity, eucalyptus plantations have expanded significantly at the expense of finger millet production. Farmers claim that eucalyptus trees provide higher return to land than cereals. The production of eucalyptus has become attractive due to the combined effects of lower production costs and relatively better timber prices. Consequently, almost all farmers in the study area have allocated a portion of their land to eucalyptus production. Farmers, however, are aware of the deleterious shading and antibiosis effects of growing eucalyptus near and around annual crops. Trees also drain underground water reserves affecting own as well as neighboring farmer fields. As a result tree growing has become a source of friction among neighbouring farmers.

In other areas such as Guangua wereda, however, finger millet production has increased due to a shift from tef and conversion of fallow lands to finger millet production. Finger millet is considered a low-risk crop, less liable to hail and other environmental hazards.
Farmers claimed finger millet yield vary greatly from location to location depending on tillage and fertility management practices, and other plot specific cultural practices such as weed control regimes. Under normal condition finger millet yield ranges from 0.4 to 1.9 ton/ha depending on the level of input use.

**Varieties grown**

Several finger millet varieties are grown in the study areas. Widely recognized and cultivated finger millet varieties include: *Necho, Angede* and *Deke* (Table 5). It is worth noting that the same variety may have different names in different localities. For instance, finger millet
varieties in Guangua and Jabi Tehnan have got different names from that of Mecha, although, the reported varieties have similar characteristics.

*Necho* is a white seeded, high yielder, early-maturing finger millet variety grown on relatively fertile and drained red soils. It makes good looking *enjera* much similar to the *enjera* that could be baked from white-seeded tef but with lower luster and taste. *Necho* commands relatively high price in the local market. The straw yield of the variety, however, is low due to its rough stems rendering it less palatable to livestock. As a result, *Necho* is less preferred by farmers.

*Angede* is a red-seeded, late maturing and high yielder cultivar having more or less similar physical features to *Necho*. It has got excellent plant stand with high tillering capacity. The grain is claimed to have high water holding capacity while the straw is good for livestock. The variety, however, is susceptible to drought and head blast and performs poorly under low soil fertility conditions.

*Tikur*, traditionally mean black is one of the preferred finger millet varieties for its grain and straw qualities. It is often called the father of all varieties or the founder variety owing to its baking quality and water holding capacity of the grain. Farmers claim that *Tikur* has a property known as *bereket* meaning that significantly more number of *enjera* can be baked from a given unit of grain compared to the same unit of grain from other finger millet varieties. Although *Tikur* displays good performance at the early stage of its growth and development, it suffers severely from head blast at grain feeling stage. It fetches reasonably good price but not as high as *Necho*.

*Deke* is an extra early maturing, blast resistant, easily treshable and high yielding finger millet variety with tiny black and white grains. It is believed to have been brought from Deke, a locality somewhere around
Laka Tana. The grains of Deke cultivar have got high water holding capacity and makes soft injera. The straw, however is of low quality least preferred by livestock.

Improved varieties are virtually non-existent in the study area. Past improved finger millet variety demonstration activities, particularly in Koga Irrigation Project area, did not succeed in persuading farmers to adopt demonstrated varieties. Recently, two improved varieties, Tadesse and Padet, were released and demonstrated in Dera and Mecha woredas. The fingers of these improved varieties: although shorter and fewer in number, produced higher grain yield than the local, black variety. However, the grain of the improved varieties are said to have low water holding capacity (ayberekitim) making it less preferred by women. Furthermore, the straw of the improved varieties are not only of poor quality (stiff) but also low in terms of quantity making the varieties less attractive to farmers. Future variety development efforts, therefore, need to consider characters that farmers value most. The most important characteristics considered by farmers for selecting finger millet varieties include early maturity, high tillering capacity, straw palatability and grain yield, threshability, grain color, number and length of fingers, resistance to diseases and pests. Finger millet varieties grown in Guangua and Jabi Tehnan are given in Table 6.

**Land preparation**

Timing and frequency of land preparation for finger millet largely depends on precursor crop and resource endowment of a household. Some farmers plough fields designated for finger millet production at regular monthly intervals while others may not even plough at all in the dry season.

In most instances, fields planned for finger millet production are ploughed 7 to 12 times from January to March by oxen drawn traditional plough. For a maize precursor for instance, the field is
usually ploughed two to five times immediately after harvest most often in February, twice in March, once in May and then planted to finger millet in June with a final pass.

In case of a barley precursor which is often harvested in September, the field is ploughed four times and planted to lupine or noug. Harvesting the lupine in March, the field is ploughed three to four times immediately after harvest, three times in May and then planted to finger millet in June. According to farmers, ploughing fields designated for finger millet in May reduces blast incidence. Farmers also claim the likelihood of blast and insect pest incidence would be reduced and better plant stand establishment achieved if fields are ploughed in March/April following the small rains. Nonetheless, overlapping of operations particularly land preparation for maize prevents them from doing so.

**Planting**

Finger millet planting largely depends on the onset of rainfall. In West Gojam, the best planting time is the second week of June. In Dera wereda of South Gonder zone, finger millet is planted from the third week of June to the second week of July while in Jabi Tehnan area, planting is done from the end of June to mid July. In Guangua, planting extends to the end of July. In Guangua area, planting is carried out one week after the last tillage accompanied by *gulgualo* in July. *Gulgualo* is the practice of removing weeds and crop debris from a field and then trampling the field by livestock for better seedling establishment and as a means of weed control. In all cases, seeds are broadcasted on the field and then covered by a last pass of oxen drawn traditional maresha.

**Intercropping**

Intercropping finger millet with other crops is a rare practice in the study area. In some fields where the precursor crop is maize, one may find mustard plants growing among finger millet plants. These are volunteer
plants growing uninvited and should not be mistaken for intercropping. It is worth noting that in some cases lupine may be grown as a border crop around finger millet fields as a deterrent from encroaching animals.

In Guangua and Jabi Tehnan, the practice of intercropping finger millet with other crops which was once a common practice has declined considerably. The use of 2,4-D as a means of weed control in finger millet fields has discouraged farmers from intercropping finger millet with broadleaved crops. And yet, in Guangua wereda, finger millet is intercropped with sparse populations of sunflower and rarely with linseed and lupine.

**Crop rotation**

Crop rotation is a well known agronomic practice in the study area. In most cases finger millet is grown after maize, barley, noug, tef or hot pepper. In Dera, the most ideal sequence is maize followed by finger millet and then tef. The tef field could then be planted to maize and ultimately to finger millet suggesting maize can be grown two years after finger millet. Development agents in the study area, however, do not support the practice of growing finger millet after tef. According to the development agents, growing finger millet after tef depletes the soil as both crops have got similar shallow root structures and soil nutrient requirements and hence should not be planted one after the other.

In Guangua finger millet may be preceded by noug, maize, barley, tef, hot pepper depending on the fertility status of the plot in question. Some farmers in Guangua area also grow finger millet as mono crop for three consecutive cropping seasons.
Seed source and seed rates

Farmers reported that there is no finger millet seed supplier in the region and hence depend on their own seed, acquire from neighbours, relatives or local market through bartering or cash purchases.

In the study area farmers use highly variable seed rate depending on location, degree of soil pulverization and soil fertility of the plot. In Mecha and Dera, most farmers use a seed rate of 40 to 50 kg per hectare. On well pulverized and fertile plots, however, a lower seed rate of 20-30 kg/ha is often used.

In Guangua wereda, most farmers generally use a higher seed rate of 50 kg/ha whereas in Jabi Tehnan a lower seed rate, ranging from 16 to 30 kg/ha is used. Farmers deliberately use higher seed rates in an attempt to get higher density but thinner plants which ultimately produce good quality straw.

Fertilizer use

Most farmers are well aware of the importance of using the right amount of inorganic fertilizers on grain yield of finger millet. Fertilizer use on finger millet in the study area largely depends on the level of soil fertility of the plot and resource ownership of households. Most farmers use 100 kg/ha Diaamonium Phosphat (DAP) while others apply 100 kg DAP and 50-60 kg Urea per ha. Usually the fertilizer is broadcasted along with the seed and then trampled by animals. Few farmers apply all of the DAP and half of the urea at planting and the remaining half of the urea at weeding.

Farmers gave contradictory report on the usefulness of urea fertilizer on the production of finger millet. While some claim application of Urea has detrimental effects on grain yield of finger millet, others advocate the use of urea fertilizer mixed with DAP.
Weeding

Weeding is one of the most important cultural practice used in the production of finger millet. A wide variety of weeds attack the crop of which mech (Guizotia scabra), adiyo (Bidens spp), yekok sar (Arthraxon micans), dimum (Setaria pumila), lanbut (Polygonum nepalense), rench (Corrigola capensis), akakima, muchich, gorteb (Plantago lanceolata), yewof gomen (Erucastrum arabicum), amora guaya, wazzima (Medicago spp) and serdo (Cynodon dactylon) appear to be of economically significant. Normally, weeding finger millet fields starts 40 days after planting. It is claimed that early weeding enhances tillering. In most instances, finger millet fields are weeded once from August to September. In some cases where the weed composition is diverse and the density is high, a second weeding may be done in September.

In Jabi Tehnan, 2,4-D herbicide is commonly used on finger millet supplemented with one hand weeding 15 days after spray. Although farmers in Jabi Tehnan prefer to hand weed their fields, labour shortage has forced them to resort to herbicide application.

Diseases and pests

Pests and diseases such as head blast, grasshoppers, African bollworm (ABW), stalkborer and shoot fly are common production constraints on finger millet in the study area.

According to farmers, head blast, particularly in moist and windy weather, inflicts considerable damage on the crop. African bollworm and shoot fly, however, are occasional pests. In some seasons, one may find as many ABW larvae as the number of fingers making the whole panicle chaffy without fruit. Farmers reported that little maggots which might probably be shoot fly larvae emerge when the shoot at the seedling stage is pulled out.
Contrary to popular belief which says that ploughing a field immediately after harvest by exposing all carryover pest and disease agents to the vagaries of weather reduces pest and hence ensure pest free environment the subsequent season, farmers in Mecha and Dera claim that such a practice creates favourable environment for the proliferation of grasshoppers and blast. Similarly, farmers of Guangua and Jabi Tehnan reported ploughing in April enhances the prevalence of head blast. On the other hand, farmers argue that leaving the field unploughed for the entire dry season and then ploughing in May after the on-set of the small rains reduces the incidence of both grasshoppers and blast. This cairn, however, have no scientific support and hence merit further investigation.

Harvesting and threshing
Time of finger millet harvesting varies depending on variety, planting time and location. Generally, finger millet is harvested from November to mid January while threshing is done form January to March. Threshing is the most arduous task in the cultivation of finger millet requiring up to 30 consecutive days. Threshing of finger millet involves three steps, namely, whole threshing (separating the straw from the head), head threshing (separating the seed from the panicle) and finally husk threshing (separating the husk from the seed). Farmers explain the difficulty of threshing as “dagussa taru …”, meaning the cultivation of finger millet is not only arduous but also its consumption results in constipation.

Storage
Finger millet grain could be stored in any container as long as required without loss of quality. Storing finger millet grain for 5-10 years was not uncommon in the recent past. In fact, the quality of the grain increases with time, the grain color and luster improves with time becoming more ideal for consumption. In the old days, farmers used to store finger
millet in dug up pits mainly for fire protection. Recently, however, with dwindling land per caput and low productivity of the crop as a result of biotic and abiotic factors much of the produce is consumed soon after production leaving very little to store anyway. Hence, available finger millet grain is stored for a short period mainly in mud silos, locally known as *gota*.

**Marketing**

According to farmers, there is hardly any surplus produce for the market. Nonetheless, as much as half of the produce may be marketed to generate cash required for settling debts for inorganic fertilizer and other related farm inputs. Farmers are expected to settle any outstanding debts as soon as the completion of harvesting. Therefore, most farmers sell their produce at harvest thereby glutting the market due to over supply. As a result farmers receive low prices as grain price fall due to the temporary glut of the market. In the study year, the price of a quintal (=100 kg) of finger millet grain at harvest was Birr 120 (≈US$12), which is much lower than 220 Birr (US$22), the price of the same unit and quality of grain during the rainy season. Had farmers stored the produce for six more months. The credit repayment system, therefore, by forcing farmers to settle their debt immediately after harvest have exposed them to a disadvantageous marketing practice. Despite the fact that finger millet is easy to store as long as necessary without losing quality, finger millet grain is not the choice traders consider to do business with. Lack of commercial seed is another marketing problem limiting finger millet production in the study area.

**Utilization**

Finger millet is consumed in the form of *enjera*, local beverages (*tela* and *areki*), porridge, bread and soup. Enjera could be prepared form finger millet grain alone or mixed with other cereals such as tef and maize. The proportion of the mixture, however, depends on a one’s economic status. It is worth noting that tef is preferred to finger millet
although the latter is the staple food in the study area. Comparing finger millet to maize, farmers prefer the former to the latter for finger millet could be stored as long as necessary without loss of grain quality. Furthermore, the taste and palatability of recipes made from finger millet grain increases with time. The straw of finger millet is also a major feed source for animals.
### Table 5. Finger millet production and utilization in some PAs in West Gojam and South Gonder Zones

<table>
<thead>
<tr>
<th>Item</th>
<th>Abiyot Fana</th>
<th>Ambo Mesk</th>
<th>Wonchit</th>
<th>Qorata</th>
<th>Gedam Geregera</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major crops</td>
<td>Finger millet, maize, barley, tef, noug, grass pea</td>
<td>Maize, finger millet, noug, tef, hot pepper, potatoes, lupine, mustard</td>
<td>Maize, finger millet, tef, hot pepper, barley</td>
<td>Finger millet, maize</td>
<td>Finger millet, maize, tef, hot pepper, barley</td>
</tr>
<tr>
<td>Production trend</td>
<td>Decreasing</td>
<td>Decreasing</td>
<td>Decreasing</td>
<td>Decreasing</td>
<td>Decreasing</td>
</tr>
<tr>
<td>Productivity (q/ha)</td>
<td>10-15</td>
<td>12-14</td>
<td>12</td>
<td>16</td>
<td>12</td>
</tr>
<tr>
<td>Local varieties</td>
<td>Necho (white seeded), Angede (red seeded), Tikur (traditional), Deke (recently introduced)</td>
<td>Necho, Angede, Tikur, Deke</td>
<td>Nech, Tikur, Qey</td>
<td>Tikur, Qu, Nech, Deke</td>
<td>Tikur, Qey</td>
</tr>
<tr>
<td>Improved varieties</td>
<td>None</td>
<td>None</td>
<td>Nech, Tikur, Qey</td>
<td>None</td>
<td>Padet</td>
</tr>
<tr>
<td>Seed source</td>
<td>Self</td>
<td>Market, self</td>
<td>Neighbors, self</td>
<td>Market, self</td>
<td>Market, self</td>
</tr>
<tr>
<td>Major uses</td>
<td>Mostly for home consumption, some for sale</td>
<td>Home consumption, sale</td>
<td>Home consumption, sale</td>
<td>Home consumption, sale</td>
<td>Home, sale</td>
</tr>
<tr>
<td>Grain price</td>
<td>Farm gate 120 Birr/q, planting time 220 Birr/q</td>
<td>Farm gate 150 Birr/q, planting time 220 Birr/q</td>
<td>&gt;200 Birr/q</td>
<td>Birr 100-150/q</td>
<td>Birr 200/q</td>
</tr>
<tr>
<td>Land preparation</td>
<td>5 times from January to February, twice in March, once in May-June</td>
<td>Six times from January to March</td>
<td>6-7 times</td>
<td>7-12 ploughing</td>
<td>7 times</td>
</tr>
<tr>
<td>Planting time</td>
<td>June</td>
<td>June 20 to 30</td>
<td>Last week of June to the beginning of July</td>
<td>3rd week of June to 3rd week of July</td>
<td>June</td>
</tr>
<tr>
<td>Seed rate (kg/ha)</td>
<td>40-50</td>
<td>36-45</td>
<td>40</td>
<td>20-28</td>
<td>40</td>
</tr>
<tr>
<td>Fertilizer (kg/ha)</td>
<td>DAP 100</td>
<td>Urea 57</td>
<td>DAP 100</td>
<td>Urea 50</td>
<td>100</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>75-100</td>
</tr>
<tr>
<td>Storage</td>
<td>Earthen silos</td>
<td>Earthen silos</td>
<td>Earthen silos</td>
<td>Earthen silos</td>
<td>Earthen silos</td>
</tr>
<tr>
<td>Crop rotation</td>
<td>Finger millet-barley/noug/tef</td>
<td>Finger millet- noug/maize/tef, tef</td>
<td>Maize to finger millet, barley or hot pepper</td>
<td>Maize-finger millet-tef-maize-finger millet</td>
<td>Finger millet-maize/tef, tef-maize-finger millet</td>
</tr>
<tr>
<td>Intercropping</td>
<td>Not practiced</td>
<td>Not practiced</td>
<td>Not practiced</td>
<td>None</td>
<td>Mustard when land is fertile</td>
</tr>
<tr>
<td>Pests</td>
<td>Grasshoppers</td>
<td>Grasshoppers and ABW</td>
<td>ABW and stemborer</td>
<td>Shoot fly</td>
<td>Grasshoppers, ABW, armyworm</td>
</tr>
<tr>
<td>Diseases</td>
<td>Head blast</td>
<td>Head blast</td>
<td>Head blast</td>
<td>Head blast</td>
<td>Head blast</td>
</tr>
<tr>
<td>Weeds</td>
<td>Broadleaved weeds</td>
<td>Broad leaved weeds</td>
<td>Broadleaved</td>
<td>Broadleaved</td>
<td>Broadleaved, serdo</td>
</tr>
</tbody>
</table>

18
Varieties grown Tidesh (red seed, recently introduced) and Tikur zerzer (white seed, loose panicle and susceptible to insect pests) are currently grown.

Productivity (t/ha) 0.96-1.28 0.4-0.80

Improved varieties None None None None None None

Uses Home consumption Home consumption Home consumption Home consumption Home consumption Home consumption

Seed source Self, exchange Self, exchange Self, exchange Self, exchange Self, exchange Self, exchange

Uses Home consumption Home consumption Home consumption Home consumption Home consumption Home consumption

Utilization Enjera Enjera, tella, areke Enjera, tella, areke Enjera, tella, areke Enjera, tella, areke Enjera, tella, areke

Seed rate (kq/ha) 25-30 16-20 16-20 On average 30 On average 50 On average 50


Harvesting time End Nov - End Dec End Nov - Early Dec End Nov - Early Dec Mainly December Dec - Mid January Dec - Mid January

Threshing time Feb - March Feb - March Feb - March Feb - March Feb - March Feb - March

Inter cropping/ mixed cropping Sole crop Sole crop --- Sole crop Sole crop Sole crop

Crop rotation Tef/maize—>barley/wheat/tef F.millet—>barley/wheat/tef Noug/barley—>f.millet F.millet—>pepper/maize F.millet—>maize/barley F.millet—>maize/teff

Insect pests Kukkufabalenta (shoot fly) Tel (in every stage of the crop) Fenta (seedling and heading) Kukkufabalenta (shoot fly) Kukkufabalenta (shoot fly) ---

Diseases Head blast Head blast Head blast Head blast Head blast Head blast


* varieties which are abandoned from production because of different reasons.
Production constraints and suggested interventions

Finger millet production is constrained by combinations of several biotic and abiotic factors. The major constraints in the cultivation of finger millet include:

- declining soil fertility
- lack of improved varieties
- high and increasing cost of fertilizer
- weeds, disease and pest problems
- poor marketing channel
- lack of agronomic recommendations such as seed rate, fertilizer rate, tillage, and crop rotation;
- drought or moisture deficit and
- poor extension service

In Mecha and Dera, increasing fertilizer costs and poor soil fertility were ranked as the major production constraints. Some farmers also ranked lack of early maturing, high yielding and pest resistant varieties as a priority production constraint. Other minor constraints raised by farmers include severe weed infestation, the need for soil trampling at planting, competition with maize and eucalyptus plantations, and lack of awareness concerning appropriate crop rotation practices (Table 7).

In Jabi Tehnan Wereda, disease (head blast) and insect pests are the most important problems while in Guangua wereda low soil fertility and disease are the top most problems. In Mircha Borerbor area of Jabi Tehnan wereda, finger millet production has given way to maize and tef due to severe insect pest attack on the former.
Suggested interventions

- Develop high yielding, disease and insect pest tolerant and/or resistant and early maturing, easily threshable varieties
- Generate or adapt technologies that may perform reasonably well under low soil fertility conditions
- Develop optimum rates of fertilizers for the cultivation of finger millet
- Determine critical crop weed competition period and develop integrated weed management options
- Develop integrated disease and pest management options
- Develop appropriate agronomic practices (seed rate, tillage, etc)
- Develop appropriate post harvest technologies (threshers)
- Develop and demonstrate different food recipes and utilization options
- Promote available finger millet technologies
Table 7. Ranking of the major finger millet production constraints by survey participants

<table>
<thead>
<tr>
<th>Rank (priority)</th>
<th>Mecha</th>
<th>Dera</th>
<th>Jabri Tehnan</th>
<th>Guangua</th>
</tr>
</thead>
<tbody>
<tr>
<td>1st</td>
<td>Abiyot Fana</td>
<td>Ambo Mesk</td>
<td>Woneitit</td>
<td>Corata</td>
</tr>
<tr>
<td></td>
<td>Increasing fertilizer cost/poor soil fertility</td>
<td>Lack of improved varieties</td>
<td>Fertilizer/poor soil fertility</td>
<td>Fertilizer</td>
</tr>
<tr>
<td>2nd</td>
<td>Lack of improved varieties</td>
<td>Increasing cost of fertilizer/poor soil fertility</td>
<td>Lack of early maturing variety</td>
<td>Early maturing variety</td>
</tr>
<tr>
<td>3rd</td>
<td>Weeds</td>
<td>Pests</td>
<td>Lack of variety with no trampling</td>
<td>Weeds</td>
</tr>
<tr>
<td>4th</td>
<td>The need for trampling</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>5th</td>
<td>Eucalyptus replacing crop fields</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>6th</td>
<td>Grasshoppers</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7th</td>
<td>Productivity less than maize</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>8th</td>
<td>Poor rotation</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

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References


Project Information

The problem: Tef (*Eragrostis tef*) and finger millet (*Eleusine coracana*) are both cereal crops that originated in East Africa. They belong to the Chloridoid sub-family of the grass family (*Gramineae*), and are hardy, resilient crops that exhibit good tolerance to abiotic stress, and produce small-sized grain with superior nutritional and storage characteristics. Both crops are of strategic importance to the food security of millions of African smallholder farmers; tef is the major staple food in Ethiopia while finger millet is an important traditional food crop in several Eastern, Central, and South African countries. These two crops, however, are among the least studied of the cereals in terms of crop improvement.

The goal: to increase tef and finger millet productivity and income generating possibilities.

The approach: The Collaborative Crop Research Program has previously funded crop improvement projects on both tef and finger millet. Since the two crops share many similarities, tef and finger millet project researchers were brought together for the first time. East African researchers decided to bring the two crops together under one research project in hopes of taking advantage of the potential for transferring knowledge and experiences from one crop to another and across borders.

The current project, "Genetic Improvement, Technology Dissemination and Seed System Development in African Chloridoid Cereals", has identified development and promotion of improved varieties and agronomic practices; tef molecular genetics; tef and finger millet seed systems; and value-added products and farmer empowerment schemes, as areas for research and development.