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DRY FARMING AMONG THE SAN IN THE CENTRAL KALAHARI

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ABSTRACT In this paper, dry farming among the San is analyzed with the emphasis on farming techniques, methods of land use, agricultural management and the distribution of agricultural products. In 1993, fields were made at 40 locations in Xade extending 20 km from the central settlement. The size of the fields ranged from less than 10 ares to more than 100 ares. The land use includes combined cultivation of watermelon, cowpea and maize. There are 10 varieties of cultivated watermelon grown for the fruit, and 3 varieties for the seeds. Due to the distribution system for watermelons among the San, it is impossible for farmers to become rich from a good harvest.

Key Words: San; Dry farming; Watermelon; Land use; Distribution system.

INTRODUCTION

The author has previously reported on hunting, livestock raising, folkcraft production and road construction in Xade (Ikeya 1989, 1993, 1994a, 1994b). The aim of this study is to clarify the social and cultural changes of the San in Xade, especially through changes in agriculture, focusing on farming techniques, methods of land use, agricultural management and the distribution of agricultural products. Also, the structure and stability of combined occupations including farming will be discussed, looking at changes over a 7-year period from 1987 to 1993.

First, the author will summarize the findings from studies of San crop farming in the Xade area. Tanaka (1978) reported on the cultivation of watermelons near the Xade pan by mixed-blood descendents of the San and Kgalagadi in 1971. However, according to Tanaka, apart from simple plowing of the fields for sowing, and putting up fences around the fields with thorny bushes to protect the crops from animals, no other farming method was implemented, and the harvesting was basically equivalent to gathering wild watermelons. Osaki (1990) reported that people started to cultivate maize, sorghum and cowpea fields 2~3 kilometers from the central Xade area following a free government distribution of these seeds in 1982.

However, there has been no report on methods of land use, harvest quantities or consumption systems. Since there have been no field investigation during the rainy season from January to April, the period when crops are cultivated, a detailed study of crop farming during this period is required.

The author carried out an investigation of crop farming in Xade over a 4-month period in the rainy season from January to April 1993. The investigation included measurement of the land area of all fields in Xade as well as

surveys conducted in the camps of crop farmers. Follow-up studies were also conducted in April 1994 and May 1995, as well as interviews with the officials of the Ministry of Agriculture.

The population of Xade is approximately 600, including both the San people from the ǁGana and ǀGui language groups, and the Kgalagadi people, who are Bantu livestock farmers. The Remote Area Development Programme was applied to the Xade area in 1979, and the borehole at Xade, initially constructed by G. Silberbauer in 1960s, provided a stable supply of water throughout the year. Migrants around Xade began to settle down in the vicinity of the well. At present, although many of the San are involved in money-earning activities such as road construction and craft production (Ikeya, 1994a), most are engaged in a combination of various subsistence activities, such as hunting, gathering wild edible plants and fruit, goat raising, and crop farming. However, labour devoted to gathering plants has decreased recently due to the free monthly government distributions of cornflour.

Currently, in Xade, there are three types of watermelons: 'ǁnan' (*Citrullus lanatus*) wild watermelon gathered by traditional methods; 'thaagi' (lekatane, kaffir melon), a cultivated watermelon of which the time of introduction into Xade is unknown; and 'ghaapu', a commercial crop introduced recently. Other crops in Xade include maize, and cowpea, both native species and later introduced by the Botswana government.

CULTIVATION TECHNIQUES

Characteristics and Nutoritional Composition of Watermelon Varieties

The three main crops produced in Xade are watermelons, cowpeas and maize. Sorghum and carrots were also cuitivated each farm. The different types of watermelon seeds are distinguishable with the naked eye. There are two varieties of cowpea seeds, one traditionally cultivated variety and another distributed by the government. These seeds are also distinguishable with the naked eye. There is only one variety of maize seed. The shape of the 'thaagi' watermelon is either slender with a length of approximately 50 cm or round with a diameter of 40 cm. The color is either green or yellow. Some look like huge wild watermelons. Although the color and shape of the seeds are different, the color of the watermelon pulp is always yellow.

The results of nutritional analysis of the wild and cultivated watermelons in Xade conducted by the Japan Food Products Analysis Center are shown in Table 1. The main components are water, protein, sodium, potassium, and vitamins A, B1, B2 and C. The sugar concentration which indicates the degree of sweetness is only Brix 2% for wild watermelons and Brix 2.3% and Brix 3.5% for the two cultivated 'thaagi' watermelons. For comparison, Japanese watermelons have a sugar concentration of Brix 10% to Brix 13%. Another notable difference between Japanese and Xade watermelons is the sodium and potassium contents. Japanese watermelons contain no sodium, but the two cultivated

Table 1. Comparison of the nutritional components of three kinds of watermelon (per 100 grams)

	wild watermelon	cultivated watermelon	Japanese watermelon
Water	97.0	95.9 97.3	91g
Protein	8.7	10.2 4.5	0.7g
Sugar concentration	2.0	3.5 2.3	10~13
Na	1.25mg	1.19mg 1.33mg	0mg
K	239mg	173mg 157mg	120mg
Vitamin A	0	0.02mg 0.07mg	120 micro gram
Vitamin B_1	0.03mg	0.04mg 0.02mg	0.03mg
Vitamin B_2	0	0.01mg	0.03mg
Vitamin C	6mg	8mg 7mg	6mg

Wild and two cultivated watermelons in Xade were analyzed by the Japan Food Productions Analysis Center.

'thaagi' watermelons in Xade contain 1.19 and 1.33mg. The 'thaagi' watermelons were possibly an important source of sodium for the San and Kgalagadi people, as it is very difficult for them to obtain salt. The potassium content is also higher in Xade watermelons than in Japanese watermelons: 157 and 173mg in 'thaagi' watermelons, compared to 120mg in Japanese watermelons. Watermelon seeds, consumed in Xade, also contain protein and lipid.

The San criteria for watermelon cultivation was simply fruit or seed. In Xade, cultivated watermelons are collectively called 'thaagi'. There are 10 varieties of watermelon grown principally for the fruit and 3 varieties grown for the seeds. The former varieties in Setswana are called 'tamokane', 'tsilaleuts' meaning many lines, 'goru', 'lesweu', 'leleramaga', 'leletshana', 'mododonego', 'subi', 'balani' and 'kantshunyane', and the latter are 'kuroo', 'sihope' and 'kgogo'. However, not all the San are well-versed in the different varieties of watermelon, and the author was only able to specify the meaning for the 'tislaleuts' variety.

In addition to the above varieties, there is also the 'koba' watermelon, which resembles a cultivated watermelon in shape, but has white-colored pulp inside and the same bitter taste as the wild watermelon. According to the San, the 'koba' watermelon is mid-way in the transition of cultivated to wild watermelon. It is thought that the 'thaagi' and 'kuroo' watermelons change into wild watermelons through a process of seed transformation, into the white, thin 'koba' seeds. The 'koba' watermelon is often used as feed for donkeys.

An investigation of the acquisition route of watermelon seeds among crop farmers in Xade showed that many of the farming households had traditionally

collected the seeds themselves. Six farming households in Xade obtained the watermelon seeds from people in Xade, and seven farming households obtained them from households in Molapo and Ghanzi, more than 100 kms from Xade. Recently, 'ghaapu' seeds, were obtained from outside Xade, as they are first filial generation (F1) seeds which can not be reproduced from harvested watermelon seeds. In contrast, 16 crop farming households obtained cowpea seeds from the government, while one had their own supply and another 5 households obtained them from people in Xade. In the case of maize, 11 households obtained the seeds from the government.

Crop Farming Implements, Plowing, Sowing and Building Fences

Table 2 shows the types of crop farming implements used by each farming household in Xade. Eleven farming households owned large steel plows (6 San households and 5 Kgalagadi households), 17 households owned small wooden plows, 12 households owned shovels and 2 households owned wooden digging sticks. Four of these households owned both large and small plows, and 3 households had no farming implements at all.

A |Gui father and son who both worked on road construction purchased large steel plows in 1984 from the Ghanzi agricultural office. Some shovels were obtained in Xade or Ghanzi through cash purchases. A shovel was bartered for a female goat. One household received a shovel as a reward for cooperation in the production of a movie in this region. Small plows were either hand-made or purchased with cash in Xade or Racops. The hand-made plows were approximately 85cm in length, with handles made from antelope horns.

Small and large plows were borrowed among the farmers in Xade. These were borrowed among both the San and Kgalagadi, although there was no borrowing between the two groups.

Many of the farmers in Xade combine their crop farming with other wage-earning activities. In the farms which use large plows, farmers often work on Saturday and Sunday, which are rest days from wage-labor. Generally, plowing is carried out for the rain water to infiltrate soil and not escape. Plowing is also necessary to preserve the water after rainfall. However, in Xade, plowing is often carried out after only a little rainfall.

Interestingly, the agricultural calendar in three representative dry farming regions of Asia and Africa (Iran, Senegal and Kenya), reveals the characteristics

Table 2. Number of households by implement ownership

	San	Kgalagadi
Large plow	6	5
Small plow	17	1
Shovel	12	
Digging stick	2	
None	3	
Total	40	6

of farming in Xade. The Iranian farming schedule (Goto, 1981) is similar to the Xade crop farming and Senegalese and Kenyan farming schedule is similar to Xade livestock herding (Ogawa, 1980; Itani, 1992). However, two differences are noticable between dry farming in these countries and in Xade. Firstly, plowing and fallow land grazing types of farming, which are used in Iran, are not seen in Xade. In other words, there is no organic association between crop farming and livestock in Xade. Secondly, although herders in Turkana land, Kenya, have devised ways to prevent damage to the sorghum crop from birds (Itani, 1992), many of the farmers in Xade, who are faced with the same problem, have chosen to abandon sorghum cultivation rather than devise ways to prevent crop damage from birds.

Crop farming tasks include putting up fences, plowing, sowing, weeding and harvesting. Among these, the job which requires the greatest effort is building fences.

Farming begins with plowing and sowing. Plowing is usually the job of women in Xade. The plow used in Xade has a wooden handle 1m long to which a square metal plate is attached. Some women use a shovel and wooden pole for plowing. As the women only work in the fields from 8 to 10 a.m. when the temperature is cooler, the area plowed in one day is less than 1 are. Thus, 10 days would be needed to plow a 10-are field.

After the day's plowing has finished, small holes are dug in a line and 2 seeds are put in each hole. Mixed cropping is often carried out in which any two of maize, cowpea and watermelon are sown together.

During this time, fence building is also carried out. Fence building is a hard and time-consuming task, and several men often assist in this task. Round or square-shaped fences are constructed around the fields to keep out hyenas, donkeys, goats, and other wild animals. In Xade, the size of the field is not predetermined, but is either expanded or contracted according to the amount of rainfall. As fences are not necessary until the plants have sprouted above ground, the fencing is not completed until this time. If the plants fail to sprout, some farmers abandon their fields and set off hunting or gathering wild edible plants and fruit.

Another method of plowing in Xade uses a large metal plow which is pulled by 2~4 donkeys. Although only a farmer named **TU** employed this method of plowing before settlement, the use of large plows has increased in recent years since the Ministry of Agriculture began to offer plows at a cheap price.

Farmer **TU**, with a large plow pulled by 4 donkeys, could plow a 100 meter row in only a few minutes. For this operation, one man holds the plow while another controls the donkeys, and another man sprinkles seeds (mainly free maize seeds from the government) over the plowed earth. This is a relatively simple way of sowing compared to the traditional method.

The maize sprouts about 10 days after sowing. The next task of weeding the fields is carried out by women. The next day after rain, women go into the fields and make small mounds with the wet soil around the stalk of each plant in order to conserve water in the root. At this time, fences are completed and care is always taken to make sure no animals, such as donkeys or goats, get into the fields. In the past, hyenas and springboks have managed to get into the fields and

cause considerable damage to the crops. In 1993, the corn crop sustained heavy damage due to an invasion of crickets. In that year, the maize harvest was only 2~3 kilograms per hectare. Although some farmers dug a 50cm-deep ditch around the perimeter of their field to try to stop the invasion of crickets, such efforts were only seen among a few of the more hard-working San and Kgalagadi farmers, while most of the farmers in Xade did nothing to try to stop the invasion of crickets.

Most of the people in Xade walk from the village to the field and back each day, an average distance of more than 5 kms each way. Five households, however, made makeshift huts near the fields to live in while tending the fields. Farmer **KE**'s field was 6 kms away from the village where he had been living for about 10 years. He was able to manage a large field of 200 ares using a large plow pulled by donkeys. When harvest time for the watermelons draws near each year, he moves with his wife and 20 goats, to a temporary hut near his field where they live until the harvest is over. The man earns extra money from trapping animals and dog hunting, while his wife makes folkcraft.

Harvesting, Storage and Processing

Watermelons are ready for harvesting 2 months after sowing. Harvesting begins in the middle of April, but only a few are harvested each day for food. However, vines begin to wither in June due to the cold, and all the remaining watermelons are harvested at this time. The harvest of maize may be any amount from zero to several hundred kilograms. The harvest of cowpeas is in the range of several kilograms.

The farmers in Xade determine the size of their fields according to the amount of rainfall, and cultivate a mixture of maize, watermelons and cowpeas. In 1993, the cultivation period was delayed due to heavy rainfall in February. However, the harvest was the same as a usual year, at 220 watermelons per 0.1 hectare. After harvesting, the watermelons are stored around trees near makeshift lodgings. Generally the watermelons have a thick, strong skin, and can keep for up to 6 months in the dry climate.

Watermelons are consumed by the people in Xade in 5 different ways. The most popular way of eating it is watermelon stew. The preparation of this stew is very simple. The fruit is sliced up, placed in a steel pot, and boiled with no water or seasoning. The watermelon melts into a pasty liquid. After the fire dies down, watermelon seeds are crushed with a mortar and added to the stew. These crushed seeds are not only an important source of fat, but also give the stew a good texture.

Another way of eating watermelons is by roasting it whole. A whole watermelon is simply placed on top of burning woods, and roasted until the skin becomes black and soft. The fruit of the watermelon turns into a jelly-like substance. After roasting to the core, the whole watermelon is eaten, including the skin. The seeds are collected for sowing or used in watermelon stew.

Watermelons are also steamed in hot ashes. This is the same method generally used for cooking the meat of smaller antelopes such as springboks or duikers,

and also a superb way for cooking watermelon. The watermelon is left in the hot ashes for about 1 hour, and then taken out and eaten together with the skin. Naturally, people in Xade also eat watermelons raw, as in Japan, although they also eat the soft inner skin and naturally do not throw away the seeds.

The final way watermelons are consumed in Xade resembles the watermelon stew. The watermelons are first sliced and dried for one day in the sun, and then boiled in water to a stew.

Thus, for the people of Xade, watermelons are not only a thirst-quencher, but also a staple food.

LAND USE

The Distribution of Fields

The Xade area is a designated area within Central Kalahari Game Reserve, which is a protected area for animals, and therefore, all the land in Xade is owned by the government. People living in Xade all have the right to cultivate land. Records of changes in farming locations in Xade from 1979 to 1993 show that there are two types of farmers: those who settle down and establish a farm in one location and those who move around making fields in different locations every 2 to 3 years.

In the rainy season (January to April) of 1993, fields were made at 40 locations in Xade (Fig. 1). The locations of the fields were spread over an area extending 20 km from the centrally located elementary school, with most of the 40 fields located within a 10 km radius. One of the major conditions for selection of the field location is the availability of trees nearby for making fences.

The average distance from the central village area to the fields has gradually increased over the past 10 years; 2~3 km in 1983, 5 km in 1988, and 10 km in 1993. The reason for this increasing distance to the field is because trees needed to build fences have been depleted because they are felled for firewood.

Farm Land Use

Figure 2 shows the land use of the fields at 6 locations in Xade. Most of the fields are rectangular in shape, although some are round or other shapes. Land use includes three combinations of "watermelons and cowpeas," "watermelons, cowpeas and maize" and "cowpeas and maize," or single crop cultivation of just one of these crops. However, the ratio of the crops in these 3 combinations differed for each field.

In the case of (a), a combination of watermelons and cowpeas was cultivated, with no maize. In (b) and (b)', a combination of all three crops were cultivated. In (c), there was a combination of watermelons and maize as well as some single-crop cultivation of only cowpeas and maize. In (d), apart from a small area of

single-crop cultivation of watermelons and cowpeas, most of the land was used for maize, was the crop promoted by the government.

According to the village elders, the basic pattern of cultivation in Xade has been mixed cultivation of watermelons and cowpeas, although it is not clear when this pattern of cultivation started. However, Tanaka (1978) reported the cultivation of only watermelons in some fields in 1971. Thus, it is supposed that the traditional mixed cultivation of watermelons and cowpeas changed to a mixed cultivation including maize or to single-crop cultivation either of maize or of cowpeas. The range of crop diversification was greatly influenced by the agricultural policies of the government in Botswana.

FARM MANAGEMENT

Maize and cowpea seeds are distributed free to the people living in the Central Kalahari Game Reserve by the Ghanzi office of the Ministry of Agriculture. According to the records of the Ministry in 1993, 125kg of maize seed, 32kg of cowpea seed and 12 sacks of sorghum seed were distributed to the people in

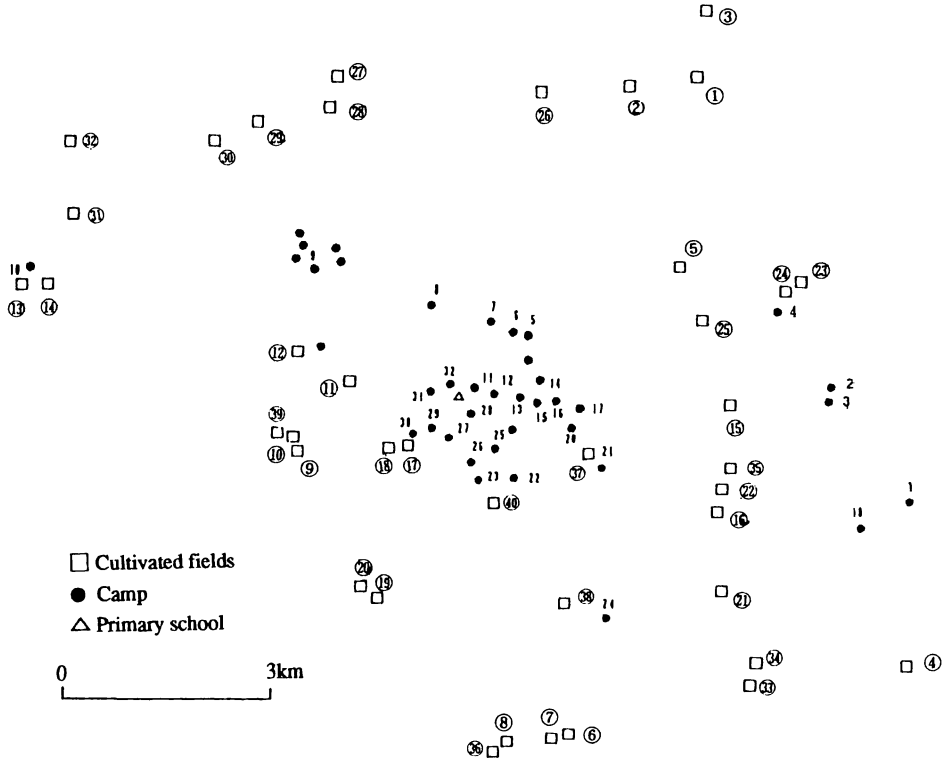

Fig. 1. Distribution of cultivated fields in Xade (January~May, 1993).

Xade. However, as sorghum was only being cultivated by one household, most of the sorghum seeds must have been consumed for among the villagers. The government also provided a drought relief subsidy to each farmer, based not on the amount of harvest but on the area of cultivated land, 1 pula per 1 are of cultivated land (by the 1993 exchange rate, 1 pula=approximately us$0.5). Thus, a farmer who cultivated 1 hectare of land received 100 pula in cash from the government. However, people who did not cultivate any land could receive any government money. There have been cases where farmers have abandoned their fields after receiving the government cash payment.

In 1993, the Kgalagadi people began cultivating the 'ghaapu' watermelon, which is similar to the Japanese watermelon in terms of it color and sweetness. The seeds were bought from the town, and the watermelons were cultivated as a commercial crop, and sold for 2~3 pula (approx. us$1~1.5) to visiters from the towns. However, Xade is a long way from markets, such as at Gaborone or Ghanzi, and people were not economically compelled to engage in large scale cultivation of the 'ghaap' watermelon.

Thus, 'ǁnan', 'thaagi', 'ghaapu' and maize are respectively indeces of gathering, traditional farming, commercial farming and government-subsidized farming.

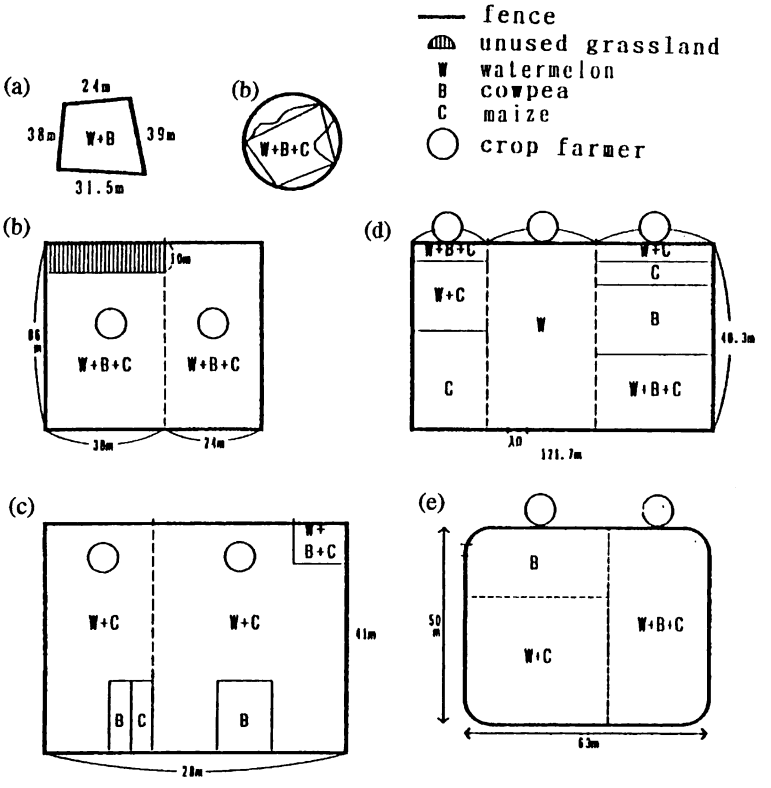

Fig. 2. Examples of land use of cultivated fields in Xade.

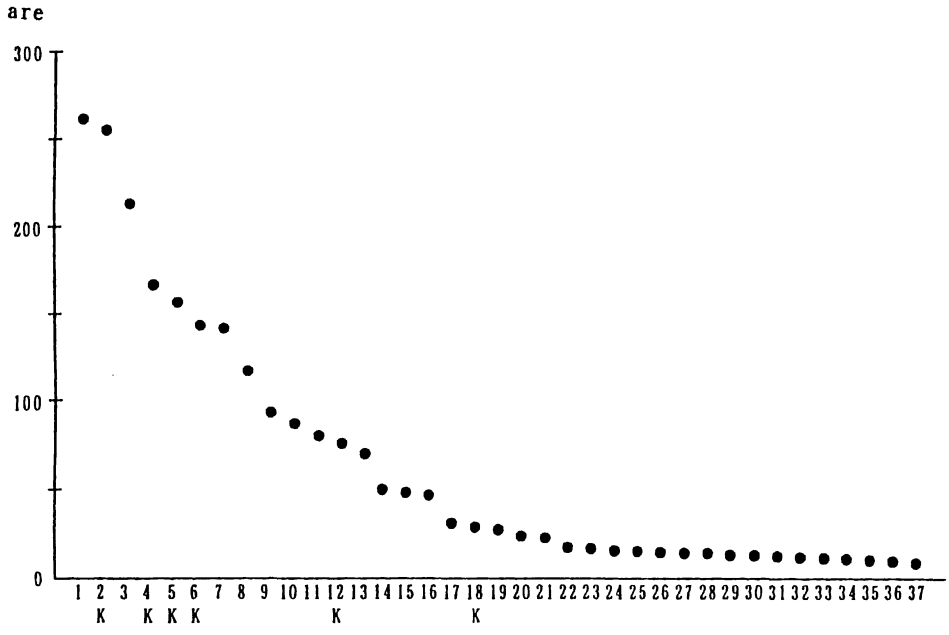

Fig. 3. Cultivated land area per household in Xade (1993). K indicates Kgalgadi people.

Annual Variation in Cultivated Area and Watermelon Production

In the rainy season of 1993, there were 37 farming households in Xade (Fig. 3). Six of these households were Kgalagadi (Fig. 3: 2, 4, 5, 6, 12, 18) and 31 were San. Two of the San households had abandoned their fields after plowing. The size of the fields ranged from less than 10 ares to more than 250 ares. Four of the six Kgalagadi households had fields of more than 100 ares. The size of the field was determined by whether or not the household owned a large steel plow.

Figure 4 shows the watermelon production per are of land in fields at 8 different locations belonging to farmers A to H. The watermelon production was estimated in kilograms by multiplying the number of watermelons harvested by the average watermelon weight of 5kg. Farmer H had the highest watermelon production at approximately 180kg, and farmer A, the lowest at around 30kg. One field produced about 1000 watermelons in a 2 hectare area, which converts to a production quantity of 2500kg per hectare. However, as a watermelon is composed of 90% water, the true production quantity could be calculated at 250kg per hectare. The watermelon production per area of land is affected by many different factors, such as rainfall, soil, and the timing of plowing and sowing. Thus, in 1993, some fields in Xade had a good harvest while other fields in the same region did not.

In April 1993, the author counted a total of about 1000 watermelons harvested from KE's field. The harvest of cowpeas was also average for this year. However, maize suffered damage from crickets.

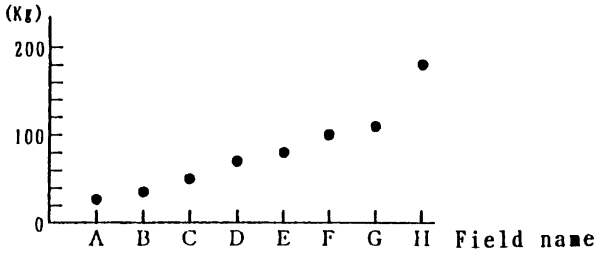

Fig. 4. Watermelon production (kg) per are of cultivated land (1993).

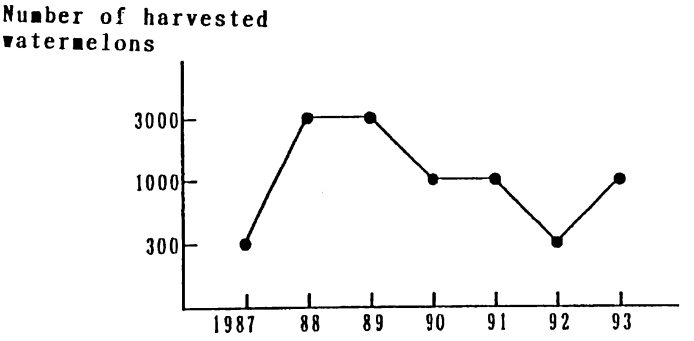

Fig. 5. Fluctuations in the number of harvested watermelons from 1987 to 1993.
Source: Interview and direct observation

Figure 5 shows a rough estimate of annual fluctuation in watermelon production for farmer **KE's** field. Over the past 7 years, the watermelon production for **KE's** field had remained at about the same amount, ranging from a good harvest of around 3,000 watermelons in 1988 and 1989, an average harvest in 1990, 1991 and 1993, to a poor harvest of only around 300 watermelons in 1987 and 1993.

Flexibility in Farming Activity: An Example

In 1993, although the total rainfall in Xade for January was less than most years, there were three days of heavy rain in February: 24mm on Feb.7, 66mm on Feb.10 and 49mm on Feb.15. With these heavy rainfalls, most of the farmers in Xade began plowing their fields from about Feb.13. For example, farmer **AC** plowed his fields at 1~3 day intervals (Feb. 13, 15, 18, 22 and 24) after the heavy rainfalls. However, instead of working in the fields everyday during this period of heavy rainfall, he spent some of the time gathering wild edible plants and fruit for food as well as building fences around his fields, felling about 250 slender trees such as 'ǁqx'oa' (*Acacia mellifera*), 'ǁxamts'a' (*Lonchocarpus nelsii*) or 'ǀgaa' (*Terminalia sericea*). In contrast, famer H, who had already finished plowing at the end of December, decided to expand his field area. Determining the field size only after the rainfall is characteristic of a dry farming system that

depends only on rain for the water supply.

At the end of February, news of an outbreak of green caterpillars near their fields reached the farmers in Xade. Immediately, farming operations were abandoned, and farmers set off to catch these green caterpillars, which were an important food source for them. The green caterpillars were brought back home after being steamed over a fire and dried. These dried caterpipllars keep for a long time, and are not only an important food source but are also popular as food for guests and as gifts to friends.

Thus, in San society, farmers adapt to circumstances, switching between farming and gathering, the ratio of which is determined by fluctuation in rainfall.

Labor and Labor Organization

Figure 6 shows the changes in the joint use of fields by more than one household in 1983 and 1993. One of the characteristic changes in Xade farming over the past 10 years is the decrease in the number of households sharing fences. In 1983, there were a total of 5 fields in different locations, each of which was shared by more than 3 households: 1 field shared by 6 households, 2 fields shared by 5 households, 1 field shared by 4 households, and 1 field shared by 3 households. However, in 1993, there was only 1 field shared by 3 households.

Up to 10 people may be required to perform the tasks of fence construction and plowing with donkeys. In the case of farmer **TU**, almost 10 people assisted in putting up the fences and plowing. Some farmers use paid labor. For example, **F** received 50 pula for his labor in a field managed by a Kgalagadi farmer. **D** received two goats for helping in the fence construction of a field operated by a Kgalagadi. He later exchanged one of the goats, a female, for a male, as female goats are not used for food. **M** also received one goat for wiring the fences between the fence the posts around a field operated by a Kgalagadi. Thus, the Kgalagadi pay the San for their labor not just in cash, but with goats and even alcohol.

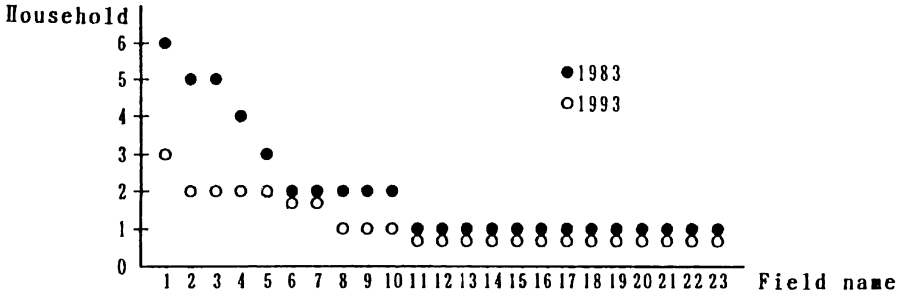

Fig. 6. Number of households jointly using fence around field areas in 1983 and 1993. 1983 data from Osaki (1990) and 1993 data from author's investigation.

DISTRIBUTION SYSTEM OF CULTIVATED WATERMELONS

This section is a look at the consumption system of crops in Xade with respect to the distribution of the household surplus. The following analysis is focused on watermelons.

In 1993, the field cultivated by a !Gui farmer **KE**, living in a hut near his field, yielded almost 1,000 watermelons. However, when harvesting began in April, many people from his family and his relatives visited his field almost daily, and each received 4~5 watermelons. Later, two other !Gui (**CH** and **KN**), not related to **KE**, moved close to **KE's** field, and **KE** ended up giving a way the remaining watermelons to them.

In the same year, a ǁGana man **GB** had a field that yielded around 2,000 watermelons. It seemed doubtful that his family consisting of only 4 members could consume the entire crop by themselves. However, when time came to harvest the crop, several families, who had not been involved in the cultivation of his field, began camping near his field (Fig. 7). The watermelons were distributed among the campers near his field over the next three months, and after the watermelons had all been eaten, the campers broke up into two groups and moved on to another place.

Three women, who continued to receive watermelons from **GB's** field, each began cultivating their own watermelons the following year 1994. Thus, it appears that the reason these three women did not try to cultivate their own watermelons in 1993 was not because they did not know how to, but because they decided to gather wild plants rather than try cultivation themselves. However, after receiving the watermelons from **GB**, they decided to use the seeds from these watermelons to try cultivating their own watermelons. **GB**, on the other hand, did not cultivate any crops in 1994 due to the lack of rainfall that year.

Thus, with such a distribution system for watermelons among the !Gui and ǁGana, it is impossible for the watermelon farmers, even if they are skillful at farming as in the case of **KE** and **GB** above, to accumulate from their harvest. There is also the problem of rainfall, the lack of which causes a poor harvest about once every three years.

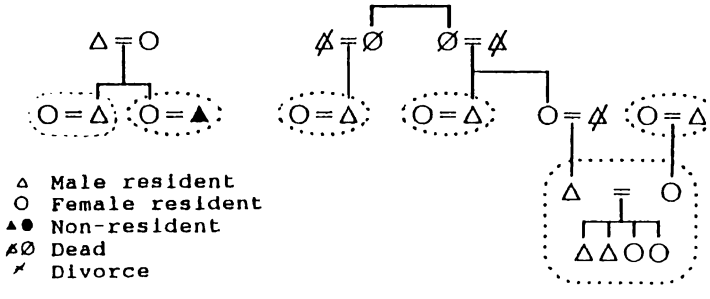

Fig. 7. Genealogy of camp members near one field. GB:crop farmer

DISCUSSION

The crops presently cultivated in Xade are watermelons, cowpeas and maize. Of these crops, only maize was introduced to Xade after settlement by the San. Farming in Xade has been undergoing change over many stages: 1) cultivation of native crops (watermelons, cowpeas, and sorghum) until the 1970's, 2) single-crop cultivation of maize after the 1980's, aided by government subsidies, and 3) cash-crop cultivation of watermelons for the market in 1993. Before the San settled in Xade in 1979, not many of them were engaged in farming. Most of the 40 San households now engaged in crop farming had been farmers before settlement in Xade. Thus, the main change in farming following settlement in Xade was not an increase in the number of households engaged in farming, but rather an increase in the size of fields.

Although the findings from this investigation in 1993 are similar to those from the 1982 investigation by Osaki (1990) concerning the free government distribution of maize and cowpea seeds, the amount of sorghum seeds has decreased due to crop damage by birds. As for watermelon seeds, the author's investigation revealed that these seeds were not obtained from the government but from the people in Xade. Although the trends toward more cultivation of watermelons, cowpeas and sorghum will probably continue, the author's investigation did reveal a decline in the number of households engaged in maize cultivation.

The fields used to be located an average of 2~3 km away from the central village in 1982, but the distance increased to an average of 10 km in 1993. Also, there was a clear recognition among owners as to field ownership, even if some owner households were not engaged in cultivation. This contradicts the claim by Osaki (1990) that fields were jointly-owned. I found that joint ownership applied not to the fields but rather to the fenced area. Although Osaki (1990) reported joint-cultivation of fields by 4~6 households, this situation could not be found in this study. The system of joint-cultivation had broken down and there was a shift to cultivation of fields by individual households.

It is tempting to assume that great variation in field size and harvest would cause social stratification among farmers. But my study on watermelon demonstrates that such an assumption is not relevant to the people in Xade. The important point is that such a simple system of watermelon distribution from "those who have" to "those who do not" can maintain a stable crop production per household each year. As this system of watermelon distribution had been carried out before settlement, there seems little likelihood of this system changing in the near future.

The harvest from dry farming, which relies on rain for water, is naturally affected greatly by the amount of rainfall (Akagi, 1990). For example, compared to the irrigation farming in the Fielus area of Iran which has a stable harvest wheat per hectare, the harvest wheat from dry farming varies greatly year by year: 300kg in 1971, 90kg in 1972, and 540kg in 1973 (Goto, 1981). This pattern of variation in the harvest is very similar to that of watermelons in Xade.

People in Xade combine farming with other subsistence activities, such as goat raising, hunting, gathering wild edible plants and fruit, making folkcraft, and road construction (Ikeya, 1994a). When there is a poor harvest of cultivated crops due to lack of rain, the people supplement their food supply by gathering wild edible plants and fruit. For the people of Xade, crop farming is viewed as a means to secure only a part of their food supply, as well as a means to acquire the government subsidy. Thus, it seems that the subsistence lifestyle of the San and Kgalagadi, who inhabit the Xade, is strongly influenced by government policy.

Single-crop farming dependent on rain water is very unstable in a dry climate with large fluctuations in annual rainfall. Thus, in such regions of northeastern Sudan, it has been pointed out that dry crop farming should be combined with other activities (Hjort, 1991). The principle of "equal distribution," which is part of the consumption system in Xade, helps to facilitate the possibility of combined activities. While there may be a noticeable difference in material wealth among the San in field size, the possession of steel plows, and the number of goats (Ikeya, 1993), the "equal distribution" principle prevents these differences in material wealth from creating a class society.

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