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# 4 Cultivation Strategy and Historical Change of Sorghum Varieties in the Hoor of Southwestern Ethiopia

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## INTRODUCTION

It is known that a number of 'primitive societies' have preserved diverse indigenous crop varieties and have also maintained genetic purity in each variety (Jackson et al. 1979; Brush et al 1981; Richards 1986). Recent anthropological studies have shown that people select new varieties based on perceptual distinctiveness and introduce them to their inventory of indigenous varieties (Boster 1984, 1985; Shigeta 1988, 1990; Miyawaki 1991, 1995). But not every new variety necessarily spread in the given society. Some studies have also demonstrated that the frequencies of cultivation of indigenous varieties among native cultivators show significant differences for each variety (Shigeta 1988; Miyawaki 1991, 1995; Fujimoto 1995). This indicates that some varieties spread but others do not. We should consider, then, what kind of factors influence the process of diffusion of varieties. It also induces us to study the historical process of rise and decline of indigenous varieties. The dynamic process of introduction and disappearance of varieties is an important, but rarely investigated aspect of indigenous agriculture.

This paper deals with the sorghum cultivation of the Hoor, Cushitic agro-pastoralists in south-western Ethiopia[1]. They cultivate sorghum on flood plains of the Weito River that flows from north to south on the eastern edge of their territory. I have already published some articles on their sorghum cultivation and the selection of indigenous varieties (Miyawaki 1991, 1995). Based on the results of these articles, this paper intends to show further consequences, namely, what kind of factors are relevant concerning the decline and change of indigenous varieties. As one of the most significant factors it focuses in particular on people's knowledge and strategies that enable them to adapt to harsh ecological environments.

Firstly I illustrate the sorghum cultivation of the Hoor, and demonstrate how people determine cultivation strategies based on consideration of a number of factors and fine observation of indigenous sorghum varieties. Secondly I explain folk taxonomy and native categorization of indigenous varieties. Thirdly, I summarize the result of a questionnaire to cultivators with questions concerning

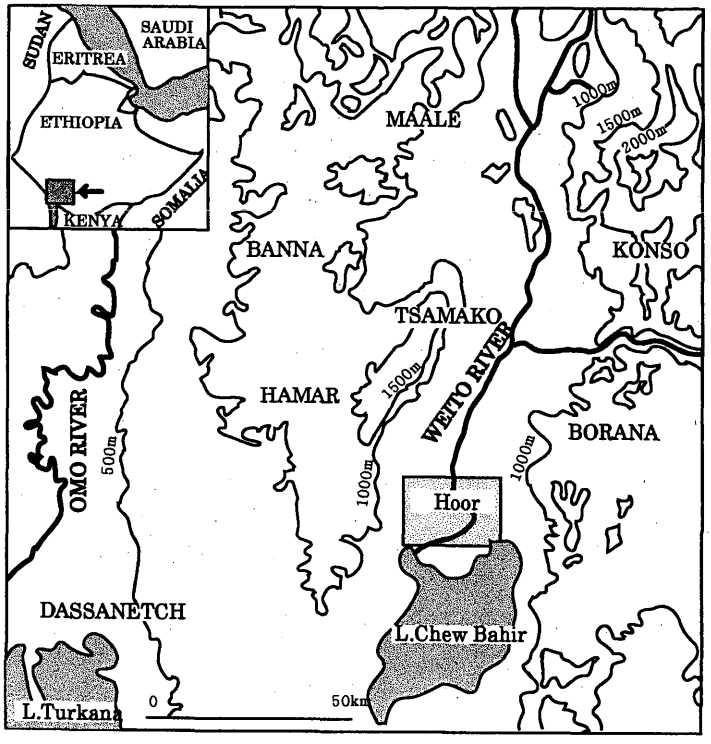



**Figure 1.** Map of the Hoor and their neighbours

sorghum varieties, and take up twenty nine varieties which are the most popular among the cultivators. Then I carry out a multi-variate analysis on the varieties, based on the results of the questions that are relevant to the determination of their cultivating strategies, and show that the varieties can be classified into certain categories according to the specific utilities they have. Finally I demonstrate that the utilities relevant to cultivation strategies have a significant influence on the fate of varieties.

## ECOLOGICAL AND SOCIAL ENVIRONMENTS

The Hoor are a Cushitic agro-pastoral people with a population of about 2000 residing in the South Omo Administrative Region of southwestern Ethiopia. The Weito river (*limo*) flows from north to south along the eastern edge of the territory, flooding into Lake Chow Bahir (*chelbi*) on the border with Kenya. The Hoor reside in an area extending downstream along the Weito river to the north shore of Lake Chaw Bahir (Figure 1). The lowlands in the southwest region of Ethiopia, including the Hoor territory, are a semiarid zone with an annual precipitation of 200 mm to 600 mm. Rainfall in this region is characterized by two rainy seasons, totaling six months of the year. The first rainy season lasts from February to May

**Table 1.** Seasons and agricultural cycles of the Hoor

| | Name of months | Seasons | Fluctuation of the river | Agricultural practices in each kind of field *gofa irit* | *simako* | *daabante dersit* | Meanings of the names of month |
|---|---|---|---|---|---|---|---|
| Jan. | *Halmo Duddai* | *Maar* (dry season) | | harvest | | | Entering the buttocks (end) of Vega |
| Feb. | *Gaar maar* | | | | harvest | harvest | Near hunger |
| Mar. | *Gurandal* | *Guh* (big rain) | flooding | sowing | | | (from Banna language) |
| Apr. | *Bitche Yett* | | | | sowing | | Black water |
| May | *Chamsa/ Kore* | | | harvest | | sowing | (no reported meaning) |
| June | *Lee Warigare* | | | | harvest | | Month of Wari Garle (name of a clan) |
| July | *Harata Metett* | | | | | harvest | 'Head' (start) of a malaria month |
| Aug. | *Haratt Duddai* | *Maar* (dry season) | | | | | Entering the 'buttocks' (end) of a malaria month |
| Sept. | *Kodd* | | | | | | Satisfied |
| Oct. | *Hagai ta Metett* | *Hagai* (small rain) | | sowing | | | 'Head' (start) of a small rain |
| Nov. | *Hagai Duddai* | | flooding | | sowing | sowing | Entering the 'buttocks' (end) of a small rain |
| Dec. | *Halmoda Metett* | | | | | | 'Head' (start) of Vega |

and the second from October to November, with a particular concentration of rainfall in the month of April (Daniel 1977).

Rainfall in rainy seasons causes large-scale flooding (Table 1). The course of the Weito river has changed three times this century. The former riverbed (*leba*) still remains, creating a complex topography. During rainy seasons, the river floods and water overflows into the former riverbeds, which run through Hoor territory, and inundates plains. The Hoor call the flood plains *hoor*, and the dry plains *abaar*, which are not inundated.

The Hoor consist of two regional groups, one of which lives in the north and calls itself the Arbore. The northern regional group is further divided into two territorial groups, the Gandarab and the Kulam. The former live in the northernmost region of Arbore territory in a village of over 200 households, while the Kulam live to the south in a village of about 100 households. The southern regional group is called the Marle. This group also consists of two territorial groups, the Murale to the north and the Egude to the south, both of which comprise about 100 households. These four territorial groups are politically independent of each other. Each has its own hereditary religious chief (*kawot*), a political chief (*kernet*) selected by consultation, councilors (*jalaab*), distributors of arable land (*murra*), cattle guards (*modo ha me*) and punishers (*danto*).

The Hoor raise cattle, goats and sheep. Although cattle have significant social value and produce dairy products which are quite important for their diet, they depend for their staple mostly on crops. Seasonal floodings bring fertile alluvial soil from upstream. They cultivate most crops in inundated plains after floodings have receded. The cultivated crops include sorghum (*rub, Sorghum bicolor* MOENCH), maize (*gamo, Zea mays* L.), cow pea (*ham, Vigna sinensis* ENDL.), green gram (*gade, Phaseolus radiatus L.var.typicus* PRAIN), gourd (*kalu, Lagenaria siceraria var. siceraria*) and pumpkin (*bote, Cucurbita moschata* DUCH.). Among these sorghum is the most important not only in its amount of cultivation and production, but also in its great number of varieties.

As is represented in their self-denomination, the flood plain is of prime importance to the Hoor as a source of edible wild plants, as pastureland for grazing during the dry season, and most importantly, as arable land. Figure 2 shows the core part of the Hoor territory. They give names to each topographically distinct place, and the land alongside the river and former riverbeds, and flood plains are especially finely named. This indicates the importance of the river and flood plains in their recognition of environments. The area of inundation grows larger to the south, and the plain in the southern most part of Hoor territory is always inundated by the Weito river, creating a large marsh called Hoor Tuliya. In their world view, the southern direction, comprising large flood plains represents seniority, and it symbolizes superiority.

**Distribution of arable allotments and cultivation practices**

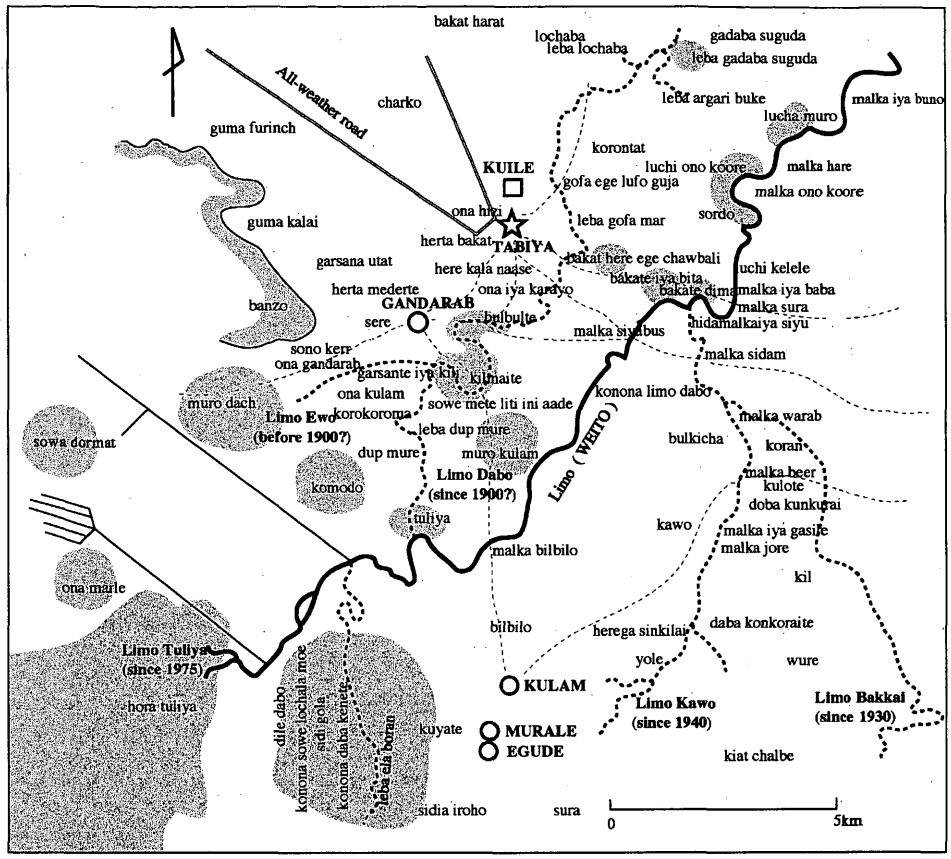
The land of Hoor is considered to be fertile by the Hoor themselves, as well as by

the neighboring ethnic groups, due to the Weito river and its seasonal floodings. The Hoor are regarded as the provider of grain in exchanges with bond partners of neighboring groups. However, rains and floodings of the Weito river are far from stable. Firstly, they are very unreliable, especially in the small rainy season. The Hoor usually say,"Big rain (*guh*) is like a man (reliable), but small rain (*hagai*) is like a woman (unreliable)." Table 2 shows the degree of floodings and the flood plains utilized as main cultivating fields (*daabante dersit*) by each territorial group from 1990 to 1995. It demonstrates that they suffer from drought once every four rainy seasons (two years). In a season of no flooding, people go to the marsh, clear the dense weeds and cultivate sorghum. But due to the heavy labor, they cannot cultivate enough. Secondly this Table also shows a frequent shift in places inundated by floodings. Inundated places change unpredictably every season especially in the northern part. On the contrary in the southern part, inundated places move steadily from west to east, which they consider a symptom of the change in course of the river. Thirdly the river course itself has changed almost every thirty years, at least in this century (see Figure 2). Locations of inundated plains have changed accordingly. The unreliability of floodings and frequent shift of inundated plains do not allow either territorial groups or households to occupy fixed flood plains as hereditary resources. Distribution of arable plots is thus a social matter of significant importance.

To cope with these difficulties, the Hoor have developed a social system of distribution which is based on the semi-age-grade system, the structure of which is common to the four territorial groups. The leaders of each territorial group are selected from a generation set called *herr*, which means "elders," by the elders of the senior generation set (see Miyawaki forthcoming). The seven distributors of flood plain (*murra*) are selected from this generation set[2]. After flood water has receded, the distributors of adjacent territorial groups gather and discuss where to draw the border on the flood plains to demarcate the fields of each territorial group. They then set the border by planting stakes called *aanke*. If difficulties are encountered in the negotiations, the political chiefs of each group participate, and try to come to an agreement. The distributors sometimes order irrigation ditches (*kolam*) to be dug from the main stream to make artificial flood plains. Before the river changed its course in 1975, they used to use such irrigation ditches and irrigated fertile plains called Bulkicha and Kawo, located on the west side of the river. After the river course changed, the people of the Marle, the southern regional group, made irrigation ditches to induce water from the new stream to flood the east side of the river. In addition to this social system, an ideology which pervades among the Hoor seems to play an important role. This ideology is established on a dual symbolism, the core of which is the complimentary pair of senior (*angaf*) and junior (*manda*) (see Miyawaki forthcoming). They think that seniors should be generous and juniors should be obedient. The symbolism of junior and senior is applied to the relationship among the four territorial groups. The territorial groups located on the southern side are considered to be senior to those on the northern side.

**Table 2.** Locations of *daabante dersit* from 1990 to 1995

| Ethnic Group | TSAMAKO | HOOR | | | |
|---|---|---|---|---|---|
| Regional Group | | Arbore | | Marle | |
| Territorial Group | Kuile | Gandarab | Kulam | Murale | Egude |
| 95 *guh*/small flooding | *Wari Marle* (irrigation) | *Wari Marle* (irrigation)<br>*Muro* | *Dile Dabo* | *Leba Ela Boran* | *Leba Ela Boran* |
| *94 hagai*/small flooding | *Wari Marle* (irrigation) | *Wari Marle* (irrigation) | *Malka Garsabte* | *Leba Ela Boran* | *Leba Ela Boran* |
| 94 *guh*/big flooding | *Korokoroma* | *Bulbulte*<br>*Leba Argari Biche* | *Malka Garsante* | Sura | Sura |
| 93 *hagai*/no flooding | *Wari Marle* (irrigation) | *Wari Marle* (irrigation) | *Tuliya* (swamp) | *hoor Tuliya* (swamp) | *hoor Tuliya* (swamp) |
| 93 *guh*/big flooding | *Hereg ege Chau Bali*<br>*Kilmaite* | *Bulbulte*<br>*Muro Datch*<br>*Kilmaite*<br>*Sowa Dormatt* | *Kilmaite* | *Leba Ela Boran* | *Leba Ela Boran* |
| 92 *hagai* | *Muro Kulam* | *Komodo* | *Tuliya* | *Leba Ela Boran* | *Leba Ela Boran* |
| 92 *guh*/small flooding | *Lucha Muro* | *Muro Kulam* | *Muro* | *Konona Daba Kenete* | *Konona Daba Kenete* |
| 91 *hagai*/no flooding | *Wari Marle* (irrigation) | *Wari Marle* (irrigation) | *hoor Tuliya* (swamp) | *hoor Tuliya* (swamp) | *hoo Tuliya* (swamp) |
| 91 *guh*/big flooding | *Bakate iya Pita*<br>*Lucha Muro* | *Komodo*<br>*Muro Datch* | *Konona Daba Kenete* | *Konona Daba Kenete* | *Konona Daba Kenete* |
| 90 *hagai* | *Luchi Ono Koole* | *Wari Marle* (irrigation) | *Konona Daba Kenete?* | *Sidi Gola* | *Sidi Gola* |




Weito River (*Limo*)
former riverbed (*leba*)
irrigation channel made by NGO
depression watered by rain (*gofa irit*)
inudated flats (*hoor*) (*simako/dabante dersit*)
Arbore settlement
Tsamako settlement
police station
path

**Figure 2.** The Hoor territory

Although it does not mean that the southern territorial groups have a commanding role, while the northern groups are obedient, this ideology seems to give a sense of order to the whole society, establishing complementary parts of a whole.

Within each territorial group, the inundated flats are allotted to households by the distributors. The Hoor categorize arable land into the following four types according to their ecological environments and social criteria for distribution. 1) *Gofa irit* are small-scale fields made in dry plains, relying on natural rainfall during rainy seasons. *Gofa* means a place where grasses grow due to its retained moisture. *Irr* means rain. These fields are made in natural depressions where precipitation

collects. Except for a few cases, there is no restriction on cultivating in *gofa irit*[3]. Since these fields are watered by rain, people can start cultivation earlier than in flood plains. But moisture and fertility are said to be less. 2) *Luchi* primarily means strips of riverside demarcated by banks. It also means a field cleared in a riverine forest by some individuals. *Luchi* belong to those who have cleared them until they leave. As this entails more labor for clearing than other fields, *luchi* are small in size and few in number. 3) *Simako* are inundated areas not enclosed as *daabante dersit*, explained below, and they can be freely cultivated by any household. 4) *Daabante dersit* is land cultivated in the most fertile part at the center of flood plains. *Daaban* means moisture, and *dersi* means certain specific grasses used in rituals to protect an area from the evils outside. After flood plains have been divided among the territorial groups, the land is then further subdivided in each territorial group into small rectangular plots about 1500 $m^2$ to 2500 $m^2$ with stakes called *saaban,* and distributed to each household. A field made in *daabante dersit* is usually the largest and most important field for each household. The distribution and cultivation schedule for *daabante dersit* is strictly regulated by the distributors. Before cultivation they perform several rituals. Agricultural activities such as sowing, thinning out, bird scaring and harvesting are carried out simultaneously in each field by order of the distributors. Cultivators that violate the regulations are fined by the distributors[4]. Before explicating cultivation strategies, let us look at the cultivation process in *daabante dersit*.

**Cultivation in *daabante dersit***

When the Weito River floods, and the water inundates plains, the ritual called *sube daaban* is carried out. In Gandarab, the ritual chief (*kawot*) come to the shore of an inundated plain, and cuts the neck of a nulliparous sheep (*sube*). He digs a hole under the water, and put a part of greater omentum into it. They say that the purpose of this ritual is to spread the sheep's fertility to the whole inundated plain through the water (see also Ayalew 1995)[5].

A couple of weeks after the ritual, the water recedes. The distributors discuss what areas to enclose as *daabante dersit*. They meet the distributors of adjacent territorial groups, and demarcate the border with the stakes called *aanke*. Then they enclose the central part as cattle flood plain (*hoor ot*) for communal pasture in the dry season. Then they divide land into several long strips with stakes called *aanke* parallel to the flooded former river bed. They estimate the scale of flooding by referring to the number of stakes. For example, "one stake (single strip)" is a very small flood. "Two stakes (two strips)" is a small flood. "Three stakes (three strips)" is a large flood. "Four stakes (four strips)" is a very large flood. Strips are then divided into rectangular plots by stakes called *saaban*, the lines of which are at right angles to the former river bed. They distribute plots to each household, considering the number of family members. The ritual chief is given a plot twice as large as any other, since he has to invite a lot of guests.

Then they start to clear the fields. This is done by men. They squat, holding

a digging stick with an iron tip called *gaidan*, and scratch the surface of the field to clear weeds. Trees and shrubs are cut by a hand ax (*hikich*) and a machete (*banga*) They sometimes organize a communal labor called *haila,* and finish the work within a day or two. Otherwise clearing lasts for more than ten days. The cleared weeds are gathered, dried, and burned.

A week after the clearing, a ritual called *dumabuto* is performed. A man called *moha duumabe* is appointed by the distributors[6]. He digs four holes in his field, and sows sorghum seeds which can be of any variety. He is believed to have the power to keep away birds and sorghum diseases, and to bring a good harvest. Four days after this ritual, the sorghum germinates. Then every cultivator is allowed to sow seeds.

In sowing, men dig a hole with a digging stick about two meters long (*hoosan*) at intervals of one meter. Then women remove soil from the hole by hand, or sometimes dig it again with *gaidan*, and make it like a funnel twenty centimeters deep. Then they put in germinating sorghum seeds which have been soaked in water in a calabash bowl since the day before. They put about fifty to one hundred seeds with their hands into each hole. Then they cover it with soil.

They spend several days sowing, then wait for germination. If the seeds do not germinate, they change the place and sow again.

They sometimes make mud walls about 30 centimeters tall around plots after sowing. Small ones which surround several plots are called *hid,* and long ones which surround many plots are called *moosi*. The purpose of these walls is to protect plots from re-inundation, since young sprouts cannot survive under water.

After about a month, the plants become about thirty centimeters tall. The Hoor have a rich vocabulary to differentiate the growing stages of sorghum (see Table 3), and always pay attention to the condition of the plants. This stage is called *futi garbat*. The *moha duumabe* thins out weak plants from four holes of his field. Four days after that, the cultivators are allowed to start thinning out. Weeding is not usual in the flood plains through out the period. They sometimes weed by hand when they come to plots.

When stalks grow and have eight or nine joints, tall varieties become vulnerable to wind. This stage is called *koldunna beda aana* (bad kind of *koldu*). The cultivators bundle the stalks growing from one hole together so that they are not blown down.

About three months after sowing, panicles come out and start to flower. If his sorghum has reached this stage and becomes vulnerable to birds, the *moha duumabe* constructs a bird scaring platform (*konna*) about two meters tall. Four days after, the cultivators are allowed to construct platforms in their fields. If the *moha duumabe* plants are not mature enough, but others' are, he constructs only a frame for a platform (*kaitente*). Then others can construct platforms immediately. They start to scare birds from early in the morning till sunset by throwing small lumps of mud by hand, or by swinging a long rod with a lump of mud on its tip to release it (*hordach*). This early period of flowering is called *tuzuba eer* (seven of

**Table 3.** Stages of sorghum growth

| days | stage name | meaning | stage of growth | relevant activities and other information |
|---|---|---|---|---|
| | *gos* | to sow seed | not germinated | |
| | *mukachi* | | germinated | with no leaves |
| | *bakal* | | germinated with leaves | |
| 30 days | *futi garbat* | | about 30 cm tall | Start thining out.<br>The Garba was a small ethnic group who once lived between the Konso and Wata. They had no livestock, and lived on hunting and sorghum cultivation. They taught the technique of thining out to the Arbore. They have been absorbed into the Wata. |
| | *futi* | | about 50 cm tall | Thining out |
| | *koldu* | | about 150 cm with five or six joints | |
| | *koldunna beda aana* | bad *koldu* | have eight or nine joints | Breakable, vulnerable to wind. Binding some stalks not to fall. |
| 50 days | *ii mirgi gede* | became pregnant | panicle comes out | One week after the former stage. |
| 60 days | *ii eerude* | *err* means flower | start to flower | |
| | *ii wattuse* | became black | white flowers become black | |
| 80 days | *ii charaa gede* | *charake* means immature grain | have immature green grain, very juicy | Appropriate food for children but not adults. Construct platforms and start bird scaring. |
| | *ii hiise* | | grains have colors but still juicy | Appropriate for *taka* (sticky porridge). |
| 90 days | *ii gera kaae* | | grains become hard | |
| 100 days | *ii goge* | *gog* means dry | grains become dry<br>Till this stage the plant itself is called *baraku* (first shoot). | Collecting seeds (*bado*). Harvest. |
| | *ina chakalidai* | *chakali* means second shoot | second shoots sprout | *Chakali* usually lacks the stage of *futi*, and immediately becomes *koldu*. |
| | *ina dunna dai* | *dunna* means third shoot | third shoots sprout | *Dunna* usually become *tursiko* (panicle with black powder) |

flowers). Almost half the sorghum in the field has panicles. This period is considered to last for seven days.

Then half the sorghum starts to flower and become white, while the other half has new panicles. Some have immature grain. Children may take this. This period is called *tuzuba init* (seven of children), and is considered to last for seven days.

Then the panicles start to ripen. Almost three and a half months have passed since sowing. The cultivators ask the distributors to collect the seeds for the next season. These seeds are called *bado*. They construct a hut (*bara*) in their field. If the distributors judge that the plants are mature enough, they allow the cultivators to bring four panicles from their fields and eat them in their huts. Then they can collect the panicles for seeds and join them with a thong. This bundle of panicles is called *kankaito*. They spend a day in their huts, eating sorghum and drinking coffee. Then they bring their *kankaito* to their house in the settlement. They do not have a name of this period, but they consider it to last for seven days.

Although it is the command of the distributors that enforces them to collect seeds before harvesting, they recognize some merits in this habit. Firstly, it is to avoid early rain that damages ripe grain. Secondly, it is to keep seeds in an case of outbreak of ethnic warfare. They say, "You can run away with cattle and seeds, but not with plots." Thirdly, once harvest starts, a lot of bond partners come from neighboring ethnic groups for grain. It is difficult to refuse the requests of bond partners especially at times of drought. Before they take everything, some seeds must be put aside.

After a week, the distributors patrol the fields and make sure the collection of panicles for seeds has finished. Then, they discuss when to allow the harvest to begin.

At first, the distributors order the cultivators to collect wood to construct a platform to dry the harvested sorghum. This platform is called *doru*. Then they order the cultivators to harvest the field of the ritual chief, since he is not allowed to do any cultivation by himself. They bring the harvested panicles to the *doru*.

Thereafter, they are allowed to harvest their own field. They cut down the stalks, and cut the panicles off with a knife (*bilaw*). They dry the harvested panicles, and then bring them to their house. Thereafter they release cattle to graze the fallen stalks. If they have enough rain after the harvest, second shoots (*chakali*) grow. They say that second shoots give the same amount of grain as first shoots (*baraku*).

Cultivation in *daabante dersit* is therefore completely under the control of the distributors. They distribute plots, and interfere, sometimes through a ritual expert appointed by them, at each important stage in cultivation such as 1) sowing, 2) thinning out, 3) bird scaring, 4) collecting seeds, and 5) harvest. Those who ignore orders are punished and ordered to pay some gourds of honey, which are quite expensive for the Hoor[7]. People say that if it were not for these regulations,

some would start to harvest earlier than others, and those remaining would suffer from serious bird attacks. Thus the regulation by the distributors is considered necessary to protect plots from birds.

## SORGHUM CULTIVATION AND ITS STRATEGY

We have seen that the Hoor cope with unstable ecological environments by mobilizing social organization to distribute inundated plots equally to each household, and that they realize the security of the harvest by imposing social control on cultivation. But on an individual level, cultivators have to take other micro factors into consideration. They decide how many plots to cultivate in what kind of field, and what kind of varieties to sow in which plot, and in what kind of pattern to sow the varieties in one plot. The factors they consider are the degree of moisture retention and kinds of soil in a plot, types of favored food, the necessity of an early harvest for the household, the number of consumers, the possibility of bird attacks in relation to the cultivation strategy of adjacent plots, and the distribution of manpower among different fields. Considering these factors, they decide the constitution and plan of cultivation of different varieties in their plots. In this section I show how the factors mentioned above influence cultivation strategies, and selection of certain sorghum varieties. Firstly, I point out the utilities of sorghum in Hoor. Then I demonstrate the factors people consider, and exhibit how they select certain varieties appropriate for specific situations. Finally I show how cultivators determine the cultivation plan of their plots considering these factors.

### Utilities, food processing and varieties

Sorghum is a multi-purpose crop. Young stalks thinned out at the stage of *futi garba* are brought back to the settlement and given to calves. The fallen stalks after harvest are good forage for cattle. Temporary huts in the fields are sometimes thatched with sorghum stalks. Empty panicles after threshing are used as a cushion for steaming food in a pot. Grain of a red variety called *gababo* is used for a ritual called *herdu na dussen* among the *Olmok* and *Heruf* clans, and is given to a new born child with coffee. But its use as a staple food is far more important.

The edible parts of sorghum are the stalk and the grain. Most of the sorghum varieties of the Hoor have sweet stalks, and young stalks are favored by children. But the staple food is made only from grain. The Hoor differentiate more than fifteen kinds of food made from sorghum (*kooka rubut)*. Figure 3 shows a processing chart for each food. Considering this chart, we can find some broad categories. The first one includes those which bypass the grinding process, and are eaten as grain (*tise, kalkaltu, abas*). The second includes those that are ground, and thereafter, mixed with hot water (*sol, mankal, leleito, buru, kodan, bada*), or with boiled greens (*hafare*), or are made into dough and steamed (*danut lacho, danut*), or baked (*lasa*). The third one is *taka*, the processing of which includes the kneading of wet dough and discarding of white water (starch). The last one is

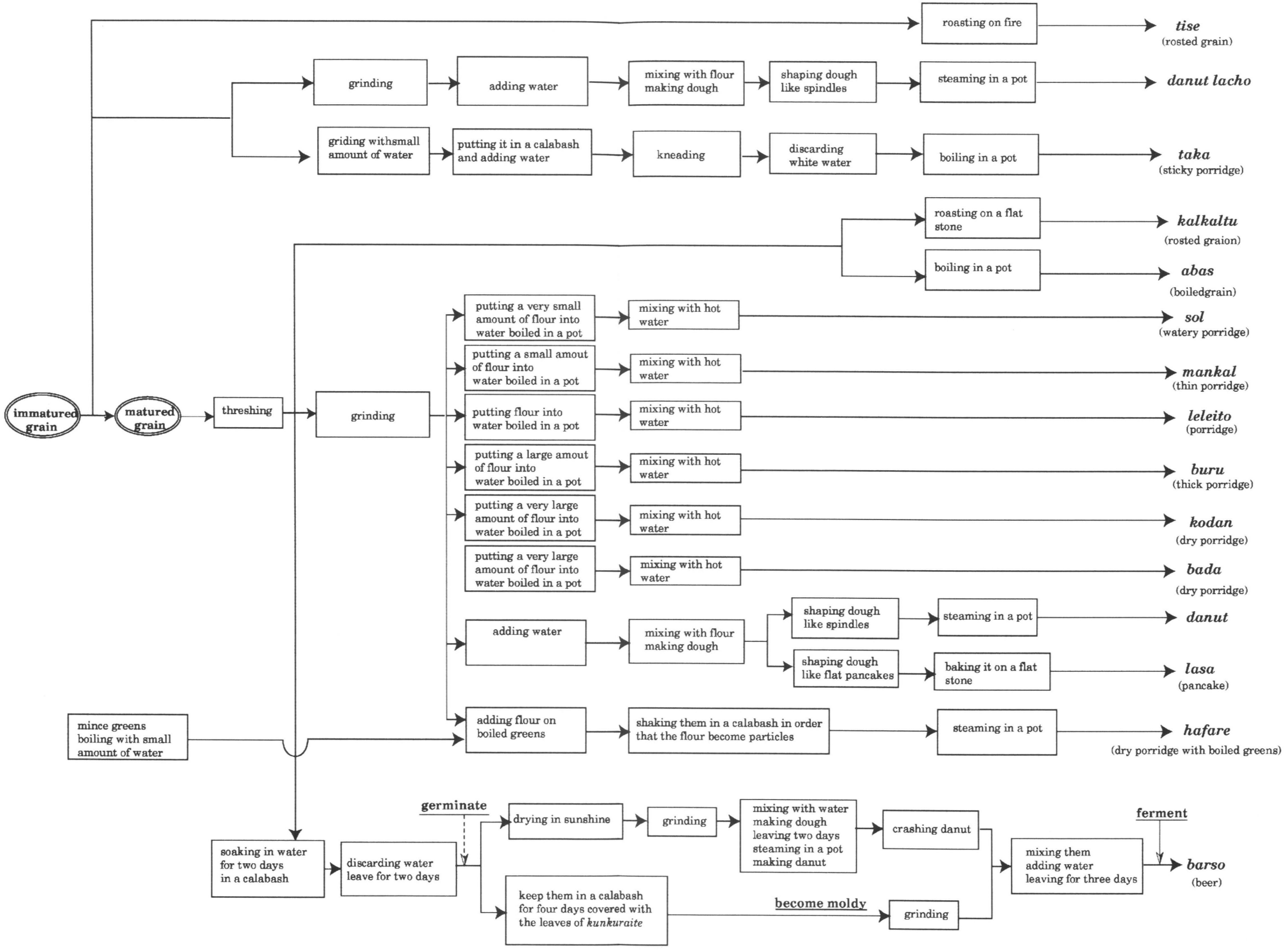



**Figure 3.** Food processing chart

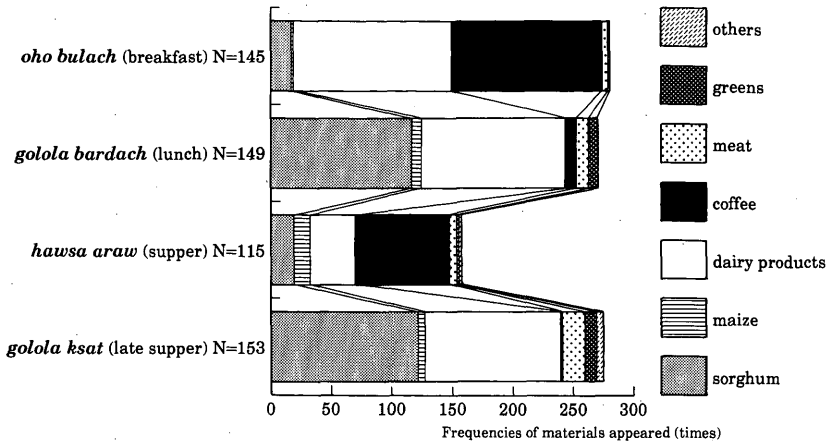



**Figure 4.** Frequencies of materials by four meals of A's household from July to December 1993

barso, the process of which include germination, molding and fermentation. Certain sorghum varieties may be considered to suit each category. I selected *abas, danut, taka* and *barso* as representatives of each category, and asked eighty cultivators which varieties most suited each food (Miyawaki 1995). It turned out that white varieties which lack polyphenol were considered to suit *danut* and *abas*. Red varieties which contain polyphenol were good for *barso*. As for *taka*, some insisted that only red varieties would do, some others said red and white varieties must be mixed, and others considered only white varieties to be appropriate.

To estimate the actual importance of the different varieties, I asked my informants to record their daily diet for six months. Figure 4 shows the frequency of materials appearing in the meals recorded by one of my informants from July to December 1993. The Hoor usually have four meals a day. *Oho bulach* is breakfast, taken at around eight o'clock. *Golola bardach* is lunch taken at noon. *Hawsa araw* is taken in the evening around five o'clock after they returned from daily work. *Golola ksat* is taken at around ten o'clock at night. The figure shows the apparent contrast of *oho bulach* and *hawsa araw* with *golola bardach* and *golola ksat*. The former are light meals, and usually consist of coffee with milk or coffee only. The latter are main meals consisting of milk and food made from sorghum. Thus milk and sorghum are quite important in the Hoor's daily diet. Let us turn to the frequencies of kinds of food made from sorghum (Table 4). We find that *danut* is outstandingly more favored than other foods. Most of the foods appearing in this data are considered to have the best quality when they are made from white varieties. On the other hand, *taka* and *barso*, which red varieties suit, are quite few in number. So according to their taste, they would grow white varieties that best fit their daily diet.

**Table 4.** Breakdown of materials appearing in the meals of A's household in Gandarab from July to December 1993

| | frequency | | %* | |
|---|---|---|---|---|
| dairy product | 400 | | 71.2 | |
| cow's milk | | 309 | | 55.0 |
| cow's sour milk | | 49 | | 8.7 |
| smallstock milk | | 32 | | 5.7 |
| butter | | 10 | | 1.8 |
| sorghhum | 273 | | 48.6 | |
| *danut* | | 197 | | 35.1 |
| *lasa* | | 24 | | 4.3 |
| *abas* | | 21 | | 3.7 |
| *tise* | | 11 | | 2.0 |
| *taka* | | 6 | | 1.1 |
| *buru* | | 5 | | 0.9 |
| *others* | | 9 | | 1.6 |
| coffee | 208 | | 37.0 | |
| meat | 41 | | 7.3 | |
| maize | 28 | | 5.0 | |
| greens | 21 | | 3.7 | |
| others | 7 | | 1.2 | |

*Percentage in total number of meals (N=562)

**Moisture and soil**

One of the most important factors that cultivators consider is moisture retained in the soil of their plots. The Hoor call moisture *daaban*, and it is brought through rain (*irr*), overground flow of rain water (*biche ilet*), flood water of the river and riverbed (*chafa*), and underground water (*chuf*) to arable land. They consider that *gofa irit*, fields watered by rain and overground flow, retain less moisture than *simako* and *daabante dersit*, the fields in the flood plain watered by flood and underground water. They thus tend to grow drought resistant varieties in *gofa irit*, and slow but productive varieties in *simako*, and *daabante dersit*.

Another important factor is type of soil. The Hoor consider the soils in their territory "soft soils" (*bii ta nunga*), and contrast them with "stony soil" (*biie kachet*) in mountainous areas. They classify the soil into seven types.

1) *Zeech* is the soil found in dry savanna (*abaar*). They consider *zeech* to be a mixture of the following three types of soil, that is, *agarte, konon*, and *muro*. This is the soil of *gofa irit*, and is possible to grow crops there with rain, but it is considered not to have the best quality for cultivation since it hardens when it dries.
2) *Agarte* is sandy soil usually found along the river. Some of my informants

categorize this soil into three sub-types, "white *agarte* (*agarte eze*)," "red *agarte* (*agarte bura*)" and "green *agarte* (*agarte ilie*)" according to the color. They consider that "red *agarte*" and "white *agarte*" do not suit sorghum cultivation. According to them, sorghum grows very fast on these soils till the stage of *futi,* but thereafter stops.

3) *Konon* is silty soil found in flood plains and dry savanna which has been once inundated. They characterize this type of soil by its red color and fine particles. It is found especially in the southern part of their territory where dry silt always whirls in the wind.
4) *Muro* is clay soil found also in flood plains and dry savanna which has been once inundated. *Muro* is characterized by its black color, stickiness when wet, and cracks when dry.
5) *Hurgub* is found also in flood plains and dry savanna which has been once inundated. They say that the color of *hurgub* is red and black, and that it is a mixture of *konon* and *muro*. More precisely, its most apparent feature is that it consists of thin alternating strata several millimeters thick of different kinds of soil. That shows that *hurgub* is alluvial soil.
6) *Nalbe* and *samle* are characterized by saltiness and are not considered to be suitable for cultivation. The places where these soils are found sometimes seem wet, or oily, and are called "urine of the sun (*sindi awate*)."

The Hoor seem to distinguish *agarte, konon, muro* and *hurgub* from other kinds of soil since they consider them to have been brought from upstream by the river. They say that these soils have been sorted by the river and are pure in texture. From this point of view, *agarte, konon* and *muro* may correspond to our concepts of sand, silt and clay, whose classification is also based on that of texture. But they also observe these soils from a practical point of view, namely, their fertility. They call fertility *ruup*, and say that *ruup* is in the soils brought by the river. They consider this fertility very important for a good harvest. When I asked which sorghum varieties give big panicles, not a few cultivators answered that the size is determined primarily by the fertility of the soil. Among the four types of soil, *hurgub* is considered to be the most fertile. Before the river changed its course in 1975, it used to inundate the plain called Kawo (see Figure 2). The soil of this area is said to be typical *hurgub*, and the land used to produce a great amount of sorghum. After the change in course, the amount of harvest per plot has decreased, and people have been suffering from overwork to keep up a certain amount of harvest in a larger plot.

Table 5 shows the result of chemical and physical analysis of the thirty one soil samples I collected from the Hoor territory[8]. Types of soil were judged by my informants. The samples cover all the types except *nalbe*. The analysis shows some interesting results. As for texture, *zeech*, *agarte* and *samle* show the same constitution. Considering that *zeech* and *agarte* are ordinary soils, and that the Hoor say that *zeech* and *agarte* have a different texture, this similarity seems strange. It seems to me that people distinguish these two soils not only from

**Table 5.** Physical and chemical analysis of soil constitution

| | | Texture (%) | | | | Exchangeable Cations me/100 gm soil | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type of soil | No. of Samples | sand** | silt** | clay** | ph | Na* | K** | Ca** | Mg** | C.E.C.Det.** | Organic Carbon (%) | Total Nitrogen |
| *zeech* | 2 | 75.0 | 15.0 | 10.0 | 8.21 | 7.28 | 1.05 | 10.12 | 2.13 | 13.27 | 0.61 | 0.072 |
| *agarte* | 4 | 77.5 | 16.0 | 6.5 | 8.23 | 1.46 | 0.27 | 7.00 | 2.11 | 12.87 | 0.27 | 0.024 |
| *konon* | 11 | 31.5 | 43.8 | 24.7 | 8.91 | 4.02 | 0.75 | 27.35 | 9.97 | 37.80 | 0.44 | 0.039 |
| *muro* | 7 | 21.4 | 27.1 | 51.4 | 8.44 | 3.88 | 1.55 | 33.14 | 13.57 | 48.16 | 0.69 | 0.061 |
| *hurgub* | 6 | 18.2 | 47.1 | 34.7 | 8.24 | 7.18 | 1.90 | 38.83 | 14.07 | 48.34 | 0.92 | 0.090 |
| *samle* | 1 | 68.0 | 18.0 | 14.0 | 8.45 | 13.60 | 1.60 | 8.23 | 2.16 | 15.60 | 0.48 | 0.035 |
| *Total/ Average* | 31 | 36.5 | 34.4 | 29.0 | 8.53 | 4.79 | 1.14 | 26.52 | 9.80 | 36.66 | 0.58 | 0.054 |

significance level among the type of soils by ANOVA *0.05 **0.01

texture but also from situational information. The belief that *agarte* is brought by the river and that it has a pure texture may induce them to classify sandy soils in flood plains as *agarte*, and those in dry plains as *zeech*. *Konon*, *muro* and *hurgub* show a different constitution not only from sandy soils but also among themselves. *Konon* consists mostly of silt and sand. *Muro* consists mostly of clay. *Hurgub* contains silt and clay, and shows characteristics intermediate between *konon* and *muro*. Turning to the content of chemical elements and exchangeable cations which indicate the degree of fertility, *konon*, *muro* and *hurgub* turned out to have more content and fertility than other kinds of soil. *Hurgub* in particular shows the highest content of every chemical element except sodium (Na), which *samle* contains far more than others, confirming its saltiness. As for the content of organic carbon and nitrogen, there is no significant difference among the soils. Although we cannot conclude that *hurgub* is the most fertile due to lack of sufficient samples, the soils that cultivators consider good for crops (*konon*, *muro* and *hurgub* ) are at least more fertile than other sandy soils.

**Household requirements and others**

1) Number of Consumers

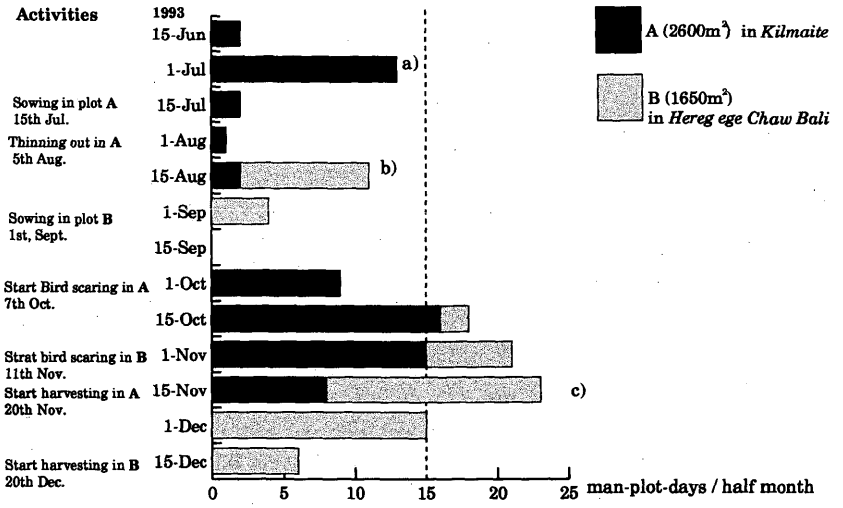
In addition to micro environmental factors, cultivators consider the requirements of their household. They employ a certain strategy according to these requirements, and select appropriate varieties to grow in their plots. Households that have a number of consumers need grain to feed them till the next harvest. To cope with this situation, they adopt two types of strategy. One is to maximize harvest by cultivating multiple plots. The other is to grow those varieties which can produce a large harvest, or can reduce consumption.

a) Maximization of harvest

Although *daabante dersit* is the most fertile land, plots are distributed by the distributors and the cultivating process is under strict control. Those who want to cultivate more under no restriction look for plots in other kinds of land such as *gofa irit, simako* and *luchi*.

One of the reasons they cultivate plots other than in *daabante dersit* is to expand their plots and increase their harvest. *Simako* is a good option for this purpose since it is as fertile as *daabante dersit*. But cultivation in *simako* competes for labor with that in *daabante dersit,* especially at the stage of bird scaring, since both of them are in flood plains. To accommodate this problem, they sow bird resistant varieties in one of their plots, and try to save labor for bird scaring.

In Gandarab in 1993, a number of households cultivated plots in *simako* called Komodo, and most of them planted maize there. When I asked them, "Why did you grow maize here?" they used to answer, " Because those who cultivated here before me sowed maize." Then I asked, "Why did you choose maize instead of sorghum when your neighbor was growing maize?" "Since maize is more resistant to birds than sorghum, sorghum plots adjacent to maize plots are especially




a) The cultivator organized a communal work party for clearing his field.
He spent most of the days during 1st July to 14th July in his elder brother's field for clearing instead of his brother. The field was almost equivalent to his own.
Workdays of this period is estimated by his record in his brother's field.

b) Workdays of the clearing of plot B are estimated from the workdays of his brother's plot by considering the relative size of the plot.

c) The cultivator was single and lived with his aged mother in 1993.
The available labor force in his household was only himself. The dotted line shows the limit below which he can manage to cultivate his plots by himself.
During the period of bird scaring, he asked his sister's husband to dispatch his younger siblings to scare birds in his plots.

**Figure 5.** Workdays of two plots cultivated by B

vulnerable to attack. Maize needs much more moisture than sorghum, but the place was wet enough." "You wanted to avoid bird attacks?" "You know that I have several plots. My children cannot be bird scaring in all of them at the same time. I decided to sow maize to save labor for bird scaring."

The same problem occurs when they happen to have two plots in *daabante dersit*. Figure 5 shows the workdays of one of the cultivators in Gandarab from June to December 1993. He had two plots in different *daabante dersit* around Gandarab. The periods of bird scaring for the two plots overlapped. He coped with this difficulty by growing a bird resistant variety on the larger plot A to save labor.

b) Selecting varieties with a large harvest and low rates of consumption

Many cultivators grow varieties that they think give a large amount of flour. Some other cultivators grow varieties that are not consumed so quickly. Red varieties are said to last longer because they satisfy people with a small quantity.

2) Expectation of Early Harvest

Some households suffer from a shortage of food, especially in off-crop seasons. Since harvest in *daabante dersit* is regulated by the distributors and tends to be retarded, those who want to have an early harvest have plots in other fields. *Gofa irit* is especially appropriate for this purpose. Since it is watered by rain, they do not need to wait for the recession of the flood, and can start cultivation about one month earlier than in the flood plains. As *gofa irit* is usually considered to retain less moisture than the flood plains, those who cultivate there select drought resistant varieties. On the other hand, they may cultivate varieties which grow slowly and need more moisture but which give a large amount of harvest in their plots in *daabante dersit*.

3) Dispersion of Crop Failure Risk

Some cultivators have several plots to avoid a complete crop failure. What they are afraid of in particular is the loss of seeds for the next sowing. Once they collect seeds for next season (*bado*), they make a bundle of panicles (*kankaito*) and suspend it from the ceiling of their house. It is smoked and protected from insects. Then they remove the seeds carefully so as not to mix varieties, and store them by variety in two calabashes. However it is quite difficult to keep seeds alive for more than a year. Therefore they have to continue to sow seeds to preserve the varieties they have. To avoid loss due to crop failure, some of them sow seeds in multiple plots. In contrast to those mentioned above, the cultivators who want to avoid the risk of crop failure and to maintain varieties grow as many varieties as possible in each plot.

**Cultivation plan of a plot**

Before sowing, cultivators have a blueprint of where to grow which varieties. One of the most important factors they consider is the plan for bird scaring. Since the labor force is limited, they seldom have more than one bird scaring platform in one plot. Thus they usually grow white varieties, which are vulnerable to birds, at the center of the plot, where the platform is constructed. On the other hand, bird resistant varieties are grown at the peripheries of the plot. Furthermore, they grow short varieties around the center, and tall ones on the fringe of the plot to have a view from the platform.

Another important factor is the fertility of the soils found in their plot. Flood plain soils are found in strata which change every 30 to 40 cm. They usually dig holes about 1 m deep at several spots in their plot, and probe the hole by hand to collect soil samples. They grow quick growing varieties if the surface soil is a fertile type like *hurgub*, and a lower stratum is sandy like *agarte*. This is because quick growing varieties can mature before the root system reaches the infertile sandy stratum. If the surface is sandy but the lower stratum is fertile, they grow varieties which have a long root system that can reach the fertile stratum before maturity. They also consider the texture of the soil. Clay soil like *muro* cracks when it dries.

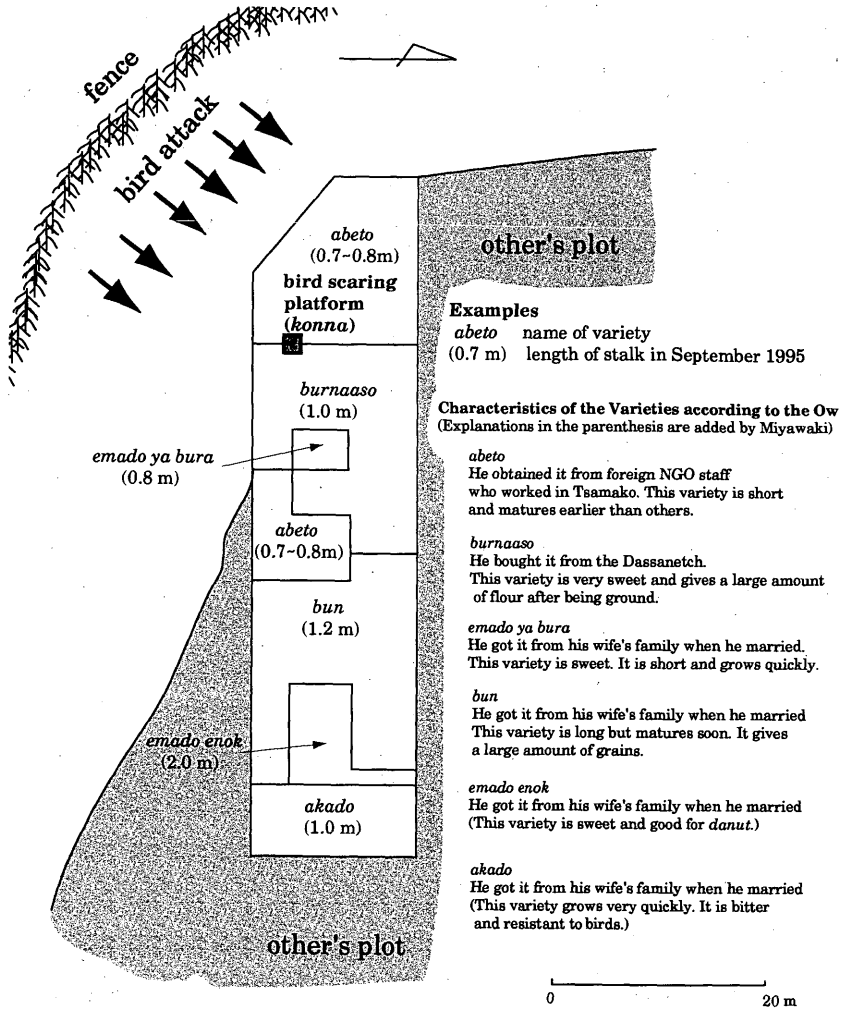



**Figure 6.** The Plan of a plot cultivated in *gofa irit*

They avoid growing short root crops such as maize on such soil since it tends to fall.

Figure 6 show one of the plots made in *gofa irit* around Gandarab in 1995. The cultivator is in his mid thirties, and his children are still small. He mainly grew quick maturing varieties since *gofa irit* does not have abundant moisture (see the explanations of Figure 6). He also grew some varieties which give a large amount of flour. This plot was located at the fringe of the field. The whole field was surrounded by a fence made of thorn trees to protect it from wild animals. Birds tend to perch on the fence before they come into the field. The area alongside the fence is particularly vulnerable to attack. Thus he constructed a platform near the fence. The other three sides are adjacent to other people's plots, and are not vulnerable because of their bird scaring. He grew the shortest variety alongside the

fence, and grew taller varieties as further from there so that his small child could have a good view from the bird scaring platform. At the end of the plot, he grew a bitter variety which is resistant to birds. This case demonstrates that the cultivator deliberately calculates in advance a number of characteristics of varieties such as quickness of growth, amount of flour, bird resistance, taste, and length of stalk, and selects and grows them in appropriate spots considering a number of factors such as type of field, moisture, location of plot, and available labor force.

## FOLK TAXONOMY AND CLASSIFICATION

We have seen that cultivators of the Hoor take into consideration a number of factors when they start cultivation, and that deliberately select sorghum varieties according to the situation they are faced with. We can thus expect cultivators to have some classification schemes that enable them to categorize varieties in relation to their specific utilities. In this section I investigate how cultivators classify sorghum varieties. Firstly, I give a lexical analysis of sorghum variety nomenclature. I show a general feature of the taxonomic structure of the variety names, and give meanings to the constituent lexemes. Secondly, I show another broad classification that cultivators employ. I demonstrate that this classification is more practical, and reduces excessive information into packed categories.

The Hoor do not have an inclusive category that refers to "plant" in general. Their classification starts with asymmetric four categories. They are *sai* (weeds), *sar* (vines) *koor* (trees) and *rub* (grain crops)[9]. The former three are classified by morphological criteria, and include wild and some domesticated plants. The last one comprises only maze and sorghum (Figure 7). In the Hoor classification of domesticated plants, only sorghum and maize have subdivisions below the generic level. Maize has only three varieties on the specific level. But sorghum has a far greater number of varieties and deeper taxonomic levels. In 1993 I asked eighty cultivators the names of sorghum varieties that they know, and gained one hundred and thirty names (Miyawaki 1995).

Indigenous plant taxonomy rarely goes beyond the level of varietal (Berlin et al. 1973). But the taxonomy of the Hoor sorghum varieties reaches the sub-varietal level. Generally sorghum variety names of the Hoor on the specific level consist of one unanalyzable word, which is called a primary lexeme (Berlin et al. 1973). Then on the varietal level, they add modifiers to the primary lexeme, and subdivide it. These are secondary lexemes, and I call the modifiers first modifiers. On the sub-varietal level they again add other modifiers to the secondary lexeme, and subdivide that. I call them tertiary lexemes, and the modifiers second modifiers. Through interviews the cultivators give a primary lexeme and several secondary lexemes together which share common primary lexemes, e.g. "What I grow in my plots are *emado, emado iya merkowa* and *emado ha kunma.*" It indicates that the Hoor nomenclature of sorghum varieties puts primary lexemes on the specific level, and at the same time diverts them to refer also to varieties on the varietal level (see Figure

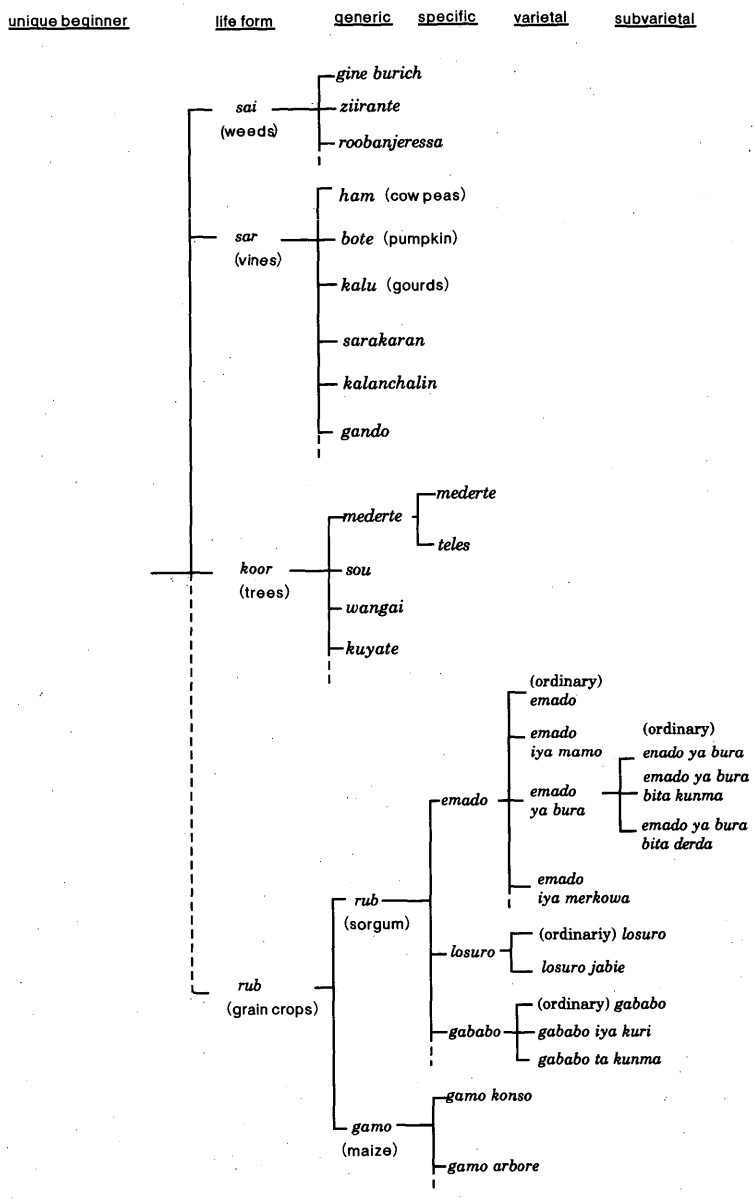



**Figure 7.** Folk taxonomy of plants of the Hoor

7).

The number of subcategories which each primary lexeme embraces is diverse. Table 6 shows the number of primary lexemes by the number of subcategories each primary lexeme embraces, and the lexical constitutions of subcategories. One primary lexeme called *emado* embraces forty seven subcategories (36% of the total names referred to), of which three varieties on the varietal level again embrace six

**Table 6.** Composition of sorghum vernacular names

| No. of varieties which share the common primary lexeme | No. of common primary lexemes | | Primary lexeme | Secondary lexeme | Tertiary lexeme | Total |
|---|---|---|---|---|---|---|
| | | | Primary lexeme | Primary lexeme + First modifier | Primary lexeme + First modifier + Second modifier | |
| 47 | 1 | *emado* | 1 | 40 | 6 | 47 |
| 6 | 3 | *adi, dinta, gabo* | 3 | 15 | | 18 |
| 4 | 1 | *bongwadi* | 1 | 3 | | 4 |
| 3 | 2 | *gababo, garaite* | 2 | 4 | | 6 |
| 2 | 2 | *losuro, organte* | 2 | 2 | | 4 |
| 1 | 51 | many | 50 | 1 | | 51 |
| Total | | | 59 | 65 | 6 | 130 |

**Table 7.** Component meanings of vernacular names

| | Primary lexeme | First modifier | Second modifier |
|---|---|---|---|
| Origin Index | 3 ( 5.0) | 22 ( 48.9) | |
| person's name, role | 1 | 16 | |
| ethnic group | 2 | 3 | |
| clan, lineage | | 2 | |
| others | | 1 | |
| Perceptual Index | 1 ( 1.7) | 6 ( 13.3) | 3 (100.0) |
| color | | 3 | 1 |
| length | | 2 | 2 |
| others | 1 | 1 | |
| Others | 2 ( 3.3) | | |
| No Meaning | 54 ( 90.0) | 17 ( 37.8) | |
| Total | 60 (100.0) | 45 (100.0) | 3 (100.0) |

subcategories on the sub-varietal level. But other primary lexemes do not have so many subcategories. Three embrace six subcategories each, one embraces four subcategories, two include three varieties each, and two include two varieties each. The other fifty one do not have subcategories.

I investigated the meanings of the unanalyzable constituent words which constitute variety names. Then I classified them into three broad categories. The first one is that referring to the origin of the varieties, and the second one is that mentioning their perceptual features. The former one, which I call origin index type, include the person's name who is believed to have brought or found the variety (*emado iya merkowa* = *emado* brought by the father of Merkowa, *dinta kernet* = *dinta* found in the field of a political chief), the name of the ethnic group from where the variety is said to have been brought (*murso* = the one which came from the Mursi, *emado sidam* = *emado* which was distributed during a drought by the government of the highlanders), the clan or lineage name whose member brought the variety (*losuro jabie* = *losuro* brought by a member of the Jabie lineage of the Olmok clan), an incident that happened to the variety when it was brought (*emado enok* = *emado* favored by smallstock). The latter, which I call perceptual index type, include color of panicle (*emado eze* = white *emado*), length of stalk (*gabo ta kunma* = short *gabo, gabo ta derda* = long *gabo*), and a thing which is associated with its morphological features (*udu* = feces). The third one includes those the meanings of which cannot be inferred from their names.

Table 7 shows the types of meanings according to constituents of names. The result shows that most words (90%) which are found in primary lexemes have no apparent meanings. But the majority of the first modifiers (62.2%), which constitute secondary lexemes combined with primary lexemes, do have meanings, either referring to origin or to a perceptual feature. All the second modifiers which

constitute tertiary lexemes have meanings which concern the perceptual index. The names of sorghum varieties seem peculiar compared to those of maize. Maize have three varieties. They are *gamo arbore* (maize of the Arbore, the northern regional group of the Hoor), *gamo konso* (maize of the Konso, a north eastern neighboring ethnic group) and *gamo redd barna* (maize of the Norwegian NGO). All of these are secondary lexemes consisting of the indigenous word for maize (*gamo*) with an origin index. This naming system clearly shows that the varieties of maize on the specific level are subdivisions of maize on the generic level. But sorghum varieties on the specific level seem to be treated as if they were independent entities on the generic level. Each of them is given a label which refers to nothing but the variety itself, just as "maize" denotes nothing but maize itself. It seems as if the focus of attention is transferred from the generic level to the specific level in the case of sorghum varieties. The depth of taxonomic levels also indicates that a different frame of reference is used in this classification[10].

Let us now move away from lexical analysis and look at another classification of sorghum varieties. The Hoor divide sorghum into two broad categories. One comprises red varieties. It includes *gababo*, which is cultivated by the majority of cultivators. The other category consists of white varieties, including *losuro, emado iya merkowa, emado* and others. *Gababo*, a red variety, has a slightly bitter taste due to polyphenol (tannin) in the pericarp. Because of this, red varieties do not attract birds, and the crop suffers little damage. For the same reason, people do not eat so much of this type at once and thus stocks tend to last much longer. Accordingly, it is the most important staple food during the pre-harvest period. White varieties, on the other hand, have a nicer flavor and consequently they are a prime target for birds and are rapidly consumed by humans.

This broad categorization of sorghum into red and white varieties shows that the Hoor are fully aware of the inherent, utilitarian features (taste and resistance to bird damage) which accompany the external feature. Major varieties are included within these two broad categories, and these categories offer a practical and simpler framework for identification, in addition to the more detailed categorization of each individual variety in folk taxonomy. The two categories do not, however, encompass all the varieties cultivated by the Hoor, and accordingly it cannot be considered so comprehensive as the categorization of individual varieties.

We have seen two different classifications of sorghum varieties. One is inferred from lexical analysis, and is somewhat complicated. It shows a taxonomic structure which has three levels of depth below the specific level. The number of subcategories embraced by each primary lexeme is diverse. Most of the meanings of the primary lexemes are not inferable. The other is utilized by cultivators, and much more simple. It is a binary classification which combines the perceptual distinctiveness of varieties with utility. It is a convenient frame of reference in classifying sorghum varieties in daily life.

Till now, the relationship between these two types of classification has not been made apparent. In the next section, I will show that these classifications have a

tacit relation with each other.

## UTILITIES AND HISTORICAL CHANGE OF VARIETIES

To elucidate indigenous knowledge concerning sorghum varieties, I asked about thirty questions of eighty cultivators, forty of whom were selected from the northern regional group, the Arbore, and the other forty from the southern regional group, the Marle. The inquiry covered the varieties they cultivated in each type of the field, the variety names they knew, utilities of varieties, concerning appropriateness for certain foods such as *barso, danut, taka, abas*, speed of growth, drought resistance, length of stalk, length of roots, size of panicles, amount of flour after grinding, feeling of fullness when eaten, bird resistance, wind resistance and rain resistance. Each cultivator gave the names of the varieties he or she thought would answer each question. Through the inquiry, I found that the cultivators had no difficulties in answering most of the questions. Some exceptions were questions concerning the amount of flour for some men, and length of roots for some women, due to the division of labor by sex. The result showed that the varieties of the Hoor were diverse in utilities, and that the cultivators' recognitions were highly consistent in general (Miyawaki 1995).

The ease with which the cultivators answered questions requring certain names of varieties posed me a question. Although the average number of names the cultivators gave on free recall was 17.7, they could identify almost forty varieties with ease when they were given the names by the investigator. If they recognize the different characteristics asked for in the inquiry about each variety, the amount of information they retain seems to be enormous. On the other hand, I demonstrated that cultivators use a binary classification based on the perceptual features combined with some specific utilities. This seems to indicate that cultivators reduce excessive information into a simple scheme. But the questions that I asked seemed to cover many more characteristics than those packed in the binary classification, and the practical situations in which they set their knowledge in motion for cultivation strategies are much more complicated than those that can be dealt with using the binary classification. It is therefore possible to suppose that there must be a certain kind of latent structure in their knowledge system that is simpler than random distribution of certain characteristics among varieties, and is at the same time more complicated than a binary classification. The first objective of this section is thus to investigate this latent structure of their knowledge concerning utilities of sorghum varieties.

The second objective is to elucidate the relationship between the fate of local varieties and cultivation strategies. If they adopt certain cultivation strategies, and if those strategies are associated with the selection of certain varieties which have certain appropriate characteristics, we can suppose that such strategies will apply selection pressure on the varieties in the long run.

Firstly, I consider twenty nine varieties which are the most popular among the

cultivators, and carry out a factor analysis on the varieties, based on the result of the questions that are relevant to the determination of their cultivating strategies. We will obtain four major factors. Then, I do a cluster analysis on the factor scores of each variety. The varieties are categorized into five clusters according to their relevance in cultivating strategies. Lastly, I demonstrate the relationship between the cluster of varieties based on relevance in cultivation strategies and the fate of varieties.

**Analysis**

I selected eleven questions concerning the characteristics that are relevant to determining cultivation strategies. 1) Suitability for *danut* and 2) suitability for *abas*. These are the most popular and favored foods among the Hoor. 3) Resistance to aridity and 4) necessity of moisture. These are important factors concerning the selection of varieties appropriate for different kinds of field. 5) Quickness and 6) slowness of growth, which are also important factors when they want to gain a harvest early in off-crop seasons. 7) Size of panicle, 8) amount of flour after grinding, and 9) feeling of fullness when eaten, which are important if they have many family members. 10) Bird resistance is important if they need many plots but do not have enough labor for bird scaring. 11) Resistance to rain damage is taken into consideration, especially when cultivation starts late and the next rainy season comes near. Then I chose twenty nine varieties that are cultivated by more than four cultivators. I sorted the scores given to each variety in each answer by the cultivators of each variety. If a cultivator mentioned the name of a variety in answering a question, the variety gains one point for that question. Then I standardized them by dividing the scores of each variety by the number of their cultivators. The scores are thus based on the evaluations of the actual cultivators of the given varieties.

I carried out a factor analysis and after varimax rotation I gained four factors the eigenvalues of which are more than one[11]. The factor loadings are given in Table 8. Factor 1 shows correlations with slowness of growth, large panicle, large amount of flour and necessity of moisture. This factor is thus considered to be associated with the late growing varieties which give a large harvest. Factor 2 is correlated with feeling of fullness, bird resistance and rain resistance. These are the characteristics associated with polyphenol (tannin) in the pericarp, and are the features of "bitter and red" varieties. Factor 3 is correlated suitability for *abas* and *danut*. These are associated with the lack of polyphenol in pericarp, and are the features of "sweet and white" varieties. Factor 4 demonstrates the correlation of rapid growth and resistance to aridity. This factor characterizes quick growing varieties.

This result seems to indicate that the cultivators can reduce the characteristics relevant to cultivation strategies into four factors, and can classify the varieties by using these four criteria concerning their utilities. They add another binary classification of quick growth-drought resistance/slow growth-moisture requiring-

**Table 8.** Factor analysis of twelve utility indices across twenty nine varieties

| | Factor 1 | Factor 2 | Factor 3 | Factor 4 |
|---|---|---|---|---|
| Grow slowly | **.889** | .056 | .049 | −.093 |
| Large panicle | **.863** | .118 | .045 | .095 |
| Large amount of flour | **.829** | .082 | .085 | −.055 |
| Requiring humidity | **.713** | .333 | .085 | −.315 |
| Fullness | .141 | **.952** | −.176 | .079 |
| Pestbird resistance | .005 | **.932** | −.243 | .140 |
| Rain resistance | .372 | **.872** | .126 | .115 |
| Good for *abas* | −.054 | −.039 | **.943** | −.142 |
| Good for *danut* | −.390 | −.273 | **.789** | −.111 |
| Grow fast | −.082 | .058 | −.002 | **.901** |
| Dry resistance | −.071 | .229 | −.294 | **.805** |

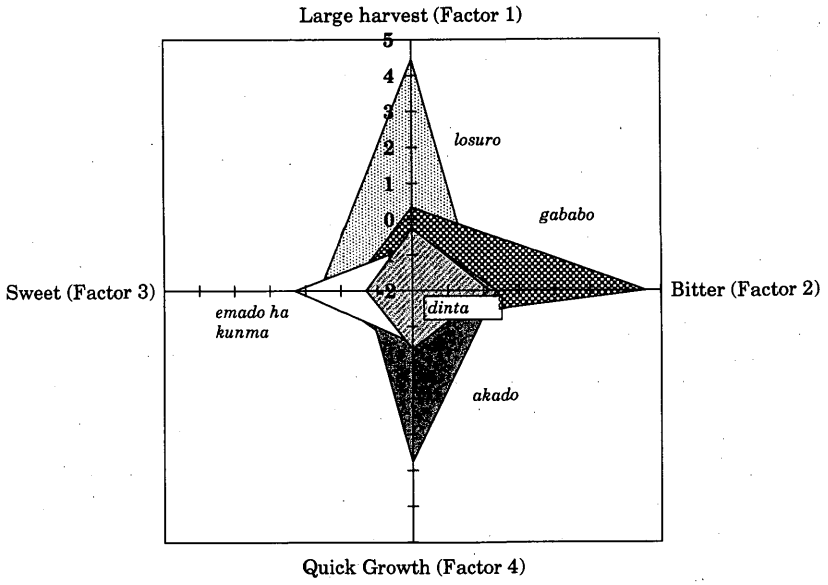



**Figure 8.** Factor scores of the specific utilities of the five popular varieties

large harvest to the aforementioned binary classification of red variety and white variety. These criteria seem to be simple enough to manipulate and practical enough to employ in daily use.

Figure 8 exhibits the factor scores of the five most popular varieties. This figure shows drastic specializations of the varieties in specific utilities. *Gababo*, the most popular variety cultivated by 63 households (78.8%), is specialized for "bitterness." This variety is regarded as a typical "red" variety. It is also considered to give a large harvest, and needs moisture. *Losuro*, cultivated by 50 cultivators (62.5%), is considered to give a large amount of harvest, but needs moisture and grows slowly. This variety is also regarded as "sweet." *Emado ha kunma*, cultivated by 23 households (28.8%), is specialized for "sweetness" which is the characteristic of "white" varieties. *Akado*, cultivated by 62 households (77.5%), is considered to grow quickly. This variety is also slightly "bitter." *Dinta*, cultivated by 29 cultivators (36.3%), is different from the other four varieties in that it does not have any specialized utilities. Three of its four factor scores are below 0. This variety is considered to have no particular outstanding utilities by the cultivators. Examining the factor scores of the five popular varieties, we happened to find the five types which are specialized for certain utilities, or for none. Now we will examine all twenty nine varieties, and explore what types there are.

I carried out a hierarchical cluster analysis on the factor scores of each variety[12]. The result is given in Figure 9. There are five clusters which correspond to the five types of varieties mentioned above. The first cluster consists of only one variety called *losuro*, and is a cluster of a late growing variety with a large harvest. The second cluster also consists of one variety called *gababo*. This cluster is that of a bitter "red" variety containing polyphenol. The third cluster includes four varieties, *akado, organte, gabo* and *bun*. These are known to grow fast, and survive with little moisture. The fourth cluster includes thirteen varieties. These are sweet "white" ones characterized by lack of polyphenol in the pericarp. They are good for *danut* and *abas*. The fifth cluster embraces ten varieties. In contrast with the former four, the varieties of this cluster show no specialization in any specific utilities.

Does this classification actually influence cultivators' strategy of cultivation? Table 9 shows the breakdown of the types of varieties by the ratio of the frequency with which each type is grown in dry plain (*gofa irit*) and flood plain (*simako* and *daabante dersit*). The samples (30 households) who cultivated both dry plain and flood plain are selected from the Gandarab. The "Dry plain/Flood plain Ratio" is obtained by dividing the number of cultivators of a given variety in dry plain by the number of cultivators in flood plain. The quick growing, drought resistant varieties apparently tend to be grown in dry plain. Since plots in dry plain are considered to retain less moisture, cultivators grow drought resistant varieties. Furthermore, some of them need an early harvest to supply grain in off-crop seasons, and thus grow quick maturing varieties in dry plain to have an early

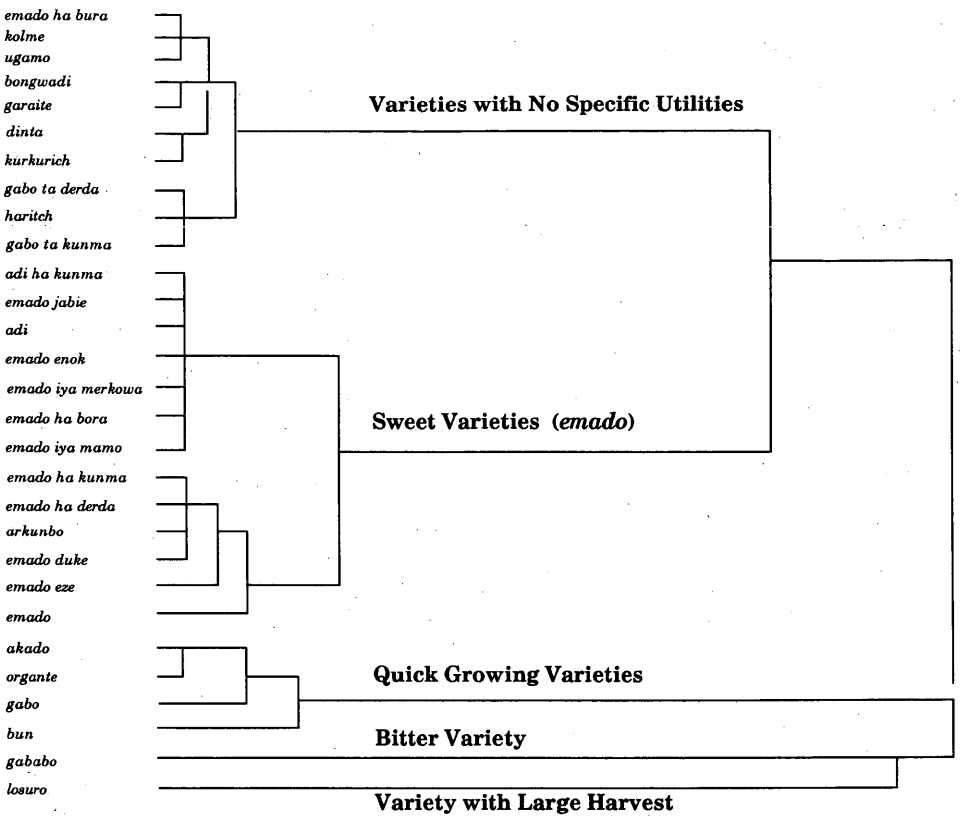



**Figure 9.** Hierarchical clustering of the Hoor sorghum varieties by ward method based on factor scores of utility indices

harvest. On the contrary, the variety which gives a large harvest but needs more moisture (*losuro*) tends to be grown in flood plain. The variety which has "bitterness" (*gababo*) also tends to be grown in flood plain. We can infer some reasons for this "bitter" variety. Firstly, this variety is considered to need moisture. Secondly, since it is bird resistant, it can be grown in a large plot where bird scaring cannot reach every corner. Thirdly, the harvest in a flood plain field tends to be delayed, and ripe sorghum grain is vulnerable to rain. In contrast with white varieties which are damaged by rain after the grain has matured, *gababo* is considered to be quite resistant to this damage. The white varieties show an intermediate ratio between the quick growing varieties and the varieties requiring moisture. These varieties have no particular relevance to moisture but solely to their sweet taste. The cultivators may thus cultivate them in both fields.

**Fluctuation of popularity among the indigenous varieties**

During the investigation I found that some varieties were recalled by many cultivators but were cultivated by few, or none. They said that such varieties had

**Table 9.** Breakdown of twenty nine popular varieties

| Type of Varieties [a] | Name of Varieties | No. of Cultivators (Tot. = N = 80) [b] | No. of Recalls (Tot. N = 80) | Cultivators/ Recalls Ratio | No. of Cultivators (Tot. N = 30) [c] | | Dry plain/ Flood plain Ratio | Alleged Origin |
|---|---|---|---|---|---|---|---|---|
| | | | | | *gofa irit* (dry plain) | *bii hoor* [d] (flood plain) | | |
| 1 | *losuro* | 50 | 80 | 0.63 | 7 | 13 | | Dassanetch |
| | | | | **0.63** | **7** | **13** | **0.54** | |
| 2 | *gababo* | 63 | 76 | 0.83 | 9 | 21 | | Arbore |
| | | | | **0.83** | **9** | **21** | **0.43** | |
| 3 | *akado* | 62 | 71 | 0.87 | 20 | 15 | | Arbore |
| 3 | *organte* | 22 | 70 | 0.31 | 12 | 7 | | Arbore |
| 3 | *bun* | 19 | 45 | 0.42 | 1 | 1 | | Dassanetch |
| 3 | *gabo* | 10 | 44 | 0.23 | 5 | 5 | | Arbore |
| | | | | **0.46** | **38** | **28** | **1.36** | |
| 4 | *emado ha kunma* | 23 | 38 | 0.61 | 9 | 6 | | Dassanetch |
| 4 | *emado iya mamo* | 21 | 31 | 0.68 | 0 | 2 | | Dassanetch |
| 4 | *emado iya merkowa* | 20 | 46 | 0.43 | 4 | 8 | | Dassanetch |
| 4 | *emado* | 12 | 25 | 0.48 | 6 | 6 | | Dassanetch |
| 4 | *adi* | 11 | 37 | 0.30 | 4 | 4 | | Arbore |
| 4 | *adi ya kunma* | 10 | 26 | 0.38 | 2 | 2 | | Arbore |
| 4 | *emado ya bora* | 10 | 21 | 0.48 | 2 | 2 | | Dassanetch |
| 4 | *arkunbo* | 7 | 17 | 0.41 | 0 | 2 | | Dassanetch |
| 4 | *emado jabie* | 7 | 13 | 0.54 | 1 | 2 | | Dassanetch |
| 4 | *emado eze* | 6 | 14 | 0.43 | 1 | 1 | | Dassanetch |
| 4 | *emado enok* | 5 | 22 | 0.23 | 1 | 1 | | Dassanetch |
| 4 | *emado ha derda* | 5 | 11 | 0.45 | 1 | 3 | | Dassanetch |
| 4 | *emado duke* | 4 | 8 | 0.50 | 2 | 4 | | Dassanetch |
| | | | | **0.46** | **33** | **43** | **0.77** | |
| 5 | *dinta* | 29 | 60 | 0.48 | 8 | 5 | | Arbore |
| 5 | *emado ya bura* | 11 | 33 | 0.33 | 2 | 2 | | Dassanetch |
| 5 | *gabo ta derda* | 10 | 29 | 0.34 | 4 | 7 | | Arbore |
| 5 | *haritch* | 9 | 50 | 0.18 | 0 | 3 | | Dassanetch |
| 5 | *kurkurich* | 8 | 43 | 0.19 | 4 | 6 | | Arbore |
| 5 | *bongwadi* | 7 | 28 | 0.25 | 2 | 6 | | Arbore |
| 5 | *gabo ta kunma* | 7 | 20 | 0.35 | 2 | 1 | | Arbore |
| 5 | *kolme* | 6 | 36 | 0.17 | 0 | 5 | | Arbore |
| 5 | *garaite* | 5 | 23 | 0.22 | 1 | 3 | | Arbore |
| 5 | *ugamo* | 5 | 20 | 0.25 | 0 | 4 | | Arbore |
| | | | | **0.28** | **23** | **42** | **0.55** | |

(a) 1 indicates the variety with large harvest. 2 indicates the bitter variety. 3 indicates the quick growing varieties. 4 indicates the sweet varieties. 5 indicates the varieties with no sepecial utilities.

(b) The 80 cultivators are comprised of 40 from Gandarab, 20 from Murale, and 20 from Egude

(c) All the cultivators belonged to the Gandarab territorial group, and cultivated plots both in dry plain and in flood plain.

(d) *Bil hoor* includes the plots both in *simako* and in *daabante dersit*.

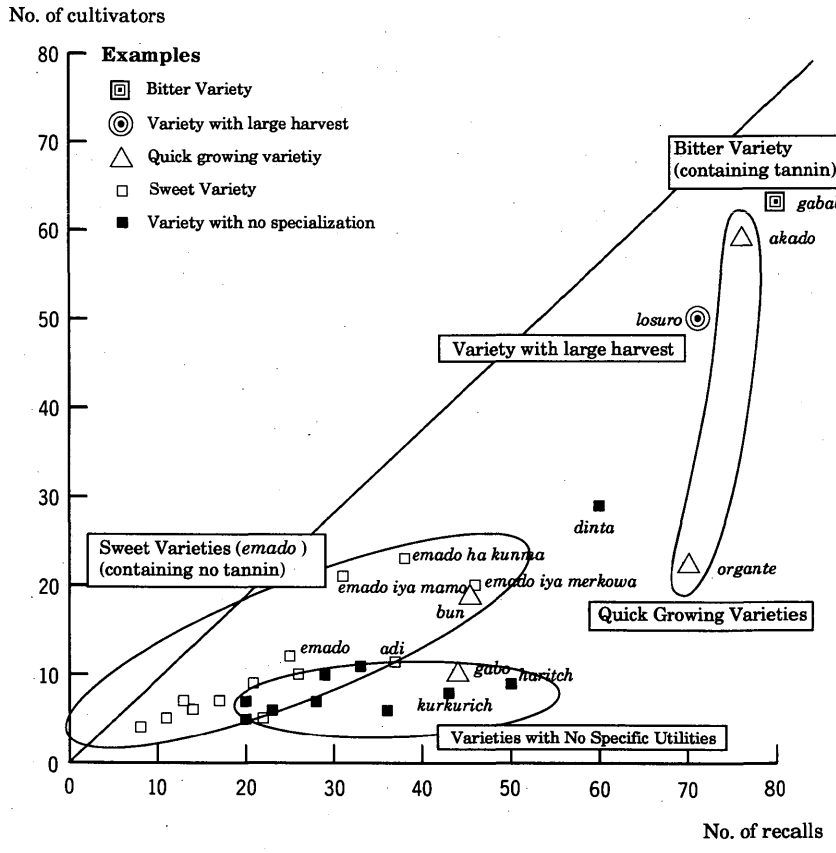



**Figure 10.** Relative popularity by types of variety

been grown before by many people, but had disappeared for some unknown reasons. For example, one of my informants mentioned as vanished varieties *tumur* (19, 0), *waakole* (15, 0), *godi* (11, 0), *gitiya* (1, 0), *nongolekanyatome* (0, 0), and *gaugau* (0, 0). (The first number in the parenthesis is the number of recalls, the second the number of cultivators out of eighty). Since the reputation of a variety does not precede but spreads with the variety itself among cultivators in Hoor, it is possible to evaluate the decline of varieties by comparing the number of cultivators who grow each variety with the number of those who can recall it. This is displayed on a two dimensional plot, the X axis of which shows the number of cultivators who recalled the variety, and the Y axis of which shows the number of cultivators who grew the variety during the research.

When a variety is introduced to the Hoor, it appears on the lower left corner of this chart. It is not cultivated by many people, nor is it known by many. If it does not spread, it will stay in this corner. As it spreads among people, it ascends the diagonal line from the lower left to the center. If it becomes very popular, it will be located at the upper right. It is known and cultivated by many people. On the

contrary, if a once popular variety loses its popularity for some reason and starts to decline it descends from somewhere on the diagonal line to the lower right. Then it gradually moves along the bottom from right to left, and finally disappears from the chart. No one recalls it any more.

Figure 10 plots the previous twenty nine varieties. Each plot indicates which cluster that variety belongs to. The following points are discernable from the Figure.

1) *Gababo* and *losuro*, the varieties which are the only members of their clusters, are located at the upper right corner.
2) Quick growing varieties are dispersed over a wide range, from the upper right (*akado*) to bottom center (*gabo*).
3) Sweet varieties are located along the diagonal.
4) Varieties with no specialized utilities are located at the bottom center.

The above points suggest three general features. Firstly, varieties such as *gababo* and *losuro* with specialized utilities quite relevant to cultivation strategies are much more successfully selected and spread among cultivators than other varieties. Secondly, various varieties which share the same utility, such as sub-categories of *emado*, are selected and maintained but spread only among a limited number of cultivators[13]. Thirdly, varieties with no special utility tend to disappear.

It may be misleading, however, to consider that cultivators consciously select all the varieties according to their utilities and discard those that do not meet their demands. A young couple obtains sorghum varieties from both of their parents and kin when they marry. They obtain more than ten varieties and start cultivation. Cultivators are careful to keep the varieties they have once accepted. Before harvest, they collect panicles of each variety and keep the seeds in two calabashes not so as to be mixed with others (Miyawaki 1991). They are careful even not to diminish indigenous varieties. If one get the seeds of a variety new to him or her from a neighbor, he or she must give to the neighbor some panicles of the same variety after harvest so that the variety will not vanish. However, people know that some varieties have vanished recently. But they cannot give any reason why certain varieties have disappeared. Thus the reason should be attributed to something other than conscious selection and discard. One possible cause may be recurrent drought. As mentioned before, the Hoor suffer from insufficient flooding once every two or three years. Even during such a drought, cultivators try not to consume the seeds kept in at least one of the two calabashes. However, some families consume seeds before sowing the next season. Even if seeds are maintained, it is difficult for the seeds to keep viable for more than two seasons. If cultivators lose seeds, they ask their neighbors to give some. At that time, they will demand the varieties which are the most suited to their cultivation strategies.

**Historical background**

The other important factor inducing fluctuation in popularity among varieties is

interethnic relationships. The Hoor consider that the Arbore, the northern regional group, were the original sorghum cultivators, while the Marle, the southern group, were not[14]. According to a legend, the first sorghum was obtained when Arbore hunters came across elephant dung from which sorghum grew. However, as mentioned before, some vernacular names suggest that varieties have been introduced from other ethnic groups. The Hoor are very eager to experiment with new varieties that they have never seen before. If they find such varieties, they ask the owner to give a panicle, and try to grow it in their plot. They obtain new varieties from any ethnic group, and recently from emergency aid from the government and NGOs. But the most important source of new varieties is the Dassanetch, a Cushitic agro-pastoral people. The Hoor consider that the varieties of the Konso, Hamar and Borana, that grow at an altitude of more than 1500 m, usually do not adapt to the climatic conditions of the Hoor territory. I tried to grow in my plot in Hoor some varieties that I obtained in Konso. All of them grew to the stage of *futi*, but did not sprout ears. On the contrary, the climatic condition of Dassanetch land is quite similar to that of Hoor, and their varieties grow in Hoor territory without any problem. The right column of Table 9 shows the alleged origins of the twenty nine popular varieties. Fifteen (52%) are said to have been introduced from the Dassanetch. It is apparent that most of the varieties introduced from the Dassanetch are characterized by "lack of polyphenol", and are included in type 4, sweet varieties. *Losuro* and *bun*, both belonging to other types, are also considered to be sweet. On the contrary, most of the varieties of Arbore origin are characterized by containing some amount of polyphenol. This seems to reflect a regional background of the two types of sorghum varieties.

*Sorghum bicolor* is classified into five races, namely bicolor, guinea, kafir, caudatum, and durra (Harlan and de Wet 1972). In Ethiopia, durra, bicolor, guinea, and caudatum are cultivated (Stemler, Harlan and de Wet 1977), and of these four, durra is the most widely cultivated race. Durra cultivation is concentrated in the eastern highlands between the altitudes of 1,000 and 2,000 m. In the western and southwestern highlands of Ethiopia, hybrids of durra and bicolor are cultivated. Due to their open-type panicle and the polyphenol (tannin) content of the pericarp which makes them resistant to fungi, they are adapted to the cool, damp climate of this area. Caudatum is cultivated in the southwestern lowland savanna. Surma and eastern Cushitic pastoral societies live in this area, and they share some cultural traits with the Nilotic pastoral societies of the southern Sudan (Stemler, Harlan and de Wet 1975).

The territory of the Hoor is located at the north eastern corner of the Nilo-Cushitic lowland agricultural area and they have come into contact with Ethiopian highland agriculture. Out of thirty three samples of sorghum varieties I brought from the Hoor, seven are identified to be durra, twenty six to be caudatum[15]. The alleged origins and affiliation to races did not correspond, but the degree of polyphenol content seems to reflect their original places. The allegedly original varieties contain more or less polyphenol, and this suggests their adaptation to the

cool, damp climate of the highlands. The Tsamako, a Cushitic agro-pastoral people who reside north of the Hoor, share some common sorghum varieties with the Hoor. For example, *gababo*, which is the most popular among the Hoor, and considered to be of Arbore origin, is called *ua* by the Tsamako, and is also the most popular among them. But they consider this variety to have been introduced from the Konso. *Akado*, which is also very popular among the Hoor and is considered to be Arbore origin, is said to have come from the Hamar according to the Tsamako. *Gabdako*, which is called *gabo* by the Hoor, is said to have been introduced from the Hamar. On the other hand, some white varieties such as *amate* (*emado* in the Hoor language) and *losuro* are said to have come from the Dassanetch, and this agrees with the origin the Hoor assert. The first comers of the Arbore are said to have come from the Gabra with cattle. It is thus unlikely that they brought a number of sorghum varieties, since the Gabra depend mostly on pastoralism. The legend that they learnt the technique of "thinning out" from a small ethnic group who once resided near Konso is suggestive (see *futi garba* in Table 2). Considering this evidence, it seems to me more reasonable to suppose that the Arbore have gradually accepted agricultural technology from northern Omotic and Cushitic highlanders with their sorghum varieties, and have been selecting those that suited their ecological environments.

The introduction of varieties from the highlands still continues, but it seems that people tend to consider "colored and bitter" varieties to be of Arbore origin as time passes. For example, *ugamo*, a tall orange variety which most cultivators think of Arobore origin, was introduced from the Hamar about seventy years ago, according to one of the oldest informants. On the contrary, introductions of "white" varieties from the Dassanetch is well remembered. Even the most popular varieties such as *losuro* and *emado iya merkowa* were introduced only some forty or fifty years ago, and the elders who witnessed their diffusion are still alive. The distribution of the varieties in Figure 10 indicates that most of them are relatively recent introduction. This recent introductions of a great number of "white" varieties from the Dassanetch may have strengthened the binary scheme of "colored bitter"/"white sweet", and may have induced people to categorize bitter varieties as Arbore ones, in contrast with the sweet varieties introduced from outside.

It is difficult to infer at the moment, however, why they recently introduced a number of varieties from the Dassanetch. The sedentarization and acceptance of agriculture by the Marle, caused by recurrent rinderpest in the nineteenth century must have played an important role. Since then frequent migration between the Hoor and Dassanetch has been reported, caused by war and drought (Ayalew 1995), and the close relationship between the Marle and Dassanetch even now induces frequent introduction of new varieties via the Marle to the Arbore. This frequent introduction seems to accelerate the replacement of varieties of alleged Arbore origin with ones of Dassanetch origin.

**Folk taxonomy**

In a previous section, I mentioned some puzzling outcomes concerning the folk classifications of sorghum varieties of the Hoor. They are as follows.

1) Peculiarity of the taxonomy of sorghum varieties, which reaches the unusual subvarietal level.
2) The naming system of varieties. Most primary lexemes have no meaning.
3) Diversity in the number of subcategories which each primary lexeme embraces. The primary lexeme called *emado*, in particular, has a number of subcategories. By what kind of principle are subcategories included in a certain category?
4) Relationship between the binary classification and folk taxonomy. At first glance, both of these classification schemes seem to have nothing to do with each other. The former seems to represent practical utilities that go with perceptual distinctiveness, the latter is more complicated and classifies every variety into a taxonomic tree.

These puzzles can be resolved in some part by considering the results that we have already obtained. Let us look at the third one first.

In a previous section, I showed that the variety called *emado* embraces forty seven subcategories. At the initial stage of my research, I guessed that *emado* refers to varieties which have white pericarps, but I discarded this simple hypothesis as I came to notice colored varieties such as *emado bora* (beige *emado*) and *emado bura* (red *emado*). I also found a variety called *emado eze* (white *emado*) whose name would be redundant if *emado* meant white pericarp. Moreover, there are many varieties which have white pericarps but not mentioned as *emado*.

Let us look at Figure 9. Cluster analysis has shown that most of the *emado* subcategories are included in the fourth cluster. Thus one of the necessary conditions to be *emado* is that the varieties lack polyphenol, and suit certain kinds of food like *danut*. But this condition is not sufficient, since varieties such as *adi* are also included in this cluster. Looking at the right column of Table 9, which shows the alleged origins of the varieties, we can find that all the *emado* varieties are thought to be of Dassanetch origin. But it is better to suppose that it connotes an "external" origin, since there is a variety called *emado sidam* (*emado* of Amhara, actually a variety distributed by the government at times of drought. This variety is not included in the 29 popular ones). Thus, we can presume that the primary lexeme *emado* refers to varieties which lack polyphenol and were introduced from outside Hoor.

But more importantly this consideration implies that the primary lexeme *emado* connotes *a complex of different concepts*. Lack of polyphenol, which is the idea the researcher presents, appears as many phenotypic characteristics for cultivators. The varieties that lack polyphenol are sweet, appropriate to particular foods, soon consumed, whose flour is white, vulnerable to bird attack, vulnerable to rain damage and so on. These characteristics are *covariate characteristics which*

*are consistent among many varieties introduced from the Dassanetch*. Such characteristics are different from morphological distinctiveness, since that is diverse among the varieties, and is not covariate. We cannot say, for example, that a white panicle always entails a short stalk, broad leaves and long roots. Now we come to the point which explains in part the second puzzle. Why do most of the primary lexemes lack meaning? The primary lexeme *emado* is a label to represent this complex of characteristics. It is thus understandable that it lacks any particular meaning since it is a unique combination of certain characteristics. It is also understandable that most of the secondary and tertiary lexemes comprise modifiers that refer to a single, meaningful characteristic such as color of panicle, length of stalk or origin of the variety, etc. They are useful to distinguish subvarieties below the level of primary lexeme, since there is no covariate characteristics there.

Let us return to the first question. Why does the taxonomy of sorghum varieties reach the subvarietal level which is unusual in folk taxonomy? In the previous section I suggested that the naming system of sorghum varieties seems to treat them as if they were equivalent to species on the generic level. Berlin, Breedlove and Raven asserted that generic taxa are psychologically the most salient (Berlin et al. 1973). Concerning folk biological classification, Eugene Hunn distinguishes two types of conceptualization concerning taxonomic categorization. One is induction which is characteristic of taxa on the generic level, and the other is deduction which is characteristic of taxa on the life form level. He indicated that folk biological taxa on the generic level are generated by induction of perceptible attributes, and that "human beings perceive organisms as existing in a classification space." "Distances" within this space are assessed in terms of overall similarity and differences between organisms with respect to perceptible attributes of morphology and behavior. Taxa are defined by reference to patterns perceived within this system of differences (Hunn 1976: 515)." Since biological species on the generic level have covariate perceptible attributes[16], their locations among each other in a classification space are discrete. The perceptual salience of taxa on the generic level is thus explained.

We have seen that some sorghum varieties of the Hoor show quite similar characteristics. They are recognized as sharing configurationally common features. We can thus suppose that this kind of multi-dimensional recognition induce perceptual salience of varieties, and makes them regard the varieties as if they were on the generic level (see note 10). On the other hand, levels below the primary lexeme are characterized by "deductive categories" which define a category by referring to a small set of abstract features. If this is true, they manage on the specific level the same kind of inferences which are usually found on the generic level. Thus it is no wonder that the taxonomy reaches "subvarietal level," because it is equivalent to the varietal level from a psychological point of view.

However, we have to emphasize some differences between generics on the whole and specifics in domesticated plants. Firstly, taxonomies of generics are rather fixed, but those of specifics of domesticated plants are changeable, since

emergence and introduction of new varieties is not rare. Secondly, the relevant aspects concerning classification are different. Biological species in a limited geographical range are capable of being perceived as forming an obvious cluster. The psychological salience of the taxa at the generic level is thus confirmed by the biological distinctiveness of the species that are the consequences of evolution, and is relatively independent of people's concerns. However, the psychological salience of varieties is much more dependent on how people are concerned with them, and what kind of aspects they pay attention to.

These considerations lead us to the other condition that defines primary lexemes, and also to the relationship between the binary classification and folk taxonomy. *Losuro* is one of the most popular varieties among the Hoor. Although most cultivators called it *losuro*, I found that some Marle called it *emado ege losuro* (*emado* of *losuro*'s mother). *Losuro* is known by its sweetness, and is said to have been introduced from the Dassanetch some fifty years ago. It therefore satisfied the conditions to be included in the category of *emado*. But what is different from other subcategories of *emado* is its large harvest and abundance of flour after grinding. It also grows very slowly, and needs much moisture. These characteristics are quite significant to the strategies of cultivators. It is thus no wonder for it to be treated differently from other *emado* varieties. Now there are some varieties that are included in *losuro*. Thus the other important condition that defines a primary lexeme seems to be its relevance to cultivation strategies.

In dealing with folk taxonomy, we need to consider how people are concerned with the subjects that are categorized by the taxonomy. Recent investigations have discovered that the practical interest of people rather than morphological distinctiveness plays an important role in folk classification (Randall 1976; Randall and Hunn 1984; Matsui 1989). Boster and Johnson recently revealed that the classification of fish is different between lay persons and professional fishermen. The former tend to classify fish according to their morphology. On the other hand the latter classify them according to their habitat and utilities (Boster and Johnson 1989). The Hoor folk taxonomy of sorghum varieties is quite similar to this case. Through my analysis I have shown how cultivators pay keen attention to specific characteristics of varieties. We can therefore suppose that the Hoor cultivators recognize varieties through a multi-dimensional evaluation that includes not only morphological distinctiveness but also other attributes such as utilitarian characteristics.

However, if such characteristics were found in random among varieties, the load on cultivators' memories would be enormous. As I have shown, such characteristics seem to be reduced to some fundamental factors[17]. These seem to play an important role for decision making by cultivators, but are not recognized as an overt scheme.

Comparing the folk taxonomy with the binary classification, I pointed out some differences. But these considerations revealed that folk taxonomy shares

common features with the binary classification. Both of them are related to the practical interest of cultivators. But there are still some differences. The binary classification is a simplified, and publicly recognized version of this latent scheme. Since it does not refer to the name of any variety, it continues to be consistent. On the other hand, the folk taxonomy is a scheme that retains historicity, since it refers to all the varieties included in the inventory through the historical process. At the same time it reflects cultivators' present interests as shown in the case of *emado* and *losuro*.

We have elicited a folk taxonomy by analyzing the lexemes of vernacular names. We also have found that practical concerns of cultivators relevant to utilitarian characteristics of the varieties are reflected in the taxonomy. However, it is difficult to assess this kind of aspect for all the varieties. Actually we cannot infer the connotations of the primary lexemes that most of the varieties have. Those of the varieties with no specific utilities are particularly difficult to interpret, since they lack the significance that they once might have had to cultivators before. This is true not only for foreign researchers but also for indigenous cultivators. The folk taxonomy of varieties is partly in flux. It is an amalgamation of some new parts that are emerging and old parts that are disappearing.

## CONCLUSION

In this paper I have dealt with some different fields that have usually been treated separately. They are 1) ecological environments, 2) cultivation strategies, 3) folk classification and 4) historical process of rise and decline of varieties. I have shown that the practical concerns of cultivators are quite important for the consideration of cultivation strategies, folk classification and fate of varieties.

Recent studies on subsistence economies of indigenous societies have paid attention to indigenous knowledge systems, and recognized their importance and validity as a system of "native science." Some studies have focused on the diversity found in such societies. They dealt with cattle coat color diversity, inter-crop diversity and intra-crop diversity. Some studies assume that the cultural values of a given society produce diversity (for example, Fukui 1988), others postulate a selection mechanism that produces diversity in varieties (Shigeta 1988); yet others associate diversity with a security mechanism for the harvest (Brown 1983).

The study of Hoor agricultural practice suggests that an explanation that postulates one mechanism that yields diversity is misleading. The state of diversity itself is a consequence of cultivators' ongoing practice and concern, and has resulted from multiple factors. Furthermore, this study indicates that the subsistence systems of indigenous societies are changeable, and are always influenced by an historical process. The method this study has presented will be one of the effective tools to analyze the relationship between people's concerns and the historical process, and will elucidate one of the most interesting aspects of "indigenous knowledge systems."

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## NOTES

1) Though they have been referred to by the name "Arbore" by linguists and anthropologists (Jensen 1959; Fleming and Bender 1976; Ayalew 1995), "Arbore" is in fact the name of the northern division of this ethnic group. The people overall call themselves Hoor, which means flood plain. In this paper I call this ethnic group the Hoor.
2) Members of the distributors are selected at the succession ritual by the retiring elders and the councilors of the new elders. Members are to be righteous and to be exempt from the pollution caused by illegal intercourse. In Gandarab, members can belong to any clan except Olmok, from which the hereditary ritual chief comes, because the members of Olmok are believed to be able to curse others, and thus may abuse this power to get large plots. But one Olmok member participates in the group, though not as an official member, and is expected to counter curse when they are cursed from outside. As is to be expected from this, the distribution of plots always entails complaints, and the task of the distributors is said to be very troublesome.
3) One of the exceptions is a depression called *Banzo*. The right of cultivation in this depression is restricted to the households that belong to a section (*ola*) called *Ole Ele* in Gandarab. A section (*ola*) comprises some clans that occupy a certain part of the settlement of a territorial group.
4) The Dassanetch, Cushitic agro-pastoralists who reside on the north shore of Lake Turkana, also depend on flood cultivation of the Omo river. But they have developed a quite different system from the Hoor. In Dassanetch land, river bank which is more stable in flooding and more advantageous for an early harvest than inundated flats is scarce but demanded social resources. River bank flats are monopolized by certain households as hereditary property, but are actually divided among most households of each territorial group. They have developed a very complicated network of bond partnerships, through which most households can negotiate with the owners of the flat and gain the right to cultivate plots.
5) In Marle, a nulliparous sheep is sacrificed by distributors. Several distributors select one black nulliparous sheep in advance. Early in the morning, seven distributors sing a song, then at the forth turn they shout, "*muran daraf*," and start to run. They snatch the sheep and sacrifice it in the forest and eat it. This is done to bring rain.

6) In Gandarab, *mo duumabe* were appointed from specific clans. But recently the distributors go to the Tsamako and ask a sandal diviner (*soakko kumaikilo*) who is appropriate. If the harvest turns out to be good, the appointed person continues to preside over the ritual the next season. If it is poor, they will look for another.
7) In spite of punishment, some cultivators discard the plots allotted by the distributors because they are not satisfied with them. One of the cultivators in Gandarab explained to me why he had left the plot in *daabante dersit*. He was allotted a plot at the fringe of *daabante dersit* which was located south of Gandarab. It was adjacent to the plots of the cultivators of Kulam, the southern territorial group of Gandarab. But the plots of Kulam cultivators were not regarded as *daabante dersit*, but as *simako*. They had the main field (*daabante dersit*) in Bilbilo, some 10 km away. Since they needed labor for bird scaring in their main field, they were supposed to harvest their plots in *simako* earlier. Once they had harvested, birds would gather at the plot of the Gandarab cultivator, which was adjacent. But he would not be able to start harvesting by himself, since the plot was in *daabante dersit* for Gandarab. Thus he discussed the matter with two other cultivators who were also allotted plots there, and they decided to leave. They dared to disregard the order of the distributors and started to clear new plots in other *simako* field.
8) The analysis was carried out by the hydrometric method at the laboratory of the Land Use Planning and Regulatory Department, National Soil Laboratory, Addis Ababa, Ethiopia.
9) They use another kind of categorization of plants according their utility. One is *deebi*, which refers to plants whose leaves are edible. The other is *deedan*, referring to plants on which livestock feed.
10) One of my informants said that maize should be included among the sorghum varieties, which would make the folk name *gamo* equivalent not to *rub* (sorghum) but to sorghum variety names such as *gababo*, *losuro*, *akado* and so on. He then added that maize had been introduced recently, and thus was regarded as one of the sub-categories of sorghum (*rub*).
11) Principal Component Analysis was used for the analysis. The program is contained in Advanced Statistics of SPSS 6.1 for Windows. The four factors cover 83.9% of the total variance.
12) Agglomeration schedule and dendgram using ward method.
13) Based on my impressions during my field research, I discussed that white varieties are disappearing (Miyawaki 1995). But the result of this analysis has revealed that my impression was wrong.
14) According to my infomants of the southern regional group, the Marle, they were once pure pastoralists, and led a nomadic life between the present territory of the Nyangatom and the Arbore. After the rinderpest outbreak had struck their flocks, they settled in the present territory and learned sorghum cultivation from the Arbore.
15) The samples were identified by the Plant Genetic Resources Centre, Addis Ababa.
16) For example, a bird has wings, a bill, feathers and characteristic legs. These attributes are shared by all birds. In coding the environment, one can expect all these features to be present together if one refers to a category such as bird. Citing the discussion of Bruner et al., Hunn calls this kind of conceptualization configurational reduction.
17) Such factors may be more than four. For example, they seem to associate long stalks with vulnerability to wind. But as I considered that vulnerability to wind is not an important factor in cultivation strategies, I omitted a variable for this characteristic from

the factor analysis.

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