

Changes in Food Production by Irrigated Paddy Cultivation in the Kilimanjaro Region

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1 Introduction

This paper chiefly examines the socio-economic impacts of modern irrigated paddy cultivation, introduced through Japan's development assistance, on the food production system and life of Tanzanian villagers. The Japanese government carried out two irrigation projects in the Kilimanjaro Region in response to Tanzanian request. One is the Lower Moshi Project near Moshi town, the capital of the Region, and the other is the Ndungu Project in the Same District (Fig. 1). This paper analyzes the impact of the Lower Moshi Project in particular.

In the Agricultural Policy of Tanzania in 1983, the Government of Tanzania placed a high priority on developing an irrigated system of agriculture. The Kilimanjaro Region is expected to play a leading role in the expansion of irrigated systems of agriculture. The Lower Moshi Irrigation Project provides a core for such a plan.

There are a variety of food production systems in the Region; these systems are practiced by family farms. Here, a family farm is defined as a small landholder who, in principle, seeks to support his/her family, using family labor, through self-sufficient subsistence. Although Tanzania is generally an agricultural country, as is most of Sub-Saharan Africa, the people of this land often suffer from hunger or even face a food supply crisis. Therefore, it is very important to develop an efficient food production system and to ensure a secure supply in order to improve living standards.

In such a context, the development of irrigated systems, wherever water is available, agriculture is very important and moreover urgently needed. However, the Tanzanian people have rarely practiced irrigated paddy cultivation. The possibility of conflict between

new technology and existing socio-economic systems is present in such communities. Thus, it is necessary to study the impact on food production and communities of irrigated paddy cultivation.

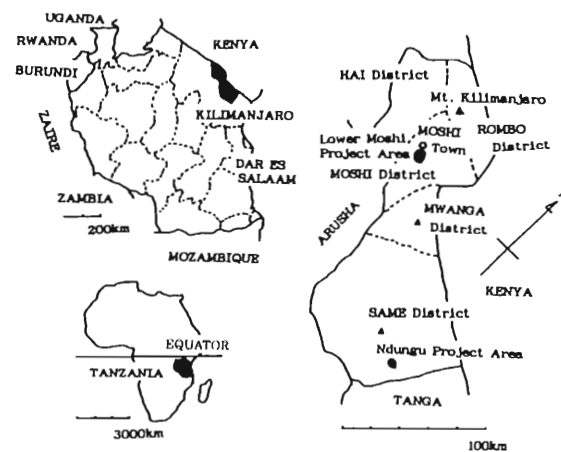


Fig.1 Location of the Lower Moshi Project Area

2 Major Food Production Systems in the Kilimanjaro Region

2-1 Natural Conditions and Food Production Systems

Food production systems vary according to natural and socio-economic conditions. Especially under systems involving traditional agro-technology, natural conditions are likely to be considered a decisive factor in food production; in other words, people under these conditions must adapt to their surroundings.

Rainfall and soil types are major factors in the agricultural ecology. Annual rainfall is roughly dependent on altitude in the Kilimanjaro Region. The Region is divided into three zones; humid high land,

semi-humid middle land, and semi-arid low land. The first zone, ranging from about 1100 m to 1800 m in altitude, lies along the slopes of Mt. Kilimanjaro and the Pare Mountains, where the annual rainfall is over 1500 mm. The second zone ranges from 800 m to 1100 m in altitude, with an annual rainfall of 800 mm to 1500 mm. The third zone is a flat savanna below 800 m in altitude, where the rainfall is less than 800 mm.

As regards the annual rainfall distribution, there are two peaks per year. One peak occurs during a long rainy (wet) season, which usually begins in March and ends in May. The other peak occurs during a short rainy season between October and December. However, rainfall distribution varies according to location and year. Due to this uncertainty, villagers cannot rely upon the stable production of food by a traditionally rainfed agricultural system.

The soils consist of alluvial or colluvial volcanic soils. These soils are considered to have great potential to produce higher yields, if irrigated [Mlambiti, 1985]. The soil type of this region is Ferruginous Tropical Soil. As these soils contain clay loam, silt loam and coarse sand, they are very likely to erode. Therefore, it is necessary to adopt soil conservation methods as well.

Under conditions of rainfall and the soil composition mentioned above, villagers in the Kilimanjaro Region practice several food production methods. These systems are classified into 7 types, depending mainly on crops and farming methods, as follows; (1) permanent upland farming with miscellaneous cereals, (2) shifting cultivation with grassland burning, (3) the "agrosilvopastoral complex" system, (4) traditional paddy cultivation, (5) modern paddy cultivation, (6) agroforestry, and (7) national estates.

Permanent upland farming is widely distributed in the arid or semi-arid lowlands. Generally, villagers grow maize and sunflowers together, with drought-resistant crops such as millet. However, villagers cannot always expect stable yields. At present, shifting cultivation is seldom practiced in the region. Traditional paddy cultivation has been carried out around swamps or rivers, but after the initiation of the Lower Moshi Project, the trend has gradually shifted to modern paddy cultivation. Agroforestry is promoted

by the World Food Program in West Kilimanjaro. National estates that grow wheat are also scattered around West Kilimanjaro. These two food production systems are practiced in a relatively limited area. Moreover, wheat from the estates is not used for local consumption. Thus, agroforestry and the national estate play only a small role in feeding the people of the area.

On the other hand, the "agrosilvopastoral complex" system and modern paddy cultivation are very important to the region. The former extends over mountain areas with high population density. The latter has had a strong impact on the life of villagers. The next section summarizes the "agrosilvopastoral complex"; a discussion of modern paddy cultivation follows.

2-2 "Agrosilvopastoral complex"

An "agrosilvopastoral complex" system is defined as a system producing multiple commodities by the combination of mixed cropping, animal husbandry, and forestry [Ikegami, K., 1994]. The Wachagga people, one of the main ethnic groups of the region, lives on the slopes of Mt. Kilimanjaro. These people depend for their livelihood on two kinds of fields, namely the "shamba" in the lowlands and the "kihamba", a kind of a homestead farm surrounding the houses. The "agrosilvopastoral complex" is practiced in the "kihamba".

In the "kihamba" plots, the Wachagga people of Maua village simultaneously cultivate more than 20 varieties of herbaceous and woody plants (e.g., beans, coco yam, potatoes, coffee, banana and other fruit trees etc. O'king'ati [1984, pp.177-186] observed 42 families of plants in the "kihamba". Such intensive land use is possible by stratified spatial use, where plants of different heights are grown. In addition, the combining of annuals and biennials with perennial herbs and arbor plants is practiced.

The diversity of the multiple cropping system provides villagers with the necessary living materials while requiring the vague labor of all systems. Villagers can achieve self-sufficiency as regards food, cooking oils, clothes, traditional medicine, fuel wood, and timber. They can also obtain cash from coffee sales.

In addition, several component plants are used in

various ways. For example, the leaves of herbs and arbor plants are indispensable as fodder for livestock. Most of the Wachagga keep livestock, such as milking cows and goats, in their huts. When feed for the animals runs short, then the Wachagga people plant various kinds of forage crops, such as Guatemala grass (*Tripsacum laxum*) and "torontoro" (*Commelina latifolia*). The Wachagga people plant forage crops intensively along the boundaries of steep bluffs, so that they can prevent soil erosion. This cropping system is one method of soil conservation included in the "agrosilvopastoral complex".

The livestock supply not only milk for daily use but also manure for improving soil fertility. Manure is spread over the "kihamba". Although family farms in Sub-Saharan countries are generally said to use manure rarely, the Wachagga people have traditionally used it for this purpose [Dundas, 1924]. Intensive land use causes a rapid decrease in soil fertility. The spread of manure contributes greatly to the solution of this problem. Moreover, this practice has mulching effects, which conserves soil moisture and controls weeds on the fields. This is practiced in conjunction with the spreading of the remains of certain crops, especially banana leaves on the fields.

The "agrosilvopastoral complex" is a sophisticat-

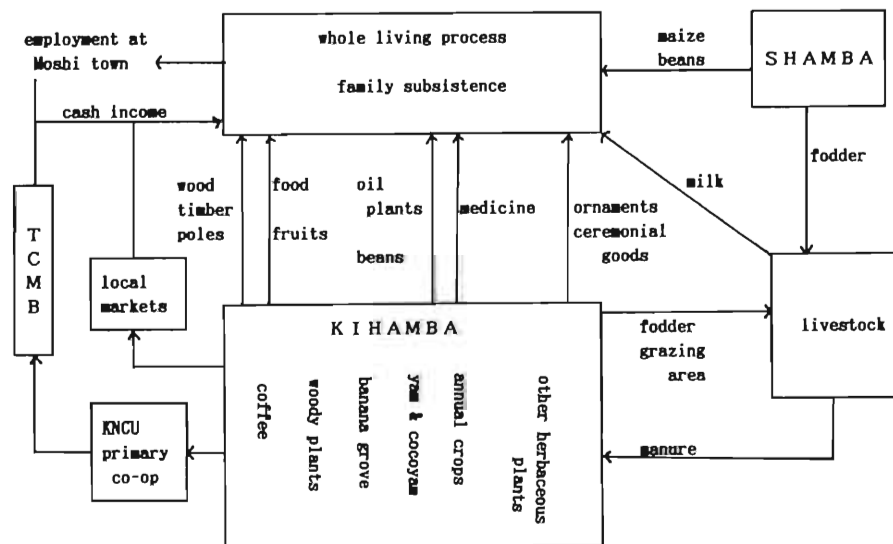
ed food production system. This system enables villagers not only to acquire almost all of the materials for their subsistence, but it also allows them to acquire a cash income (Fig. 2). This system also has a mechanism for preventing erosion and preserving soil fertility. These aspects render indigenous farming systems suitable for sustainable development in many cases.

However, the "agrosilvopastoral complex" also has some disadvantages. One of the most severe problems is population. Intensive land use has already reached the equilibrium point. The "agrosilvopastoral complex" can no longer support the increasing population. Many people move to the lowlands, seeking new land to farm. Therefore, it has become necessary to develop food production systems that would be viable in the lowlands. Irrigated paddy cultivation is one method of meeting such needs.

3 Features and Economic Performance of the Lower Moshi Irrigation Project

3-1 Advantages and Weaknesses of the Lower Moshi Irrigation Project

The Lower Moshi Irrigation Project (LMP) began in 1978 with aid from Japan. The technical assistance, which was extended several times, was interrupted in



Note: TCMB is the Tanzania Coffee Marketing Board, and KNCU is the Kilimanjaro Native Cooperative Union.

Fig.2 The Agrosilvopastoral Complex

1993. The LMP aims at the development of irrigation agriculture, especially paddy cultivation, in the tropical arid zone. In addition, the LMP hopes to improve the dietary life of local people. For this purpose, the LMP constructed two water-intakes, irrigation and drainage facilities, and developed paddy fields.

The project area is 2,300 ha, among which 1,100 ha is devoted to the paddy fields. Until 1987, an each paddy was cultivated twice a year, but since 1988, a triple cropping system was adopted due to the water shortage (Fig. 3). Although the water flow from the Njoro and Rau Rivers is relatively stable, it is not sufficient to irrigate all of the paddy fields at once. Furthermore, the actual water requirements are greater than those described in the plan. In general, the expansion of modern paddy farming further upstream makes the relationship between the supply of and demand for water very fragile.

Paddy cultivation calls for transplanting in a straight line, paddling soils by tractors, and applying pesticides and artificial fertilizers. Paddling is provided by the tractor hire service section of the Kilimanjaro Agricultural Development Project (KADP). As the spare parts are not available in Tanzania, the maintenance of tractors chiefly depends on donations from Japan. The lack of domestic production of spare parts is currently a factor limiting the sustainability of paddy cultivation.

The introduced varieties of rice are the High-Yield Varieties (HYV), such as IR20, IR30, IR54, and IR56. HYV require large amounts of fertilizers, chemicals, and water [Brown, 1971, pp.18-19, 35-36,

43-49]. According to the cultivation manual of the KADP, IR54 needs more than twice the nitrogen fertilizers of the native varieties [Horibata, T., 1992]. The input of agricultural materials also may limit the sustainability of paddy cultivation, due to delayed deliveries and relatively high prices. Furthermore, monocultures of IR54, which is preferred by villagers for easy threshing by hand, are relatively vulnerable to climatic changes, diseases, and insects.

3-2 Economic performance of paddy cultivation

At present, economic performance is very good. In 1987, the Daily News(Dar es Salaam) reported that the LMP had made "a healthy start to a constant and stable supply of major foodstuffs in the area" (21/May). The major reason for this lay in the achievement of high yields, more than 6 tons/ha (Table 1), compared with the national average of 2.4 tons/ha [Planning and Marketing Division, 1993].

The high yield of these paddies had a significant impact at both the macro and micro levels. From the perspective of the national economy, the LMP contributes to improved food supply security. For each villager, the LMP will contribute not only to self-sufficiency as regards staple foods, but also to an increase in cash income obtained by the sale of the surplus. In short, the paddy harvest has two main functions; as food and as a cash crop. However, recently, villagers tend to consider the paddy yield more as cash crops because of its high economic performance.

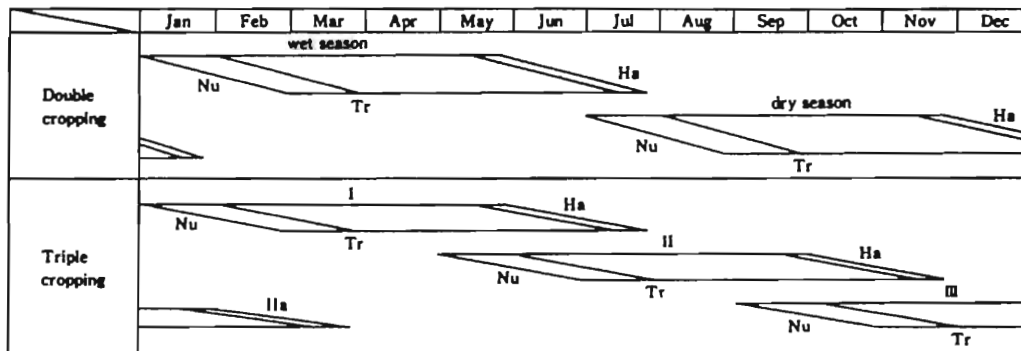


Fig.3 Cropping Pattern of Paddy

Legend Nu : Nursery Tr : Transplanting Ha : Harvesting

Source : Compiled from KADC

Table 1 Yields of Paddy Fields
(units : ha, tons, tons/ha)

Farming season	Cultivated area	Total yields	Average yield
1985	105	737	7.02
Annual production	105	737	7.02
1986 (wet)	134	1,017	7.59
1986 (dry)	524	3,401	6.49
Totals & annual ave.	658	4,418	7.04
1987 (wet)	459	3,075	6.70
1987 (dry)	526	3,519	6.69
Totals & annual ave.	985	6,594	6.70
1988 (I)	467	3,558	7.19
1988 (II)	516	2,936	5.69
1988 (III)	438	2,677	6.14
Totals & annual ave.	1,399	9,115	6.34
1989 (I)	541	2,489	4.60
1989 (II)	578	3,572	6.18
1989 (III)	455	2,584	5.68
Totals & annual ave.	1,574	8,645	5.49
1990 (I)	575	3,145	5.47
1990 (II)	617	5,207	8.44
1990 (III)	417	2,856	5.64
Totals & annual ave.	1,609	11,008	6.52
1991 (I)	373	2,852	7.11
1991 (II)	476	2,904	6.10
1991 (III)	449	3,278	7.30
Totals & annual ave.	1,298	8,834	6.84
1992 (I)	—	—	—
1992 (II)	437	3,452	7.90
1992 (III)	454	3,519	7.75
Totals & annual ave.	891	6,971	7.83

Source: KADP(Collected by Agronomy Section, KADP)

Note: In the 1992 season, cultivation was canceled due to water shortage.

Economic performance differs according to the type of farm management. Villagers engaged in paddy cultivation are classified into the following 5 types, according to whether or not they have paddy fields and whether they depend on family laborers or hired laborers; 1) pure landowners leasing paddy fields, 2) landowner-managers depending entirely on hired laborers, 3) family farms holding land and depending on family labor, 4) tenant farmers using hired laborers, 5) tenant farmers depending on family labor.

In practice, there are some villagers who lease out a part of the paddy fields or who use family labor and hired laborers appropriately, according to the type of work needed at a particular time. It is difficult to account for tenant farmers in this context due to certain political factors. I will thus refer to only three types of landowners.

According to Table 2, pure landowners occupy 21% of the registered agricultural households in the study areas. Many pure landowners live outside of the LMP area; most live in the mountain areas and some even live in Kenya (Table 3). These absentee landowners are the cause of certain problems. For example, it is difficult for the "CHAWAMPU" Rural Co-operative Society (Paddy Growers' Association) to collect water charges, tractor service fees, etc. Such difficul-

Table 2 Number of Farmers by Type of Paddy Cultivation (1992) (unit : households)

Block Number	Land owner (I)	Only employed labor (II)	Family labor + employed (III)	I + III	II + III	I + II + III	Total
MS2-3	11	1	33	9	1		55
MS3-1	9	3	22	3		1	38
MS6-1o		2	3	2	1		8
MS7-1	9	2	33	4			52
RS1-8	1		11		1		13
RS4-3	28	18	61				103
Total	56	24	163	18	7	1	269

Source: Interviews with villagers and counterparts at KADP

Note: In the LMP, 70 to 100 plots of paddy field (one plot is 0.3ha) make up 1 block, which is a basic unit for water distribution and the collection of tractor fees and water charges.

Table 3 Number of Farmers by residence (1992) (unit : households)

Block Number	Mabogini	Rau	Chakurani	Pasua	Mandala	Moshi	Uru	Kibosho	Other villages, Regions, Kenya
MS2-3	41		1	2	8				2
MS3-1	28	1		2	2			1	4
MS6-1o	2						5		1
MS7-1	26	1		1		3	17		4
RS1-8	13								
RS4-3	1	2	73			5		10	12

Source: Interviews with villagers and counterparts at KADP

ties weaken the institutional and financial bases of the "CHAWAMPU".

Pure family farms, i.e., those that do not use hired laborers at all, are fewer in number than might be expected. In the study areas, there is no pure family farm. Agricultural households occasionally using hired laborers account for the largest percentage. In addition, some villagers holding small plots of paddy lease out a part of their fields and go to work as agricultural laborers. In such cases, villagers can gain both land rents and wages, so that they can improve their economic situation.

The distribution of labor and land is determined by the variety of profitability of farm management types. Table 4 shows an income estimate per plot by farm management type in 1989 and 1992. As working time is unknown, self-employment wages are not included among the primary costs in the Table. Although family farms have the highest cash income per plot, these workers have to work longer than any other type of laborer. Pure landowners obtain high profits without any primary costs. Even tenant farmers entirely depending on hired laborers, if selling to an open market, can receive a fairly large income, although the rents and wages have recently increased.

In short, paddy cultivation actually has three func-

Table 4 Income from Paddy Cultivation by Type of Farming (unit : Tsh.)

Year	1989			1993		
	gross income	primary cost	net return	gross income	primary cost	net return
Landholders						
I Pure landowner	20,000	0	20,000	35,000	0	35,000
II Employed labor	75,000	24,195	50,805	320,000	127,400	192,600
III Family farm	75,000	7,045	67,955	320,000	62,500	257,500
Tenant system						
IV Employed labor	75,000	44,195	30,805	320,000	162,400	157,600
V Family farm	75,000	27,045	47,955	320,000	97,500	222,500

Sources: Interviews with villagers in 1989 and compiled from KADP in 1993

Note: Estimate in 1989, when the price of unhulled rice was controlled by the government, is based on the price in the open market (30,000 Tsh/bag). The price in 1993 was 180 Tsh/kg. An average yield was 25 bags containing 80 kg/plot in both years.

tions; to produce cash crops, food crops, and to provide labor opportunities for villagers. These aspects have led villagers to evaluate the LMP favorably as a whole.

4 The Socio – economic Impacts of Paddy Cultivation

4 – 1 Improvement of Living Conditions in the Project Area

How did paddy cultivation change the lives of villagers? High economic performance changed not only economic conditions but also social conditions, including social values. Above all, the LMP area is in the midst of a “house construction boom”. We can notice that housing conditions along the main road in the LMP area have improved greatly since the beginning of the 1990s. There are about 300 houses along the main road; half of these houses were newly built or under construction in 1994. In addition, 66 houses were provided with electricity.

When the villagers are able to save money, they

want to spend it on housing first, according to a questionnaire. In other words, they would not tend to reinvest in the agricultural sector, for example, purchase of a tractor or renting paddy fields would not be a first-choice investment. Of course, the domestic demand of constructing a house is considered to exert a positive influence on the regional economy.

The new houses are made of burnt bricks or concrete blocks; they have metal roofs which are regarded as a status symbol. TV antennas extend from some of the houses. At present, a TV set appears to be a new status symbol.

Improvements in living conditions have changed the ranking of villages drastically. Table 5 shows how the ranking of villages changed before and after the LMP influence in the selected villages, according to a questionnaire. Before the LMP, the people of each village ranked coffee producing areas at the top. However, after the LMP, the top positions were replaced by villages in the LMP area. Mabogini and Chekereni are villages in the LMP area. Sanbarai is located on the outskirts of Moshi, where maize cultivation is the main food production system. Maua is one of the villages that practice the “agrosilvopastoral complex” system; this area produces variety of plants such as coffee, banana, and other crops on the slopes of Mt. Kilimanjaro.

4 – 2 Differentiation of Peasants and the Emerging of “Farmers”

Although all villagers enjoy improved economic wealth, the benefits are not distributed equally. There is great variation in cash incomes, per plot, among vil-

Table 5 Ranking Score of Village Wealth by Villagers (unit : points)

Village	Ranking scores before the LMP				Ranking scores after the LMP			
	Kibosho	Sanbarai	the LMP	in savanna	Kibosho	Sanbarai	the LMP	in savanna
Mabogini	3.6	2.7	3.5	1.0	3.1	2.1	3.8	1.0
Chekereni	3.9	2.8	2.3	1.0	2.8	2.2	4.0	1.0
Sanbarai	4.0	2.7	2.3	1.0	2.0	2.0	3.8	1.0
Maua	3.8	2.9	2.0	1.0	2.0	2.0	4.0	1.0

Sources: Interviews with villagers in 1992

Notes 1) Reply to the question, “Which village is the richest? Answer in order.”

2) Ranking score was calculated by dividing the aggregated values of each point (4 points to the first, 3 to the second, 2 to the third and 1 to the last) by the number of the replies.

Table 6 The Number of the Paddy Farms per household in 1992

Block Number	Acreage of plot	The number of the plots							Area per household
		~1	1~2	2~3	3~4	4~5	5~10	10~	
MS2-3	27.6	18	23	7	1		1	1	0.54
MS3-1	19.7	2	20	6	4	4			0.55
MS6-1c	14.0		2	1		2	1	2	1.75
MS7-1	45.7	5	16	13	6	6	5	1	0.88
RS1-8	12.5		6	4	1	2	1		0.90
RS4-3	46.6	21	80	2	1	1			0.44
Total	166.1	46	147	33	13	15	8	4	0.62

Source: Interviews with villagers and counterparts at KADP

Table 7 Land Ownership Structure and Land Use of Farmers.

Farmer No.	Acreage of farm land			Land use		
	Area owned	rent in	rent out	maize	paddy	F.millet
①	8.92	0.44	—	4.4	4.96	—
②	3.40	0.88	—	1.8	2.48	—
③	8.84	—	0.88	2.4	4.76	0.2
④	1.76	0.88	—	0.6	2.04	—
⑤	1.68	—	—	0.8	0.88	—
⑥	0.44	1.60	—	0.8	1.24	—

Source: Interviews with farmers in 1994
Note: One acre is converted to 0.4 ha.

lagers. The areas of paddy fields differ greatly. Some villagers have less than 1 plot (0.3 ha), whereas other villagers have more than 10 plots (Table 6). This difference originated mainly from the redistribution of land during the first stages of the LMP. Differences were caused partly from the buying and selling of paddy fields, and from inheritance by equal distribution. Large landholders collected more paddy fields, while small landholders lost paddy fields.

Land concentration causes a big gap in the total income. In addition, villagers consume some of the yield as food; hence, the smaller the area held, less produce is available to sell. Thus, the cash income gap becomes increasingly large. Moreover, powerful landholders of numerous paddies are able to pay for initial investments such as rent and material costs incurred during the first cropping season. In short, family farms are apt to be differentiated into "farmers" and agricultural laborers.

"Farmers" are defined as landholders of large amounts of land; they depend for the most part on

Table 8 Total Yields./bag,Tsh)

Farmer No.	Total yields	Unhulled Rice by (unit:bag)		
		Sale	Self-consumption	Gift to family & friends
①	250	239	10	1
②	114	88	14	14
③	288	258	20	10
④	101	86	13	2
⑤	42	30	10	2
⑥	20	4	16	—

Source: Interviews with farmers in 1994
Note: One bag contains 70 kg of paddy.

hired labor to practice commercial agriculture. Of course, most landholders with smaller plots remain family farms, though they depend partly on hired labor. However, the differentiation of family farms may affect the social system.

Two farmers each from Rau, Mabogini and Chekereni villages were interviewed by questionnaire. Table 7 shows the land ownership structure and land use of the interviewed farmers. It is notable that Chekereni is a so-called "Ujamaa" village¹⁾ and the area of farmland is relatively small.

Table 8 shows the total yields and disposals of yields in 1993. Farmer No.3 produced 288 bags and sold 258 bags, whereas farmer No.6 produced 20 bags and sold only 4 bags. As farmer No.6 operates a garage and a local bar, he does not consistently depend for his livelihood on farming. The self-consumed yield was similar among farmers, but gifts to family members living away or to friends varied considerably. In African traditional societies, human relationships are very intimate. The farmers were likely to act against such a tra-

dition as regards paddy disposal.

By selling a large amount of their yields, most of the farmers reported receiving what was for them an unbelievably large cash income (Table 9). However, they also had high labor and material costs. It is of note that their payments contributed to increased cash income for agricultural laborers.

In proportion to the increase in cash income, the lives of these farmers improved rapidly in terms of consumption. Total cash expenditures per month ranged from 61,312 Tsh. to 233,530 Tsh. in 1994 (Table 10). Although such differences were influenced by the number of family members, the cash expenditures of these farmers exceeded the average for ordinary family farms considerably. In particular, the interviewed farmers spent large sums on clothes and health care.

Furthermore, they owned a variety of durable goods, such as TV sets, cassette radios, table fans, and refrigerators. They bought these electric appliances after the LMP assistance began.

Some farmers began or desire in the future to operate side businesses. In fact, two farmers started to trade in unhulled rice after the LMP. They bought unhulled rice not only from the LMP area but also from the LMP surrounding areas; the rice is sold at Himo market. Other farmers hoped to operate a rice milling machine or a transportation service, after enough money had been saved. In this way, farmers are advancing into side businesses related to agriculture. This trend will bring about a new division of labor in the society.

Farmer No.	Price of unhulled rice	Sale (bags)	Cash inflow	Total cash outflow	Rents	Labor	Material costs ¹⁾	Income
①	8,000	239	1,912,000	1,123,170	52,500	615,682	454,988	788,830
②	15,400	88	1,324,400	563,737	105,000	191,778	266,959	760,663
③	9,000	258	2,322,000	868,870	—	301,100	567,770	1,453,130
④	8,400	88	722,400	463,157	105,000	193,800	164,357	258,243
⑤	9,500	30	285,000	186,590	—	101,100	85,490	98,410
⑥	9,000	4	36,000	92,995	—	50,250	42,745	▲ 56,995

Source: Interviews with farmers in 1994

Notes: 1) Material costs includes "Chewamp" charges for seeds, water control, and trap

2) Farmer ② sold rice by herself after threshing and dehulling. Thus, 15,400 Tsh is the price of rice.

Farmer No.	①	②	③	④	⑤	⑥
Food	30,000	45,000	30,000	15,000	60,000	30,000
Alcoholic drinks	—	—	1,600	—	30,000	—
Soft drinks	5,000	—	—	10,000	—	—
Salt	160	160	120	100	180	80
Sugar	6,000	4,000	4,000	4,000	8,000	4,000
Cooking oil	3,000	5,000	4,600	3,800	10,000	3,200
Education	7,000	4,800	5,142	1,000	5,000	20,000
Health	14,000	20,000	2,500	5,000	20,000	5,000
Dress	20,000	60,000	12,500	8,333	90,000	8,333
Fuel	1,700	850	850	850	850	1,750
Transportation	3,000	6,000	—	5,000	6,000	10,000
Electricity	2,500	900	—	2,000	3,500	—
Total	92,360	146,710	61,312	54,883	233,530	82,363

Source: Interviews with farmers in 1994

Person No.	Field cleaning	Nursery making	Cultivating	Trans-planting	weeding	Fertilizer application	Chemical spraying	Scaring birds	Harvesting	Trans- porting	Total wage
(1)	9,000			12,500	11,250				1,500		34,250
(2)				25,000	8,000						33,000
(3)		6,000		27,000	27,000						60,000
(4)	3,000	3,000		10,000	50,000	15,000	6,400	9,000	5,000	3,600	105,600
(5)					15,000			7,000		600	22,600
(6)				12,000	12,500						24,500
(7)			10,000	12,000					9,000		31,000
(8)				11,250	20,000						31,250
(9)				23,750	15,000				10,500		49,250
(10)				13,571	15,000				10,500		39,071
(11)					10,000				9,000		19,000
(12)								30,000			30,000
(13)		6,000			24,000			20,000	7,200		57,200
(14)		7,200			12,000				9,600	3,000	31,800
(15)				12,000	24,000					3,000	39,000
(16)					15,000				4,500		19,500
(17)				11,000	15,750				2,750		29,500
(18)		4,800	11,000		13,500				4,000		33,300
(19)				5,000	9,000				3,150		17,150
(20)				26,250	15,000				8,000	12,000	61,250

Source: Interviews with agricultural laborers in 1994

Person No.	Food	Alcoholic drinks	Salt	Sugar	Soft drinks	Cooking oil	Education	Health	Clothes	Fuel	Transport	Total
(1)	9,000			1,000		2,000	417	30,000	2,417	500	250	45,774
(2)				4,000	240	3,200			1,000	500	1,000	34,470
(3)	8,000			500	720	1,700	750	5,000	3,000	1,000		20,790
(4)				2,000	600	1,500		150	3,000	850		18,280
(5)		200				3,600	500			340	300	23,150
(6)		1,500		2,000		800		1,000	1,000	425		18,845
(7)		900		1,800		1,800		4,000	500	550	600	24,870
(8)				2,000	1,200	2,400	1,800	1,800	2,000	850	3,000	35,290
(9)				2,000		2,400			2,500	450	1,000	25,470
(10)				4,000		3,200			1,800	600	1,000	28,720
(11)				5,000	1,000	2,400	5,000	8,000	1,600	850	1,000	54,870
(12)	5,000				380	1,600	5,000		1,000	400	2,200	15,680
(13)	6,000			4,000	3,500	1,800			1,300	1,500	300	18,460
(14)	16,000			2,000	7,200	800		2,800	5,300	850	1,200	36,020
(15)	4,500			4,000		6,000	5,000	2,800	4,187	4,000		30,827
(16)	7,500	1,000		4,000		1,200	3,000	7,000	500	900	5,000	30,280
(17)	1,800			4,000		900	8,000	2,700	1,458	600	7,500	27,078
(18)	15,000	1,000		3,500	700	2,400		3,000	300	500	5,000	31,520
(19)	9,000			2,000		750	417	1,200	250	850		14,587
(20)	5,000			3,000	400	2,500		40,000	2,000	3,000	6,000	62,020

Source: Interviews with agricultural laborers in 1994

4 – 3 Agricultural Laborers Engaged in Paddy Cultivation

Agricultural laborers play an important role in the actual practice of paddy cultivation. In fact, it would be difficult to continue paddy cultivation without them. They are employed in the main farming stage, especially during uprooting and transplanting seedlings, weeding, and harvesting. As mentioned already, most landholders depend more or less on hired laborers; thus laborers can easily find work.

Moreover, due to the triple-cropping system in the LMP area and the double-cropping system in the sur-

rounding villages (see next chapter), laborers can work throughout most of the year. Some agricultural laborers move from one paddy field to another field successively; this includes fields outside of the LMP area. Paddy farming techniques and sometimes IR54 seeds are used. In brief, agricultural laborers function to extend technology from the LMP to the periphery.

Where do agricultural laborers come from? What social and economic features do they have? How much income do they gain? And how does the increase in cash income affect their lives? In order to answer these questions, 20 agricultural laborers working

in the fields in September 1994 were interviewed. All of them were from Mabogini due to the water schedule (except one, Pasua). Therefore, the following description must be verified by further study.

Among interviewed laborers, 9 were male. There was no labor division by sex. Concerning age, 14 people were in their 20s and 30s; the oldest person was 60. As the laborers were relatively young, there were few working members in their families; the mean was only 2. Perhaps this was because most of these laborers settled their village after coming from other Districts or Regions in 1980s. The recent settlements made it difficult for them to acquire arable land. Only 2 people owned small fields, and 9 rented fields chiefly for growing maize. These laborers had to seek income sources, but such opportunities were restricted. More than half of them had started to work as agricultural laborers after the LMP. Thus the LMP provided labor opportunities.

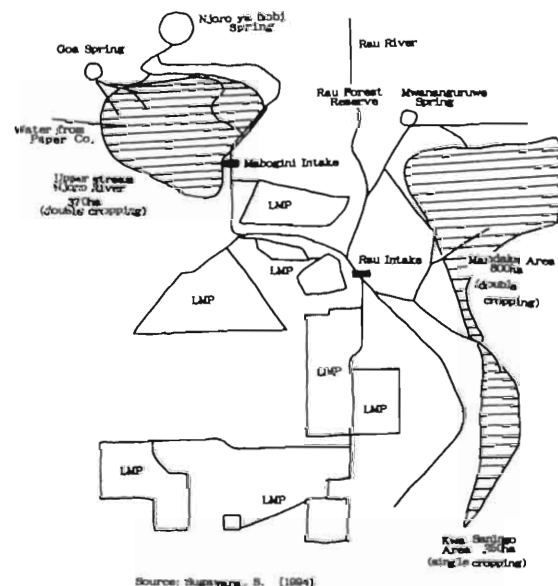
Table 11 shows the kinds of agricultural labor of the previous season, and wage per cropping season. Earnings differed by type of work. Wages for field cleaning, scaring birds, etc. depended on the area of the field. Wages for harvesting and transport depended on the number of bags. Total wages ranged from 17,150 Tsh. to 105,600 Tsh(US \$). In general, male laborers aimed to secure sufficient funds to support their families, but female laborers considered the additional income sufficient.

Were the earnings from agricultural labor sufficient to cover cash expenditures? According to Table 12, cash expenditures per month was relatively small, compared with those of farmers (see Table 10). The cost of each item varied greatly; agricultural laborers tended to spend money first on primary commodities such as food, sugar, and cooking oil. In addition, health costs, such as hospital and medicine bills, used up a fairly large portion of the income. This may suggest that the laborers paid increased attention to their health. Therefore, the standard of living continues to advance steadily with the availability of agricultural labor.

5 The Spread of Modern Paddy Cultivation

The LMP plays a leading role in the diffusion of modern paddy cultivation. Modern paddy cultivation implies the use of irrigation and HYV, artificial fertilizers, and chemicals. One standard to evaluate the LMP is to ascertain the extent to which modern paddy cultivation has spread into the Kilimanjaro Region. As regards this issue, exact data is not available at present. According to a rough estimate by the KADP, more than 1,400 ha, at least, of modern paddy cultivation exists in the area surrounding the LMP (Fig. 4). Villagers practice double cropping in about 1,200 ha among 1,400 ha; hence, the cumulative cultivated area reaches nearly 3,000 ha per year, or twice that of the LMP. In addition, modern paddy cultivation is practiced wherever water for irrigation is available. Now the Kilimanjaro Region appears to be in the midst of a paddy field "exploitation rush". The LMP has achieved a leading role in rapidly expanding the area of paddy cultivation.

What impact has modern paddy cultivation had on



the life of villagers? Here, I will analyze this issue briefly, based on a field survey in Pasua and Mandaka villages, which are centers of expanded paddy cultivation. Pasua is located on the outskirts of Moshi. The number of households is about 400, and 12,000 inhabitants live there. Cultivators comprise about 15% of the population. On the whole, Mandaka is a rural community with about 250 agricultural households and 1,050 inhabitants.

In Mandaka, traditional paddy cultivation before the LMP had been practiced using local varieties of rice. However, such cultivation was restricted to an area around the swamp, and villagers mainly depended on maize and banana cultivation. After the LMP, the economic advantage of modern paddy cultivation was recognized upland fields were changed into irrigated paddies. At present, villagers hold 0.92 ha of paddy fields and 0.96 ha of maize fields on average, per household. They also shifted agricultural labor from maize culture to paddy cultivation. In the last several years, villagers came to depend on paddy cultivation for half of their subsistence. They can sell the surplus produce that exceeds self-sustenance; cash income is acquired from hired work in areas paddy cultivation.

An increase in cash income may improve the standard of living in these areas. Table 13 shows the main cash expenditures on average per month in Mandaka and Pasua. In Mandaka, food costs were a large portion of total expenditures. We were surprised that expenses for alcoholic drinks were larger than food costs. This fact may reflect the social custom that villagers share their wealth. Furthermore, not a few villagers rebuilt houses or built new houses. Three villagers introduced electricity into the home. In this way, modern paddy cultivation contributed to improving the material life.

Because of the location, Pasua villagers held various odd jobs. Cultivators have been producing small commodities, such as vegetables, for urban dwellers. Cultivators were relatively familiar with the cash economy due to part-time work in the urban sector and small commodities production. At present, cultivators hold 1.08 ha of paddy fields and 1.04 ha of maize fields, on average. Although paddy fields replaced the maize fields, villagers did not necessarily stop small commodities production or shift from part-time jobs in the urban sector. The influence of paddy cultivation was limited to an increase in cash income by the sale of unhulled rice.

Regarding the cash expenditures in Pasua, food costs were prominent, as well as clothing expenses (Table 13). This was mainly because the cultivators had large families; this was also partially due to the fact that their diet is improving.

As mentioned above, the importance of paddy cultivation grows not only in the case of agricultural production but also in the economic life of inhabitants of both villages. These facts affect villagers' value system. For example, the ranking of villages with regard to wealth changed considerably, as shown in Table 14. Before the LMP, villagers ranked Kibosho, a typical coffee producing village, at the top of 5 villages. But after the LMP, the LMP area acquired the top position. Pasua and Mandaka also gained higher scores.

Perceived attributes of wealth also changed. According to Table 15, villagers thought that a person holding paddy fields was the richest. Cattle are traditionally the symbol of wealth in Africa. Thus, we can assume that the value system of villagers has changed dramatically.

As the importance of paddy cultivation increases,

Villages	Food	Alcoholic drinks	Cooking oil	Sugar	Clothes	Education	Health	Transport	Electricity
Mandaka	20,347	24,855	3,951	4,528	4,994	3,794	8,063	5,986	5,097
Pasua	37,200	3,250	6,760	5,800	7,719	5,551	7,273	5,320	4,733
Total av.	28,568	14,214	5,321	5,148	6,323	4,651	7,678	5,561	—

Source: Interviews with farmers in 1984

Note: Electricity cost was calculated for 3 persons in Mandaka and 12 persons in Pasua.

Village	Kibosho	Sanbarai	in savanna	the LMP	Pasua & Mandaka
Before the LMP					
Mandaka	62	35	0	13	16
Pasua	57	29	3	10	21
Total points	119	64	3	23	37
After the LMP					
Mandaka	33	8	0	55	30
Pasua	42	9	1	41	24
Total points	75	17	1	96	54

Source: Interviews with villagers in 1994

Notes: 1) Reply to the question, "Which village is the richest? Answer in order."

2) Ranking score is the aggregated values of each point (3 points to the first, 2 to the second, 1 to the third).

Village	cattle-holder	businessman	paddy-holder	maize field-holder	senior officer
Mandaka	29	11	61	21	4
Pasua	11	19	55	20	4
Total points	40	30	116	41	8

Source: Interviews with villagers in 1994

Notes: 1) Reply to the question, "Who is the richest? Answer in order."

2) Ranking score is the aggregated values of each point (3 points to the first, 2 to the second, 1 to the third).

Village	~10 bags	11~20	21~30	31~50	51~100	101~200	200~	Average yields
Mandaka	3	3	1	6	4	1	1	56.4
Pasua	—	3	3	3	7	3	1	67.6
Total average	3	6	4	9	11	4	4	—

Source: Interviews with villagers in 1994

note: One bag contains 70 kg.

the economic value of water ascends rapidly. In fact, some villagers in Pasua collect and use even the drainage from a factory (paper industry). Such situations cause severe conflicts concerning water distribution. Water distribution conflicts occur both between the upstream and the downstream communities of rivers, and within villages. As both villages in this study are located upstream, villagers occupy an advantageous position with regard to water conflicts. Therefore, most of the villagers do not accept the necessity to control water distribution between the upstream and the downstream communities.

On the contrary, water conflicts within a village are likely to cause more severe problems. This danger is due to the quite large gaps among the paddy yields (Table 16). Some villagers produced only 10 bags and bellows, while other villagers produced more than 200 bags. This gap originated from the area and the location of paddy fields. The distance from the water source is an especially decisive factor. The villager who has fields close to a water source can exploit more paddy fields with high land productivity. Thus, year-by-year, the rich villager becomes richer, and the poor becomes poorer.

6 Conclusions

There are a variety of food production systems in the Kilimanjaro Region. This paper describes two food production systems; the traditional "agrosilvopastoral complex" system and modern paddy cultivation system that was funded with assistance from Japan.

The "Agrosilvopastoral complex" is practiced on the slopes of Mt. Kilimanjaro. This system is very sophisticated, because it provides people with almost all of their daily necessities, including cash. In addition, this system nurtures soil fertility and helps to prevent soil erosion. These features imply that an endogenous food production system is sustainable.

However, ironically, due to the increasing population, this system is confronting the problem of land scarcity. Thus, many people move down to the lowlands in search of new arable land. A fall in the international price of coffee accelerated such tendencies.

Therefore, the focus on food production shifted to development of the lowlands. Generally, as the lowlands are within a semi-arid zone, food production is not reliable. The promotion of irrigation surfaced as the priority issue. The LMP was expected to play a leading role in this regard.

The LMP secured stable production of food in the paddy fields. The paddies came to be regarded as a source of cash crops rather than of food because of their economic performance, which has been better than expected, due to high land productivity, the high price of unhulled rice, and the unpaid depreciation costs and repayments of loans for irrigation and drainage facilities. The high economic performance of the paddies encouraged the expansion of modern paddy cultivation outside of the LMP area. Villagers in the LMP area and vicinity are deeply integrated into the cash economy.

However, the benefits of improved economic performance are not equal for all family farms. Landholders with numerous areas of land can obtain large cash incomes and invest in side businesses. In contrast, landholders with less land also work as agricultural laborers. Some people move from other areas to the LMP area seeking jobs.

Farmers and agricultural laborers have thus ap-

peared in the LMP area. There is now a large gap in income and expenditures among villagers. This fact will weaken the unity of the local society. In other words, the strength of paddy yields as a commodity exceeds the mechanism to reduce an economic gap, and the share of poverty. For these reasons, it is difficult to establish a water distribution order, even though water is the decisive factor in the development of future paddy cultivation.

Note

- 1) "Ujamaa" means "family" in Swahili. From 1967 to 1983, the "Ujamaa" village policy was carried out in order to make peasants move to a newly settled village who would work communally as agricultural laborers.

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タンザニア・キリマンジャロ州における 灌漑稲作の導入と食料生産の変化

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要 約

いわゆる「途上国」政府は一般に、食料の増産と生産の安定化のために、積極的に大規模な灌漑事業の導入をはかり、政策的な力点を置く傾向がある。にもかかわらず、とくにサブ・サハラ・アフリカでは、そうした灌漑事業の多くが失敗に終わっている。その原因の一つは、その地域に以前から存在しているさまざまな農法の特質を無視して、それとは無関係に灌漑農業を導入するという栽培技術的な不適合性である。第2の原因は、農業資材投入や労働投入の増大に耐えうるだけの経済的成果をあげることが難しいことである。第3の原因は、灌漑農業がその地域の社会制度や労働慣行や価値観とうまく接合できないという社会的な不適合性である。

本論文は、日本のODA援助案件の中で「成功例」に数えられることの多いタンザニア・キリマンジャロ州の稲作プロジェクト（LMP, Lower Moshi Irrigation Project）とその周辺地域を主な対象として、その社会経済的なインパクトを多面的に分析した。まず、対象地域における食料生産システムを分類し、その中から伝統的システムの代表として「農畜林複合」(agrosilvopastoral complex)を取り上げ、その意義と課題を明らかにした。この食料生産システムは自給経済のみならず、現金経済にも適合的であるが、土地集約度の限界に達しており、人口圧の増大を支えることができないという問題に直面している。そのため、多くの人々が低平地に移動した。

低平地の農耕は少ない降水量と不安定な降雨に依拠しているため、旱魃の危険性と常に直面している。そこで灌漑農業に期待が寄せられることになる。LMPに代表される灌漑稲作は、米の高い経済性と安定生産のゆえにLMPの外部にも急速に拡大している。この意味で、LMPはパイロット・プロジェクトとしての役割を十分に果たしている。しかし、経済的成果は一様ではない。大規模層はますます豊かになり、その成果を農業外に投資する。そのことは一方で地域経済全体の底上げに貢献する。他方、貧困層は雇用労働者として稲作に関与し、現金所得を得る一方で、「農業企業家」の登場を労働面で下支えしている。このいわば「階層」の登場は、「貧困の共有」といった伝統的社会システムを大きく改変することになる。