Ensete ventricosum: Camel Crop, a Livelihood underpinning of the Southern Ethiopian Highland.

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Abstract

Ensete is the dominant crop of the aged indigenous ensete based farming system in the Southern Ethiopian highland. Due to its peculiar characteristics of storing moisture in the pseudostem, it can sustain prolonged drought season which guaranteed food security in a country most part is food deficient. The major objective of this review was to create some insights about this endemic plant which is found all over the world however used for human consumption only in Ethiopia. The potential this plant gifted to store water during the rainy season made it suitable to cope up changes like seasonal moisture stress.

1. Introduction

Ensete (*Ensete* ventricosum) is the main crop of a sustainable indigenous *ensete* based farming system that guaranteed food security in a country most part is food deficient. Different types of root crops are grown in the Southern Ethiopia high lands with *Ensete* being the dominant staple diet for the Kembata, Highland Oromo, Guraghe, Sidama, Gedeo, Hadiya, Yem, Kaffecho, Wolaita, Dawro, and Shakecho people. About 15 million people (greater than 20 percent of Ethiopia's population) are dependent on *Ensete*. Most of them are concentrated on the highlands of southern Ethiopia. The known *Ensete* belt stretches from Gedeo in the southern highland to Illuababora near the countries border with Sudan in the South western part (Fig.1).

Ensete is interrelated to and look a lot like the banana and plantain plant and is produced primarily for the large quantity of carbohydrate-rich food locally called *kocho* found in a false stem (pseudo-stem) and an underground bulb (corm) locally called *amicho*. The coarse fibre as a by-product, the standing plant for forage, the dried leave sheath for construction and special cultivars of this species used for traditional healing are the extra benefits that can possibly harvested from this plant (Zippel,2002). Following this small introduction; the objective, Management aspects of the plant and conclusion made from the study were presented.

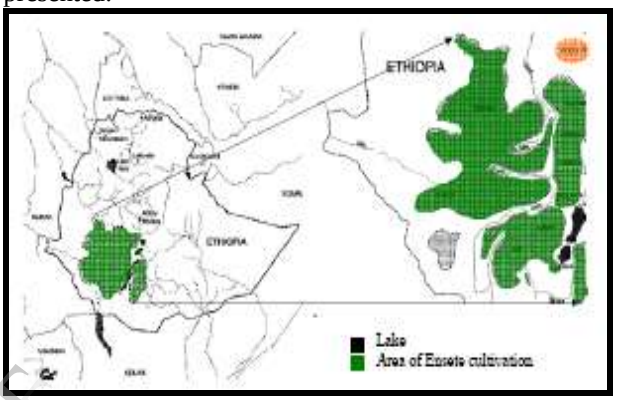

Figure 1. Area of *Ensete* cultivation in Ethiopia (Brandt et al, 1997).

2. Objectives

Though the white or grey coloured bread or porridge, which is produced from the fermented plant Kocho, can be strange and foul-tasting to an outsider, *ensete* has been having a far-reaching impact on the lives of the Southern highland dwellers for generations. The adaptation of the plant for varying environmental conditions coupled with its diverse functions in the farming system made attractive to establish *ensete* plant husbandry. Therefore the major objectives of this review is to create some insights about this plant which is found all over the world however used for human consumption only in Ethiopia, and to asses the possible contribution of this plant in improving food security in the country. The minor objective deals with the traditional *ensete* husbandry system; *ensete* based farming system, plant ecology and *ensete* processing.

3. Description of Ensete and Ensete Based Farming System

The ensete plant looks like a banana plant in many aspects. Also known as "false banana" due to its prominent resemblance to the banana plant, ensete *(Ensete ventricosum)* typically different from banana (musa spp.) in many features (Table 1).

Table 1. Difference between enset and banana plant

Comparable Features	Ensete ventricosum	Musa Sp.
Structure	Tree like herb 10 m high, well built structure, Monocarpic, internal bulb covered with starch rich sheath	Tree like herb, Monocarpic 2-6m high, Milky juice in all parts
Stem	Starch rich underground corm, at maturity 0.7m in length, up to 1m in diameter. True stem lies in between the pseudostem and the corm near the soil line.	Underground corm, short internodes, Corm produce leave sheath in spiral succession
Pseudostem .	Thick (up to 1m in diameter) layer of leave sheath rich with starch.	Made of a leave sheath layer, very thin as compared with Ensete
Inflorescence	Indication of plant maturity, non edible fruit with out a hand	Develop in to edible fruit on
Root	fibrous root system	Adventious root spreading to all sides

The stem of the plant consists of three parts; the upper-most portion is the pseudostem, which is made of a system of tightly clasping leaf bases or leaf sheaths. The pseudostem may be two to three meters tall which contains an edible pulp and quality fibre (fig 2). The underground corm is really an enlarged lower portion of the pseudostem. It may be up to 0.7 meters in length and 1 m diameter. A short section of stem near the soil line, between the pseudostem and corm, is the true botanical stem. Leaves and the single flower head initiate from the true stem at its centre, grow up through the middle of the pseudostem, and emerge at the whorl in the middle of the leaf bases (figure 2) (Brandt et al, 1997).

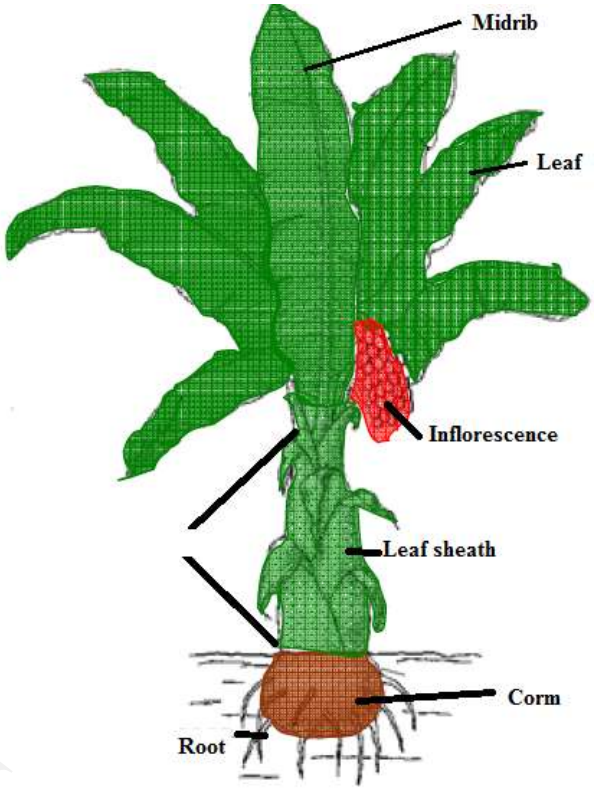

Figure 2. Parts of an enset plant (original idea from Brandt et al, 1997).

There are about four different farming systems predominantly practiced all over the country: pastoralism, shifting cultivation, grain-based cultivation, and ensete-based cultivation (Westphal, 1975 as coated by Brandt et al, 1997). Within the Ensete agricultural system, based upon environmental, agronomic, and cultural criteria, as well as the extent to which people depend upon the plant as a staple crop, four major ensete sub-systems can be recognized, (Brandt et al, 1997).

One such sub-system is where ensete is the staple food and main crop. Such systems are highly dependent upon cattle to produce manure for fertilizing ensete fields. The main ensete product is kocho, a fermented decorticated pseudostem mixed with chopped corm. Population densities in these communities are commonly 200 to more than 400 persons per square kilometre (Brandt et al, 1997).

Another ensete sub-system uses ensete as a co-staple with cereals and tuber crops. Cattle are important for manure to fertilize ensete fields, while oxen are used to plow cereal fields. Both kocho and amicho (boiled ensete corm) are eaten. Population density among these groups is high, sometimes with more than 200 people per square kilometer (Brandt et al, 1997 and Zippel, 2002).

A third ensete sub-system relies upon cereals as the most important crops, with ensete and root crops of secondary importance (Hartmann, 2004 and Brandt, 1997). Ensete is grown largely for

security reasons (i.e., if cereal crops fail) and eaten in the form of kocho and amicho. Livestock are important for transport and plowing, but far less so for producing manure as ensete fertilizer (Zippel, 2002).

The fourth ensete sub-system is where root crops are of prime dietary importance, cereals are of secondary importance, and ensete is of minor importance (Brandt et al, 1997). In this sub-system yams and taro are the most important crops, while ensete, cereals, and cattle-herding are of minor importance. Traditionally, ensete is processed for eating simply by cutting the corm into pieces and cooking. Population densities are low in these groups, and settlements are small and dispersed (Brandt et al, 1997).

4. Ecology and Propagation

However, there exists widely distributed wild ensete species in the tropics; domestication of this plant for household consumptions has been registered only in Ethiopia (Brandt et al, 1997). Domesticated ensete is planted at elevations ranging from above sea level 1,100m (woynadega) to more than 3000 m (wurche). Annual rain fall requirement varies between 1100mm to 1500mm (Brandt et al, 1997 and Zippel, 2002). The average temperature demand throughout the growing period varies from 10 to 210C and relative humidity of 63 to 80%.

Ensete propagation is possible using the vegetative part (corm) and seed. Vegetative propagation allows cultivation at high altitudes, when seeds are not developed. It also provides a high number of plants, and homogenous plant material (Zippel, 2002). Vegetative propagation of ensete enforces cutting down of an ensete plant close to the ground. Afterwards, the apical meristem is removed and leaf sheaths are either removed or pulled apart (Brandt et al, 1997). This breaks the apical dominance and enables development of callus, from which numerous adventitious sprouts appear after about three months.

Treatments during the propagation process vary regarding climate and ethnic group (Brandt et al, 1997 and Zippel, 2002). This includes (1) uprooting of mother plants, (2) drying the corm, (3) splitting the corm, (4) wounding the apical meristem (5) filling the corm with soil, manure or gravel, and (6) planting, protection and manuring of the propagated corm. All measurements must not be performed. In one region the same mother plant was used two times for propagation. At altitudes above 2800 meters special treatment could be applied before planting the corm into the final plot (Personal communication with farmers).

Field pot experiment (Figure 3) showed that this plant can sustain about three month without water at a seedling stage on altitude of 1687 masl, average monthly temperature, wind speed and relative humidity of 19.5^0c, $0.31ms^{-1}$ and 56.57 % respectively.

Figure 3. Field pot experiment to detect water requirement of enset.

At the same environmental condition, a 2 years old enset plant tolerated a seven moth water stress with minor pseudostem dry out (Figure 4).

Figure 4: A two years old enset plant after seven months of water stress.

5. Ensete Processing

Ensete processing, the most tedious job left for women, are divided in to five main operations:

- Uprooting the mature stand, separating the individual parts and fermentation pit preparation,
- Shredding and cleaning the leaf sheath,
- Decortications of the sheath,
- Grating the corm, squeezing the decorticated sheath and grated corm to produce bulla,
- Final mixing of the squeezed decorticated sheath and the grated corm; placing it in the already prepared and Ensete leaves

mated pit and covering it to create suitable environment for fermentation.

To facilitate fermentation, starters made from various herbs and spices together with small portion taken from already fermented kocho are used. Daily Turning, mixing, rinsing and chopping continues over a period of the fermentation. The fermentation takes 15 to 20 days (Brandt et al, 1997 and Zippel, 2002). After fermentation, by reducing the moisture, the product can be stored several months (personal experience).

The major food products obtained from the ensete plant are kocho, bulla and amicho, all of which are simple to produce once the plant is harvested, and can be stored for long periods without spoiling. Kocho bread is starch rich piece which is made from the fermented mixture of the decorticated leaf sheaths and grated corm. Combined with Ethiopia's spicy kitfo (minced meat), it is now an expensive dish in virtually all restaurants in the country. One of the tedious job in kocho processing is extraction of water from the fermented enset. A simple lever based technology (figure 4) designed by the author this time found very supportive for small scale farmers. With this technology, farmers can get rid of about 85% of the moisture in the raw product and easily expose all the fibres.

Figure 5. Simple lever based kocho press.

The best quality Ensete food is bulla, higher proportion obtained mainly from fully matured plants. Bulla can be prepared as a pancake, porridge and dumpling. Amicho is the boiled Ensete root. The root is boiled and consumed in a manner similar to that of other root and tuber crops.

6. Ensete and Food Security

Ensete in the farming system contributes significantly to the stability of the food supply in several ways.

a) It can be stored for long periods
b) It can be harvested at any time during the year
c) It can be harvested at any stage over several year period
d) It can survive stress years that reduce or damage other food sources and
e) Estimated highest productivity with organic fertilizer(5000kg.ha^{-1} of kocho) (farmers estimation)
f) It can generate revenue by using it as a material for landscape beautification.

Figure 6. Ensete used for landscape beautification

All together make this plant a potential for guaranteeing household food security (Brandt et al, 1997, personal communication).

7. Limitations and Constraints

Ecological restrictions placed their toll on the dissemination of this plant in the country. Development and release of ecologically adaptive species may unravel this constraint. Existence of little knowledge about the overall aspects of this plant is another restraint which placed its impact on the optimum utilization. Unbalanced nutrient content of the product made it dependent on livestock husbandry (i.e. to supplement the dietary deficiency and for the sake of manure). Cultural differences within the country also another constraint which limits the use of this potential. Vulnerability to fungal and bacterial diseases (Info Musa 2004) due to poor farm sanitation and environmental variations will continue being constraints until research revealed the solution.

8. Conclusion

Erratic and intermittent rain fall coupled with poor farm management reduced the genetic potential of most plant species. Most households are very vulnerable to drought with very small changes in environment. During the 1984-85 famine in Ethiopia, when cereal farmers from non Ensete based farming system lost all their yields, up on migration they learned how to cultivate and processes ensete. When they returned home they practiced the Ensete based system and they verified that due to their ensete cultivation and dependencies on kocho as a stable diet, they can easily cope up the 1992 drought mainly as a result

of their cereals failure. The potential this plant gifted to store water during the rainy season made it suitable to cope up changes; like seasonal moisture stress. If the aforementioned limitations and constraints are conquered through research and social mobilization, this plant is the best way out from the long history of the country usually cited with drought and famine.

9. References

Brandt A. Steven, Anita Spring, Clifton Hiebsh. *The Tree against Hunger*. American Association for the Advancement of Science, 1997.

Hartmann Ingrid. *No Tree, No Bee – No Honey, No Money: The Management of Resources and Marginalization in Beekeeping Societies of South West Ethiopia.* Paper submitted to the Conference: Bridging Scales and Epistemologies, Alexandria, March 17 – 20,2004.

InfoMusa Vol. 13 No. 2.International Network for the improvement of Banana and Plantation. France (December 2004).

Zippel Karin . *Enset Ensete Ventricosum: In Subsistence Farming Systems in Ethiopia.* Conference on International Agricultural Research for Development, 2002.