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Research Paper

# Indigenous Knowledge of the Shekacho Society in Enset (Ensete Ventricosum (WELW) Cheesman) Plantation and Management from Field to Plate

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## Abstract

In this study, the indigenous knowledge of the Shekacho society in Enset cultivation and Kocho food production was investigated. Although Enset has several advantages, only limited population of Ethiopians consume the food product mainly due to some uncommon sensory quality parameters and lack of awareness. The Shekacho society introduces the plant "Mandillo" that greatly improves the quality and palatability of Kocho products. To this end, analytical data were collected using semi-closed questionnaires, field observations, interviews and discussion with key informants. Local annotations review and Enset plant physical structure were also measured. Fermentation was carried out by knowledgeable local women quality of the products were evaluated qualitatively using sensory panellist using preference test. Descriptive analysis of the Enset histories, culture, varieties and uses, showed diversified applications of Enset and the detail knowledge of Shekacho society inherited in Enset cultivation and consumption managements. One hundred fifteen Enset local cultivars were identified and grouped into male and female types. The measurement of the parts of Enset plant in the study area showed maximum average size in total height, the pseudo stem circumference and its height, leaf height and volume of underground corm (13.1 m, 2.5 m, and 4 m, 9.1 m and 1 $m^3$, respectively). The effect of adding Mandillo during Enset fermentation resulted in visible physical quality differences of Kocho products. The study also showed that Enset productivity affected by biotic factors. The descriptive analysis of the data and the corresponding results suggested the existence of a high degree of consistency among the respondents.

**Keywords: -** *Enset, Fermentation, Kocho, Mandillo, Shekacho.*

## 1. Introduction

Enset (Ensete ventricosum (Welw.) Cheesman) belongs to the order Scitamineae, the family Musaceae, and the genus Ensete, known as false banana, which is widely distributed in Eastern and Southern Africa (Bender, 2006). It is cultivated in southern, southwestern and some other parts of the Oromia National Regional State of Ethiopia (Brandt et al., 1998; Tadese Kippe, 2002; Temesgen Magule et al., 2014). Enset is a perennial monocarpic plant with leaves, pseudostem and a large underground corm (Tadese Kippe, 2002). As it was stated by Karin et al. (2005) and Ajabu Nurfeta et al. (2008), the criteria for differentiation of the phenotype are the size and shape of the pseudostem and leaves, and color of leaf sheaths, midribs, and lamina. The plant grows fairly well between 1100–3000 m above sea level (Brandt et al., 1998). A vigorously growing healthy plant can withstand prolonged periods of drought (Brihanu Abegaz, 1987a).

Out of more than 90 million Ethiopians, Enset is a staple food for about 15 to 20 million people in mixed subsistence farming systems (Tadese Kippe, 2002; Karin, 2002; Temesgen Magule et al., 2014). The leaf sheaths and the corm provide starchy food which can be stored for long periods after fermentation. Moreover, all parts of the plant are used to provide other useful products for household, agriculture, and traditional medicinal treatments (Tadese Karin et al., 2005).

The major foods obtained from Enset are Kocho, Bulla and Amicho. Kocho is the bulk of the fermented starchy food obtained from the mixture of the decorticated (scraped) leaf sheaths and grated corm. After initial processing, the mixture is left in the storage pit for 15–30 days during fermentation, and it can further be stored for many months and even for several years. When ready for consumption, Kocho is also made to a fermented bread-like food that is consumed in villages as well as for local urban markets (Brandt et al., 1998). According to Admasu Tsegaye and co-worker (2001), Kocho yield of Enset per unit space and time, in terms of edible dry weight and energy, was much higher than the yields of any other crop cultivated in Ethiopia and estimated to range from 17.1 to 33.9 ton ha-1 year-1 indicating the potential of this crop for food security.

In spite of the fact that Kocho is very important source of food, energy and industrial raw materials (Temesgen Magule, 2009; Biruk Ayenew et al., 2012), its usage has been limited to only some regions of the country. There are key reasons why Kocho is not well appreciated among Ethiopians that could be associated with its uncommon inherent sensory attributes characteristics, long fermentation period, lack of awareness and short shelf-life. For instance, non-Enset producing areas are not familiar to the odor, taste and flavor of the food. The nutritional and organoleptic qualities of Kocho could be process related and are different from place to place. To alleviate such problems and increase safety, quality and shelf-life of the food material, addition of traditional preservatives was noted to be useful (Stuart et al., 1986; Sahlin, 1999). The traditional preservatives can impart characteristic flavors; have antioxidants as well as antimicrobial activities (Smid et al., 1999).

Traditionally, Mandillo (family, Asteraceae; genus, Crassocephalum; specific epithet, macropappum (Sch.Bip. ex. A.Rich.) S.Moore)) has been used by the Shekacho society as preservative and fermentation enhancer in Kocho production since ancient times. However, there is no proper scientific documentation on this remarkable indigenous knowledge. Mandillo has been recorded to be endemic to Ethiopia and anherbaceous plant distributed in different regions and transects of the Bonga forest (Mesfin Tadesse, 2004; Nune, 2008). The plant was also observed to grow in excess around the Sheka Zone, Gordomo and Gore, Iluu-Abbaa-Booraa Zone in the Oromia National Regional State.

Numerous research findings were performed on Enset, such as: Enset cultivation and productivity (Admasu Tsegaye and Struik, 2001), microbial dynamics of Enset fermentation and spoilage of Kocho (Brihanu Abegaz, 1987b), food security issues (Tadese Kippe, 2002), biochemical changes during Enset fermentation and the effect of altitude on microbial successions (Tariku Hunduma and Mogessie Ashenafi, 2011), chemical composition and degradability of Enset (Ajabu Nurfeta et al., 2008), mineral contents and their absorption inhibition factors (Melaku Umeta et al., 2005), improving the indigenous processing of Kocho production (Melese Temesgen, 2013), Enset fermentation in pits and Jars (Tiruha Habte et al., 2013). However, no studies have been considered on the traditional Enset fermentation using Mandillo to improve the uncommon Kocho quality parameters and to enhance fermentation rates. Therefore, this study was initiated to qualitatively investigate the indigenous knowledge of Enset fermentation practices and to evaluate the existing Enset diversity of Sheka Zone. Furthermore, the application of Mandillo in Enset fermentation process and the major advantages of Kocho consumption as well as its contribution towards maintaining food security and environmental protections were investigated.

## 2. Material and Methods

### 2.1. Description of the study area

The plant (*Mandillo*) sample was collected from Masha town. Enset samples were collected from two most *Enset* producing districts (Masha and Andracha), Sheka Zone, Southern Nation Nationalities and Peoples Regional State of Ethiopia. Masha town is located at

latitude and longitude of 7°44′N and 35°29′E, respectively, with altitude of 2223 m above sea level. Semi closed questionnaire composed of eight sections and ninety two questions was prepared in English language, validated with Sheka community living in Hawassa city and in the research area with the assistance of translators when needed. Fifty respondents were purposively selected among the knowledgeable women, farmers, agricultural experts, office holders and cultural leaders. Twenty one of the respondents were invited by the zone administrative officials. The remaining twenty nine respondents were selected based on suggestions of the 21 respondents from different villages. The questionnaire was filled in by face to face discussion. Parts of Enset plant in the study area was measured using tep meter.

### 2.2. Data from different sources and field visit

Local annotations were also reviewed. Interviews were made with knowledgeable individuals among the 50 respondents, 12 farmers and the 2 women involved in fermentation process. Pictures of the research areas and available Enset plants were taken directly from the farm of twelve farmers. Enset local cultivars were listed by their local name exhaustively.

### 2.3. Data from *Enset* fermentation

Four matured female types (*Maache*) *Enset* plants were purchased from Masha town. Two knowledgeable women were involved in the fermentation processes, who used their own local materials, including wooden board (*matoo*), bamboo scraper (*maaroo*), wooden grater (*komixoo*), knife (*shikkoo*) and bucket (*dooloo*). Prior to fermentation, the site was cleared and 1m by 1m in diameter and depth pits (*gamoo*) were prepared. *Enset* leaves were also selected and exposed to sun to make it stronger and flexible. The knife was sharpened. Fermentation processes took place following the traditional methods used by the local society and the earlier works of Berhanu Abegaz (1987a), Tariku Hundumaand and Mogessie Ashenafi (2011). All the leaves (*mato*), the interlocking leaf sheath (*dubo*) and dried leaf sheath (*kaakiro*) were removed from the *Enset* plants. Parts of the pseudostem were scraped by *Maaroo* on *Matoo* slanted against a live *Enset.* The corms were pulverized by *Komixoo.* The scraped and the pulverized biomasses were mixed and chopped by knife. The chopped biomass samples were grouped into four equal portions, sealed carefully with the prepared *Enset* leaves and put in the pits of 1 m by 1 m in diameter and depth, separately for nine days. On the same day, the starter culture was prepared from different parts of *Enset* such as *shitoo* (pre-fermented lower part of midrib), *baqqoo* (inner soft part of pseudostem), *ooqqo* (midrib), *quuro* (squeezed liquid), *mundriiqqo* (the shoot) and *uuxo* (*Amicho* or corm). The biomass was prepared in duplicates, for both samples of fermentation with *Mandillo* (1:25 *w/v*) and without *Mandillo* in the four *kiisho-goonos* (bowel shaped structures made from underground corm). About 100 g of fresh *Mandillo* stem was added to about 100 km of biomass of Kocho to evaluate its effect on product quality and change in fermentation period. The bowels were kept intact to the ground. Both groups were sealed off external air with leaf sheath (Brihanu Abegaz, 1987a) and left for nine days.

At the end of the ninth day, all the partially fermented *Kocho* and the starter culture were taken out of the pit and *kiisho-goono,* respectively. The *Kocho* was kneaded and mixed with the starter cultures along with *Mandillo* (1:1000 *w/w*) and without *Mandillo*. After mixing, the contents were buried in the pits again for another five days for maturation. On the fifth day, the *Kocho* was removed from the *gamoo* and pancakes prepared. The quality of *Kocho* was qualitatively evaluated using 30 trained sensory panelist by preference test method on the bases of the texture, taste, ripeness, color, softness, and odor of the pancake against fermentation period of the control and experimental group.

### 2.4. Data analysis

Descriptive data analysis was followed; focus group discussion data was translated and transcribed. To pronounce the names of the *Enset* plants, processes and products correctly, Latin rules of writing was used. Enset parts physical measurements were done in replicates and the results were expressed as mean.

## 3. Results and Discussion

### 3.1. Descriptive analysis of the historical background of *Enset* and its products

Based on the responses of the study participants, there is no clear indication for how long *Enset* plant has been known by the Shekacho society and from where it was introduced. However, the entire respondents unanimously agreed that the histories of existence and usage of *Enset* may linearly coincide with the long years history of the Shekacho people. The study subjects have further remarked that in the history of Shekacho society, drought and starvation have never been experienced probably because of the established tradition of *Enset* plant cultivation as a major source of food, the presence of dense forests and fertile lands (Figure 1).

Figure 1: Patchy forests and *Enset* plants in Fetafa; Sheka Zone.

## 3.2. Classification of *Enset*

One hundred fifteen *Enset* local cultivars were identified and classified as male (*Atina'o*) and female (*Maache*) types, out of which sixty one of them were physically observed from the farmer's field and virgin lands (Figure 2).

Figure 2: Cultivated (Left), wild (Right) *Enset* plants.

The criterion for classification of *Enset* as male and female, according to the respondents, were based on the structure, size, food quality and tolerance to stresses; but has nothing to do with biological reproductive systems of the plants. One third of them classified as male types, while the remaining found to be female types, as listed down below:

Male types of *Enset* cultivars: *Aa'i-barasho, Aa'i-bosso, Aa'i-gudiro, Aa'i-noobo, Aa'i-yoobo, Aajjaro, Aajjo, Aataro, Addo, Baacci-barasho, Bado, Baraadi, Baraadi-Bosso, Barasho, Baxxato, Bosso, Bushuro, Ceella-bosso, Ceellacho, Ceella-Gemo, Gajji-bosso, Ganji-baraso, Ganji-noobo, Gayaacho, Gemo, Giillo, Goomajjo, Gudiro, Gushiro, Kabbo, Necca-Gemo, Necca-noobo, Noobo, Obaano, Ookko, Qattaano, Qefi-bosso, Shondi, Taato, Tafaro, Yaafi-bosso and Yoobo.*

Female types of *Enset cultivars: Aacho, Aa'i-shimmo, Aakkaro, Agane, Agani, Arakko, Ballaa-wusso, Buuti, Caaccaro, Carallo, Ceeggacho, Ciqqaro, Ganjo, Geno,Giito, Goobachi, Googashi, Gosho, Gotano, Hii-Kiwwi, Kaa'o, Kafi-qeeqqaro, Kafiyachi, Kawo, Keci, Maacaa-dami, Maaci, Maara-tiishi, Mashaa-maasho, Mashengi, Maxaaqo, Messo, Necca-barasho, Nooqo, Ogisso, Ogiyo, Oomano, Oomi, Ooqo, Qasafo, Qasi-aafo, Qebbo, Qeeqqaro, Qeraaro, Qooppiri, Qotano, Shehi, Sheki-qeeqqaro, Shicho, Shiddo, Shiimo, Shiishiri, Shiisho, Shimmo, Shirii, Shiwo, Shukki, Shuruddo, Shuuri, Taawo, Tisha-maati, Toobbacho, Ukkano, Waango, Wushiro, Wusso, Xeeyo, Ximbirii, Yaaho, Yeebbo, Yeqqo, Yooro and Yotto.*

The interviews with key informants indicated that female types are large in number of the available cultivar, but the male types are most commonly available in the farmers' fields, huge in size, more disease and drought resistant and produce higher yields than the female ones. Some of the most abundant *Enset* cultivars and commonly used by the farmers are the following: *Baraadi-Bosso, Barasho, Carallo, Gemo, Gudiro, Maaca-dami, Maxaaqo, Noobo, Shicho,* and *Yeqqo*.

Similar to other zones that cultivate *Enset* plants, the varieties in Sheka Zone have also been identified by color, structure and size of the different parts of the plant (Yemane Tsehaye and Fassil Kebebew, 2006). According to the respondats, medicinal value, disease and drought resistance properties, food and fiber quality and yields are based on the cultivars of *Enset*.

Furthermore, the study participants described various parts and products of *Enset* as follows: the leaf (*maato*), leaf sheath (*yo'o*), midrib (*ooqqo*), inner soft part of pseudostem (*baqqoo*), pseudostem (*dubo*),

corm/*Amicho* (*uuxo*), squeezed liquid (*quuro*), *Bulla* (*ittino*), *Kocho*, starter culture (*kiisho*), and fiber (*yi'o*). It was also learnt that the Shekacho society uses *Enset* as food sources, livestock feeds, medicine, household materials and utensils, construction materials, detergent, etc. In addition, *dubbo, fusso* and *qocho* (traditional dresses made up of *Enset* fiber for female), *and gichoo (an* ornamental made up of *Enset* fiber put on the shoulder by male*)* which are special heritages of Shekacho society's traditional clothes.

3.3. Cultivation of *Enset*

The opinions of the study subjects indicated that the male types *Enset* are primarily cultivated for food source compared to the female types. In this connection, the methods and stages of *Enset* development and cultivation followed by the Shekacho society are provided in Figure 3. The study participants further indicated that all of the activities related to *Enset* cultivations are the responsibilities of both the females and men.

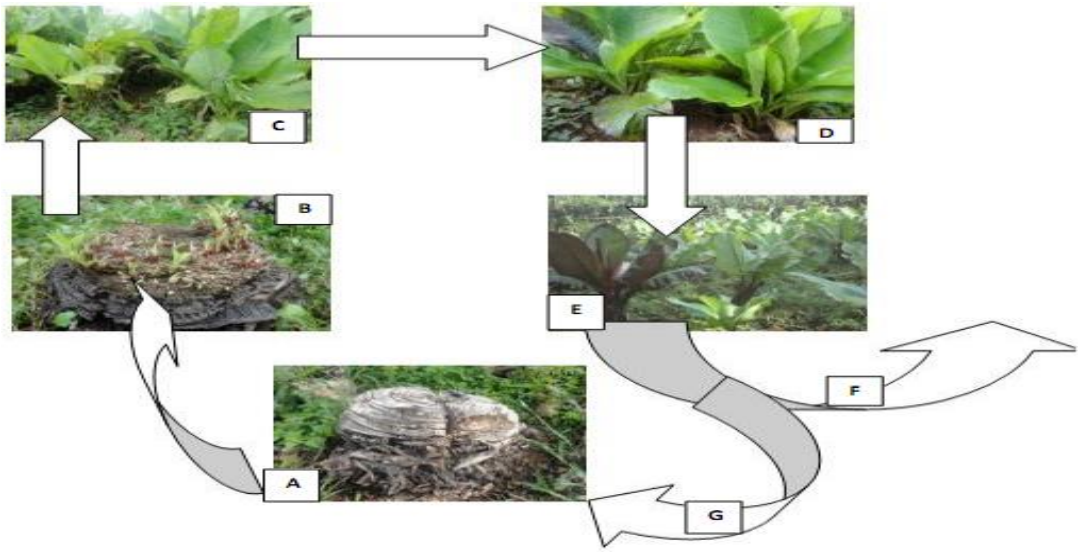


Figure 3: *Enset* cultivation at different development stages: A, division of the corm into four parts (*baqqo*); B, sucker formation (gaamo); C, seedlings (*aaco*); D, further dispersion of seedlings (*uukko*); E, final transplantation (*tokko*); G, seedling production; and F, *Kocho* production.

According to the tradition of Shekacho people, the first stage in *Enset* cultivation is the removal of the pseudostem from the corm (*uuxe-maaco*), while the second stage is division of the corm into two or four parts (*baqqo*) based on its size (Figure 3A) to increase the surface area of the corm. The third or an optional stage is either putting the corm into the pit upside down (*duukkoo*) or it could be left intact to the ground coating with cow dung (*ibe-fuutto*). Contrary to the report by Tadese Kippe (2002), that indicated about 200 suckers to emerge per *Enset* corm; in the present study, it was learnt that the number of suckers (*gaamo*) emerged per corm was found to vary from 300–400 following the traditional cultivation method in the Sheka Zone (Figure 3B). The differences in number of suckers may be as a result of differences in *Enset* caltivars, rainfall and soil fertility. Then, the suckers grow into seedlings (*aaco*) and can be dispersed after six to eight months (Figure 3C). The seedlings can further be dispersed (*uukko*) after a year for final transplantation (Figure 3D). The plant will then further transplanted (*tokko*) and allowed to grow until it matures for harvesting (Figure 3E) within two to four years of growth period. The harvesting time required by the female types varies from four to five years. However, the male types need longer periods (i.e., six or more years). In addition, based on the traditional knowledge of the local farmers, the spacing required between the two adjacent plants to grow varies from 1.5–2.0 m for male types but 1.0–1.5 m for the female types.

According to the information obtained from the experts of the woreda's agricultural offices, *Enset* plants grow best in the altitude ranging from 1800–3000 m above sea level, unlike the report by Brandt et al. (1998)

who indicated an altitude requirement starting from 1100 m for favorable growth of *Enset* plants. Moreover, medium to high rainfall is also preferred for healthy growth of the plants.

Regarding the sizes of *Enset* plants grown in Masha areas, the tallest plant grows to the average height of about 13.1 m while the pseudostem is 2.5 m in circumference and 4 m in height. Moreover, the leaves were found to extend up to the height of 9.1 m and 1.2 m in width (Figure 4A). The maximum volume of the underground corm was about 1 $m^3$.

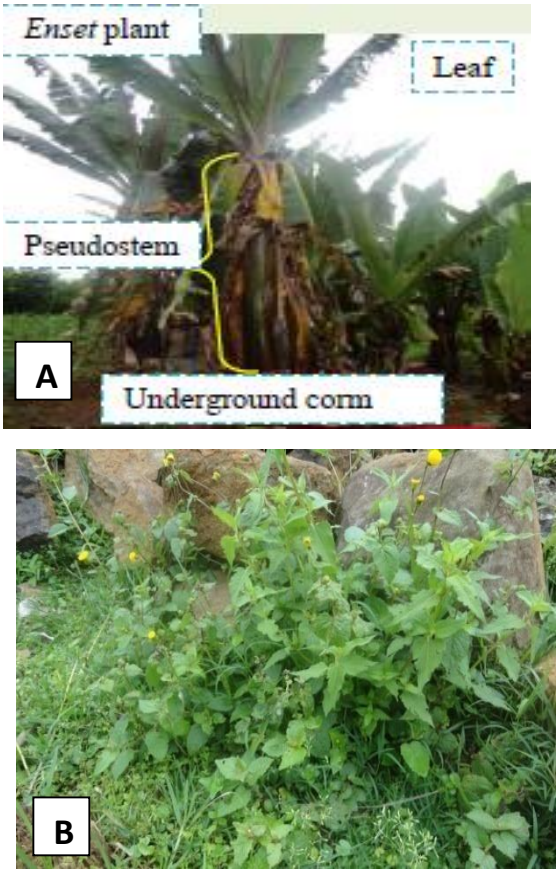


Figure 4: Parts of *Enset* (A) and *Mandillo* (B).

## 3.4. Share of Women and *Enset* management practices

The study participants further indicated that all of the activities related to *Enset* fermentation are the responsibilities of the females. This may be mainly due to the beliefs of the society that if the male even passes by the fermentation area, the fermentation process would fail. Furthermore, all the participants agreed that traditionally women add *Mandillo* (Figure 4B) when they have inadequate starter culture to enhance fermentation and shorten the fermentation period. Moreover food preparations are also on the shoulder of the women.

## 3.5. Outcomes of *Enset* fermentation

One of the observations made during the field visits was the traditional *Enset* fermentation processes. Particular attention was also given to the effect of introduction of *Mandillo* on the *Kocho* quality (Figure 5 A to F). It was further learnt that moderate rainfall is the favorable condition for *Enset* fermentation to obtain underground water to dissolve the mixed materials of starter culture ingredients **(**Figure 5E).

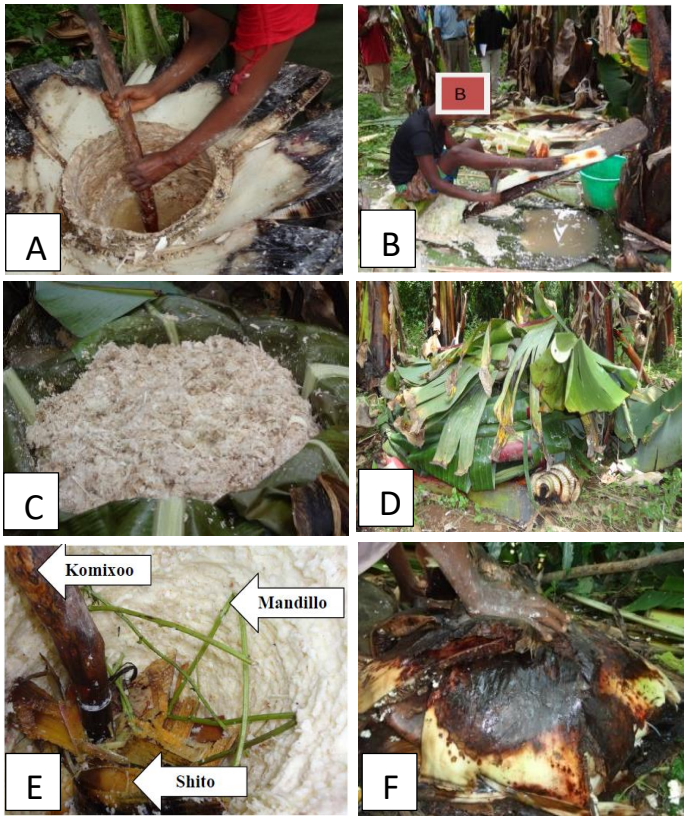


Figure 5: *Enset* fermentation processes: Pulverized corm,(A); Scraped pseudostem, (B); mixed and unfermented *Kocho* biomasses, (C); Sealed *Kocho* biomass in a pit, (D); Starter culture ingredients, (E); and Sealed starter culture (F).

The semi fermented *Kocho* on the ninth day (Figure 6A). The starter culture along with *Mandillo* and without *Mandillo*, respectively (Figure 6B).

Five days after addition of the starter cultures, the final products showed remarkable physical quality

parameters (texture, taste, ripeness, color, softness, and odor) with noticeable differences between fermentation with *Mandillo* (Figure 7B) and fermentation without *Mandillo* (Figure 7A). Accordingly, the respondents preference test unanimously confirmed that the product with *Mandillo* was whiter in color, more acceptable odor and taste, ripened in a shorter time, softer and had finer texture than the product without *Mandillo*.

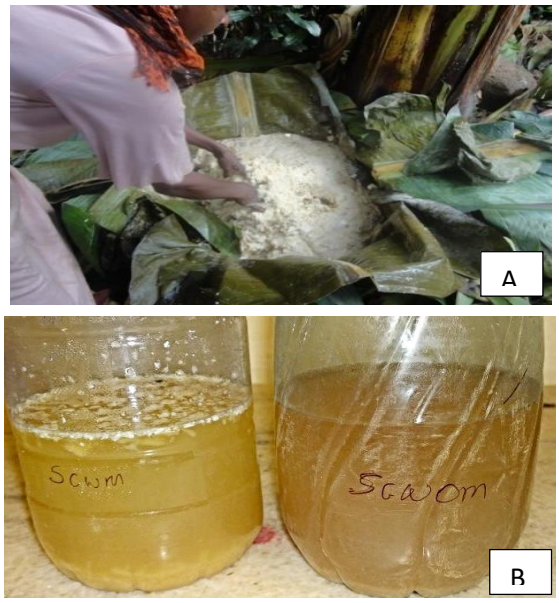


Figure 6: A, fermented *Kocho*, B, Starter culture without *Mandillo* (right) and with *Mandillo* (left).


Figure7: Kocho fermented without Mandillo (A) and with Mandillo (B).

## 3.6. Production of *Enset*

According to the information obtained from the respondents, the biggest matured male type *Enset* yields 200 to 250 kg *Kocho*, about 30 kg *bulla* fresh weight and 5 to 8 kg fiber per plant. The yield obtained from the female type is about 60 to 70 kg *Kocho*, 10 to 15 kg *bulla* and insignificant amount of fiber per plant. The productivity of *Enset* is also estimated to 62.85 to 83.33 ton $ha^{-1}$ $year^{-1}$ on wet weight bases, while this quantity is 28.28 to 38.33 ton $ha^{-1}$ $year^{-1}$ on dry weight bases. It can be concluded that the yields from the current study area are by far better than that reported by Admasu Tsegaye and Struik (2001).

The respondents have also explained that *Kocho* from the female types is softer, more palatable, better in texture and taste, matures earlier and more easily fermented than the male types. It was interesting to learn that the *Maxaaqo* variety, among the female types, is the best quality and prepared for honored guests like son-in-law, honorable personalities and leaders. *Kocho, Amicho (uuxo), eekko, Bulla (ittiino),* mixed (*bacco*) and fiber (yi'o) were also known to be the main products of *Enset* fermentation processes of the study area.

## 3.7. *Enset* based food products

The respondents indicated that from the fermented *Enset* product pancake like bread can be made and consumed with cabbage and animal products based sauces. The study subjects further noted that the pancake like *Kocho* can be served with other foods like *Injera* in the presence of sauce. Therefore, according to the tradition of Shekacho people, it is known that *maxino* (pancake) from *Kocho* is "the grace of the table". Other products such as *Bulla* are the best raw material in preparation of *kujjo* (soup). Furthermore, *uuxoo* (*Amicho*) can be boiled and eaten like potato (David, 2006). On the other hand, *uuxoo (Amicho)* from the female *Enset* type is more acceptable than the male type. *Arakko, Maxaaqo* and *Maacaa-dami* are known to be of the best quality *uuxoo* sources, while only *Ukkano* is considered from the male types of *Enset*. In addition, *kujjo* (soup), *buuxo* (porridge) *xeesso, kosso, baacuuroo, qaafoo, qoriyo, naakkasho, anjaawuro* and *buddeno* (*Injera*) are some of the cultural foods eaten along with milk, kale, cabbage, meat and different type of stews.

## 3.8. Shelf-life study

According to the respondats, the findings of the current study confirmed that the shelf-life of *Kocho,* produced by Shekacho women was found to extend from one month to one year by simple packaging with *Enset* leaves. However, the shelf-life can also be extended from one to two years by wrapping with *Enset*

leaves and dipping into a deep water body such as slowly running river. Based on further information obtained from the respondents, the *Kocho* products could also be preserved for up to six years in an air tight pit. Besides, the findings of the current study are in agreement with the previous report by Holzapfel (2002).

In addition, Shekacho people traditionally preserve *Enset* products such as *Bulla, Kocho, eekko* and *bacco* by using different spices such as *kefo (Sacred-Bassil-Yehabesha), toocho (Cymbopogon citratus), shoobbo (Lippia adoensis)* and *duqquushe-waamo* (Leaf of *Allium sativum*). On the other hand, in all preservation processes, occasionally some parts or the whole products could be spoiled and in those cases the spoiled products may be identified by their color, which turns black with sour taste, unpleasant structure, mushy and pungent smell (Berhanu Abegaz, 1987a).

### 3.9. Medicinal values of *Enset*

It was traditionally proved that some of the *Enset* plant parts and their food products have medicinal values for human being and livestock. For instance, they are applicable to cure broken and fractured bones, joint displacement, swellings, wounds, infectious disease, and diarrhea and recognized to stimulate placental discharge. According to the respondents, the most commonly used *Enset* plants for medicinal purposes include *Maacaa-dami*, *Shuuri*, and *Noobo* types.

### 3.10. Biotic factors against *Enset* productivity

It was learned, from the field survey and associated interviews, that *Enset* is attacked occasionally by different types of diseases such as bacterial/fungal wilt (Figure 8), animal pests such as insects, mole rats, porcupine, wild pig, *Enset* root mealy bug and monkeys which is similar to the report made by Temesgen Addis et al. *(*2008).

The findings of the study have further indicated that the female types are more prone to the disease caused by *Kiino* than the male types. Apparently, the immediate intervention of this problem may require intensive collaborative research activities by involving professionals from various relevant sectors as it was also described by Aritua et al. (2008). According to the respondents, *Kiino* affects the plant at all ages before inflorescence. Unlike *Kiino*, all other agents attack both types of *Enset* before and after inflorescence.

Figure 8: *Enset* plant affected by microbial wilt (locally known as *Kiino*).

## 4. Conclusion and Recommendation

*Enset* has untapped potentialin ensuring food security in Ethiopia. The long years of traditional experiences and practices of the Shekacho people in *Kocho* fermentation should be maintained and extended to other *Enset* producing and none producing regions of the country. As part of the outcomes of this study, the large differences observed between the female and male *Enset* types and the *Kocho* products, necessitate further research works related to DNA profiling of *Enset*.

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