Sorghum Cultivation and Cultivar Selection by the Arbore of Southwestern Ethiopia

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Traditional agricultural societies have developed a tremendous number of plant varieties from the relatively few plant species that have undergone domestication. Botanists have investigated the diversity of indigenous varieties for the purpose of preserving genetic resources, but there have been relatively few anthropological investigations of how traditional knowledge systems create or maintain plant varieties.

In this paper, I describe indigenous method of sorghum cultivation and variety selection in an agro-pastoral society of southwest Ethiopia, and show that indigenous knowledge and cultivation strategy play important roles in diversification process of local varieties. I introduce the Arbore society and their agriculture. Then I discuss diversification mechanisms and the people's knowledge system about indigenous varieties of sorghum. Finally I relate social and environmental factors to the introduction and loss of sorghum varieties.

Key words: Ethiopia, Arbore, sorghum, Sorghum bicolor (L.) Moench, indigenous variety.

1. INTRODUCTION

Traditional agricultural societies have developed a tremendous number of plant varieties from the relatively few plant species that have undergone domestication (see Brush 1981; Boster 1984; Richards 1986; Shigeta 1988; 1990). People in those societies have selected and maintained local varieties according to their own standards and traditional knowledge systems. In Siera Leone, Richards (1986) has argued against the common belief that local people are indifferent to breeding by plants.

In recent times, genetic erosion has been recognized as a serious problem resulting from the ongoing industrialization of indigenous societies (Harlan 1975). Investigations of indigenous knowledge systems that sustain crop diversity are therefore urgently needed.

In this paper I describe indigenous methods of sorghum cultivation and variety selection in an agro-pastoral society in southwestern Ethiopia. The Arbore people have acquired their varieties through diverse selection practices and by introducing new varieties from outside. I discuss diversification mechanisms and the people's knowledge system, and then relate social and environmental factors to the introduction and loss of sorghum varieties.

2. PEOPLE AND ENVIRONMENT

The Arbore are Cushitic agro-pastoral people dwelling in southwestern Ethiopia.⁽¹⁾ Their population is estimated to be between 2,000 and $2,300.^{(2)}$ The Arbore territory is a

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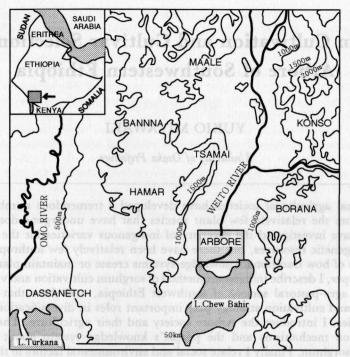


Fig. 1. Map of the Arbore and their neighbors.

savanna grassland around 500 m elevation. The Weito River (local name *Limo*) flows from north to south and runs into the Lake Chew Bahir (*Chelbi*), on the border between Ethiopia and Kenya. The people live along the lower part of the river (Fig. 1).

The annual rainfall is between 200 mm and 600 mm.⁽³⁾ There are two rainy seasons. The big rain, from March to May, is quite reliable, but the small rain, from October to November, is not reliable.⁽⁴⁾ The Arbore call the big rain *guh*, and the small rain *hagai*, and the two intervening dry seasons are called *maar*.

The Weito River is a small stream during the dry season, and often stops flowing at the driest time. In the rainy season the catchment provides a large amount of water which carries fertile soil from the highlands and causes flooding in the lower reaches of the river. The Weito has changed its course several times this century, and former courses still remain. Floods fill these river-beds and overflow. Inundation lasts for two or three months (Table 1).

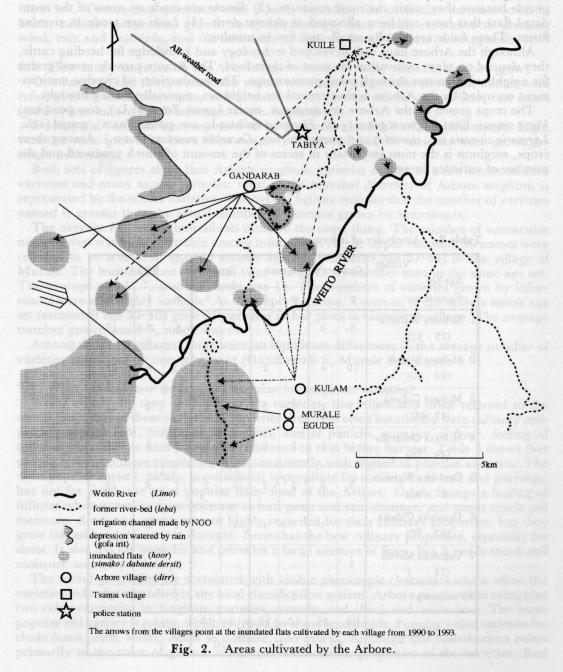
The Arbore call the inundated flats *hoor*, and distinguish them from places that are not inundated by the river (*abaar*). The Arbore cultivate sorghum (*rub*, Sorghum bicolor (L.)

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

Table 1.	Folk taxonon	v of months	and agricultural	cycles of the	Arbore

Moench) on the inundated flats after the river recedes (Fig. 2). The overall Arbore consists of a northern division called Arbore, and a southern division called Marle. The northern Arbore have a close relationship with the Tsamai, and the Marle have a close relationship with the Dassanetch, who dwell on the northern shore of the Lake Turkana.⁽⁵⁾ The Arbore overall call themselves "Hoor", in reference to their dependence on the inundated flats.

Each major social division embraces two geographically distinct communities, or villages (*dirr*). The northern Arbore occupy the villages of Gandarab and Kulam, and the Marle occupy the villages of Murale and Egude. These villages are autonomous social units. Each has a religious chief (*kawot*), a political chief (*kernet*) and a group of elders (*jalaab*). Areas of inundated flat are assigned to each household by elders called *mura* (Ayalew 1993). After



floods recede, the elders of neighboring villages meet to decide where to draw borders on the inundated flats along the river; in this way the arable areas are divided and distributed to each village.

The Arbore distinguish four types of field according to ecological status and the social rules of distribution: (1) Gofa irit are fields made in areas of the plain that are not inundated. The fields are usually in small depressions that receive rainwater from an adjacent hill and are cultivated shortly after a rainy season has finished. (2) Dabante dersit are fields made at the center of the inundated flats. The mura distribute plots to each household, demarcating the borders with sticks called saaban. After distribution, the schedule of cultivation is put under the control of the mura. Dabante dersit are the most important fields for the people because they retain the most moisture. (3) Simako are made on areas of the inundated flats that have not been allocated as dabante dersit. (4) Luchi are made in riverine forest. These fields are usually small, and few in number.

Although the Arbore have well developed technology and knowledge for herding cattle, they depend on plant cultivation for most of their food. The Arbore provide cereal grains for neighboring groups through bond partnerships. The productivity of riverine environment occupied by the Arbore is thus crucial for neighbors, especially during drought.

The crops grown by the Arbore are sorghum, 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 crops, sorghum is the most important in terms of the amount of starch produced and the number of varieties present.

Village Age Set	Gand	larab	Mu	rale	Eg	ude		TOT	AL
(estimated age)	m	f	m	f	m	f	m	f	TOTAL
1 Milbasa Watania (25 · 32)	6	3		1	2	3	8	7	15
2 Milbasa Marole (33 · 40)	10	4	2	2	1	2	13	8	21
3 Milbasa Gidama (41 -48)	3	1	2	2	3	1	8	4	12
4 Milbasa Obbarsha (49 · 56)	11	1	3	2	1	2	5	5	10
5 Oggalsha Watania (57 – 62)	3	5	2	2	2	2	7	9	16
6 Oggalsha Gidama (63 · 70)		1		1	1	1007	1	2	3
7 Oggalsha Marole (71 –)	2						2	and and and a	2
99 unknown		and and a second	1				1	* Excercise and the	
TOTAL	25	15	10	10	10	10	45	25	20
IUIAL	4	0	2	0	2	:0	45	35	80

Table	2.	Attributes	of	in	formants.	

3. SORGHUM CULTIVATION, NAMING AND USES

3.1. Interview Method

In order to investigate cultivation strategy and indigenous knowledge on sorghum varieties, a standard interview was carried out with a total of 80 informants from three villages. The attributes of the informants are given in Table 2. The interviews were conducted with one or two Arbore translators who can speak Amharic. The questions were asked, sometimes by myself, and sometimes by the translator, in Arbore language. Each reply was translated into Amharic immediately. It took about one to two hours to complete each interview. Twenty-two questions were posed, regarding the particular varieties sown in fields, culinary properties, growth rate, morphology, flour yield, resistance to dryness, wind, rain and pestbirds, and the treatment of variants found in plots (see Appendix 1).⁽⁶⁾

3.2. How many varieties do the Arbore know and how many varieties do they grow?

One hundred and thirty vernacular names were collected by interview. Ten names were referred to by most informants, and 51 names were mentioned only once. Only one name (gababo) was known to all informants (see Appendix 2).

Seventy-six varieties were reported to be grown in the fields of the informants. Eight varieties were grown by more than twenty informants, and 30 varieties were grown by single informants.

Both sets of figures show that Arbore sorghum varieties consist of a few common core varieties and many minor varieties; most of the nominal diversity of Arbore sorghum is represented by the minor varieties. The overall figures indicate that the number of varieties named is greater than the actual number of varieties grown by informants.

The average figures for individuals indicate the same thing. The number of vernacular names given was highly variable among informants. At the upper extreme, 36 names were referred to by a man of oggalsha watania age set (estimated age 57-64) in the village of Murale. The least number of names, two, was given by another man in the same age set. The average was 17.7, and the mode was 14. The numbers of varieties grown by informants were also highly variable. At the upper extreme, a woman of the milbasa marole age set (estimated age 33-40) grew 21 varieties in her plots in Gandarab village. The average number grown was 6.6, mode was 6.

Among the three villages, there were no significant differences in the average number of varieties cultivated by one informant (Gandarab 6.8, Murale 6.2, Egude 6.9).

3.3. What kind of uses do people recognize for sorghum varieties?

When asked why they cultivate certain varieties, the informants often referred to the useful properties of these varieties. Properties that were often mentioned were culinary properties, growth rate, resistance to dryness, size of panicle, quantity of flour, feeling of fullness, resistance to bird pests, and resistance to rain before harvest. Table 3 shows that people recognize these properties quite consistently with regard to popular varieties. The most popular variety, gababo, is considered appropriate for making local beer and porridge, but not for danut, the most popular daily food of the Arbore. Gababo brings a feeling of fullness when eaten, is quite resistant to bird pests and rain damage, and needs much soil moisture. Akado and organte are not highly regarded for their culinary properties, but they grow fast and are resistant to drought. Losuro has the best culinary properties, especially for danut. It also has big panicles and provides a large amount of flour, but it needs much soil moisture and grows slowly.

The useful properties are correlated with visible phenotypic characters which allow the varieties to be distinguished in the local classification system. Arbore people often recognize two color categories in sorghum varieties, namely, red (*buri*) and white (*ezi*). The most popular red variety is gababo, which is grown by most households. Popular white varieties include *losuro, dinta, emado, emado ya merkowa*, and others. Although this classification refers primarily to the color of grains, it also parallels certain properties of the varieties. Red

Variety	TOTAL	gofa irit		dabante	luchi	Q6 parso	Q7 danut	Q8 taka	Q9 abas	Q10 dry	Q11 humid	Q12 fast	Q13 slow	Q14 tall	Q15	Q16	Q17	Q18		Q20	Q21	Q22
gababo	63	gora inc 11	20	50	2	53	Oanut	<u>така</u> 36	abas 14	ary 4	numid 36	fast 3	slow 12	tall 27	short 0	root 59	panicle 18	flour 16	full 71	birdpest 74	wind 22	rain 51
akado	62	24	12	48	1	17	0	12	2	61	2	42	1	0	27	5	7	5	14	13	0	16
losuro	50	11	14	41	0	7	55	20	22	2	40	1	63	0	10	11	32	41	8	0	2	19
dinta	29	10	6	18	1	6	2	4	7	3	9	3	7	0	5	1	4	4	5	4	o	7
emado ha kunma	23	11	6	12	1	1	9	1	7	9	0	6	0	0	27	1	2	0	0	0	0	3
organte	22	12	5	13	1	5	0	2	0	60	0	41	0	0	44	0	1	0	12	18	0	8
emado iya mamo	21	1	2	20	2	4	12	7	9	0	4	3	4	1	1	2	4	6	2	0	1	4
emado iya merkowa	20	5	4	13	1	4	18	9	17	0	10	0	10	0	5	3	7	5	0	0	0	5
bun	19	3	3	16	0	2	15	12	10	3	8	23	0	32	0	2	8	4	1	0	35	1
emado	12	6	3	6	0	5	24	11	20	0	6	3	0	0	2	0	3	3	0	0	1	3
emado ya bura	11	2	2	9	0	1	4	1	4	0	0	0	0	0	8	1	1	0	0	0	0	1
adi	11	4	2	5	0	1	19	9	10	2	7	1	0	1	1	0	2	7	1	0	0	0
emado ya bora	10	2	1	9	0	1	2	2	1	0	3	0	1	2	9	2	3	1	0	0	1	2
ade ya kunma gabo	10 10	2	0	8	0	0	5	1	3	2	1	1	0	0	7	1	1	2	0	0	0	0
gabo ta derda	10	5	2	6	0	0	0	3	1	9	1	9	0	3	1	0	3	2	9	11	2	7
haritch	9	0	0	2	0	0		1	0	2	5	2	2	21	0	1	2	1	1	2	12	0
kurkurich	8	4	1	9		1	6	6	12	0	9	5	2	24	1	2	11	2	0	0	21	2
arkunbo	7	0	3	5	0	0	0	3	2	0	9	11	0	26	1	1	2	4	2	4	26	1
bongwadi	7	2	3	5	0		13	5		2	1	2	0	0	8	0	11	0	0	0	0	0
emado jabie	7	1	3	A	0	1	5	2	11	0	4	1	2	1	0	0	4	-	0	0	3	0
gabo ta kunma	7	3	2	2	0	0	0	0	4	8	0	0	1	0	2	0	0	1	0	0	0	0
kolme	6	0	1	5	0	0	0	0	2	0	2	2	0	25	0	3	3	0	1	2	11	1
emado eze	6	1	3	3	0	2	2	2	3	1	1	0	0	0	2	1	3	0	0	2	0	1
ugamo	5	0	0	5	0	2	0	0	0	0	1	0	0	7	0	0	0	1	0	0	3	1
emado enok	5	2	0	4	0	1	6	4	10	0	0	1	3	ó	2	0	0	1	0	0	0	0
garaite	5	1	1	3	0	0	6	3	3	0	5	0	2	8	0	0	0	2	0		6	0
emado ha derda	5	1	3	1	õ	1	3	0	2	0	2	0	0	0	0	0	1	0	0	0	3	0
emado duke	4	2	2	3	0	1	4	1	2	0	0	1	0	0	1	0	ò	0	0	0	1	0
adi ha derda	3	0	0	3	0	0	2	2	4	0	4	0	0	10	0	0	0	4	1	o	8	0
burnaso	3	0	0	3	0	1	0	1	1	2	0	1	0	0	0	0	0	0	0	0	1	1
maana	3	0	0	3	0	0	1	1	0	0	0	0	1	0	015	0	0	0	0	0	1	0
dinta kera	3	2	1	1	0	0	0	0	1	0	1	0	0	0	0	0	0	2	0	0	0	0
emado geleba	3	1	0	1	1	1	3	1	3	0	0	0	0	3	0	0	2	0	0	0	3	0
emado lokole	2	0	1	2	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
akamachi	2	0	0	2	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
emado olmok	2	0	0	2	0	100	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
iiera	2	0	0	2	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
jaja	2	0	0	2	0	0	1	0	1	0	0	1	0	4	0	0	0	0	0	0	2	0
murle	2	0	. 0	2	0	0	0	0	1	0	1	0	0	0	0	0	1	1	0	0	1	0
nongolebok	2	0	0	2	0	0	1	1	1	0	1	0	0	1	1	0	2	1	0	0	0	0
woigochu	2	0	0	2	0	0	4	1	1	0	1	1	0	2	0	0	0	3	0	0	0	0
dinta kernet	2	1	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1
emado erbokach	2	1	0	1	0	1	1	1	0	0	0	0	1	0	3	1	1	0	0	0	1	1
emado ha kunma eze	2	1	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
losuro jabie	2	0.11.01	6 1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
babasinte	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
bongo	1	1	0	1010	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
bongwadi ha derda	1	0	0	sciols	0	0	3	1	2	0	1	0	0	6	0	0	0	0	0	0	4	0
chalabila		0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
daaja emado arian	1200	1	0	06,500	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emado arjan	1	0	0	1	0		0	0	0	0	0	1	0	0	0	0	1	0	0	0	0	0
emado boke emado ege gale		0	0		0	1	1	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
	anis.	0	0	and and	0		0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
emado iya dale emado iya gido		0	0		0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emado iya gido emado iya lebi	1	0	0	0 910	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emado korinya	1	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emado kulinan	,	0	0		0	0		0	-				0	0	1	0	0	0	0	0	0	0
emado munte	1	0	0		0	1	0	0	1	0	0	0	0	0	-		0	0	-	0	0	-
emado sidam	1	0	0	1 Contraction	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emado ya bora derda	in	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
kero	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
liwen	Sin	0	0	001.0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
lotiniro	i	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
udu	1	0	0	101.0	0	1	0	0	3	0	0	0	1	0	0	0	0	0	0	10	0	0
adi eze	1	0	1	ò	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
bongwadi iya baje	1	1	1	0	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	0	0	0
emado dilo	v ref	o	1	0	õ	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0
emado ege seela	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emado lokoarok	1	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emado neeko	1	1	1	0	0	1	o	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
emado ya bura bita kunr	1	0	1	0	0	1	0	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
bongwadi ya kunma	1	1	0	0	0	0	3	1	2	0	o	0	õ	0	2	0	0	o	0	o	0	0
emado dork marwa	1	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
gabo iya kuri	1	1	0	0	0	0	õ	0	o	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 3. Properties of the varieties recognized.

varieties have large amounts of polyphenol compounds in the pericarp, and have a bitter taste, but are said to have two advantages. First, they are resistant to bird pests because of bitterness. Second, they give a feeling of fullness when eaten. Since people are satisfied with small amounts of food made from them, these varieties are not consumed quickly. This secondary quality is especially important for households with many family members. Conversely, white varieties are considered tasty, but they are vulnerable to bird pests and are consumed quickly by families. The red and white classification indicates further culinary properties. Red varieties are considered appropriate for making local beer (*parso*); white varieties are good for the daily food called *danut*. The correlations between visible grain character and the properties of varieties during cultivation and consumption are stable. This stability allows people to grasp, in a broad sense, the important properties of the varieties referred to during daily social interactions.

3.4. How are the uses of varieties related to cultivation strategies?

Most Arbore households are mainly concerned with food security. *Gababo*, which is known by its resistance to bird pests, is grown by 63 households (79%), while *akado*, known by its drought resistance and quickness of growth, is grown by 62 households (78%). These varieties do not have good culinary properties, nor do they yield as much grain as other varieties, but they do produce an adequate yield under poor conditions. Most households maintain one variety resistant to bird pests, several drought resistant varieties, and some varieties which have good culinary properties.

Other Arbore households are not only concerned with food security. They maintain a large number of varieties for other purposes. When asked why they cultivate so many varieties, they usually answer, "to preserve these varieties", or "to exchange varieties with others". It is these households that contribute to preservation of rare varieties.

4. HOW HAVE THEY DEVELOPED DIVERSITY OF SORGHUM VARIETIES?

Some of the varieties are considered to be of local Arbore origin. According to one legend, Arbore ancestors discovered sorghum growing in elephant dung, when they went hunting. However, varieties considered to have been derived in this manner account for only 10% of the inventory.⁽⁷⁾ The present diversity of Arbore sorghum varieties has arisen by (1) introducing new varieties from neighboring ethnic groups, and (2) selecting morphologically distinct variants produced by existing varieties.

4.1. Introduction from neighboring ethnic groups

Some varieties have been introduced from outside the Arbore community: seven informants (9%) reported that one of their family members had brought a new variety from outside the Arbore community, and six of these introductions were from the Dassanetch.

Dassanetch varieties are usually brought first to the Marle, the southern division, and are then gradually dispersed to the northern villages. Until the rinderpest epidemic in eastern Africa during 19th century, the Marle were purely pastoralists who tended cattle in a wide area from Nyangatom territory in the west to Arbore territory in the east. Even after settling in their present territory, the Marle have maintained a close relationship with the Dassanetch, and continue to intermarry. Marle men sometimes go to the Dassanetch to see their relatives, and they sometimes return with a new sorghum variety.

The Dassanetch varieties are well regarded for their good taste and their adaptability to Arbore environments. The varieties of the Tsamai people are less attractive since they are little different from those of the Arbore, and the varieties of the Hamar, Borana and Konso people are not suitable because they are adapted to high altitudes.

4.2. Selection of morphologically distinctive variants

Some varieties have been selected locally from indigenous varieties or earlier introductions. When sorghum reaches maturity, people collect panicles from each variety and preserve them to provide seeds for next season. During this process, farmers may discover morphologically distinct variants. This brings about three possibilities.

First, they may consider a new variant useless, and consume or discard it. The Arbore have two names for such a useless new type. The first name is *paranda*, which primarily refers to wild sorghum. Wild sorghum has an open panicle and its seeds fall very easily. People consider sorghum with an open panicle a kind of *paranda*, and usually discard it. The se-

cond name is *yoofo*, which indicates a form with a longer stalk than the original variety. Most people don't preserve the seeds of *yoofo* because they are believed to reproduce the original variety when they grow.

Second, they may find a new variant useful, but consider it to be one of the existing varieties. They may preserve seeds if they don't have this variety, or may consume the seeds if they do have it.

Third, they may consider a variant worth preserving. Full acceptance of a new variety is not immediate. At first, having recognized the distinctive morphology, they preserve the seeds. Then, in next season, they try to multiply the stocks and they also observe the plant characteristics carefully. If useful properties are found, they will give the variant a name, and preserve it. If the variant appears useless, the farmers will consume it. New varieties are thus gradually incorporated into the local inventory.

Twenty-seven informants (35%) had discovered a new variant in their field. One informant gave a variant a new name. Eleven informants had once preserved a variant but then lost the seeds, or still have been preserving the seeds without giving a name. Fifteen informants had identified a variant with an already existing variety. The remaining informants (65%) had never discovered a new variant, and six of these informants denied the possibility that a particular known variety can produce another variety other than *paranda* and *yoofo*. These figures indicate that variety diversification depends on the knowledge, recognition and sensitivity of individuals within the community.

Arbore naming of sorghum varieties reflects the roles of introduction and local selection in variety diversification. The most frequently found name is emado, and names which include emado account for 37% of all vernacular names recalled by the informants. Emado varieties are considered sweet, and edible raw, and most are believed to be of Dassanetch origin. Some vernacular names indicate the variety origin (kolme = lowland Konso, murso = Mursi, murle = Murle, emado geleba = emado of Dassanetch). Others have the foreign names and indicate recent introduction (adi = "white" in Borana language, harich, chalabila, liwen from Dassanetch language). Some names are qualified by words that indicate the name or the clan of the person who has found or introduced the variety (emado iya dale = emado found or introduced by the father of Dale, emado jabie = emado found in the field of Olmok Jabie clan), and the name of the ethnic groups who brought the variety (emado sidam = emado brought by the Amhara), and the visible characteristics of the variety, such as length of stalk and color of grains (gabo ta derda = long gabo, emado ya bura bita kunma = short, red emado), which may have been named for morphological distinctiveness of a variant discovered among the original variety. The vernacular names of varieties that were considered to be of Arbore origin have no reported meaning (gababo, akado, dinta, organte, gabo, to mention some).

4.3. Disparity between genetic diversity and nominal diversity

Some recent studies have revealed that crop diversity of native societies is primarily based on a selection process described as "perceptual" (Boster 1984) or "cognitive" (Shigeta 1988). According to Boster, perceptual selection means to add to an inventory those varieties that can be distinguished from other similar appearing varieties by perceivable (visible) morphological traits. Selection based on useful properties is described as "cultural" (Boster) or "utilitarian" (Shigeta) selection. Both kind of selection can operate simultaneously or sequentially. Both were recorded for Arbore selection of sorghum varieties.

Among the Arbore, perceptual selection apparently sets the diversification process in motion. For example, one farmer may find a variant in his own field or in another farmer's field, recognize it as different from any other variety that he has seen, and may then take it and preserve it. Next, he will grow it experimentally to observe its properties. Utilitarian selection then starts: if the variant is judged to be useful, it will be named, preserved and cultivated again. If judged to be useless, it will be consumed. Here, the tendency to maintain diversity, which some diligent farmers have, plays an important role. In most cases, a new variety seems to pass the test for usefulness, and is preserved as a minor variety. Arbore criteria for useful properties do not seem strict generally. Loss or rejection after initial adoption seems to be rather haphazard.

In our fieldwork, we have recorded nominal diversity of Arbore sorghum varieties. We cannot regard nominal diversity as directly equivalent to genetic diversity. First, different vernacular names may refer to the same genetic variety: one genetic variety brought from outside by different individuals might be given different names by each individual. Second, some varieties which have different genetic constitution may be classified into a single category: when a variant is found in a field, people tend to or attempt to identify it with one of the varieties they know by observing immediately visible characteristics. If they are convinced that it is the same as an existing variety, they will treat it as such; they have no means for distinguishing different genotypes other than a direct perceptual basis. Thus, we can expect a disparity between nominal diversity and genetic diversity among the varieties of the Arbore overall. Within most individual households, however, the deliberate maintenance of morphologically distinct varieties indicates that nominal diversity is most likely congruent with genetic diversity.

5. NEW VARIETIES ARE EMERGING AND OLD VARIETIES ARE BEING LOST—DYNAMICS OF ARBORE SORGHUM VARIETIES—

Varieties are usually dispersed among households through marriage and individual's demand. First, when young spouses are given an arable plot, different varieties are given to them by their relatives. If they come from different villages, it brings about a chance for particular varieties to cross the border of the villages. Second, if a farmer loses seeds for next season by accident, he can ask neighbors for seeds. Varieties are thus dispersed among neighbors. It is also possible to ask for seeds if one finds an attractive variety in another farmer's field. In both cases, the recipient has to give some panicles back to the owner after his harvest, in order to help maintain the variety.

While new varieties are introduced to the Arbore sorghum inventory, other varieties are lost due to various natural and social hazard. Varieties can be lost due to crop failure. People may fail to grow sorghum because of drought, re-inundation of the field after the seeds sprouted, or insect attack. Also during drought, some people may consume seeds that were intended for planting in next season. The small rainy season is quite unreliable in Arbore, and a good inundated flat is lacking almost once every two or three years. In the poor years, people cultivate swamp areas. This requires so much energy, because of thick bush, that some people can cultivate only a small area. The resulting small yield may force people to consume the seed stocks before next planting.

Fields may be abandoned because of ethnic warfare, and this also leads to loss of varieties. The Arbore had persistent conflict with the Hamar till 1991. After reconciliation with the Hamar, a fight broke out with the Borana in 1992. Some fields near the battlefield were abandoned by the Arbore.

The Arbore are usually very careful to preserve their varieties. They keep the seeds of each variety in two calabashes, and even during serious drought, they preserve the seeds in at least one of the calabashes. Nonetheless, the loss of seeds is common, and minor varieties kept by few people are especially vulnerable to loss.

The process of introduction of new varieties and accidental loss of existing varieties brings dynamism to the Arbore sorghum inventory. Some of my informants have pointed out that some indigenous Arbore varieties are vanishing. In my survey, these varieties were named by many informants but cultivated by few, or none. Although the informants could not explain the vanishing of varieties, some reasons can be inferred.

Some core varieties of Arbore origin have strong characteristics such as drought resistance, and they are grown intentionally by most households that are concerned with food security. In contrast, the vanishing varieties seem to have the white and tasty properties associated with Dassanetch varieties, according to the answers of the informants. If a certain proportion of households are damaged and lose seeds by some disaster, the core varieties, shared by most of the households, will be dispersed automatically to those who lost seeds. These red or drought resistant varieties will also be acquired by farmers who are concerned with food security. In contrast, white varieties have many functional equivalents in the inventory. They will be acquired not as a particular variety but as a category. Each particular white variety will be shared by only some households. For these varieties, the chance of surviving disaster is less.

This argument implies that locally selected Arbore varieties, and other varieties from outside, may fluctuate in terms of popularity, as long as they have similar properties. Disasters such as drought and warfare are rather frequent, and fluctuation in the distribution of each variety may be very frequent and rapid. Minor varieties are probably lost almost every year.

Arbore sorghum diversity is the result of an ongoing process of introduction, preservation and genetic erosion, and a number of minor varieties form a substantial basis of this diversity. People's knowledge and cultivation strategies play important roles in this process.

Finally, I will suggest some recent social factors that will upset this diversification process. These factors are related to the political change in Ethiopia during 1991.

First, aggravation of ethnic warfare might cause mass erosion of rare varieties. After the collapse of Mengistu's army, merchants have sold a large number of modern weapons to agro-pastoral societies in southwestern Ethiopia. The recent war against the Borana was fought with bazookas, hand grenades and machine guns. Further use of such modern weapons will bring about the destruction of villages and fields on a large scale.

Second, development programs facilitated by the present government will change Arbore agriculture. With government approval, a private agricultural farm was started in 1992 in Tsamai territory. The aim of this project is to produce cash crops for big markets such as Addis Ababa. Project mediators first made contact and won favor with a chief of the Tsamai, who lives near the Arbore and is quite influential in both groups. Riverine forest of the upper stream of the Weito was then cleared, and the project started to employ some of the local people as *zabania* (guards) in the farm. Most of them were the relatives of the chief. In the small rainy season of 1993, there was little rain in the area. The river was blocked to irrigate the farm. Although there was no apparent conflict between the project and the local people on this occasion, some people suspected that the project had blocked the upper stream and went there to see it. Development projects of this kind may bring about a drastic change not only in agricultural practices but also to the local society in general. To prevent excessive erosion of genetic resources, many social factors must be taken into consideration.

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NOTES

(1) Though they have been referred to by the name of 'Arbore' by linguists and anthropologists, 'Ar-

bore' is in fact the name of the northern division of this ethnic group. The people overall call themselves Hoor, which means inundated flat. In this paper, I use 'Arbore' in the manner of previous writers (Jensen 1959; Fleming & Bender 1976; Ayalew 1993).

(2) I made a population census of the villages of Gandarab, Murale and Egude, with the assistance of the informants from each village. The result is shown in the Table below.

Village	Number of households	Population
Gandarab	198	821
Kulam	unknown	unknown
Marle	94	473
Egude	81	389
Total	373	1683

Number of households and population of each village

The village of Kulam is almost similar to the village of Marle and Egude in its population, that is, between 400 and 600. The total population of the Arbore is, therefore, estimated to be between 2,000 and 2,300.

- (3) On the climatic conditions of southwestern Ethiopia, see Daniel Gamachu (1977).
- (4) During the period 1990 to 1993, there was no rain in the small rainy seasons of 1991 and 1993. It appears that there is no rain in small rainy season in every two or three years.
- (5) Concerning inter-ethnic relationship, especially between the Arbore and the Tsamai, see Miyawaki (1994).
- (6) The prototype of this questionnaire was based on the questionnaire in Boster (1984). The final version was prepared after discussing the properties and uses of sorghum with Arbore informants.
- (7) The Tsamai who dwell along the Weito river north to the Arbore share the same sorghum varieties which Arbore consider to be of local Arbore origin. The Tsamai say that those varieties have been brought from the northern Konso, and distinguish those varieties from white varieties such as *emado* and *losuro* which have been introduced recently from the Arbore. This suggests a connection of the Arbore local varieties with northern highland.

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YUKIO MIYAWAKI: College of Integrated Arts and Sciences, University of Osaka Prefecture, Sakai, 593, Japan.

MIYAWAKI: Sorghum Cultivation and Cultivar Selection

I will a	sk you about sorghum varieties in Arbore.	
Q 1. I	Have you grown sorghum in "gofa irit" in this season? Where is it?	
	Which varieties have you grown there?	
	Why did you select these varieties?	
Q 2. H	Have you grown sorghum in "simako" in this season? Where is it?	
	Which varieties have you grown there?	
	Why did you select these varieties?	
Q 3. H	Have you grown sorghum in "dabante dersit" in this season? Where is it?	
	Which varieties have you grown there?	
	Why did you select these varieties?	
011	Have you grown sorghum in "luchi" in this season?	
Q 4. I	Where is it?	
	Which varieties have you grown there?	
	Why did you select these varieties?	
05.1	So for the second state of the	
	Do you know any other varieties?	
Q 6. V	Which variety is the best for making beer?	
Q 7. V	Which variety is the best for making danut?	
0 8. V	Vhich variety is the best for making <i>taka</i> (porridge)?	
Q 9. V	Which variety is the best for making <i>abas</i> (roasted grains)?	
Q10. V	Which variety can survive when soil is dry?	
Q11. V	Vhich variety needs much moisture in soil?	
Q12. V	Vhich variety grows fast?	
Q13. V	Vhich variety grows slow?	
Q14. V	Vhich variety becomes tall?	
	Vhich variety is short?	
Q16. V	Vhich variety has a long root?	
Q17. V	Vhich variety has a big panicle?	
018 V	Vhich variety produces much flour after grinding?	
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Q19. V	Which variety gives people a feeling of fullness when eaten?	
Q20. V	Vhich variety is resistant to birds?	

Q22. Which variety is resistant to rain after reaching maturity?

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Appendix 2. The inventory of Arbore sorghum varieties.

Q20. Which variety is resistant to hirds?

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O22. Which variety is resistant to rain after reaching maturity

YUKIO MIYAWAKI: College of Integrated Arts and Actions, University of Oraba Prefecture, Solat, 699

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		Appendix 1 The inventory of Arbore sorghum varieties
	Keys Sex	: m=male, f=female.
	Villa	age : g=Gandarab, m=Murale, e=Egude.
		e Set : 1 Milbasa Watania (21-32)
		2 Milbasa Marole (33 - 40)
		3 Milbasa Gidama (41 - 48)
		4 Milbasa Obbarsha (49 - 56)
		5 Oggalsha Watania (57 -62)
		6 Oggalsha Gidama (63 -70)
		7 Oggalsha Marole (71 -)
		99 unknown
	O ir	ndicates the varietiy is named but not cultivated by an informant
	1 in	dicates the variety is cultivated in one plot by an informant.
	2 in	dicates the variety is cultivated in two plots by an informant.
	3 in	dicates the variety is cultivated in three plots by an informant.

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the formal articles provide the personal history of a researcher who has witnessed changing of the 'present in history,' as referred to in the first half of the cite.

For a Japanese reservation of a younger paneration working on modern Egyption history, the irriches in part (2) and (1) are clusted to which we must refer when stativing the arms folds. Three of the clustical articles are as follows: The 1919 Revolution of Egypt, originally published in 1970 (in Japanese) this described the multi-layer structure of the intertalist rule, and analyzed the confrontiation between institution for metootal government) and a 'associated movement' in the Wald movement, and up possible revolus during the 1919 revolution. On the Disolution of Mudian Brethren, in article wither in 1963 and Japanese), this structure is during the 1919 revolution. On the Disolution do Mudian Brethren, in structure wither in 1963 and Japanese), this structure in hitmare state theory rather than the opportunian by Namer's government is a latter structure, the author conferred that he altered this somewhat The Middle East is considered an abnormalty mysterious area which can not be underatood except in the continuous and unlimited process of internationalization. The Middle East proilense always text to became global and at the same time the world has been embedded inside be Middle East" (ibid.).

The author started his discussion on the pushbility of a new areal science by assessing basic notions like 'area' or 'nation' synematically. He revealed the flexibility or fluidity of these notions in relation to the Middie East as well as the interdependency between them. In other words, the meanings of these notions very according to their restant and the changing modern world system. hagain has tried to grasp the notion of 'area' ar an entity which embodies the bipolarity of the whole and the part.

For example, in the case of the history of imperialism and notionalist movements, one area can be defined "a place of the confrontation between three factors ($P \neq R \times Q$) as follows, P the power of reproducing and expanding the