FOLK *IN-SITU* CONSERVATION OF ENSETE (*ENSETE VENTRICOSUM* (WELW.) E.E. CHEESMAN): TOWARDS THE INTERPRETATION OF INDIGENOUS AGRICULTURAL SCIENCE OF THE ARI, SOUTHWESTERN ETHIOPIA[1]

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ABSTRACT By employing the concept of "indigenous agricultural science," both constructive and unconscious activities of the Omotic Ari people in southwestern Ethiopia, who cultivate as well as preserve ensete genetic resources, are exemplified and described. The Ari people are so deliberate and accurate in their efforts to keep the diversity of ensete landraces as compared to the *ex-situ* conservation of plant genetic resources performed by research stations and gene banks. By their folk belief system, not only the cultivated populations but the wild populations of ensete are also conserved in a ritual sanctuary. Moreover, there are certain mechanisms of bringing into cultivated populations new genotypes originated from natural crosses between cultivated populations and wild populations. The Ari's conservational efforts can be considered as one of a few ideal cases of *in-situ* conservation of crop genetic resources. Proper interpretation of their "folk *in-situ* conservation" activities for ensete can eventually lead us to full understanding of their indigenous agricultural sciences.

Key Words: Folk *in-situ* conservation; Plant genetic resources; Landraces; Indigenous agricultural science; Ensete; Ari; Southwestern Ethiopia.

INTRODUCTION

We should tackle several kinds of ideological obstacles when we commit ourselves to the debates on the developmental issues of contemporary African agriculture. First, modern-traditional dichotomy has provided notorious but influential concepts to the implementation of agricultural development projects and research for the enhancement of production in the small scale agricultural sectors in African nations. "Traditional African agriculture" may inherently involve some, though not entirely, irrational factors within its systems. However, it is wrong to think that it must always be changed or transformed (i.e. modernized) by external forces. Second, another prejudicial attitude towards the African mode of living still persists in the sentimentalism of some journals and novels where the self-reliant African farmers are considered as conservative and without motivation to improve their own subsistence technology. In such literatures, stereotyped African farmers are either well adapted to their natural environment, or facing devastating crisis out of their control. Therefore, readers can mistakenly get a false impression, regardless of the author's wishes, that there is no need of changing their way of life or they simply cannot. Third, the eclectic and most problematic school, lay their foundation on the what-is-called "scientific truths," which are presumed to be absolute ones. They opportunistically attempt to discover and appreciate some "scientific truths" in African

"traditional" agricultural systems only to the extent that those truths can be explained and understood by "modern science," i.e., the logic of the Western way of thinking. In scientific reports on traditional agriculture it is a frequent cliché that with the help of modern science, the wisdom of otherwise primitive African agriculture must be re-evaluated and improved.

This paper aims neither to denounce those prejudicial standpoints of evaluating African agriculture nor to criticize the ethnocentrism in the field of science. Instead I would like to emphasize that in contemporary African agriculture, there exist "indigenous sciences" (*sensu*, Poul Richards, 1985; "folk knowledge systems," Fukui, 1987; "indigenous knowledge system," Brokensha et al., 1980), which we cannot ignore. Of course, these "sciences" are not available in a written text, nor as a given entity of inherent nature. In many cases, they appear like analytical models of researchers. We can observe them in a tangible form and should comprehend them when the farmer applies and modifies in agricultural activities. We may even say that farmers themselves are incessantly conducting on-farm experiments as they go about their daily agricultural activities. Under these circumstances, what we should do now is not to find out "scientific truths" in African "traditional" agriculture, but try instead to interpret the whole system of indigenous agricultural science. It exists within contemporary African agriculture. In this paper, I describe the case of the Omotic speaking Ari, ensete cultivators of southwestern Ethiopia.[2] Ensete is one of the Ethiopian endemic cultivated plants of African origin. I attempt to interpret, though partially, their own indigenous science by which they have achieved "folk *in-situ* conservation" of ensete genetic resources.

The Ari people are mostly self-reliant on agricultural production. At the same time, they are involved in monetary economy through several channels. Not being conservative, they are open to the examination and acceptance of new agricultural technology (e.g., introduction of the ox-plough, new crop varieties, etc.). However, they have not yet undergone much forced agrarian reform by external authorities such as aid agencies or governmental institutions.[3] This is why I call their agriculture neither traditional nor modern, but contemporary. The Ari people wish to change their mode of life. The key of the engine is still in their hands but we do not yet know in what directions the vehicle will go to.

We often find the term "*in-situ* conservation" in the textbooks of crop genetic resources conservation (e.g., Frankel, 1970; Frankel & Soule, 1981). However, it is most ambiguous for the students of this subject to devise how to apply the theme and realize such ways of conservation. As Miguel & Merrick (1987: 87) denote, "most researchers consider that *in-situ* preservation of landraces would require a return to or the preservation of microcosmos of primitive agricultural systems." These kinds of views are mainly due to our prejudicial attitude towards "traditional" agriculture, as mentioned above, and partly because there have been few successful and vivid examples of *in-situ* conservation of crop genetic resources.

The main aim of this paper is to present a case study of *in-situ* conservation efforts based on "peasants' rationale" (Alcon, 1984) and to maintain that the Ari people are intelligently preserving their crop genetic resources by themselves. I con-

tend that proper interpretation of their folk *in-situ* conservation activities for ensete eventually leads us to full understanding of their indigenous agricultural science.

ARI AGRICULTURE, OVERVIEW

The Ari people's habitat, in the southern margin of the Abyssinian Highland and western side of the Rift Valley with the highest peak Mt. Garagir 3,375 m above sea level, is a land of diverse vegetation ranging from lowland Acacia savannah (500–800 m) to Afro-Alpine vegetation. The Ariland has the dry season, *haasin*, and the wet season, *bergi*. The higher the altitude is, the more the annual precipitation is. There is about 1,200 mm rainfall per year at around 1,300 m above sea level, while the monthly average temperature does not go below 10°C even at the altitude of 1,600 m. The Ari territory is divided into five geographical sections, each of which is represented by a local chief called *baabi*. Each section has both highlands, *dizi* and lowlands, *dawla*. Although this folk-classification of territory is rather imprecise, it can be considered that the highland *(dizi)* and lowland *(dawla)* are divided at approximately 1,600 m high above sea level with an intermediate zone. The Ari regard *dizi* as the land of barley and ensete, and *dawla* as that of coffee and sorghum.

The Ari hold a great repository of crop diversity. Crops are categorized into two groups, *ishin* and *tika* in their classification of cultivated plants. *Tika* includes yam, taro, ensete, coffee and other vegetable crops. Households are dispersed within a village enclave, and gardens of *tika, tika haami*, surround each household. *Ishin* consists of grain crops such as barley, sorghum, tef and maize, and pulse crops such as lentil, pea and faba bean. *Ishin* crops are always grown in fields called *wony haami*, which literally means fields of labor. When working in the *wony haami*, people organize several kinds of labor exchange groups but not when working in the *tika haami*. *Tika* crops are usually farmed by the members of the household.

ENSETE CULTIVATION AND UTILIZATION

1. Specific Characteristics of the Ensete Life Cycle

Ensete, *Ensete ventricosum* (Welw.) E.E. Cheesman, belongs to Musaceae (banana family) and is an endemic cultivated plant in southwestern Ethiopia. The peculiar characteristics of its life cycle and cultivation are summarized as follows: First, it is monocarpic and ends its life cycle after flowering at the end of eight to twelve years of vegetative growth. Second, although propagated by seeds under natural conditions, ensete in normal cultivation is vegetatively propagated with the hundreds of adventitious buds induced by removing the apical growing point before flowering. It has no voluntary suckers like those of cultivated bananas (*Musa* spp.). Third, it is transplanted twice to three times in the course of growing to maturity.

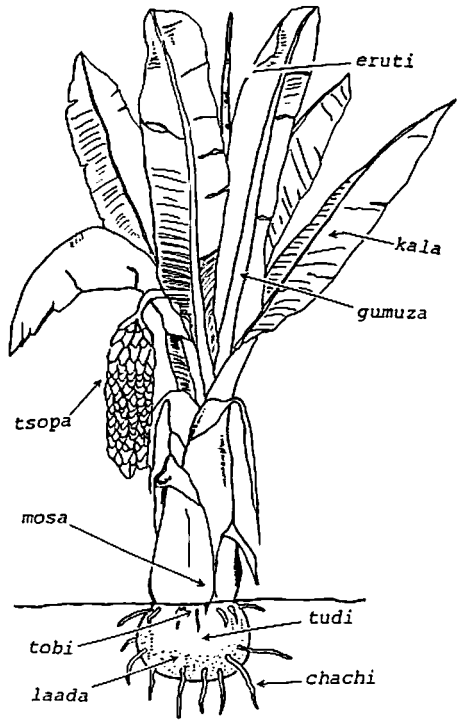

Fig. 1. Ari nomenclature of ensete.

Ensete has entomophilous flowers with abundant sweet smelling nectar. The flowering raceme is cylindrical, 30–40 cm in diameter and 1 m at longest. In addition to *agemi*, a general term for ensete, the Ari people identify each part of ensete plants in vernacular terms (Fig. 1). They divide ensete life cycle into three stages. After three to eight years of growth, *agemi* is ready to be processed for food throughout the year.

II. Utilization of Ensete Products

Several researchers have reported on the economic and cultural importanre of ensete cultivation, and its utilization as food as well as material cultures in Ethiopia (Smeds, 1955; Bezuneh & Feleke, 1966; Shack, 1966; Sakamoto, 1969; Fukui, 1971; Bezuneh, 1984; Shigeta, 1987, 1988). In this section, I briefly describe the case of ensete utilization among the Ari [for details, see Shigeta (1988)].

Ensete is a typical multipurpose crop, of which every part is thoroughly utilized by the Ari. Throughout its growing period, the leaves and pseudostems are used for various purposes. Cut leaves of ensete are indispensable for wrapping, thatching, sheeting to sit, making containers, dressing as women's skirts and personal orna-

ments for funeral and wedding, shading some crops and human beings from sunshine and also protecting them from rain. The pseudostems yield strong fibers, even when used unprocessed, for tying livestock, bundling harvests from the fields and so on. Dried fibers are whitish and strong enough to make high quality ropes. Most parts of the ensete plants are good fodder for livestock. Since the plant contains much water in cell-like structures, it is drought resistant to some extent. So some ensete are cut down for cattle feeding especially in the dry season when grass is scarce. A large number of ensete plants in *tika haami* around the house provide comfortable shades for people as well as for some kinds of crops such as coffee which need only moderate sunshine.

The edible and most important portion of ensete is the reserve starch at the basal part of pseudostems (Fig. 2). The pseudostem pulp (parenchymatous tissue) is prepared on a wooden board reclining on the ensete plant. The pulp is squeezed out of the pseudostem by means of a split bamboo stick (Fig. 3). The pulp, sometimes mixed with the pulverized underground corm, is kept in the fermentation pit for a week or so to be ready for cooking. After carefully removing fiber from the fermented substance, *washi,* it is shaped into a disk-like form and wrapped in ensete

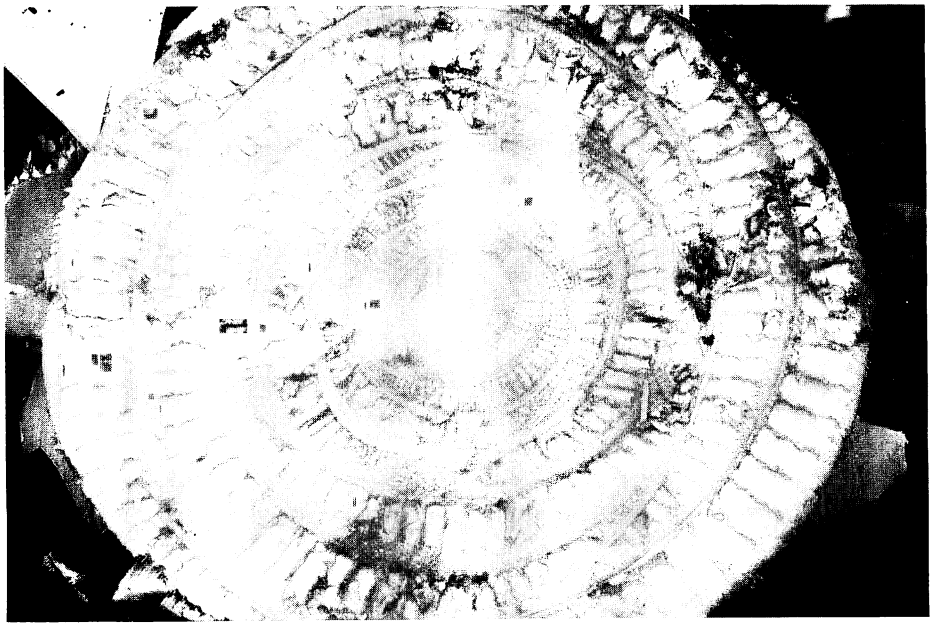

Fig. 2. A cross section of ensete pseudostem, of a landrace of *kaksa,* which is 65 cm in diameter at the grpound level. Cell-like portions are filled up with crude starch.

Fig. 3. Processing of ensete pseudostem. Separated pseudostem are pulverized on the wooden stage. A bam boo stick is used for scratching out crude starch along with pulp.

leaves for cooking on a clay pan. This, *washi katsa,* is one of the most preferred dishes among the Ari. *Washi* is also made into porridge, *washi daatsa,* and sometimes steam-boiled with vegetables in a pot. The steamed *washi* is called *wocha* and usually contains grain flour. The corm and basal parts of pseudostems, which are collectively called *mosa,* are sometimes cut and boiled with vegetables in the clay pot. It is said that local beer, *agemi gola,* is occasionally brewed using the flowering ensete stems having a high sugar content.

FOLK *IN-SITU* CONSERVATION

I. Diversity and Genetic Identity of Ensete Landraces

Table 1. Some ensete landraces with their characteristics.

Vernacular name of land-race	Characteristics
aasha	Little pigmentation on the midribs and petioles. Roundish at the basal part. Compared with *daakai*, it has wider leaves and blackish at the base of pseudostems.
alaka	Little pigmentation on the midribs and petioles. Corm quality is similar to *daakai*, but *alaka* is quicker to be boiled. Narrow leaves with no creases.
daakai	Thin red stripe on the midribs and petioles. Blackish at the base of pseudostems. Leaves with creases along with veins.
garecha	Very whitish midribs and petioles. Plant height is low and slow to grow. It takes six years to reach the height of a two-year *daakai*. It has short petioles. The corm and leaves are large in size.
gena	Gigantic. Redish brown to black midribs and petioles. It is used only for the fermented food stuff called *washi*. The corm cannot be eaten. It takes about five years to mature.
intada	Peculiar landrace which lost its apical dominance. It has voluntaly suckers like those of bananas. The corm and basal part of the pseudostems don't grow large. Leaves are utilized for various material cultures. It is not utilized for food.
joolak	Red pigmentation on the midribs and petioles. Red spotted at the basal part of pseudostems. Narrower leaves than *shuupalak*.
kaksa	Red pigmentation on the midribs and petioles. Leaves with creases and easy to be torn. Not suitable for wrapping purposes. The corm has a bitter taste. It takes three years to give flowers.
mooset	Red stripe on the midrib and petioles. The corm is boiled easily and gives floury starch.
oosade	It has dark red to black color on the midrib and petioles.
salta	Red pigmentation on the midrib and petioles. Narrower leaves longer petioles than those of *shupalak* and *joolak*. Compared with *tsala*, it grows as quickly as bamboo.
shupalak	Red pigmentation on the midrib and petioles.
tsala	Red pigmentation from the basal part of the petioles to the top of them evenly. Slower to grow than *salta*.
zinka	Red pigmentation on the midrib and petioles. Long and wide petioles. Narrow and tough leaves. Petioles twist upwards.

A total of seventy-eight folk varieties (landraces) of ensete are recognized by the Ari people whom I interviewed. Each landrace is clearly distinguished by its vernacular name and peculiar characteristics. Table 1 lists some vernacular names of the ensete landraces with their distinguishable characteristics. The interviewees referred first to the morphological characters of any ensete landrace when asked for key classifying characteristics. The characters with regards to food usage, food quality, method of processing, and usage other than food, were usually mentioned as those of second importance.

The Ari classify ensete landraces at a glance with the help of their folk systematic taxonomy. The interviews enabled me to construct a key dendrogram as shown in Figure 4, but this does not necessarily mean that everyone completely following the same method of identification as shown in the figure. This is evidenced by the fact that I sometimes failed to identify certain landraces though my judgment at each branching point is agreeable with informants.

They usually know as many as twenty or more vernacular ensete names. However, the number of vernacular names which each farmer knows was usually greater than that of the landraces which they are actually planting in their own *tika haami*.

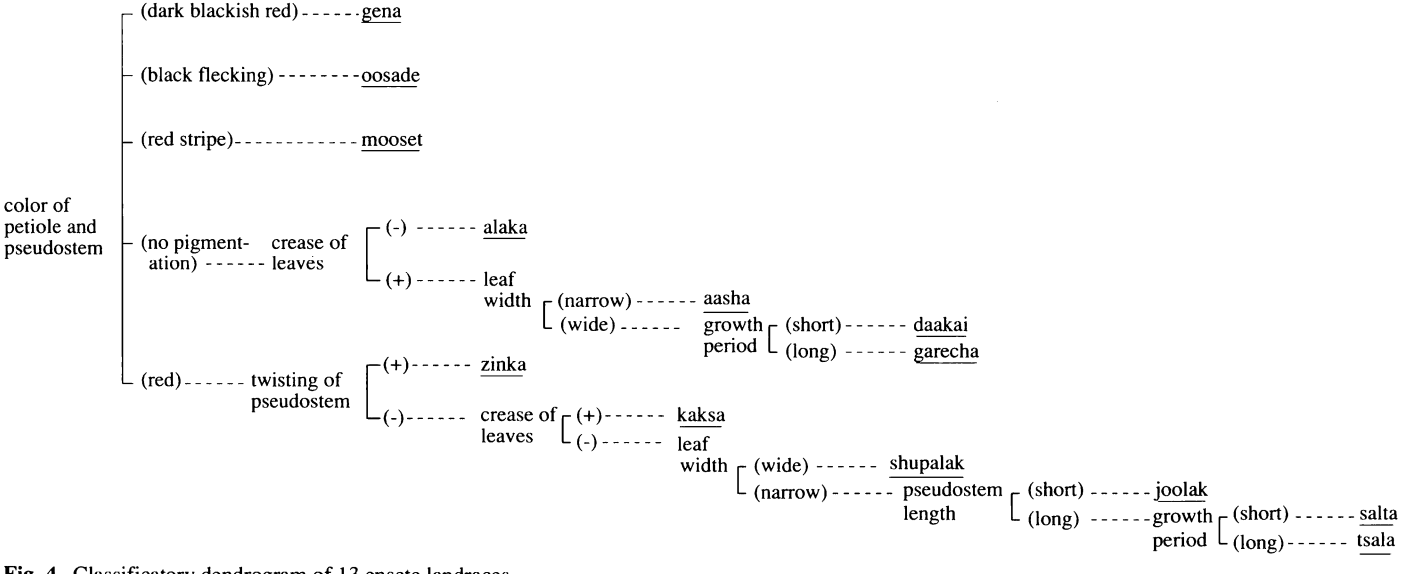

Fig. 4. Classificatory dendrogram of 13 ensete landraces.

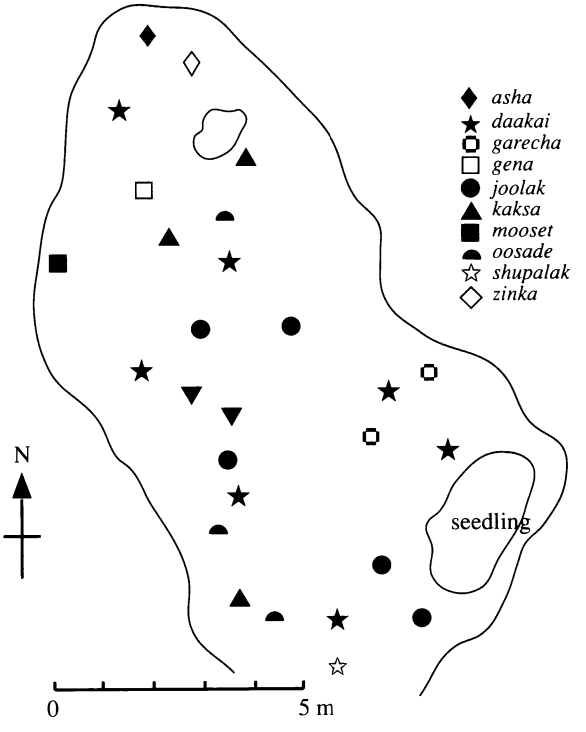

Fig. 5. An example of ensete planting pattern in the garden.

Table 2. Difference between wild and cultivated populations of ensete.

	Cultivated population	Wild population
Vernacular name	*agemi*	*gela*
Habitat	gardens around houses *tika haami*	swamp and riverbank *kau*
Mode of propagation	vegetatives: depending on men	seed: not depending on men
Variation	recognized by vernacular names	recognized sometimes by vernacular names of cultivated landraces
Corm	big	small
Base of pseudostem	enlarged	not enlarged
Population density at the habitat	high	low
Utilization by people	food and other multipurpose	not utilized
Ownership	owned by the head of the household	no ownership
Altitudinal zone of distribution (m)	1,200–2,800	1,200–1,600
Taste of corm	not bitter	bitter

The way of planting ensete seedling in the field is rather random. They are rarely planted in line, and same landraces, not more than three, are seldom grouped in one place as shown in Figure 5.

The genetic identity of each ensete landrace, distinguished by different vernacular names and morphological characteristics, is undoubtedly maintained in Ari agriculture. This presumption is based on the following reasons: (1) Offspring obtained by vegetative propagation are identical to the parental landrace. At any one time, more than two hundred clonal seedlings are obtained. (2) People are thoroughly informed of the vernacular name and its characteristics when making seedlings for planting. (3) People are always referring to the vernacular name when planting, transplanting, managing, utilizing, giving and exchanging ensete. (4) Ari farmers in general have so much intimacy with ensete through daily association with, and their proximity to, ensete plants in *tika*. They often know not only the vernacular name but also the life history of each individual ensete plant.

II. Wild Ensete and Cultivated Ensete

The wild populations of ensete grow in wetter places such as swamps, *baz,* and river bank, *chaka*. The area of distribution spreads all over the Ari territory from 1,200 m to 1,600 m above sea level. One can often find some flowering ensete plants especially in swampy places where people cannot cultivate. On the riverbank side, wild ensete plants are sometimes cut down when sorghum and other crops are cultivated. They say that monkeys like the fruits of ensete and damage nearby crops. In contrast, cultivated ensete rarely flowers in the *tika* garden, because most of them are consumed before reaching the flowering stage. Wild ensete plants, propagating spontaneously by seeds, are collectively called *gela* by the Ari people. People distinguish *gela* from *agemi*, cultivated ensete, and insist that they never eat wild ensete. They say that wild ensete plants are too bitter although some cultivated ones also have a rather bitter taste. However, the wild population cannot be clearly distinguished from the cultivated one by the key morphological characters. Variations of both populations overlap each other and are within the range of one botanical species (see Table 2 for various differences between the wild and cultivated ensete populations).

III. *Kaiduma*: A Ritual Sanctuary of Wild Ensete Population

Among the spontaneous habitats of the wild ensete population, there are certain areas called *kaiduma,* entering which is tabooed (Fig. 6). It is believed that in the *kaiduma* there are fire-balls. Seeing them in daytime would be fatal, and even at night, one would suffer from serious sickness. Or it is said that there are huge snakes in *kaiduma,* and were one to step in there, he would either be killed by snake bite or go mad. Furthermore, *kaiduma* may never be cultivated under any circumstance. If someone should cultivate this area by mistake, he would die from the violation of this taboo. However, these strong prohibitions do not completely prevent the Ari

Fig. 6. *Kaiduma:* Ritual sanctuary of the wild ensete population. Wild ensete plants in *kaiduma* are distributed sparsely making several colonies.

people from going into *kaiduma.* There are, like it or not, even some occasions for them to enter in *kaiduma.* For example, the water in the *kaiduma* is indispensable for the ceremony of purification called *sheena.* For performing this ceremony, they dare to fetch a small amount of water from *kaiduma. Kaiduma* is a place that holds the Ari people in fear as well as in awe. They are well aware of the fact that wild ensete plants, *gela,* grow in *kaiduma,* propagating by seeds, and always flowering. They even point out that there are some of the same landraces as among the cultivated ones among the wild populations. According to the Ari's myth, *gela,* wild ensete, was planted by God.

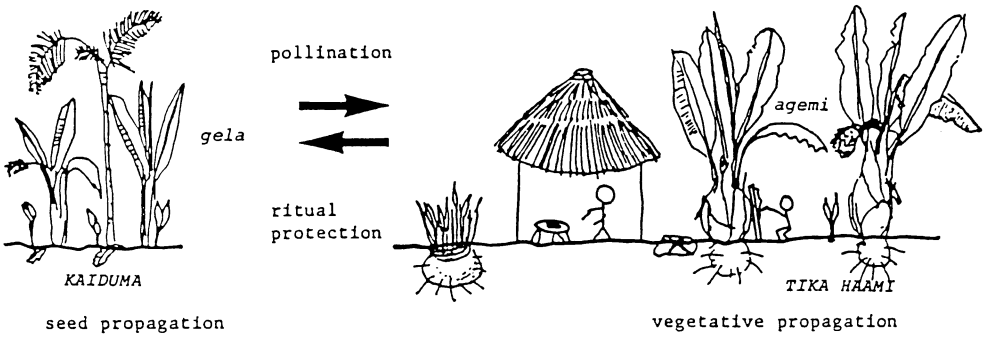

Fig. 7. Schematized relationship between cultivated and wild populations of ensete.

Consequently, the spontaneous habitat of wild ensete is protected from human disturbance and destruction. In other words, *kaiduma* is a ritual sanctuary of the wild ensete population. However, people do not regard just the existence of wild ensete as a prerequisite for a *kaiduma*. There are several spontaneous habitats of wild or escaped ensete where there are no *kaiduma*. Their conservation of wild ensete is backed by firm ritual belief but realized in an unconscious and indirect way.

IV. Dynamics of Folk *In-Situ* Conservation

Activities for plant genetic resources conservation are operated in several levels, from rescue operations for endangered species to the establishment of natural reserves for permanent conservation. In the same manner, *in-situ* conservation itself has two different perspectives. One is to prevent plant genetic resources from being completely lost at that moment, that is more suitable for *ex-situ* conservation. The other is to maintain genetic diversity on site through natural gene flow in the long run although immediate losses occur to a certain extent. It is noteworthy that the conservation activities of the Ari farmers can meet both demands. The loss of ensete landraces seldom occurs under the present conditions of Ari agriculture as described above. Furthermore, they even increase the genetic diversity of cultivated ensete populations.

Genetic diversity of cultivated ensete can be increased directly by either bud mutation within cultivated populations or by introducing a new variation from out of the cultivated populations.[4] I have not come across a case of new landraces originating from a bud mutation, though it is within the range of possibility. However, we have four circumstantial evidences that indicate there are gene exchanges between wild and cultivated ensete populations (Fig. 7): First, the wild populations maintain sexual propagation with a high frequency of flowering individuals. Second, although rarely, there are flowering ensete among cultivated populations. Third, there are ritually protected areas of wild ensete population near the village as *kaiduma*. Lastly,

ensete is predominantly an out-crossed plant pollinated by insects.

There was an actual case of seed propagated ensete being introduced into cultivated populations. The mother plant was cultivated in *tika haami*. It happened to flower, and consequently fruited. Finally some of its seeds germinated. In this case and similar cases, the seedling is first called *gela*. People never remove those seedlings from *tika haami* but foster them with great care. After a year or so when morphological characteristics become evident to allow identification, the ensete plant is named accordingly to an already known landraces or is given a new name. At this point, *gela* transforms into one of landraces in *agemi*. Once established as a landrace, the landrace is propagated in the same way by vegetative propagation as the other landraces, making it quicker to spread and be known to the people. This ensete is also called *arfi agemi*, "seed ensete." The "seed ensete" is praised for its origin when people are exchanging seedlings with friends or selling ensete products in barter markets.

Conservation of ensete genetic resources in the Ariland is realized as the consequences of both (1) conscious efforts such as protection of seed propagated ensete and the introduction of new landraces, and (2) unconscious ones such as ritual protection of the habitat of wild ensete.

DISCUSSION AND CONCLUSION

Ensete genetic resources are conserved through dynamic interaction between man and plants in the Ariland. The Ari people's conservational efforts are both deliberate and unconscious, but their efforts are fully reinforced by their cultural system. First, it is their religious belief that prevent the Ari people from entering *kaiduma*. However, as a result of this taboo, natural habitats of wild ensete is preserved totally unconsciously and unintentionally by them. Second, the Ari people put high cultural value on planting and possessing as many ensete as they can manage, and have deeply interested in the diversity of ensete landraces through the cognition of ensete with various vernacular names. Introduction of seed-propagated ensete seedlings is in line with their keen interest in ensete plants.

Here I would like to employ the concept of "indigenous agricultural science" as an analytical framework for compiling the Ari farmers' rationale. It concerns ensete cultivation, in particular, as well as the Ari's agriculture in general. The scope of indigenous agricultural science covers a wide range of folk knowledge. It includes the interpretation of not only the facts and realities directly related to agriculture but also the final effect, whether that effect is consciously sought after or an unconscious concomitant result of seemingly unrelated activities. For instances, the Ari's belief system is indirectly related to the preservation of the wild ensete genetic resources as described above. This is because the genetic conservation of ensete landraces by the Ari is not accomplished within their farming activities in the field but is an extension of a system beyond the scope of ordinary agricultural science. This is why I call their conservational artivities of ensete as "folk" *in-situ* conservation, one of the

tangible forms of indigenous agricultural science.

As compared with *ex-situ* conservation of plant genetic resources at the agricultural research stations or gene banks, their way of conserving ensete genetic resources is largely different in several points: First of all, it is worthwhile considering that the Ari people themselves are preserving both the wild and cultivated populations under *in-situ* conditions. They are even increasing ensete genetic resources through natural gene flow, in a way no less perfect than that of an established gene bank. Second, perennial root crops with huge mass are generally more difficult to maintain in gene banks than annual crops since large root crops need much field space, manpower and expenditure for longer periods. It is rather technically impossible to preserve them in the cold storage. Therefore, the Ari's case exemplifies that *in-situ* conservation is most suitable for the maintenance of both cultivated and wild root crops such as ensete.

The Ari farmers seem to have no specific goal-seeking-intention with regard to the maintenance and selection of landraces except for increasing overall diversity of their ensete collection. Nevertheless, their farming activities together with their attitude towards ensete are firmly sustained by their cultural value system. Ensete is not merely a crop for the Ari people to subsist on but one of their cultural heritages which induce them to possess large numbers of different landraces.

I conclude that the Ari's conservational efforts provide an ideal case of *in-situ* conservation. The Ari's case gives us many insights and useful examples for our commitment to regional agrirultural development.

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NOTES

(1) The earlier version of this paper appeared in (Kei'ichi Sakamoto,ed.),*The Structure of Technique, Economy and Society of Traditional Agriculture in Equatorial Africa.* 1988, Faculty of Agriculture, Kyoto University.

(2) The field reseach was carried out in Hamer-Bako District, Gemu-Gofa Province, in southwestern Ethiopia, from November 1986 to February 1987, which was financed by a Grant in Aid for the Overseas Scientific Research of the Japanese Ministry of Education, Science and Culture (Project No. 61041043).

(3) After the socialist revolution in 1970's, new administrative organizations called "farmers' association (*gaber mahaber*)" have organized by grouping two to several conventional

territories based on the inhabitants' clanship. At this moment, its main role in the Ari area is tax collection but in future it will play an indispensable part in agrarian reform.

(4) Genetic diversities of cultivated populations are also increased by the introduction of new landraces from outside of the Ariland. Certain landraces are known to be of foreign origin among the Ari.

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