Chapter 6 Results and Discussion --- Life Team

6-1 Goal of Life Team

The integrated watershed management of inland valleys in Ghana is a joint project with the government of Ghana through the Crops Research Institute (CRI) and Japan through the Japanese International Co-operation Agency (JICA). It is a collaborative project with different disciplines working together in teams to develop technologies for the management of the watersheds in the country and especially for the production of rice in inland valleys. These technologies are to be developed participatory, location specific and in a sustainable way for effective adoption by farmers

Sustainable land use is that which achieves production combined with conservation of the resources on which that production depends, thereby permitting the maintenance of productivity. The maintenance of soil fertility and continuous production is what Young (1989) refers to as sustainable production. The objective of sustainable land use is to continue production over a long period. According to Young (1989), sustainability applied to land use can be expressed as a pseudo-equation: Sustainability = Production + conservation of productivity.

Young sees sustainability as the situation where production is tied in with the conservation of production. Thus a particular resource in the case of agricultural land, should be able to support production over a long time, if it is to be referred to as sustainable. The life team uses the definition of the Consultative Group for International Agricultural Research (CGIAR) which made sustainable agriculture their goal since its inception in the 1970s. They defined sustainable agriculture as:

> " The successful management of resources for agriculture to satisfy changing human needs, while maintaining or enhancing the quality of the environment and conserving natural resources." (CGIAR 1990)

This definition has been clarified by the American Society of Agronomy. The Society describes sustainable agriculture as agriculture that over the long term enhances environmental quality and the resource base on which agriculture depends, provides for basic human food needs and fiber needs, is economically viable, and enhances the quality of life of farmers and society as a whole (ASA, 1989).

Sustainable land use is again defined as a set of technologies, policies, and activities which, aimed at integrating socio-economic principles with environmental concerns simultaneously to maintain or enhance production and/or services, reduce the level of production risk, achieve environmental stability, and be economically viable and socially acceptable (Latham and Syers 1994). This definition involves a wide range of activities that needs to be addressed through policy, incorporating the social and economic issues in land use. People use Land and thus require the participation of all users to achieve better results in attempts to improve land or soil fertility and agricultural production in general. With the present low productivity and food shortage in tropical Africa, it is important that programs that will help solve these problems, be designed and implemented taking into consideration all social and economic factors that influence adoption. These will ensure better adoption of such programs, the sustainability of production as well as the maintenance of the soil for increased future production.

It is in this light that the Sawah technology, which is a land and water management as well as agronomic package, is looked at as a sustainable approach to rice production in the inland valley. The Fig.6-1 presented shows that the Sawah technology takes into consideration socio economic and cultural issues in a participatory approach in the provision of technical assistance to rice farmers. Ensuring increased productivity, good access to markets and profitability for farmers.

The project looks at the various systems within the water catchment area, it is therefore important to understand the traditional systems within which the project is being introduced. Tripp (1991) has mentioned that any planned agricultural change needs to be organized around the understanding of farmers' conditions and priorities. The farming systems approach thus seeks to address this understanding of the various systems and circumstances within which farmers' operate. This allows for effective, efficient and sustainable implementation and evaluation of improved agricultural practices.

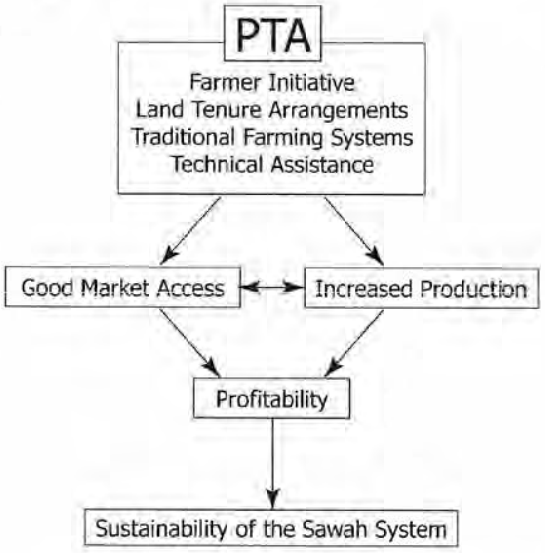

Fig. 6-1. Sawah, a participatory technical approach (PTA) to rice production

The life team in order to understand farmers' circumstances and the socio economic conditions of the project area had the following activities to achieve its goals:

1. Ethno-ecological studies on traditional agricultural system
2. Baseline survey on land used systems, major farming & forestry activities
3. Baseline survey on marketing, preservation, post harvest issues of rice production.
4. Baseline survey on present status of water born diseases
5. Financial & economic assessment of sawah technology
6. Adoption and impact analysis of sawah technology

6-2 The socio-economic condition of the Mankran Rver Basin in the Ashanti Region of Ghana (Adugyama)

6-2-1 Introduction

Farmers in Adugyama, who work in collaboration with JICA, have formed various groups of rice growers. These farmers where interviewed with an objective of studying the land ownership and tenure system and how it affects rice production and watershed management in the area.

6-2-2 Methodology

The study covered Adugyama Township. A Participatory Rural Appraisal (PRA) method was used to collect information. This comprises an informal group interview with JICA club member and also interviews with key informants. Information was synthesized and analyzed. The following are some of the results.

6-2-3 General Description of the area

Adugyama has about four thousand people in the area from different tribes though most of team are Ashanti's. It is on the main Kumasi-Sunyani road and a market center for most of the surrounding villages. There is Junior Secondary School, three primary schools, two clinics and ten religious denominations including a mosque. Water is scarce in the area though there is standing pipe but it rarely ran.

6-2-4 Cropping System

The major crops grown in the area in order of importance are rice, maize, and cassava with some considerable amount of garden eggs, okra, pepper, and tomatoes. About 75% of the farmers grow the first three major crops with rice mostly grown by men. The remaining crops are grown by both sexes. Rice is normally planted in April whiles the other crops are planted in May. This is however dependent on the weather.
The main agricultural problems in the area were noted to be scarcity of water and lack of finance.

6-2-4-1 Farmers Practice of Rice Production

It was observed that about 75% of the people in the area grow rice.

6-2-4-2 Planting

The following rice varieties are planted in the area; local Asantemo (6 months and 3 months) and Sikamo an improved variety (4months), all being white in colour. The people grow the Sikamo because of its high yielding, drought resistance and relatively small land Area needed.

They plant in April (normally) depending on the rain. The rice tassel two and half months after planting. It then takes one and half months for maturity and harvesting. Both men and two seedlings per stand. The average farm size was estimated to be two to four acres for the local and two and half acres for the Sikamo the improved varieties, respectively.

6-2-4-3 Weeding Practices

Weeding is done using family and hired labor with the women mainly responsible for the local variety. The people growing the Sikamo weed themselves. Weeding is done twice before harvesting using hoes, and cutlasses for the local variety. The first weeding is done two weeks after planting and the subsequent one when the need arise. Weeding on the Sikamo is done once using hand picking. The common weeds found in the area are mostly grassed and '' ananse dokomo''(lantana camara)

6-2-4-4 Fertilizer Application

No fertilizer is applied on the local rice. Club members do the application on the Sikamo.

They use N.P.K. 15: 15:15 one month after planting as basal application and use sulfate of ammonia to top dress it just before the booting stage. The members could not say anything about the rate. The fertilizer is obtained from JICA.

6-2-4-5 Insect and Diseases
The major insects and diseases are termites and stem borers on local rice and Sikamo respectively. Whiles false smut disease attack all the varieties. These are detected when there is stunted growth and leaf discoloration. The insects are controlled by spraying, hand picking and their seriousness depends on the time of detection.

6-2-4-6 Harvesting and Storage
The farmers do harvesting and storage of local rice in barns and Sikamo in fertilizer sacks after threshing. The Sikamo is normally harvested after four months with the yield of 4tons/ha whiles the local one yields 2 ton/ha. The cost of rice was 34,000 cedis a tin ($1\ ^1/_2$ tins = 50kg) at the time of the interview.

6-2-4-7 Seed Selection and Chemical Use
Farmers/Club members are responsible for these activities. There are no marketing problems and price differences between varieties at the time of the interviewing. Sikamo is preferred due to its high yielding and the small land needed. These are no new foods replacing the traditional ones.

6-2-4-8 Resource Allocation: Access to Land
Access to land would enhance the adoption of the sawah technology. This section addresses land tenure and ownership issue in Ghana and the situation in Adugyama that enhance the adoption of the sawah technology in this area.

There are two forms of land ownership in Ghana. They are the Government ownership, which is the public ownership; and the private ownership, which may include stool, or skin (as pertains in the north) land, clan or family land and probate individual land ownership (Bortei –Doku and Ofori Ban 1998).

The land is vested in the community or family. It is the chief who has authority over it assisted by his elders, he allocates lands to families within the community. An individual could not own land traditionally. The individual could have use rights to the land over generations through inheritance, husband, or gift from on owner.

Now through the direct purchase system, an individual or family could own land and would have the power to transfer ownership to another individual. There are however several traditional and legal procedures that one has to go through before the transfer. If it is family land the chief should show his concern as well as the head of family before the direct purchase arrangements are made. Family members have use rights over family lands and wives could also have this use right so long as they remain in the marriage and could also have access to her own family land if she is from the community or village.

The land ownership system is very dynamic and changes with time. It however differs from culture to culture and society to society and because of this, in Ghana there are several land tenure arrangements. In Adugyama the common ownership system is the family land ownership. The chief and his family have their own land and would not interfere with any other family's land unless it is being sold to another person for building

purposes. In such situations the arrangements include the chief. His consent has to be sought before any purchases are made.

One issue in this village that is not very common in Ghana, is that woman or wives do not have free access to the family lands of their husbands. They only have access to those non-family lands that husbands acquire either through direct purchase or renting. Though women's access to land has always been a major constraint, in most areas in Ghana, they have use rights on their husband's lands (Marfo and Haleegoah 1993) and have access to only their own family lands. A Ghana Grains Development Project survey (GGDP, 1991: Table 1) for instance shows that women are disadvantaged when it comes to access to own, rented or sharecropped land. The exception is family lands, where majorities of women (58.5 percentage) have access to fame on, confirming the situation in Adugyama.

Table 6-1 Access to Land by Gender (Fermers in GGDP Survey)

Land ownership / Tenure	Percentage of Men	Percentage of Women
Own land (N=49)	61.2	38.8
Family land (N=53)	41.5	58.5
Rented land (N=36)	58.3	41.7
Sharecropped land (N=11)	63.6	36.4

Source: Haleegoah, 1991 GGDP survey from GGDP 1993.

6-2-4-9 Land tenant-ship

This is mainly the arrangement between people who own land and those who do not own land but wants to use land in any given community for agricultural purposes mostly. In Ghana there are several types of land tenant-ship. They include, hiring; renting/leasing and sharecropping. Hiring of land involves the given out of land to a tenant for a season or two and the method of payment depends on the land lord or lady and could be in cash or kind which is normally paid after the use of land. In some cases in northern Ghana, there are no monetary arrangements; the tenant at his or her own will give some of the farm produce to the owner (Langyintuo et al 1997).

Renting and Leasing involves the giving out of land for some time but this requires money payment either in full or in part before the land is released for the tenant. The difference between the two is that while renting is for a shorter period, leasing is the direct opposite, for a longer period of time.

Sharecropping is the system where the land is given out to the tenant with an agreement of sharing the produce of the farm at the end of every season. The percentage of sharing could be half (''Abunu'' system, literally mean break into two) and one third (''Abusa'' system, literally means break into three). With the later the landowner may take one third and the tenant would take two third.

Renting and hiring is the common practice of land tenure-ship in Adugyama. Depending on the type of farming activity, land could be hired by anybody, men or women. The landowner and tenant who could be a man or woman make tenancy arrangement. There are no disputes on land in this area and has encouraged investments into sawah though respondents mentioned that wet land is scarce in this village.

6-2-5 Other Socio-economic factors

6-2-5-1 Labor

Labor is scarce especially between June and October due to migration. Both men and women are responsible for the hired labor and family labor, which are the major types in this town.

6-2-5-2 Money (Cash)

Money is scarce in the area. The main source of income being loan from lenders and farmers own resources. The scarcity of cash is normally at the beginning of the farming season. This normally coincides with the re-opening of schools (school fees) and the expenses involved in the Christmas holiday. The most serious constraint to the production of rice is money.

6-2-5-3 Women's Roles

Apart from farming activities women are involved in petty trading.

6-2-6 Conclusion

From the above results, we have noted the cropping systems of Adugyama and their rice production practices. We have also discussed farmer's access to resources for production, which includes labor, capital in terms of cash and land. Land ownership and tenure ship is not much of a problem in this area. People have access to wet lands and so could easily adopt any production practices to increase production however when it comes to constructing permanent bounds on land, its access becomes a problem to people who may not own their land but have to rent or hire land to farm on. No rational farmer for instance would invest so much in his farm operations because of an improved technology and at the end would give out half of the produce to a landowner who just contributed land.

It must be said that land is fixed but now a very commercial commodity in the country. Because of this, tenure-ship is very dynamic and changes with the changing conditions in a particular place. This should be taken into consideration for sustainability purposes in any technology that requires the use of land over a long period. If the sawah technology is to be accepted in any area, land ownership and tenure should be studied and its dynamics studied, people should be consulted be consulted in a participatory approach before the introduction of any technology. If the later were developed with the user, adoption would be enhanced.

Therefore it is recommended that detailed studies on land ownership and tenure-ship should be done in any area before any watershed management interventions could be introduced. Though such studies could be expensive they are always worth it since they ensure that interventions are that which would be adopted and which would have positive impacts on people in a community and the nation as a whole as well as donor countries.

It is also recommended that study on the monitoring and evaluation, impact and adoption studies are incorporated into the planning and implementation of all the watershed management interventions to ensure the sustainability and continuity of such interventions.

6-3 Traditional farming systems of an inland valley and the potential of rice production

6-3-1 Introduction

Rice has become one of the major staple diets in the country. Its production, however, falls below its consumption. This has necessitated the importation of about 60percent of the nation's requirement. Figures from the Ministry of Agriculture shows that rice ranked next to wheat in food imports (MOFA, 1990). Ghana has the potential of being self sufficient in rice production but she is still a net importer.

There have been several efforts to correct this situation through research, which has gone on since 1960, and other large-scale irrigation projects. One of such research efforts to increase rice production is a collaborative research work undertaken by the Japanese International Cooperation Agency (JICA) and the Government of Ghana, through the Crops Research Institute (CRI) of the Council for Scientific and Industrial Research (CSIR). This project named ''the Integrated Watershed Management Project'' seeks to address rice production in an integrated approach involving all the various systems within a watershed area and the introduction of a water management technology called the sawah technology.

The sawah technology, a water management system of bounding and level for rice production goes alone with improved variety. This system was introduced in the Dwinyan valley of the Mankran river basin three years ago. It is also being introduced in another river basin, the Biem river basin that has a lot of potential for rice production.
The project looks at the various systems within the water catchment area, it is therefore important to understand the traditional systems within which the project is being introduced. Tripp (1991) has mentioned that any planned agricultural change needs to be organized around the understanding of address this understanding of the various systems and circumstances within which farmer's operate. This allows for effective, efficient and sustainable implementation and evaluation of improved agricultural practices.
This study has a general objective of ensuring sustainable technology transfer and adoption in the study area. It has the following specific objectives:

- To understand the land use and cropping systems of the village.
- To identify rice production system
- To identify constraints to rice production and
- To access the potential of sawah in the farming system.

6-3-2 Methodology

6-3-2-1 Location

The study area is Biemso No.1, located north east of Kumasi and about 40km off the Kumasi-Sunyani road at Adugyama.

6-3-2-2 Research methodology

Participatory Rural Appraisal (PRA) method of group village interview and key information interviews was used to obtain data, which was analyzed, and its being reported on. The group interview started with about 27 people both men and women. It increased to about 45 persons by the middle of the interview, which took about two hours.

6-3-2-3 History of village

The inhabitants of Biemso No.1 are believed to have migrated from Denkyira through Fufuom and settled around the Mankran water source long time ago. Later, another water body was discovered as the people exclaimed "biem nso ni" which literally means here is another one. This was how the village got her mane Biemso No.1 since they found the water source first before the people of Biemso No.2.

6-3-2-4 General Characteristics of the village

The Town has a school up to the junior Secondary level and a clinic with one resident public nursing officer. There are about one hundred and forty six (146) households in this village. The number of people within a house ranged from six to about forty with a total population of about 1652 (PPAG 1996).

Many ethnic groups are found in the village with most of the occupation in the village associated with each tribe though all are predominantly farmers. The following were the occupations associated with the tribes:

Table 6-2 Tribe and Occupation in Biemso No.1

Tribe	Major Occupation
Fulani	Herdsmen
Baasari	Soap makers/care takers/cola sellers
Dagati	Night soil carriers
Sesala	Charcoal burning
Wala	Driving
Ashanti's	Farmers and Land owners
Akwapims	Cocoa farns care takers
Other tribes	Cocoa farns care takers

6-3-2-5 Land Use and Cropping Systems

Crop grown include cassava, cocoyam, plantain, maize, yam, rice, cowpea, cocoa, vegetables like onions, garden eggs, pepper, tomatoes, okra, cabbage, cucumber and other are oil palm, citrus, sugar cane and sunflower.

Table 6-3 Ranking of Crop as Important Cash and Food Crops

Crop grown	Rank for cash	Rank for Food	% of farming Production Trends	Productio n Trends	Consumption Marketability trends	
Cassava	3rd	3rd	100	Increasing	Increasing	Easy (bad price)
Cocoyam	5th	2nd	100	Increasing	Increasing	Easy
Plantain	4th	1st	100	Increasing	Increasing	Easy
Maize	2nd	4th	100	Increasing	Increasing	Easy (bad price)
Yam		6th	50	Stable	Stable	Easy
Rice	6th	5th	70	Increasing	Increasing	Easy
Cocoa	1st	-	90	Decreasing	-	Easy
Pepper	7th	-	100	Increasing	-	Not easy (sent to Kumasi)
Egg plant			100			
Tomatoes			30	Decreasing		
Oil plam			20			
Cabbage			20			
Cucumber			20			
Suger cane			<5			
Cowpea			<5			
Sun flower			<5			
Okra			50			

The system of farming in this village is basically traditional with the use of hoes and cutlasses. Most farmers however plant in lines, using improved varieties of crops like maize, cucumber and cabbage. They also plant improved cocoa trees. Some farmers also use chemicals for the spraying of cocoa as well as the use of herbicides and weedicides. Crop production is the most dominant feature of the farming system however some farmers have poultry – local birds, ducks-local breeds and some sheep and goats. These are normally free ranged but normally kept in pens around houses in the night and are fed occasionally for poultry and duck and regularly for the sheep and goats. Few farmers are involved in fishing.

Cocoa ranked first as the most important cash crop followed by maize and then cassava. Plantain comes as the fourth most important cash crop, followed by cocoyam and then rice as the sixth. Most of the crops that provide substantial cash to people in this village are also important as food sources. Plantain ranks first, then cocoyam before cassava. Almost all households in the village grow these crops except yam, which is grown by only 50 percent of the households.

The production trends of the crops are increasing except that of yam that is stable and cocoa, which is decreasing. The major reason for the increased production trend of food crop is the readily market for the produce as well as the good prices offered by traders. That of cocoa is decreasing because of land by ''Acheampong weed'' Chromolaena Odorata and high cost of labour for weeding. Other reasons are the high cost of chemical, which does not make the cocoa farming attractive to the youth of the village. They rather go into maize production and other food crops, which require lesser capital to go into.

Table 6-4 Estimated Yields and Labour requirement of some Crops

Yields per Acra for the Year		Land Requirements (Very high, High, Average,Low)			
Crop	Yield	Land	Planting	Weeding	Harvesting
Cassava	80 baskets	High	Low	Very High	High
Cocoyam	40 baskets	High	Low	Very High	High
Plantain	200-400 bunched			Very High	High
Maize	Monocrop-15Mbags/ Mixcrop-10Mbags	High	Average	Very High	Low
Rice	15tins	High	High	High	High
Cocoa	Could not be estimated	High	High	High	High

6-3-2-6 Cropping Patterns

Mixed cropping is the predominant system however there are also sole cropping systems for some crops especially vegetables. There are four general cropping patterns identified in this village. The patterns are shown in the table below.

Table 6-5 Cropping Patterns

1	Maize	Cocoyam	Plantain	Cassava	Cocoa	Vegetables
2	Maize		Cassava		Cocoa	
3	Rice		Maize			
4	Sole Cropping for all Vegetables; Rice; Cocoa					

6-3-2-7 Criteria for Land Use

Criteria used by farmers to distinguish which crop to grow on which land is simply the soil type (Table 6-5 shows the different types, their characteristics and the crops grown on them) and the oldness of the land determined by the fallow period. In this village the fallow years range from 2 to 10 with an average of about 3 years. The type of weeds, drainage/water holding capacity, permeability of soil and the burrowing activities of earthworms were the major criteria used to determine the suitability (goodness) of land for Agricultural purposes during the fallow period.

For instance, rice is grown in water logged areas whiles cassava dose well in well-drained soils. The presence of earthworms' activities means the land is fertile. Some weeds like sanku nhoma, sukruwa, sahoma and acheampong (chromolaena odurata) weeds mostly grow on fertile soil. They sometimes use density of the growth of weeds to determine the fertility of the soil after the fallow period. The length of the fallow is a determining factor.

6-3-2-8 Women in Agriculture

When farmers were asked about the specific activities that women do in the village. The response was that there is no distinction among the crops, anybody at all whether men or women, could plant any crop provided he or she can afford. The women are however into more of vegetables especially onions, plantain and cassava production. Women also offer their services as hired labor for various activities in the field apart from land clearing and land preparation, which is usually the task for men. There is a need for further studies into the gender roles of the economic activities in the village.

6-3-2-9 Agriculture Extension

The village has access to extension service for the food crops and animals as well as cocoa and other tree crops.

6-4 Land Owner ship and Tenant-ship for sustainable sawah development of Inland Valley of Ghana

6-4-1 Introduction

Ownership of land is basically through inheritance or purchase apart from the family land, which individuals have use rights but no transferring rights on. A few household have their own land and majority of household use family lands. Other system of land acquisition for farming activities are hiring or sharecropping for the majority of both natives and settlers.

In the share cropping system there are different arrangements for the different crops. The major system however is the Abunu and the Abusa system. This is where proceeds from farm produce are share equally by the farmer and land owner and where the landowner receives one third of the produce and the farmer rakes the rest respectively.

Maize for instance is shared between the farmer and the landlord in the ratio of 2:1; Cocoa is however shared in the 1:1ratio after the farmer has taken the foodstuffs from the field. Other farmers plant the cocoa for the landlord and take all other crop. In this case, they are expected to leave the land for the landlord after the cocoa is fully established. Some farmers also act as caretakers for landowners and in such cases the landowner provides

inputs like chemical for spraying. All other cost is borne by the caretaker and at the end of the year they share the proceeds as follows: one-third for the farmer and two-thirds for the landowner.

Land rented for other agricultural activities other than tree crops are normally on short-term bases. This is a personal arrangement among the farmers and the landowners and its flexible that a farmer could go in for longer periods if they so with.

6-4-2 Rice in the cropping system

6-4-2-1 Introduction

The Asanti buroni, white varieties of 3 month and 6 months duration are the two major types of local rice grown. Some few farmers also grow the red variety. Rice is grown as a sole crop with some maize, which is used to feed workers on the farm until the harvest of rice. Rice is usually grown on rented lands for short duration, if farmer dose not own land. It is ranked as the 6th most important cash crop and 5th most important food crop in the village and about 70 percent of households in the village grow it. Men farmers dominate in the production of rice though there are a few women who do it.

Planting method is by dibble at random with 5-20 seeds per hill. Some spray weedicides after planting and then do hand pulling of weeds afterwards. Weeding is done twice or thrice before harvesting which is normally done with sickle or knives pinnacle by pinnacle. After rice is harvested it is threshed from the stalks, winnowed and sun dried and stored in sacks in the room (could be specified) of farmers. Sometimes the millers assist in the drying and storing of rice until there are buyers to buy. Marketing of rice is not a problem in the village. They used to have two millers (one was recently deceased) who mill and sell rice for them as buyers come to buy from the village.

6-4-2-2 Constraints to Rice Production

Rice production constraints include the following: Weeds especially elephant grasses that are very difficult to clean and thus expensive if hired labor is used. Birds the next constraint could bring about a 100 percent crop failure if they are not scared away especially at the milking stage of the plant growth. This leads to the next problem of low yields, which is due to birds' problem and the nature of the local variety. The farmers need to spend almost all their times on the rice fields thought they have other fields to work on. As has been shown earlier, famers do not grow only one crop in the village.

6-4-2-3 Summary and Implications

Rice ranked 6th as the most important cash crop and 5th as the most important food crop. Of about 17 crops grown in the village rice has a lot of potential in this village with about 70 percent of households growing it. However the local varieties and the traditional agronomic practices do not allow for increased production and thus the various constraints to its production.

The sawah technology, a water management system of bounding and level for rice production goes alone with improved varieties and other agronomic packages, which seeks to address some of these constraints especially that of weeds and low yield. The water management through bounding and level reduces weed infestation and improved varieties with the technology could increase yield up to about three times the local

practices (Talajashi 1999). When yield are increased they would pay for farmers extra time on the rice field as well as his or her labor and could even have excess income for other requirements.

Now, for the adoption of the technology by farmers to be high, there are several factors to consider. The technology requires initial capital investment, whose returns would not be immediate, thus farmers must be motivated and helped in the initial stages for the adoption of the technology.

Apart from the initial high cost of investment, one other issue is the land ownership system. These bounds are made permanent on land and in this village it is only a few people who own inlands. Most farmers rent land on short-term basis for rice production. The system should thus be flexible enough for longer contracts since formers would need the lands for longer periods to be able to adopt the sawah technology and get good returns from it.

In this village a few farmers have been motivated by various reasons to form a group and with technical assistance from CRI and JICA, more have adopted the sawah technology. It is hoped that the benefits of sawah technology would be able to attract other rice farmers in the village to adopt the technology for increased rice production.

6-4-3 land Tenure Arrangements

6-4-3-1 Sawah Tenure Arrangements

Land tenure is an important issue to the sustainable use of the Sawah technology since Sawah developed is permanent and the fertility of the soil needs to be sustained for continual cropping. Are landowners willing to give up land entirely or the system is not flexible enough for those who are not landowners to adopt the Sawah technology. From the studies its been shown that land tenure is a dynamic system in the country and thus proper arrangements could allow for the development of the Sawah technology at different locations depending on the type of land tenure system prevalent at a particular location. The different types of tenure arrangements are describe as it prevails at each of the sites

Biemso no. 1 (type1)

In this village, the sawah land belongs to the family of one of the sawah group members. He rented the land to the group, including himself and has signed a five-year lease agreement. The terms of payment is a yearly rent in the form of rice produced from the land.

Biemso no. 2 (type 1)

The land tenure arrangements for this sawah group who call themselves Progressive Rice Growers Association is similar to the type 1 describe above.

Adugyama (type 2)

At Adugyama sites, there are two types of land tenure arrangements. The first type as described above and a second type. With this second type, the land belongs to a family.

Six members of the sawah group, Club D, belong to that family. They have therefore given the land willingly to the club D member of which they are part to farm on it without any rent payment. They share the produce equally among all the 10 club members.

In consultation with the chief's of the villages there are currently new laid down procedures for acquiring more land for project purposes in the villages. Land is never sold for such purposed since it is communally owned and the procedures are to be followed cautiously.

6-4-3-2 Conclusion

Most development theories agree with the idea of progress in technological innovations backed by governmental and institutional policies. There has been some debate about the conflict between economic growth and environmental degradation. One school of thought has argued that in achieving economic growth the environment is exploited and economic development has resulted from pollution and general environmental degradation. Others also argue that with improved development through high technological development, the environment can be improved upon. Any technology developed to improve the environment should be that which attains its goal without any possible negative effects in the long run. Technology should be designed and implemented with users, considering all the socio-cultural aspects that will influence its development and implementation. Their development and implementation should also be backed by appropriate governmental and institutional policies.

Sawah technology integrates into the traditional farming systems of the various villages in which it was introduced. This because the traditional system was understood and considered in the development of the technology. Proper land tenure arrangements where made and technical assistance was also given to farmers in a form of technological package of land and water management as well as improved varieties with its agronomic practice, crop rotation technology to ensure improved soil fertility all help to increase productivity. With an improved post harvest techniques access to market for produce increases thus ensuring profitability of the Sawah system making it sustainable.

6-5 Development intervention and incentive structure for residents: case study of traditional landownership system and small-scale paddy field, Sawah, development in central Ghana*

*This section is cited, after English translation, from "Africa report No. 30", March 2000, IDE-JETRO, Japan

6-5-1 Introduction

Many studies in recent years show that to increase the sustainability and efficiency of a rural development project and to encourage residents to take part in the project, the project team should take account of the institutions and socio-cultural factors of the project site. But there are only a few cases where the outcome of these researches is fully reflected on the planning and implementation of development programs. One reason that the results of studies and lessons learned in this field have not been used efficiently in actual projects is that the regional diversity and characteristics of institutions and socio-cultural factors have

made it hard to apply the lessons gained in an area to other areas. Because of this, lessons drawn from case studies have mostly been vague ones (e.g. "Factors peculiar to the area should be reflected adequately on the project") or have only resulted in so-called "shopping lists" that contain the matters to be checked at random. Thus there have been not many proposals for methods that would extract regional features effectively and would be applicable to all districts and fields.

This section attempts to present, as one of widely applicable methods, an approach that pays attention to the traditional land system and to the structure of incentives for residents found in the system and to apply this approach to a case of cash crop production in central Ghana. The author believes that this approach will have some important implications for many development projects not merely in Ghana and in cash crop production but in other regions and fields as well.

The investigation by this approach was conducted in the Village of Ashanti B in central Ghana in October and November 1999. The main cash crops grown in this village are cocoa (cacao bean) and rice. In central Ghana, rice is grown in inland valleys by the traditional method, depending on rainwater for irrigation, and an irrigated system is introduced only rarely. But in the Ashanti area attempts have been made since 1997 to develop small-scale paddy fields by residents' participation. In Village Biemso No1, too, the villagers' group opened up about 1.2 ha of paddy fields, sawah, equipped with small irrigation facilities in mid-1999.

In the case study below, the author adopts the method of comparing the relations between land and farmers in the production of the three cash crops: cocoa production, rice growing by the traditional system, and paddy agriculture (see Table 6-6). In the Table, sections 1 and 2 deal with cocoa production and traditional rice growing and compare land lease contracts and incentive structures contained in the contractual relations in the two types of cash crop production. Then attention is paid to the newly introduced system--small-scale paddy field development project by farmer participation--and it is pointed out that the farmer-land relations in paddy agriculture are closer to those in cocoa production than to those in traditional rice growing. In conclusion, the importance of the traditional land system and the structure of incentives for farmers is summarized.

Table 6-6 Comparison of cocoa production, traditional upland rice growing and Sawah agriculture in central Ghana

	Cocoa production	Traditional rice growing	Sawah agriculture
Crop type/farming method	Tree crop Harvestable period from the same cocoa tree:about 30years	Annual crop Farms changed every year	Annual crop Same paddy fields used for a long time
Workload	Heavy in the first year (development of new cocoa farm);gradually decreases in the second and subsequent years; weeding/harvesting work in the fifth year and after	Same every year	Heavy in the first year(development of new Sawah fields); decreases in the second and subsequent years
Farmer-land reletions	Continue long	Short (only for one rice -crop period)	Continue long
Landlord-tenant contract	Share renting tenancy	Fixed rent tenancy	Fixed rent tenancy
Tenancy period	Comtinues as far as cocoa farms are well managed	Only for one rice-cropperiod	Six years
Farmers' inxentives	Cocoa production (profits) and acquisition of land rights (benefits from land)	Only rice productio(profits)	Non-leader members of the farmers' group:only increased rice production(profits); leaders: profits from rice and future succession to Sawah fields (benefits from land)

6-5-2 Farmer-land relations in cocoa production

The residents of Village B are composed of two main groups: native residents who used to live in the village, and the immigrants who came from northern parts of Ghana to work mainly as farm hands and their descendants. Land in the Village Biemso No.1 area is owned by natives and immigrants get arable land by land lease contracts with native people.

Cocoa growers have two types: owner farmers who grow cocoa on their own land, and tenant farmers who have no land and produce cocoa on land leased by contracts with landlords. The tenancy contract used in cocoa production is of the share renting system in which the harvest and other profits are divided between the landowner and the tenant. This share renting contract has two kinds: one of them is the agreement under which the tenant does only weeding and harvesting work in the landlord's existing cocoa farm and they share profits with each other, and the other is the contract in which the tenant does all the work from the development of a cocoa farm to its management and harvesting (hereinafter referred to as "reclamation and sharing contract"). The characteristics of the reclamation and sharing contract, which is important in studying farmer-land relations in cocoa production, are discussed in detail below.

The reclamation and sharing contract has three variations of what is divided between the landowner and the tenant. First of them is the method of sharing the sales of cocoa (hereinafter referred to simply as "profits"). The second method is to partition the cocoa farm into two in a certain period after it was opened up and to divide grown cocoa trees between the landlord and the tenant. Finally, there is the method of sharing the cocoa farm, rather than cocoa trees, after it was developed, between them. In the second method, where the landowner and the tenant divide cocoa trees between them, the land itself remains the landowner's assets and if the tenant can no longer harvest cocoa as a result of, for example, the withering of cocoa trees, in the future, he loses his usufructuary right to the land. By contrast, in the third method, in which the cocoa farm is divided between the landlord and the tenant, the ownership to part of the land is transferred to the latter after a certain period of time. In these two contract systems, the landowner and the tenant share, at an agreed ratio, the profits earned from the cocoa farm by the time the cocoa trees or land is divided.

In the reclamation and sharing contract, the workload of the tenant is the heaviest in the first year and then gradually decreases every year, reaching a generally constant level about in the fifth year. The workload in the first year is very heavy because the development of a new cocoa farm requires hard labor for clearing undergrowth, cutting tree, burning weeds, planting cocoa trees, etc. As cocoa trees grow taller, weeding and harvesting become only the labor needed, thus reducing the total workload.

One important characteristic of the reclamation and sharing contract is that the tenant's usufructuary right is long and stable. According to the explanation of the contract made by its parties and the contents of its clauses, the landlord may cancel this agreement only in one of the following cases: (1) if all the cocoa trees planted die; (2) if the tenant leaves the village and abandons the cocoa farm; (3) if the tenant steals harvested cocoa; or (4) if it is found that the tenant practiced evil magic. Thus, except in these special cases, the tenant who grows cocoa under this contract is guaranteed the right to continue cocoa production on the same land for a long time.

Another related feature of the reclamation and sharing contract is that the right acquired by the contract may be inherited. Even if the tenant dies, his wife, children and relatives may take over the contract rights as a group and continue cultivation on the same land. In other cases, the tenant donates his usufructuary right to part of the contract land to his wife or children, or after the tenant dies, his two or more relatives succeed to the land by dividing it among them and continue their own contractual relationship with the original landlord individually. In short, the usufructuary right to the land under the reclamation and sharing contract is no right with a limited term and granted to one particular tenant; instead, it has a value as an asset inheritable to the tenant's wife, children and relatives.

As noted above, unlike the share renting contract that only stipulates the sharing ratio of profits, etc., the reclamation and sharing contract is strongly linked with the tenant's continual right to land. In other words, this contract guarantees the tenant a usufructuary right and the right to donate and inherit it as far as cocoa trees is productive. It also gives the tenant the chance to become a landed farmer because he can get part of the land from the landowner. Therefore, the tenants engaged in cocoa production by this contract have two incentives: the "profit" incentive (profits from cocoa) and the "land" incentive (guarantee of long-term and stable right to land).

Another important fact in considering farmers' incentives to grow cocoa trees is that the existence of cocoa trees helps strengthen their owner's right to the land. This greatly depends on the characteristic of cocoa trees: the harvest can be reaped from the trees for as long as 30 years or so. It is actually hard to divide the right to land from that to cocoa trees planted in the land. Because of this, the good management of the trees by the tenant under a reclamation and sharing contract leads up to his guaranteed right to use the land for a long time. As stated so far, cocoa production in central Ghana is supported by a traditional institutional foundation that enables the tenant's labor expended for opening up and managing a cocoa farm to be rewarded by guaranteed benefits from long-term land use and continued profits from it.

6-5-3 Farmer-land relations in traditional rice growing

By contrast with cocoa production in which there is a long-term connection between particular land and the farmer who cultivate it, the farmer-land relations are short in traditional rice growing. Traditional rice production is carried out in lowlands in the rainy season but it is rare that the same land is used continuously for more than one year. Instead, rice growers move their fields every year. But there are some cases where they plant vegetables and other crops in the land after they have harvested rice.

As already noted, in cocoa production, workload is the heaviest in the first year because a new farm needs to be developed and then decreases gradually. But in the production of rice, an annual crop, by the traditional system, farm work is the same every year and workload per unit area does not change from year to year.

In the Village Biemso No.1 area, tenants from northern Ghana, who have no land of their own, almost always carry out traditional rice growing. The tenancy contract is fixed rent tenancy in which the amount of money or product (polished rice) the tenant pays to the landlord is fixed in advance, and is a short-term one only for one rice crop. In almost all cases, tenants change land every year and seldom use a particular land lot for many years. They also change landowners with whom they sign a tenancy contract every year, which

means that landlord-tenant contractual relations do not last long. Neither are those cases where the tenant's land right is a long-term and stable one and can be inherited, unlike in the reclamation and sharing contract in cocoa production. The landlord makes no transfer of land ownership to the tenant.

It is considered that the above-mentioned temporary farmer-land relations observed in traditional rice growing is the combined result of the characteristic of rice (only several months are needed for the whole process from land development to harvesting) and that of the traditional farming system (cropland is moved from place to place). In the case of rice, an annual crop, the labor of farmers is rewarded several months later in the form of harvested rice. Thus the work of the tenant engaged in traditional rice growing is supported only by the "profit" incentive--the crop reaped in a short time. On the other hand, since the period from field development to harvest is relatively short in rice growing, there is no need for any institutional support that would guarantee farmers the use of particular land for a long time. In addition, because fixed rent tenancy in traditional rice growing is short and the land used changes frequently, there exists no "land" incentive unlike in cocoa production, where farm development and management by tenants guarantee them a long-term land use. As described above, the farmer-land relations in traditional rice growing is in a striking contrast to those in cocoa production.

6-5-4 Farmer-land relations in a small-scale Sawah project

In Village Biemso No1, a small-scale sawah project has been continued since 1999 by residents' participation to examine the potential for rice growing in inland valleys. In this project, a group of 12 villagers was organized and this group opened up sawahs equipped with small-scale irrigation in the land it borrowed from two landlords and started sawah based rice agriculture there.

Seen from farmer-land relations and incentives for farmers engaged in rice growing activities, this newly introduced sawah agriculture resembles cocoa production more than traditional rice growing. First of all, in this sawah agriculture, the relations between farmers and particular land lots continue long. In traditional rice growing, almost all farmers (tenants) change land and landowners every year. But in sawah agriculture, farmers continue to use the same land for a long time because they can expect a high yield from sawahs they have opened up. These long-term relations between farmers and particular land lots in sawah agriculture are the same as those in cocoa production.

Sawah based agriculture and cocoa production are similar to each other in the yearly change in workload and the pattern of profits--returns--for labor, too. In the former, the work for creating sawahs in the first year (land leveling, bank making, canal construction, etc.) requires great labor. But in the second and subsequent years, the tasks are mainly the maintenance of sawah fields and rice growing and labor needs decrease. On the other hand, a higher yield than traditional rice growing can be got from sawah fields, once completed, and the high yield continues long. In the case of cocoa production, too, the work for developing a cocoa farm is heavy in the first year but workload declines subsequently. The yield from a cocoa farm developed gradually increases as the growth of trees, which allows farmers to earn profits for a long time. The two types of agriculture have a common feature: initial labor input (initial investment) is large but profits (returns) last long.

This characteristic commonly observed in sawah agriculture and cocoa production--long-term farmer-land relations and a large initial investment rewarded by continued profits in subsequent years--leads to the following implication: to prevent the incentive for farmers doing either of the two types of crop production from being reduced, there is the need for some institutional backing that would guarantee that the farmers could continue using the land for a long time and at the same time could surely gain profits from the land. As already noted, in cocoa production, such an institutional guarantee system has been established by the reclamation and sharing contract that gives tenants a long-term land right.

In the newly introduced sawah agriculture in the project the system for guaranteeing growers a long-term land use right is not perfect yet. The sawah fields created exist in the land of the two owners and the group's members individually signed a six-year land lease contract with the landlords. The contracts, which is shown in Fig. 20 in page 37, with the two owners are almost the same as each other and the main clauses are: (1) the group give a certain volume of rice to the landowners each year as rent for the land; (2) the group never commits illegal acts; and (3) unless the contract is renewed, the group returns the land to the owners six years after. One problem relating to incentives for the farmers' group is the six-year land use period in (3). While the reclamation and sharing contract in cocoa production guarantees tenants the right to continue using the cocoa farm as far as they manage it well, the period for land use is limited to six years in advance in the paddy agriculture in Village Biemso No.1. Therefore, whether or not the great labor for sawah field development by the farmers' group in the first year depends on whether or not the landlords would agree to extend the contracts six years after.

A major factor that affects the possibility of long-term land use by tenants is the social relationship between the landlord and his tenants. One of the landowners who lend land to the group in Village Biemso No.1 is a maternal uncle of the group leader. The residents of Village B adopt matriarchy and inherit land and other assets from the brothers of their mothers in most cases. This leader is also in a position to succeed to the land of this maternal uncle (where the sawah fields exist) in the future. Thus, the contract was concluded between the leader's maternal uncle and the farmers' group but the leader is a "potential landlord" who will inherit the land in which the paddy fields are. When like in this case, the farmer who created sawah fields and the landowner who owns the land belong to the same family group, the possibility of the farmer being prevented from long-term land use diminishes greatly.

Since he is likely to inherit the land where the sawah fields exist from his maternal uncle in the future, this group leader has a stronger incentive to contribute to the heavy initial investment in new sawah field development than the other members. This is because the leader has the "land" incentive--the hopeful prospect of inheriting the land with a value added of sawah fields--in addition to the "profit" incentive, that is, a higher yield of rice by sawah agriculture. On the other hand, the other members of the group have no family relationship with the landlord and have no "land" incentive of their labor rewarded by any land right in the future. Their major incentive is thus the "profits" earned by increased rice output realized by paddy fields. As noted, differences are observed between the incentive of the group leader and that of the other members, who take part in the same project.

6-5-5 Conclusion

This section examines the impact of regional institutions and socio-cultural factors on a rural development project taking the case of a small-scale sawah project in central Ghana. The approach adopted here is paying attention to the traditional land system, examining the relations between farmers and land and crops grown on the land and analyzing the relations from the viewpoint of farmers' incentives. The analysis of the Ghanaian case by this approach revealed that farmers' incentives should be studied not merely in terms of the "profits" derived from crop production but also from the "land" aspect--stable land right.

The above-mentioned approach of attempting to examine what relations residents have with land and crops (or tree crops) in the context of the existing land system will be applicable to rural and agricultural development, forestry, environmental and other projects in many other countries as well as to central Ghana and small-scale paddy field development. Who of rural residents has land right, to which land do they have such right and what kind of land right do they have? To whom the crops and trees on land belong? What are the socio-economic relations between residents inherent in the traditional land system? These are the basic problems to be investigated before the implementation of rural area-related projects. This section tries to show that these factors are inseparable from the incentives for residents who participate in the project and are likely to have considerable effects on the whole project.

6-6 Farmers motivation for the development of sawah at Biemso No.1 and the integrated watershed management project

6-6-1 Introduction

The Integrated Watershed management project located a new inland valley of the Biemso River, which is very suitable for the development of Sawah, a water management system for rice production introduced in the country some three years ago. Rice farmers from the village willingly came together to form a group for the construction of the sawah and rice production. The aim of this study is to find out the motivating factor that encouraged the group formation for the sawah construction, sustainability of the group as well as the sawah project and a general ethno-ecological study of the traditional, rice system in the village. The study has the following specific object:

1. To obtain general baseline information on water management, rice production and marketing in the village
2. To obtain information on land use systems, agricultural and forestry systems.

6-6-2 Methodology

An informal survey method of focused group interview was used for the study. Sixteen members of the Sawah group were interviewed on the 21st of May 1999.

6-6-3 Characteristics of Group Members

The group consisted of thirteen men and three women. Their educational levels ranged from primary six to secondary form five. Only two of the members were single.

6-6-4 Perception about Sawah

The group members had various reasons why they are interested in the sawah technique. These are the summary of their reason (Table 6-7):

Table 6-7 Major reasons why farmers are interested in the Sawah technique.
Table....Motivation and Problems of Sawah Rice farmers

Village	Motivation	Current Situation	Problems	Future plan
Adugyama	·To achieve more good rice production ·Improve and better yields ·Land availability (most of the members are landowners) ·Better Income ·Already local rice production experience	·Satisfied with rice production in the past ·Have acquired almost all the know - how in rice production	·Laborious sawah construction ·Difficulties of land and soil improvement ·Bad quality of milling machine (not good for the new rice variety) ·Water management	·Increaseing sawah rice ·Extension of sawah rice land ·Plan to integrate other activities within the farming system such as animal husbandry and fishing
Biemso No.1	·To achieve increased rice production ·Giving it a trial ·Convinced by the Sawah officials ·Because of the canal ·Hope it would improve yields ·Just interested ·Just to prive that we are also hard working ·Had some better yield from an improved variety the previous year ·Just getting involved ·Moved by the Adugyama project ·Secondary usage of rhe canal besides the rice project	·No enough time for other crop production ·No cash income during hard time on rice cultivation ·Dissatifaction to official's additude (no regular visits after the canal construction) ·Have not yet started production	·Laborious sawah and canal construction ·The failure of the water to pass through the canal after its ·Lack of field boots to prevent water borne disease	·Good results of rice production ·Get enough money of sponsors to travel abroad

They also expressed some dissatisfaction about the project. These included the seemingly discouraging attitudes of the CRI official especially after the water the construction of canal, they often failed to meet them at appointed times. The failure of the water to pass through the canal after its construction was another source of disappointment to the members. Other things, which they were not happy about, was their lack of field boots to

help prevent some water borne diseases. They appealed for funds for feeding to enable them stay longer on the farm and do a lot of work. The also asked for loans for their other agriculture work which was being neglected because of time spent with the sawah construction and the growing of rice.

6-6-5 Local Rice production

Two kinds of Asanti buroni (4 and 5 months varieties) were being planted both being red and white in color. They dibble at random with 5-20 seeds per hill. Some spray weedecides after planting and then do hand pulling afterwards. Weeding was done twice or thrice before harvesting. Harvesting was normally done with sickle or knives.

6-6-6 Marketing Preservation and Post Harvest of Rice

The cost of processing (milling) rice for marketing was either borne by the farmer or the buyer depending on the market forces of demand and supply. At a higher demand, buyers were ready to cater for the expenses involved in milling. The situation was different at a lower demand. The quality of the grain after milling was an interaction of the efficiency of the milling machine and the nature of the grain. Storage was done on cribs and sometimes the farmers' bedroom.

6-6-7 Problems of Rice Production

Lack of sunshine for efficient drying was a serious post-harvest problem, since the harvesting normally coincided with the peak of the reining season. One farmer exclaimed that they were always running at a loss considering the returns they get and the input they invest. Other general rice cultivation problems in the area included the following: lack of finances; untimely planting; pests(grasscutter, birds) ; bad soil (laterite); lack of water; and spots on the rice leaves.

6-7 Rice millers and rice marketing in Ghana

6-7-1 Introduction

Rice is becoming one of the major staple diets in Ghana. However, its production falls below its consumption. This has necessitated the importation of about 60% of the national requirement. Rice tanked next to wheat in imported food (MOFA 1991). Ghana has the potential of being self-sufficient in rice production but is a net importer.

To correct this situation, research into rice improvement in Ghana has been going on since the 1960's. Marketing research has been minimal. Dankyi et al (1995) reported in their study of female rice farmers in some inland valleys in the Volta Region,that locally grown rice is sold almost through out the year except in September and October when the new rice was in the field. A study by Ansere-Bioh and Bam (1997) in the Western region showed that there was always a ready market for locally produced rice and though consumers seem to like imported rice, the local rice has its demand in this Region. There has not been any detailed rice, identifying the role of local rice millers as the focal point in rice marketing and the flow or locally grown rice from the producer to the consumer.

6-7-2 Objectives

The objectives of this study are to
1. Identify the channel through which rice moves from the producer to the consumer
2. The roles of the millers in rice marketing and
3. Its consequence to rice production and marketing in the Ashanti Region.

6-7-3 Methodology

The method used in an informal survey using interviews with some randomly sampled rice millers along the Asawasi railway line in Kumasi. Millers in two villages (Biemso No.1 and Adugyama) outside Kumasi where rice is grown were also interviewed. Traders and buyers of rice were also interviewed at the milling sites.

6-7-4 Rice Millers and their Locations

Most of the local rice millers in Kumasi are concerntrated alone the railway line at Asawasi. There are other that are not concentrated but are scattered at different places in the city. The millers at Asawasi are members of the Ghana Food Processors Association and have also their local association. There are about 21 members of this local association with only one women member, the secretary to the local association.

Table 6-8. Rice millers and their locations

Location	Number of millers
Asawasi Railway lines	21
Biemso No.1	2 (one is deceased)
Adugyama	1

They serve as a focal point for rice traders and a marketing center where sellers (farmers included) and buyers meet for the sale and purchase of locally grown rice (Figure 1). The millers' existence and performance of storage and milling if rice on demand shows their very important role in the marketing of local rice in Ghana.

6-7-5 Rice Traders or Middlemen between Farmers and Millers

Rice traders are mostly women though some men are involved. They travel to village in the Brong Ahafo and some parts of the Ashanti region to buy unmilled local rice from farmers. They send the rice down in truckloads to these millers at Asawasi. These traders are not only rice sellers but also other cereal sellers depending on the season and their availability. They have no criteria for selecting rice from farmers apart from the price and their profitability after weighing all the cost involved mostly, transportation, dying and milling cost. The millers, who are refunded after the milled rice has being sold, pay most of this cost.

6-7-6 Rice Buyers

Buyers, mostly women come from mostly Western Region and also from Kumasi to buy the local rice. Though rice is also grown in the Western Region, the demand for rice in this region is high (Ansere-Bioh and Bam 1997). To meet this demand, traders come to

the Ashanti Region to buy some for their local market. These buyers from the Western Region come once in a week to buy rice in bulk and sell to bought retailers and consumers who are mostly " cooked food sellers". Their criteria for purchase of rice are mainly the appearance in terms of broken grains and color as well as price of the varieties.

The red varieties attract more buyers and higher price as compared to the other varieties. The reasons traders and buyers gave for this, was that there were several imported while varieties but no other red varieties apart from the local ones grown. There could therefore be not mixture of this variety with the improved, which could be done to the other white color rice. They also taste good as compared to the other varieties. One miller described the red variety as having plenty starch and therefore used for different kinds of food and also as starch substitute in other dishes. Study by Dankyi et al (1995) showed that farmers preferred red color grains for home consumption. Their main reason being that the red was more palatable than the white wariety.

6-7-7 Rice Millers

The role of "local rice millers" in rice marketing is very essential and needs to be addressed critically to enhance local rice production and marketing in the region. It is often presumed that the quality of local rice is not good and they have a lot of stones because of the processes it goes through before it finally gets to the final consumer. The needs of these millers therefore should be addressed because they are responsible for the final rice product that goes to the consumer.
Owners of mills at Asawasi are big time businessmen, mostly Moslems, who hire operators (usually men) to operate the mills for them. They have other boy and men who serve as laborer and dryers for the mills. The miller pays them and their moneys are refunded after the sale of the rice. The mills are operated by electricity and so if the electricity supply is not reliable it goes against them especially during the busy period. They have mechanics, who help in the maintenance of the machines when they are out of order.

The main operational costs of these mills are the cost of maintenance, spare parts (which are very expensive ranging between 100,000 and 500,000 cedis per part) and electricity bills. These bills range between 30,000 and 400,000 cedis depending on the month and the number of hours they work in a day. They could work from 6 am to 6 pm during the peak periods. They also pay some feeds to the Ghana Railway Cooperation and the Kumasi Metropolitan Assembly. The feed are 120,000 cedis and 48,000 cedis respectively per year. The cost of one tin miller rice is for the miller is 2500 cedis now but was 2000 for last year. One tin is made up of 60-64 margarine cups. Five maxi bags of unmilled rice give approximately. 10 tins after milling.

The first role of the rice miller is that they serve as a focal point for local rice marketing. They serve as market center for local rice. Farmers, traders bring their ware to be dried, stored and milled at the milling sites and buyers from all over the country come to buy from there. Figure 2 is a flow chat of the local rice from the producer to the consumer.

The also serve as a storage base for the local rice. When the rice come in the truckloads, they are dried and stored by the millers until buyers come to purchase them. The rice is thus milled on demand. Their reason for this is that the rice expands after milling and this trader's prefer to milling the rice and storing them which reduces the size of the grains.

Traders and farmers have the advantage of a storage facility for their rice before buyers come to buy. The millers serve as a cushion for the farmers and traders some of whose risks and costs are born by the millers until their rice is sold. The role of the millers could be summarized in the Table 6-9.

Table 6-9 The Role of Local Rice Millers

Millers play role as
Dryers
Storage facilities
Millers of rice
Source of Credit for traders
Provide money for transporters
Provide money for labores

These roles are not very different from millers in the villages except that they get the supplies direct from farmers who could be men, women, young boys and girls. Their machines are diesel operated. One miller uses about 4 gallons of diesel a day during their peak period, which is also between October and March. In the village buyers come from Kumasi (women) as well as local cooked rice sellers to buy the rice from the millers. The criteria for not purchasing rice include

- The method of drying and the presence of stones
- Broken grains
- Unclean rice (presence of lots of un-milled rice)
- White rice (these are from early rice, they are not well dried)

If rice is clean, no broken grains and is well dried there are no problems of selling. The only problem for the village miller is that during the harvest time, when there is plenty of rice, buyers purchase on credit. This a problem because the miller receives his money for the milling and drying only when the rice is bought and paid for.

6-7-8 Marketing Channels

There are two marketing channels for local rice if the millers are the focal point. Figure 1 describes the various channels through which local rice is marketed.

1. Farmer could send rice to the miller who will mill and sell to the buyer would then send it to sell to the retailer or cooked food seller.

2. Trader buys from farmer in the village or at the milling site, send to mill before it is sold to the buyer. The buyer would then send it to sell to the retailer or cooked food seller.

Here are some characteristics of the local rice varieties that come to the mills regularly and their prices for last year.

Table 6-10 Local Rice Varieties, Prices and Characteristics

Variety Name	Price Rnge(cedis)	Variety Characteristics
Asante Broni (china)	29,000-32,000	Whiste with grains close to imported ri
Asante Kokoo	36,000-40,000	Red withl large round grains
Asanti Fitaa	35,000-39,000	White with large round grains and tast
Kwame Danso	33,000-35,000	Red with smaller round grains, has a lot of starch and very palatable.

Prices are not different to farmers with the different varieties. This is because they sell mostly to the traders at the farm gate and determines the price they would buy from the farmers. The price this traders sell to the buyers however differ because of the demand for the different varieties and also the grain quality, brokenness and presence of paddy in the milled rice (Table 6-10). Asante Kokoo attracts higher price because of its color and palatability. The lowest prices are quoted during the harvest times and highest during the lean season when rice is yet to be harvested from the field.

6-7-9 Conclusions

It is obvious from these informal interviews that local rice is very important source of employment as well as income to most people in the country. Farmers, trader, miller and laborers at the mills have their assured source of income if rice production increases.

The mill sites serve as the center for local rice marketing in Kumasi, thus bring sellers and buyers together. They serve as a cushion for traders, a form of credit without any interest, by paying for transporting, dying and milling cost for them. They deduct these costs from the money after the sale of the rice before the rest of the money is given to the trader. They also store rice till there are buyers before they are milled. These roles are very important for rice production and marketing in the country.

Survey respondents did not mention improved varieties which indicate that either the farmers in areas where the trader go to buy the rice do not grow improved varieties or they grow in but have different marketing channels for the improved rice. Again it could be that they are growing improved varieties but mixed them with the local varieties. This is a speculation that needs further investigation.

6-8 Financial & economic assessment of sawah technology

6-8-1 Introduction

Under the technical cooperation between the Crops Research Institute and JICA, the joint study project titled The Integrated Watershed Management of Inland Valleys in the Republic of Ghana (from August 1997 to March 2001), 7 sawah sites have been being developed and practiced for rice cultivation. The development had practically started in January 1997 before the official project commencement. At the beginning of the development, the use of the machinery was limited. No heavy machinery were available in order to make the development way fit for local farmers condition. Because of this

limitation, it seemed very unattainable to create such a rice field in local bush. However through these practices of sawah development mainly by man power, sawah has been gradually formed and several manual and small machinery technology fit for the local condition were also developed. As the result of for year's cultivation, the sawah produced the yield of 3 -5 ton/ha rice. It may be 4 times more than the yield of local rice cultivation.

But on the contrary, it was found that the development site should be very carefully selected mainly because of the water condition. Also, the development requires a lot of investment, mainly to buy power tiller, especially at the first stage. In addition, the members of sawah cultivation association, which was formed to promote the extension of sawah activities are fluid. In this report, the labour investment data during these four years, the movements of sawah activities are analyzed.

6-8-2 Preliminary data collection of Labor Investment for Sawah Activities during 1997-1998

6-8-2-1 Labor Investment for Sawah Construction: Main Engineering works and some agronomic works

Through the practice of sawah activities, or the construction and sawah rice cultivation, in 1997 and 1998, the labour investment under local condition to practice all processes of sawah activities has been calculated. From Table 6-11 to Table 6-17 show the expenditure for each process at each sawah site in Adugyama and Potrikrom. Also the construction investment for the nursery, which supplied seedling for all Adugyama sites in 1998, is shown in Table 6-18 because the nursery was collectively constructed. As for the 1997, the seedlings for Adugyama were gained from Crops Research Institute experimental farm. Among the processes, plowing includes the harrowing process, too. In Table 6-19., the other investments besides labour (fuel for a power tiller and water pump, fertilizer etc.) are shown.

The investment has been calculated according to the three categories. The Figure of upper line represents the total number of man-days engaged in the process. The working hours of daily work vary day by day. So that the total working hours (man-hours) to be spent for the process is shown in the middle line. It is gained by the multiplication between actual working hours of one day and the days working personnel number. The lower number is the total wages actually paid for the labour. It does not take into account the work of volunteers, e.g. the member of sawah cultivation association.

These investments of course are calculated from only the human investment. For example, the fees for the fuel for a power tiller, pumping machine etc. are not included.

6-8-2-2 Features of Labor Investment for Sawah based Rice farming: Mainly for Agronomic works

As shown in from Table 6-11 to Table 6-19, needles to say, the labor investments vary from site to site according to the size, micro topography etc. Also the data are far from enough to be analyzed so that in this section, only two features that find out from the gained data are discussed

Table 6-11 Labour Investment for Sawah Activities - Potrikrom Site, 1997

Process	Preliminary survey	Site clearing	Survey & Layout		
Total No. of man-days (A.)	15	-	8		
Total No. of man-hours (B.)	42.00	-	8.00		
Wages (cedi) (C.)	35,00	0	0		
	Preliminary leveling	Bond construction	Ploughing	Nursery Construction	
(A.)	0	65	4	13	
(B.)	0	-	14.00	12.67	
(C.)	0	274,000	9,000	10,000	
	Leveling	Transplanting	Reservoir construction	Fertilization	Weeding
(A.)	86	99	5	9	24
(B.)	554.08	418.25	15.00	3.09	69.94
(C.)	772,000	109,000	0	0	0
	Chemical spraying	Water pumping up	Harvesting & Threshing	Drying	Total
(A.)	4	x	80	36	448+
(B.)	62.94	x (18 days)	307.05	108.00	1,615.02
(C.)	0	0	91,000	0	1,300,000

Table 6-12 Labour Investment for Sawah Activities - Afreh's Site, 1997

Process	Preliminary survey	Site clearing	Survey & Layout		
Total No. of man-days (A.)	17	6	5		
Total No. of man-hours (B.)	55.00	19.83	14.50		
Wages (cedi) (C.)	47,200	0	3,000		
	Preliminary leveling	Bond construction	Ploughing	Leveling	Transplanting
(A.)	25	16	7	24	29
(B.)	124.92	81.67	19.67	130.58	151.17
(C.)	180,000	142,500	12,000	208,000	72,000
	Reservoir construction	Fertilization	Weeding	Chemical spraying	
(A.)	0	13	9	2	
(B.)	0	12.50	20.75	2.00	
(C.)	0	33,000	0	0	
	Water pumping up	Harvesting & Threshing	Drying	Total	
(A.)	21	15	8	189	
(B.)	47.69	102.50	24.00	806.78	
(C.)	0	40,000	0	737,700	

Table 6-13 Labour Investment for Sawah Activities - Danyame Site, 1997

Process	Preliminary survey	Site clearing	Survey & Layout		
Total No. of man-days (A.)	17	22	5		
Total No. of man-hours (B.)	43.00	51.00	9.00		
Wages (cedi) (C.)	27,300	0	0		
	Preliminary leveling	Bond construction	Ploughing	Leveling	Transplanting
(A.)	0	94	7	28	68
(B.)	0	404.25	29.75	188.77	175.95
(C.)	0	531,500	24,000	269,000	49,000
	Reservoir construction	Fertilization	Weeding	Chemical spraying	
(A.)	9	11	29	2	
(B.)	21.00	4.00	52.17	3.59	
(C.)	0	0	0	0	
	Water pumping up	Harvesting & Threshing	Drying	Total	
(A.)	31	54	44	401	
(B.)	39.87	279.44	88.00	1,389.79	
(C.)	0	71,000	0	972,300	

*. - : no data x: unknown (no actual pumping hours data)

Table 6-14 Labour Investment for Sawah Activities - Afreh's Site, 1998

Process	Preliminary survey	Site clearing	Survey & Layout		
Total No. of man-days (A.)	0	8	0		
Total No. of man-hours (B.)	0	29.34	0		
Wages (cedi) (C.)	0	40,000	0		
	Preliminary leveling	Bond construction	Ploughing	Leveling	Transplanting
(A.)	0	0	4	19	20
(B.)	0	0	12.20	33.25	81.67
(C.)	0	0	10,000	23,750	100,000
	Reservoir construction	Fertilization	Weeding	Chemical spraying	
(A.)	0	6	8	2	
(B.)	0	2.67	11.50	2.00	
(C.)	0	0	0	0	
	Water pumping up	Harvesting & Threshing	Drying	Total	
(A.)	9	18	4	98	
(B.)	13.50	69.34	14.00	269.47	
(C.)	0	0	0	173,750	

Table 6-15 Labour Investment for Sawah Activities - Danyame Site, 1998

Process	Preliminary survey	Site clearing	Survey & Layout		
Total No. of man-days (A.)	0	31	6		
Total No. of man-hours (B.)	0	82.92	13.00		
Wages (cedi) (C.)	0	50,000	0		
	Preliminary leveling	Bond construction	Ploughing	Leveling	Transplanting
(A.)	11	57	9	116	138
(B.)	43.54	202.80	24.80	350.67	437.19
(C.)	55,000	170,000	28,000	426,000	452,000
	Reservoir construction	Fertilization	Weeding	Chemical spraying	
(A.)	75	9	10	2	
(B.)	168.70	4.17	22.42	4.00	
(C.)	181,000	0	0	0	
	Water pumping up	Harvesting & Threshing	Drying	Total	
(A.)	15	42	16	537	
(B.)	16.05	187.35	32.08	1,596.69	
(C.)	0	0	0	1,362,000	

Table 6-16 Labour Investment for Sawah Activities - Nicolas', 1998

Process	Preliminary survey	Site clearing	Survey & Layout		
Total No. of man-days (A.)	0	30	5		
Total No. of man-hours (B.)	0	62.17	7.50		
Wages (cedi) (C.)	0	0	0		
	Preliminary leveling	Bond construction	Ploughing	Leveling	Transplanting
(A.)	18	48	5	141	50
(B.)	64.19	177.44	16.10	532.19	197.00
(C.)	95,000	124,000	20,000	618,000	181,000
	Reservoir construction	Fertilization	Weeding	Chemical spraying	
(A.)	0	8	9	2	
(B.)	0	2.67	24.25	2.00	
(C.)	0	0	0	0	
	Water pumping up	Harvesting & Threshing	Drying	Total	
(A.)	18	39	14	387	
(B.)	28.20	347.12	38.50	1,499.33	
(C.)	0	0	0	1,038,000	

*. - : no data x: unknown (no actual pumping hours data)

Table 6-17 Labour Investment for Sawah Activities - Anthony's Site, 1998

Process	Preliminary survey	Site clearing	Survey & Layout		
Total No. of man-days (A.)	0	31	4		
Total No. of man-hours (B.)	0	103.72	10.00		
Wages (cedi) (C.)	0	65,000	0		
	Preliminary leveling	Bond construction	Ploughing	Leveling	Transplanting
(A.)	17	51	2	126	40
(B.)	69.7	190.14	5.84	408.25	160.37
(C.)	85,000	269,000	10,000	501,000	155,250
	Reservoir construction	Fertilization	Weeding	Chemical spraying	
(A.)	40	7	10	2	
(B.)	50.60	3.50	22.00	3.00	
(C.)	65,000	0	0	0	
	Water pumping up	Harvesting & Threshing	Drying	Total	
(A.)	9	37	11	387	
(B.)	27.50	168.67	29.34	1,252.63	
(C.)	0	0	0	1,150,250	

Table 6-18 Labour Investment for Nursery Construction in Adugyama, 1998

Process	Nursery construction
Total No. of man-days (A.)	27
Total No. of man-hours (B.)	94.87
Wages (cedi) (C.)	132,000

Table 6-19 The Other Investments (in cedi)

Site	Diesel for Power tiller	Petro. For pump	Chemical	Fertilizer	Total
Potrikro (1997)	6,500	x		24,154	30,654+
Danyame (1997)	4,875	11,965	x	14,620	31,460+
Danyame (1998)	6,500	3,840	6,080	28,140	44,560
Afreh (1997)	4,875	16,243	x	0	21,118+
Afreh (1998)	3,250	9,690	3,040	7,535	23,515
Nicolas (1998)	6,500	8,986	4,560	15,717	35,763
Anthony (1998)	4,875	6,998	4,256	15,261	31,390

x: unknown

Table 6-20 Comparison of Man-hours of Afreh's site between 1997 and 1998

Process	Preliminary survey	Site clearing	Survey & Layout		
Man-hours in 1997 (A.)	55.00	19.83	14.50		
Man-hours in 1998 (B.)	0	29.34	0		
Difference (C.) {(B.)-(A.)}	-55.00	9.51	-14.50		
	Preliminary leveling	Bond construction	Ploughing	Leveling	Transplanting
(A.)	124.92	81.67	19.67	130.58	151.17
(B.)	0.00	0.00	12.20	33.25	81.67
(C.)	-124.92	-81.67	-7.47	-97.33	-69.50
	Reservoir construction	Fertilization	Weeding	Chemical spraying	
(A.)	0	12.50	20.75	2.00	
(B.)	0	2.67	11.50	2.00	
(C.)	0	-9.83	-9.25	0	
	Water pumping up	Harvesting & Threshing	Drying	Total	
(A.)	47.69	102.50	24.00	806.78	
(B.)	13.50	69.34	14.00	269.47	
(C.)	-34.19	-33.16	-10.00	-537.31	

Table 6-21 Possible Income from Man-hours Invested for Sawah

Site	Total No. of Man-hours	Possible Work Day	Possible Income
Potrikro (1997)	1,494.35	298.87	896,610
Danyame (1997)	1,301.79	260.358	781,074
Danyame (1998)	1,596.69	319.338	958,014
Afreh (1997)	782.79	156.558	469,674
Afreh (1998)	269.47	53.894	161,682
Nicolas (1998)	1,499.33		899,598
Anthony (1998)	1,252.63	250.526	751,578

Table 6-22 Yield (kg) Danyame 1, Potrikrom 1 constructed in 1997. Danyame 2 and Potrikrom 2 constructed in 1998

Site	1997 kg (t/ha)	1998 kg (t/ha)
Adugyama		
Danyame 1 (1,606.6 m^2)	557.35 (3.47)	490.60 (3.05)
Danyame 2 (1,485.8 m^2)	-	418.57 (2.82)
Afreh (828.1 m^2)	302.50 (3.65)	262.52 (3.17)
Nicolas (1,727.1 m^2)	-	671.27 (3.89)
Anthony (1,677.0 m^2)	-	580.71 (3.48)
Potrikrom		
Potrikrom 1 (2,654.2 m^2)	1,035.65 (3.90)	u
Potrikrom 2	-	u

u: data under collection

'-' : Research trial site

Table 6-23 Possible Income from Harvested Rice in Sawah

Site	Yield (kg)	Weight of Polished Rice (kg	Possible Income (in cedi)
Potrikro (1997)	1,035.65	776.74	728,194
Danyame (1997)	557.35	418.01	391,884
Danyame (1998)	909.17	681.88	639,263
Afreh (1997)	302.50	226.88	212,700
Afreh (1998)	262.52	196.89	184,584
Nicolas (1998)	671.27	503.45	471,984
Anthony (1998)	580.71	435.53	408,309

(i) Afrehs site - Declining of Labour Investment in Second Year
Table 6-20 shows the difference of total number of man-hours from the first process up to reservoir construction process at Afrehs site between in 1997, when sawah was newly developed and in 1998, when the cultivation has come into second year. As always roughly speaking, the fact that the necessary labour in second year to practice sawah activities comes much smaller than that in first year is very clear from this comparison.

(ii) Labour Productivity of sawah
The way of thinking what is labour productivity is very complicated. But in this sub-section, it try to be calculated very simply. The way of thinking here is that if the participant use the man-hours invested for the sawah activities for a paid job which may be available for him in project area, how much he can get from the job instead of sawah farming. Table 6-21 shows the way of calculation. Possible Work Day is the assumed possible working days calculated from total number of man-hours/ 5 hours (usually employee may be expected to work 5 hours by an employer in Adugyama). Possible Income is gained from the possible working days 3,000 cedis (an employer may get such a amount for his work in Adugyama).

Secondly, Table 6-22 shows the yield of each site of sawah and Table 6-23 shows the way of calculation to earn the possible income from harvested rice at each plot. Polished rice weight is calculated by unhusked rice weight 0.75. Possible income is calculated by polished rice weight/32(weight of 1 tin) 30,000cedi. Comparing Possible Income in Table 6-21 with that in Table 6-23., only the value of Potrikrom seems to be balanced in 1997. However, such an employment assumed in Table 11 is actually very difficult to get often in Adugyama area. Also, the investment for sawah construction can be compensated through continuous cultivation. This feature of sawah economy is clear judging from the that possible income from possible working day has come lower than one from harvested rice at Afrehs site in 1998. Anyway, it is very necessary to get more data not only about sawah itself but about the other peoples economic activities before answering the question, how benefit sawah is.

6-8-2-3 Sawah Cultivation Association - Club C in Adugyama

Sawah Cultivation Association have been formed in March, 1997. The member consists of mainly landowner group in Adugyama, the age group of which is between 24 to 75. Table 6-24 shows the status of member of the association by January 1999. Current members by the end of August are shown in Table 6-32.

This association was organized for the purpose of the promotion of sawah extension. Through actual sawah cultivation at some members land, the member are expected to gain the technology and to extend to their own land. By forming the communal association, it is also expected to manage the work of sawah construction, which need a heavy and intensive labour. This association was organized with 12 members in April, 1997. The association welcomed three female members, Ms. Lidia, Ms. Akuya and Ms. Janfuya in July 97 and Mr. Afreh, who has developed his familys sawah in 1997, joined the member in January 98. But on the contrary, 5 members of the founders withdrew from the association activities and all female members also withdrew within 4 months. It seems that the reason of their withdrawal is mainly due to the fact that they could not own sawah because there were no place suitable for sawah in their own land. However, on the beginning of third years construction, in January 1999, Mr. Aboagyei Dakoster took part

in the activities again.

Table 6-24 Club-c Member of Sawah Cultivation Association (omit titles from names), Adugyama, during 1997-1999. (Current situation, see Table 3-32)

Name of Member(age) Ownership	Village	Time of Join	Time of Withdraw	Sawah
1. Anthony Becon (47)	Adugyama	April 97	-	Yes(98)
2. Nana Owusu (34)			-	Yes(97)
3. Nicolas Donkor (42)			-	Yes(98)
4. Kwame Gyanfi (34)			-	No
5. Aboagyei Dakoster (30)			May 98	No
6. Kwasi Nthiamoa (43)			-	No
7. Kwabena Afrie (75)			-	No
8. Kwabena Agyei (75)			-	No
9. Kwaku Frinpong (38)			March 98	No
10.Emanuel Agyei (40)			Dec.98	No
11.Yao Baah (38)			June 97	No
12.Daniel Opong (27)	Potrikrom		Aug. 97	No
13.Lidia (25)	Adugyama	July 97	Oct.97	No
14.Joseph Afresh (50)		Jan. 98	-	Yes(97)
15.Akuya (24)		July 97	Oct.97	No
16.Janfuya(24)		July 97	Oct.97	No

6-8-3 Comparative economic evaluation of various sawah systems tested

Based on the various primary data described above as well as the data collected during 1999 and 2000, all relevant economic parameters of various sawah systems tested in this study are summarized in Table 5 in page 31. Table 5 summarizes the economic parameters of various sawahs tested. Labour mandays for soil movement per ha were 2530, 2370, 1866, 2920, 2040, 1182, and 920 mandays per ha for Gs, Rs, B2s, As, Ns, Ps, and B1s respectively. These figures can be compared with the total soil movement as shown in Table 4 in page 23. Since labour cost was about 2dollars per manday, estimated cost for the construction of the various sawahs were 5060, 4740, 3732, 5840, 4080, 2264, and 1840 dollars per ha for Gs, Rs, B1s, As, Ns, Ps, and B1s, respectively. In addition to these labour cost, the costs of fuel for pump and power tiller for the development were estimated at 48, 48, 57, 102, 38, 23, and 46 dollars per ha for Gs, Rs, B2s, As, Ns, Ps, and B1s respectively. In the case of B1s, materials for dyke construction were purchased. Total cost was about one million cedi, equivalent to 400dollars for the dyke, which has a capacity to irrigate more than 5ha. Therefore the cost per ha was 80 dollars. Total costs for the development of the various sawah systems were therefore 5100, 4800, 3800, 5900, 4100, 2400, and 2000dollars per ha for Gs, Rs, B2s, As, Ns, Ps, and B1s, respectively.

Table 2 in page 33 compared the cost estimation for the sawah development in dollars per ha both based on estimated mandays for the development (Masuda, 1999) and on the volume of soil movement (Table 4 in executive summary). The mean cost including fuel

and materials was 4570, 3900, 3600, 5470, 3600, 2400, and 2350 dollars per ha for Gs, Rs, B2s, As, Ns, Ps, and B1s, respectively. If the cost of power tiller and pump are 4,000$ and 500$, respectively, life span of the machines are five years, and the maintenance is 20% of the total machinery cost, then machinery cost per ha of sawah development will be 1,080$. Therefore the grand total will be 5,650$, 4,980$, 4,680$, 6,580$, 4,680$, 3,480$, and 3,430$ per ha for Gs, Rs, B2s, As, Ns, Ps, and B1s, respectively.

Cost estimation of various agronomic practices for rice farming in mandays was summarized in Table 5 in page 31. The breakdown of the various agronomic practices was shown in Table 6 in page 34. Since the participant farmers were all new in sawah based rice farming, these figures will be reduced through the improvement of agronomic skills of farmers.

Among the cost that farmers have to bear, fertilizer and spare parts comes first, then fuel. Total cost in dollars equivalent per ha was estimated at $139 for B1s site, the lowest, and $208 for As site, the highest. Although at the moment we can not estimate the cost of the maintenances for the pump and power tiller properly, those will be the most expensive. Tentatively we put the 2 % of the total price of the machines. Total running cost can be estimated in the range of 174 to 276 dollars per ha per year.

6-8-4 Economic evaluation of ecotechnolgy based sawah development

Biesmo No. 1 sawah group expanded their sawah to 1.80 ha during 2000. By the end of August 2001, Biemso No 1 Sawah groups (new and old) developed more than 3 ha of sawah. Total paddy productions and selling in 1999 and 2000 of both Adugyama Clab-C and Biemso Sawah are shown in Table 3 in page 21. In 2000, the total rice production of Biemso No.1 sawah group was 6.1 (3.4t/ha) ton in paddy base, of which 0.25ton for landlord and 0.13ton for household consumption. The remaining 5.7 ton were sold as shown in Table 6-25. The price was 14.4million Cedis as shown in the Table 6-25, which was equivalent to $2,057 (1US$ =7000 cedies at March 2001). Total dollar equivalent of rice production was $2200 ($1222 per ha). Table 6-26 shows the plan of running cost allocation of the Biemso No.1 Sawah group for the rice production during April to November 2001, which was decieded by the group meeting on the end of March 2001.

Table 6-25 Total rice production and selling of Biemso No.1 Sawah group during January to March, 2001

	Tin	kg	Cedies per kg	Charge for cleaning in Cedies	Total amount in Cedies(x1000)	condition of rice for selling	The place to sell	Date at sell
1st	40	1,000	2,800	200,000	2,600	polished	Biemso	Jan
2nd	160	4,040	2,500	0	10,100	paddy	Kumasi	23-Mar
3rd	27	680	2500?		1,700	?	?	
Total	227	5,720		200,000	14,400			

Table 6-26 The Plan of Running Cost Allocation of Biemso No.1 Sawah group during April to November 2001 for rice production

Break down	cedis	Note
Fertilizer	900,000	
Karate	80,000	
Fuel for power tiller	200,000	25galon
Fuel for pump	52,500	5galon
Engine Oil	120,000	3galon
maintenance for machine	500,000	
chop money	600,000	
TOTAL	2,452,500	

Table 6-27 Plan of Distribution of the Money of Rice Selling among the BiemsoNo.1 Sawah group (Agreed on the group meeting at the end of March 2001)

	1st profit	2nd profit	Running cost payment	TOTAL
A	337,662	1,459,378	103,896	1,693,144
B	236,363	1,021,565	72,727	1,185,201
C	337,662	908,940	103,896	1,114,706
D	337,662	772,599	103,896	1,006,365

A: Five male members who were evaluated as the hardest worker among the group members. The evaluation was made on the group meeting at the end of March 2001.
B: One female member who was evaluated as the hardest worker
C: One male member who was not work so hard
D: One male member who was not work so harder than C

The distribution plan that was described in the Table 6-27 was very interesting. The distribution was based on the mutual evaluation of the sawah group members on the contribution of the rice production. This income level is very high comparing to the income such as maize production in this village, which was about 200,000 cedies per acre, i.e. 500,000 cedies per ha during the same period. There are many farmers who want to the Sawah group in this village, therefore the farmers who were evaluated as C and D are in the pressure to resign. This kind of evaluation will be very important to activate and sustain this Sawah project.

6-9 Impact and Effect of Sawah Development

6-9-1 Introduction

This section examines the impact of the sawah development projects conducted in rural areas in southern Ghana from the viewpoint of the residents recognition of and opinions about different types of land-use (sawah, traditional sawah, mixed-crop fields and cacao farms). The purpose is to study the opinions of the participating and non-participating farmers (residents) on the scenery of sawah in the project sites from various angles. The survey sites are two villages, Biemso No. 1 and Adugyama, where the development of small-scale sawah has been attempted by farmer participation since 1997. In Biemso No.1, the groups of local farmers are making sawah equipped with small-scale irrigation facility. This section examines what effects these sawah have had on residents and participating farmers as well as on the villages' scenery and attempts to forecast what problems will arise and how the rural communities will change in the future. Subsection 3 examines what impact the sawah development has had on residents and what impressions it has given to them. Subsections 4 and 5 deal with the relations between the sawah and residents' awareness of these land-use. They study differences in images of sawah between residents and participating farmers and whether rural people regard the newly appearing land-use (sawah) as a special one, or see the land-use just as part of farmland and feel no particular impact. Subsection 6 studies the prospect of participating farmers for sawah by sounding out their feelings about a sawah development plan.

6-9-2 Outline of the survey sites

The survey sites, Biemso No. 1 and Adugyama, are located 40 km northwest of Kumashi, a local city in the Ashanti District, Ghana. Belonging to the tropical rain forest zone, this district has a yearly precipitation of 1,200 mm. The year is divided into the rainy season from March to October (a short dry season comes in August) and the dry season from November to February or March.

Having a population of about 1,600 and about 2.500, respectively, Biemso I and Adugyama are medium-scale villages according to the Ghanaian standard (GOG, 1995). Recently, declines in those in their twenties are remarkable. This clearly shows the outflows of young people to cities and needless to say, is one of the main reasons for depopulation in rural districts. Ninety-five percent of the villages' population is engaged in farming, and main farm products are cassava, yam, maize, plantain and other crops for own consumption plus cocoa and rice, the cash crops. Rice is grown in inland valleys by the traditional method dependent on rainwater.

6-9-3 Interview survey on the residents' opinions about sawah

6-9-3-1 Purpose

This interview survey was conducted to investigate, first of all, the recognition of villagers (1) to examine the level of interest in and awareness of sawah of residents in the project sites. In addition, it analyzed (2) how residents' interest in sawah changed in the village in the third year of sawah development (Adugyama) and in the one in the first year (Biemso), (3) how different such interest has been between sexes, between

rice farmers and non-rice ones and between settled-down and migratory groups, (4) what background situations exist for different types of interest, and (5) people's reasons for having interest in sawah.

6-9-3-2 Survey results 1: Questions and answers

Table 6-28. Answers of residents in the two villages by sex, ethnic group and birthplace (%)

Question	Bl *[1]	Ad *[2]	Sp *[3]	Mp *[4]	M *[5]	F *[6]	Wr *[7]	Wor *[8]	Av. *[9]
Know what the project is doing	93	100	95	97	100	92	96	93	88
Have heard the word "sawah"	58	71	75	54	67	62	66	49	71
Know the difference between sawah and traditional rice growing to some extent	84	96	68	71	72	67	76	57	74
Have seen sawah	51	88	93	85	95	84	92	61	81
*How did you see sawah?									
Took the trouble to go seeing them	43	63	49	58	62	45	60	48	54
Happened to pass by the sawah	57	37	51	42	38	55	40	52	46
*Do you know the members of the project?									
Know some of them but don't know the total number correctly	60	71	64	67	67	64	67	75	64
Know all the members and can say the total number	20	27	30	16	16	28	19	25	24
Don't know at all who are doing the project	18	3	5	17	17	7	15	6	11
Are you interested in the project? (Yes)	85	84	84	85	87	81	92	63	83
*Why?									
Want to earn more money	43	52	43	53	50	45	44	28	45
Can learn sawah techniques	86	41	65	62	64	63	66	42	61
Attracted by the machines	14	11	14	9	22	1	14	26	14
Want to find a job	28	26	33	20	31	22	23	19	25
Intensive method for rice growing	93	85	87	87	94	82	87	89	88
Beautiful	13	10	16	10	1	25	8	19	13
Others	11	16	11	15	16	11	13	17	14

(*[1]Biemso No.1, *[2]Adugyama, *[3]Settled-down people, *[4]Migratory people, *[5]Mean-males, *[6]Mean-females, *[7]Those with rice growing experience, *[8]Those without rice growing experience, *[9]Average)

More then 70% of the respondents on average have heard the word "sawah." But almost all of them say that they heard the word first in their village and that they heard the word but do not know what it is. To the question "Do you know what the Japanese and other people from other areas are doing?", 93% of the respondents in Biemso, the village in the first year of sawah development, and all of them in Adugyama, the village in the third year of the project, correctly answered "They are doing a rice growing project" or "They are growing rice." Those who said "I don't know at all what they are doing" existed only in Biemso, accounting for 7% of the respondents, and all of them were women. About 50% of the respondents in Biemso and nearly 90% of those in Adugyama saw the sawah on some occasion or other. The ratio of those went to see the sawahs was higher in Adugyama than in Biemso, which indicates that residents' awareness of the project increased with the passage of time (Figure 6-2). While those who actually saw sawah made up 70% of all the respondents. As many as 90% of them were able to describe roughly the differences between sawah and the traditional rice growing system (e.g. the use of small machines, such as power tillers and pumps, dikes and canals, planting method, banks). This suggests that though residents do not see sawah, they can get knowledge of them from other residents. Those who knew the differences or had some knowledge about sawah had a higher ratio in Adugyama, showing that this knowledge was more widely spread in the village. In Biemso, 18% of the respondents said they don't know at all who are doing the project but the ratio was only 3% in Adugyama.

As evident from Figure 6-3, residents' knowledge of the members increased as time passed, too. Both in Biemso and in Adugyama, 85% of the respondents say that they want to take part in the project if they have a chance. The most mentioned reasons are that they want to learn sawah techniques and that the sawah system is more intensive (or more profitable). There are also many people who find the introduction of machines attractive, who have interest because of a better appearance (sawah are beautiful) and who consider that the project and the participating farmers have an employment contract. Other main reasons include that it is attractive to work with foreigners or to work as a group. Some answered "Because it is possible to grow off-season crops in sawah" or "Because the rice from sawah has a better taste." From these reasons given, it can be known that the knowledge villagers generally have about the sawah system is that it has a high yield and so is more profitable than the traditional system and that it uses new technology.

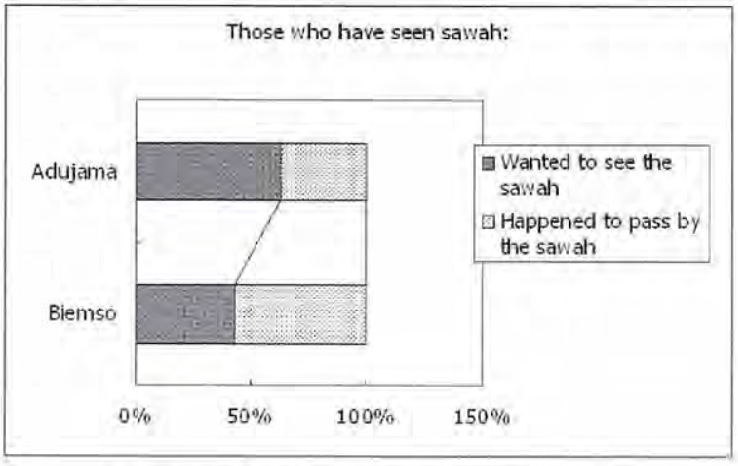

Fig. 6-2. Opportunities to see sawah

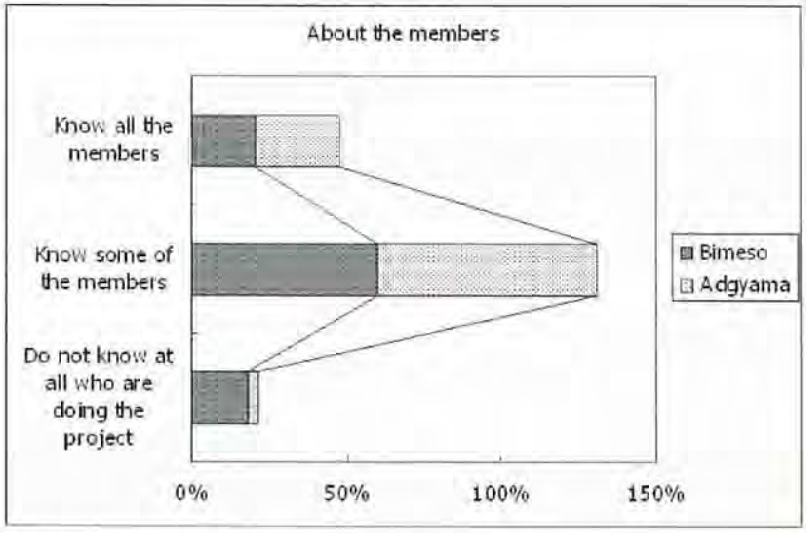

Fig. 6-3. About the project members

Those settled down in the villages have more knowledge of sawah than the migratory groups. This is partly because the villagers who took part in the sawah project were almost all those living in the villages permanently but also because the sawah are far from the areas where migratory groups live. Despite this, migratory people went seeing the sawah more positively than those settled down in the villages, which shows that the former (many of whom are engaged in farming, mainly rice growing) have a stronger interest in sawah.

Men tend to get information both by the "ear" and by the "eye" more positively than women and so it can be said that men are more interested in sawah than women. Behind this is probably the fact that men occupy a far larger portion of the project members than women. Though men have a bit higher interest than women, both of them show a fairly great interest in sawah. More women admire sawah "beautiful" than men and the fact that they consider sawah are "beautiful" is interesting. Men are more interested in machines than women. These facts indicate that the outward appearance of sawah and paddy agriculture is one factor for arousing their interest. No differences in the desire to learn sawah techniques are observed between men and women.

Those who have experience of rice growing clearly have a greater interest in sawah than those who do not. This difference is larger than that with regard to sex and birthplace, indicating that interest is greatly affected by experience in rice cultivation. In addition, those with experience know the project members better. Those having no experience tend more to judge sawah by outward appearance (the machines are attractive; sawah are beautiful), whereas experienced people have the tendency to have more interest in technical sides.

6-9-3-3 Advantages and disadvantages

This section studies how villagers consider the advantages and disadvantages of sawah and makes an objective analysis of their knowledge of sawah. Table 6-29 summarized the opinions of villagers. Eighty-three percent of the respondents in Adugyama and

76% in Biemso gave at least one advantage or disadvantage.

Table. 6-29. Advantages and disadvantages of sawah pointed out by the residents

Advantages of sawah given by the respondents in Biemso (%)	
Higher efficiency by using machines	15
More Intensive	36
Simpler	5
Higher yield	32
Easier harvesting	2
Always can grow rice because of irrigation equipment	10

Disadvantages of sawah given by the respondents in Biemso (%)	
More time needed for land preparation	13
Large quantity of water needed	14
More labor needed	19
None	29
More costly	22
More farm hands needed	3

Advantages of sawah given by the respondents in Adugyama (%)	
Earlier harvesting possible	14
More intensive	18
Simpler	3
Higher yield	32
Easier harvesting	1
Always can grow rice because of irrigation equipment	5
Better taste	3
Higher efficiency by using machines	8
Earlier growth	8
Off-season crops can be planted	8

Disadvantages of sawah given by the respondents in Adugyama (%)	
Water management needed	17
More farm hands needed	2
More time needed for land preparation	23
Large quantity of water needed	1
More labor needed	36
Machines needed	5
More costly	2
Hard transplanting work	23
Harder harvesting work	32
None	5

The answers of Biemso respondents about the strong and weak points of sawah have smaller varieties than those of Adugyama ones. The latter respondents do not understand sawah fully but their opinions are more diverse and their reply ratio is higher. This suggests that residents in Adugyama get more information and knowledge firsthand.

6-9-3-4 Summary

Biemso was in the first year of introduction of sawah but the survey showed that many residents in the village are aware of and are interested in sawah. But they did not understand the advantages and disadvantages well and most of them had positive images of sawah only. One reason that "rumors" about sawah spread quickly is probably that the village is a relatively small community of about 1,600 residents, but it was also found that the use of machines, group working and the existence of foreigners and people from other districts helped heighten impact on them. In general, it can be said that they have a great interest in sawah and feel much attraction to sawah techniques, intensive ways of rice farming and possibilities to make more money (get a job).

Similarly, people in Adugyama have a considerable knowledge of and a fairly high interest in sawah. Many of the respondents correctly point out the advantages and disadvantages of sawah and have a rough understanding about them. "Making sawah is the task that needs hard work and much money but is interesting because it is profitable"--this is the general image of sawah that the residents of Biemso and Adugyama have. They seemed to have a firm belief that rice cultivation is profitable and that rice is a cash crop.

The respondents' interest is affected more by experience in rice growing than by sex and birthplace. Their knowledge and awareness of sawah increase as more years have passed since the start of sawah development. But the number of those who showed interest or wanted to take part in the project is not much affected by the duration of the project. This indicates that getting more knowledge about sawah would not directly lead to a greater intention to participate or a higher interest; instead, interest in sawah is inducing the people to get more knowledge about them.

6-9-4 Farmers' images of sawah: "sawah is more beautiful than traditional rice farms?"

6-9-4-1 Outline

What images do the participating farmers and residents have of newly created views of sawah relative to traditional cocoa farms, mixed-crop farms and traditional rice farms? The semantic differential (SD) method (This method is used to measure the mental reactions of persons who have seen and experienced a certain kind of space) was used to measure the reactions of the farmers and other residents to sawah, cocoa farms, mixed-crop farms and traditional rice farms. Whether their images differ according to sex and whether they took part in the project or not is examined, too.

6-9-4-2 Survey method

(i) Summary of the survey method
First of all, a preliminary experiment is conducted to obtain factor axes which can obtain from adjectives. Then the representative scales composing the factor axes are used to conduct the main experiment. The adjectives, which have antonym, frequently mentioned by the respondents for the interview survey on the residents' opinions on sawah, were used as the factor axes. Survey was conducted in January 2000. What is important here is to take care not to miss the adjectives likely to be used to describe the target land-use and to choose the opposites of such adjectives (Architectural Institute of Japan, 1987). Figure 3 shows the flow of SD method.

(ii) Evaluation scales
The evaluation scales were designed as shown in Figure 6-4. The factor axes used are the following seven: beautiful (ugly), impression of newness (old-fashioned impression), impression of richness (impression of poorness), wet (dry), machine power (human power), intensive (extensive) and simple systems (difficult systems). As noted above, these adjectives were selected from among the words the respondents used frequently in the questionnaire survey.

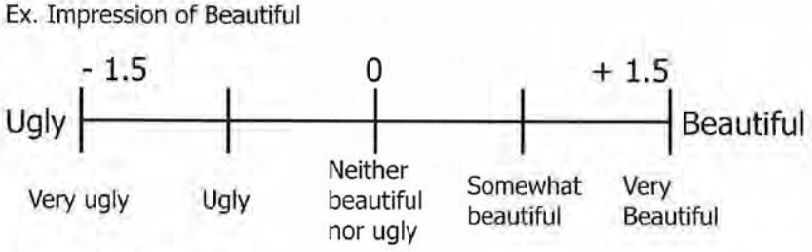

Fig. 6-4. Evaluation scale

(iii) Target land-use
The target land-use are sawah, traditional rice farms, mixed-crop farms and cacao farms.

(iv)Method of measurement
For each of the target land-use and evaluation scales, average values are calculated and the data of all the respondents are plotted on the graphs of each evaluation scale.

(v) Respondents
The respondents are the 48 men and women living in Biemso, of whom eight are those who took part in the sawah project (hereinafter referred to as the "sawah members"). Of the respondents, 80% are those with experience in rice growing and 70%, those having experience in cacao cultivation (including day laborers). The sex ratio is 1:1.

(vi) Evaluation experiment
In the SD method, the respondents are usually given the chance to experience the target land-use and are asked to evaluate the land-use either at the same time as or just after the experience (Architectural Institute of Japan, 1987). Therefore, only those who had already seen sawah were selected.

6-9-4-3. Result and discussion

(i) Impression of beautiful

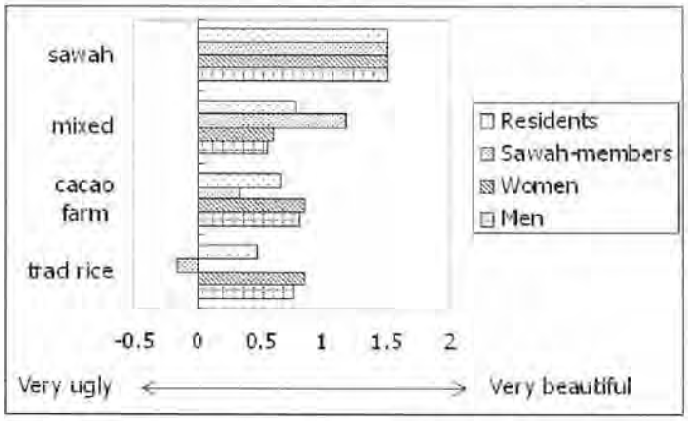

Fig. 6-5. Impression of Beautifulness

The respondents' opinions on mixed-crop farms, cacao farms, traditional rice farms and sawah were analyzed. As seen from Figure 6-5, all the respondents say sawah is more beautiful than any other types of farm. There are no significant differences in opinions between men and women. There is the big difference between sawah members and residents. According to the answers of residents, sawah is the most beautiful, followed by cacao farms, traditional rice farms and mixed-crop farms while sawah members says that followed by mixed-crop farms, cacao farms and traditional rice farms. The sawah members considers traditional rice farms to be "not beautiful" or "somewhat ugly," which suggests that this group lays a greater stress on the factor "beautiful" than the other farmers.

(ii) Impression of newness

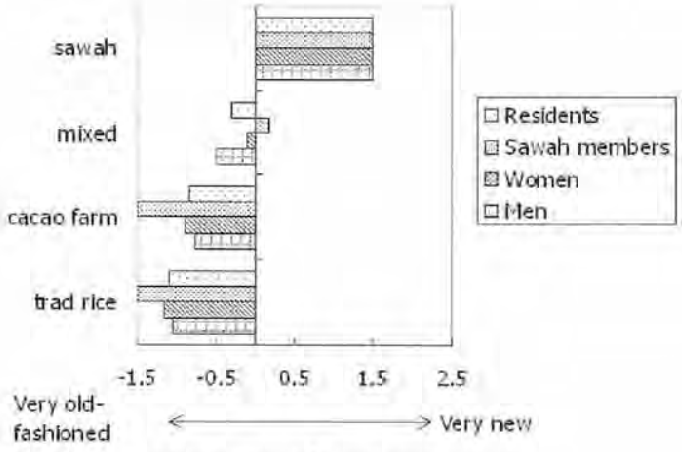

Fig. 6-6. Impression of newness

As evident from Figure 6-6, the respondents have impressions of newness about sawah but feel that all the others are old-fashioned. Residents (non-sawah members) regard traditional rice farms the most old-fashioned, followed by cocoa farms and mixed-crop farms while sawah members have the image of rice farm as the most old fashioned as well as cacao farms. Sawah members slightly regard mixed-crop farm as "somewhat new". Attention should be paid to the wide gaps between the sawah members' image of sawah and that of the two other types of farm, cacao and rice farm.

(iii) Impression of richness

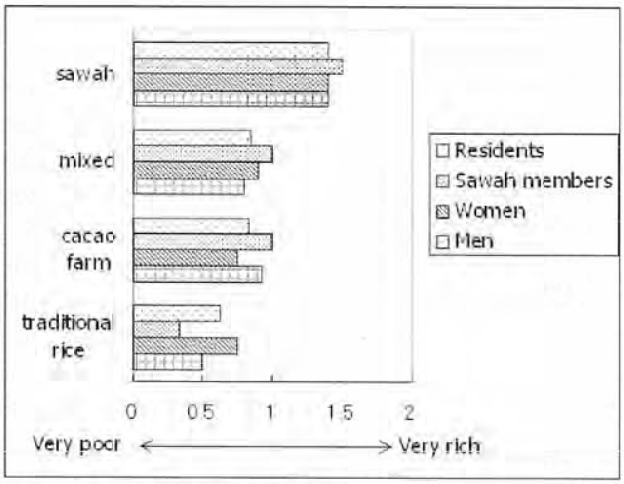

Fig. 6-7. Impression of richness

The respondents have the impression that all of the four types of farm are more or less rich and do not consider that any of them are poor. They have the image of sawah as the richest, followed by mixed-crop farms, cocoa farms and traditional rice farms. Here again, the sawah members evaluates sawah as far richer than the other types of farms and the gaps in its impression are very wide between sawah and all the others.

(iv) Impression of wetness

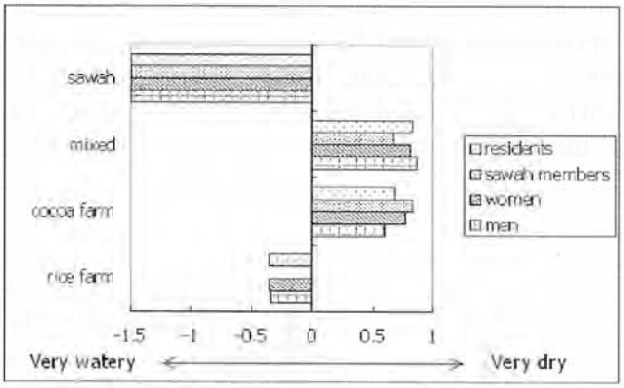

Fig. 6-8. Impression of wetness

Sawah gives the respondents an image of being much more wet (watery) than traditional rice farms. By contrast, mixed-crop farms and cocoa farms give them an image of being dry. The sawah members feels that compared with much watery sawah, traditional rice farms are neither wet nor dry, which somewhat differs from the impressions of the other respondents who do not know sawah very well.

(v) Impression of machine power

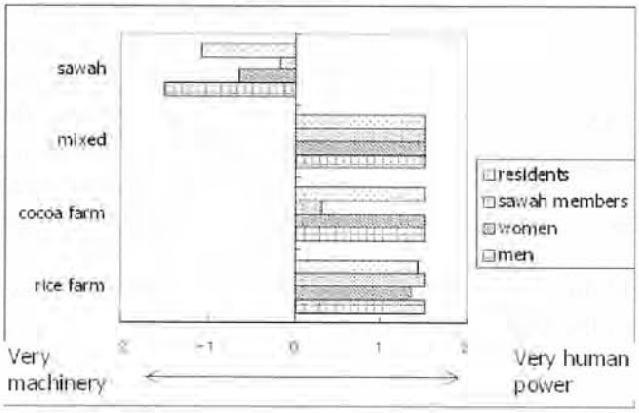

Fig. 6-9. Impression of machine power

All the respondents have the impression that sawah uses "machine power" and the others, more "human power" in order of mixed-crop farms, traditional rice farms and cacao farms. As for sawah, men are more impressed by machine power than women. But the sawah members does not so much have an image of sawah as a machine power-using system; it tends to consider that sawah development needs human power as much as machines.

(vi) Impression of simple systems (easiness)

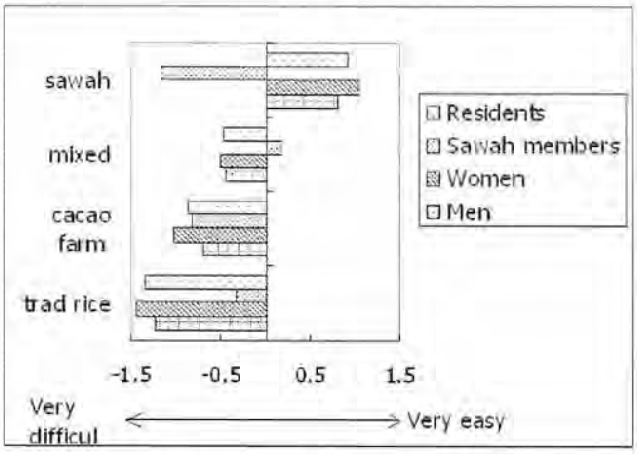

Fig. 6-10. Impression of easiness

The respondents who did not take part in the project think that work in sawah is simpler(easier) than other types of farm work. By contrast, the sawah members considers that compared with the management of sawah, that of cocoa farms and traditional rice farms is not so difficult and that of mixed-crop farms is simple.

On average, the respondents regard work in sawah as the simplest and think that workload is the heaviest in traditional rice farms, followed by cocoa farms and mixed-crop farms. It is noteworthy that the answers of the sawah members differ greatly from those of the other respondents.

(vii) Impression of intensiveness

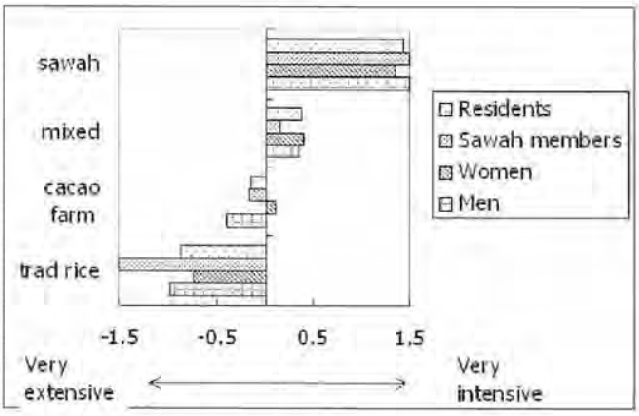

Fig. 6-11. Impression of intensiveness

According to the answers of all the respondents, sawah is the most intensive, mixed-crop farms, somewhat intensive and cocoa farms and traditional rice farms, extensive. Only women says that cocoa farm is somewhat intensive. The sawah member's image of traditional rice farms is greatly different from the other

Finally, the survey data were summarized by putting the images considered positive on the lower half of the graph (section for plus factors). In Figure 6-12, the higher the point showing a space is, the more favorable image the respondents have of the space. But two factor axes, which are machine/human power and water/ dry, have been excluded since it was difficult to judge which one would be more positive/ negative idea.

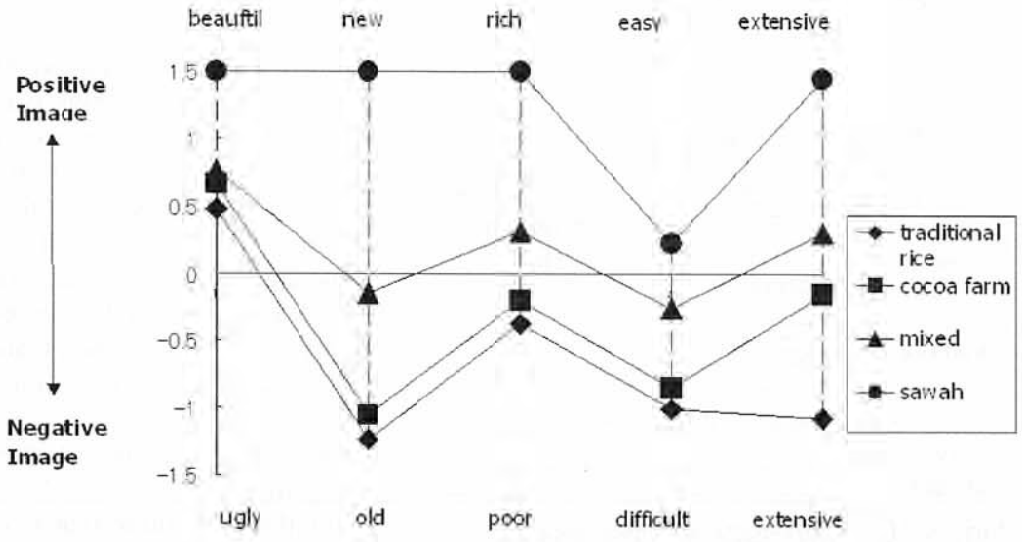

Fig. 6-12. Respondents' overall images of four types of farm

From this chart, it may be concluded that the respondents have the best image of sawah, followed by mixed-crop farms, cocoa farms and traditional rice farms. Their impression of sawah is much better than that of the other types of farm. The main reason that traditional rice farms are given the lowest evaluation is probably that the respondents directly compared them with sawah.

The survey results show that in general, the farmers in the villages have a more favorable impression of sawah than of the other types of farms. While it will become possible to analyze the farmers' awareness more in detail by increasing factor axes and evaluation scales, it will be necessary to get across various barriers (differences in national sentiments, in languages, etc.) and devise better methods in advance. Also needed will be to combine the language method like the one used here and the illustrative technique described in the next section and to examine the attitude of residents from many sides.

6-9-5 Structure of residents' recognition of different land-use in Biemso No.1

6-9-5-1 Purpose and survey method

To examine how people recognize land-use or spatial elements and to know the mechanism of their perception and recognition of land-use, study on the process of their understanding of land-use is an effective method for approaching the problem of how they consider the position of sawah in the entire spatial structure from a psychological side.

There are roughly two methods for taking out the psychological space of individuals. In the "language method", we try to get information about the subjects' internal image by interviewing people. In the "illustrative method", we try to obtain information about their image by using some materials and illustrating the image on a piece of paper. In this section, the latter technique was used.

The tools often used in the illustrative method--the method by which the subjects' images are illustrated--are Cognitive maps. If the subjects are asked to draw an image map, they will illustrate, concretely and visually, the structure of the landscape they draw in their mind based on daily behaviors and experiences. Thus such an image map is very effective and interesting (Architectural Institute of Japan, 1987). More specifically, the subjects are asked to draw the spatial elements they know on a sheet of paper.

The investigator specifies the scope of the areas to be drawn. The present investigation aimed at seeing whether sawah, new spatial elements, are recognized by residents as special land-use, or as just a type of farm, having no effect on their understanding of land-use. Because of this, residential areas and farm, the areas of their daily activities, were specified for the investigation. In specifying the scope of illustration, the investigator did not mention any specific places or farm, such as sawah and cocoa farms and left the selection of the areas drawn totally to the subjects. Plane charts were used as the method of illustration and the subjects were shown sample drawings in advance to help understand the method. The mention ratios of component elements, such as roads and houses, were calculated to know the subjects' awareness of land-use. Finally, their recognition of spatial structures was summarized.

6-9-5-2 Subjects

The subjects of the investigation are the 18 men and women in Biemso, their age ranging from 14 to 40. Four of them are the members of the sawah members. The locations of their houses are shown in Figure 6-13 (those painted out with black).

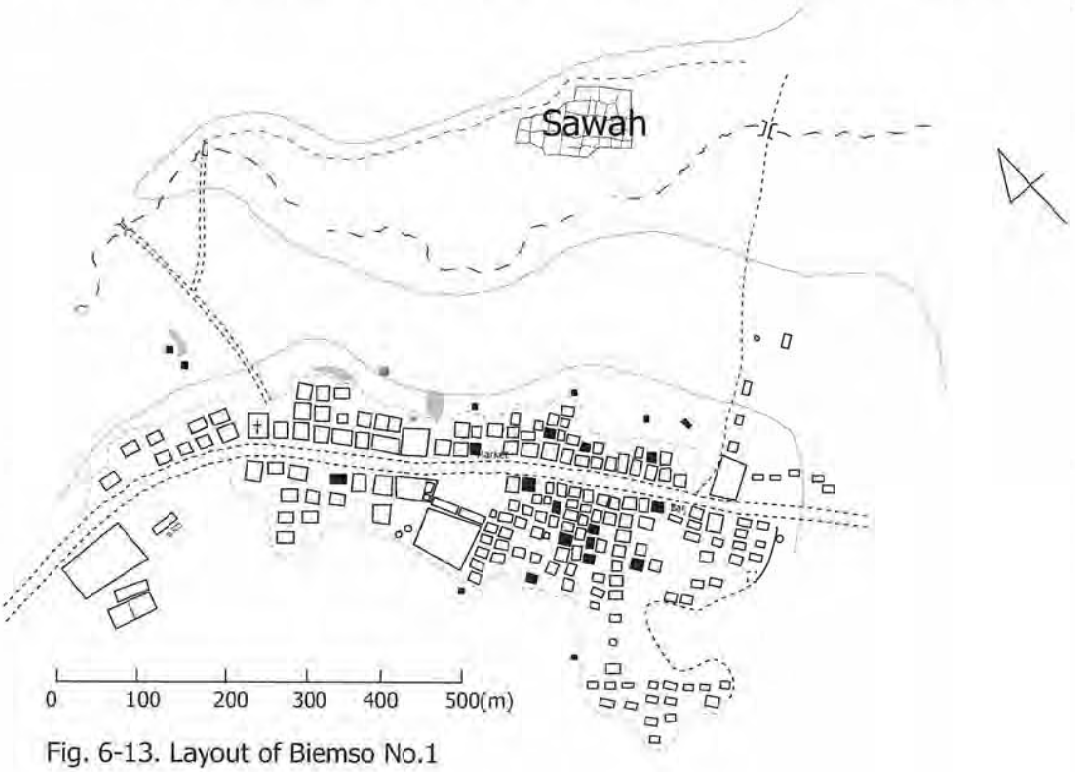

Fig. 6-13. Layout of Biemso No.1

6-9-5-3 Result and discussion

The component elements were selected from the free drawings of the subjects (An example is shown in Figure 6-14) and their mention ratios were calculated. The mention ratios, rate of which different element are mentioned, are shown in Table 6-30. The different locations of farmland were mentioned but they are totaled in the table. The data were divided into those of the sawah members and those of the other subjects and mention ratios were plotted on the maps, firstly classified 2 elements, i.e. point elements such as church, school, and market, and linear elements such as roads. Each elements are again classified by the mention ratios, those 1-25%, 25-50%, 50-75% and 75-100% (Table 6-30 and Fig.6-15). Moreover, it forms group into three: those frequently mentioned, those mentioned infrequently and those not mentioned. These three categories are here named recognized areas, latent areas and unrecognized areas (Fig.6-15a,b,c).

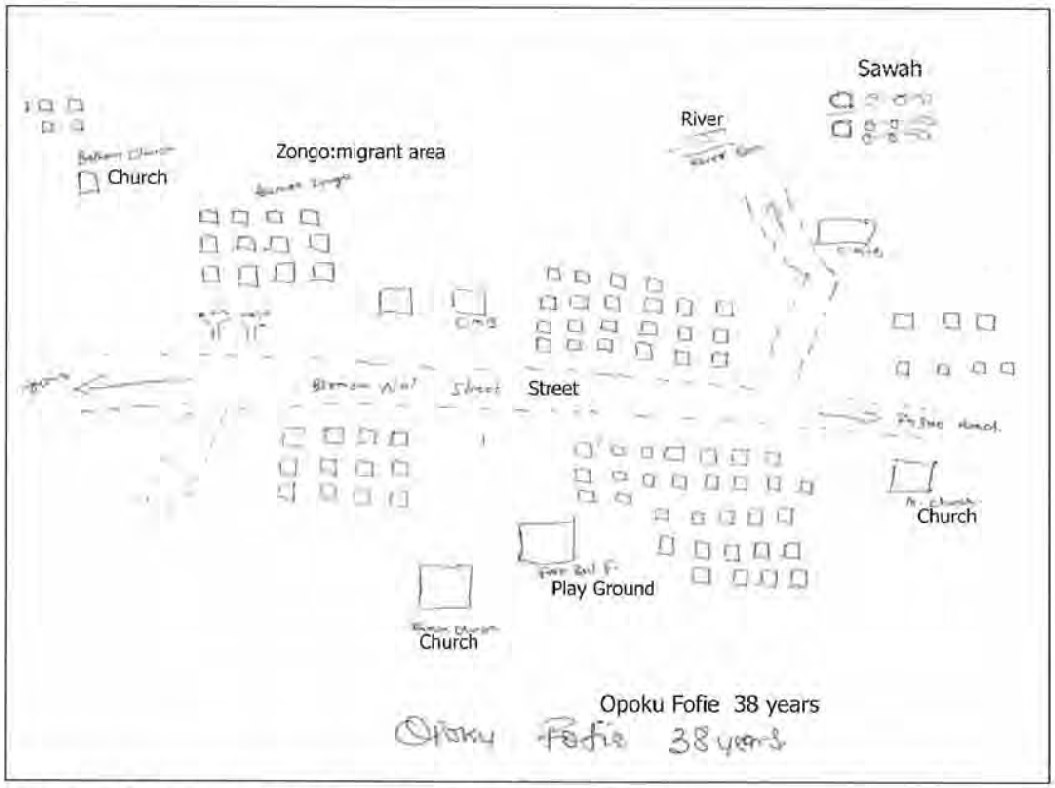

Fig. 6-14 Examine of the free drawing of the residents

According to this criterion, the recognized areas of the subjects other than the sawah members are within roughly 500m from their houses, while those of the sawah members extends to sawah and the irrigation dikes and then to a country road to the town. The mention ratios of sawah is 37% for the residents and 100% for the sawah members. For the residents, the cocoa board (cocobod) building leads others (mention ratio: 100%), followed by the church, the market and the water pumps (89%), and sawah rank 15th with a mention ratio of 37%. For sawah members, sawah and cocoa board building leads others (mention ratio: 100%), followed by school, church and market. The cocobod building is located just in front of the bus stop and is conspicuous. In case of the sawah members, the cocobod building and sawah have the highest mention ratios, accompanied by the schools, the churches and the market. The members of the sawah members draw sawah and their surrounding areas more frequently, suggesting that sawah is much closer to their life.

From the foregoing, it is found that while the cocobod building, the market and the church are the community land-use affecting the residents more, sawah have an impact equivalent to or stronger than these on the members of the sawah members. But the mention ratio of sawah is fairly high among the residents, too, which shows strong effects of sawah on the space recognition of the subjects.

The areas of daily activities are those within 500m of the subjects' houses and extend to their farms (or sawah). Sawah gives a very strong impression on the residents and are recognized as special land-use. It was also found that sawah is being established as a spatial component element or a new scenery component element in the subconscious awareness of the subjects and that they have a greater effect on the space recognition of those involved in the sawah project.

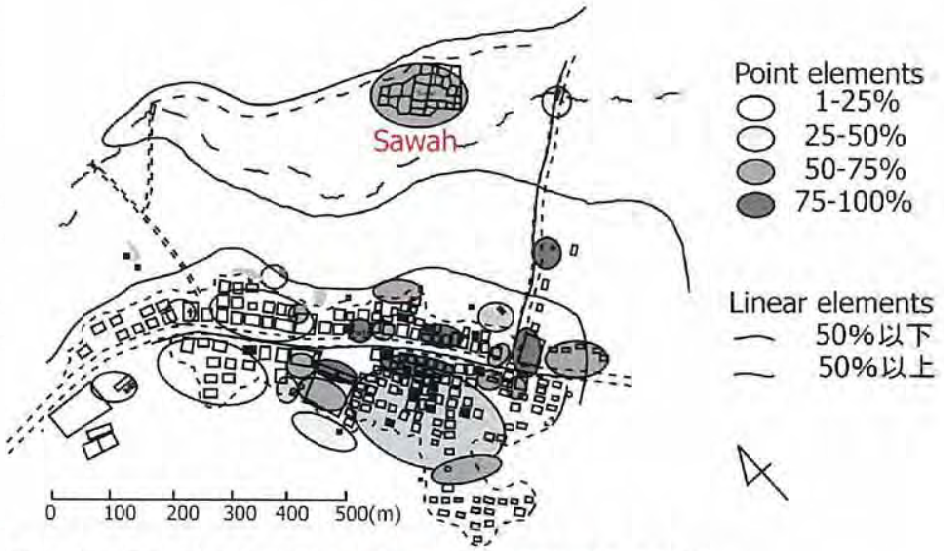

Fig. 6-15a. Point elements and linear elements

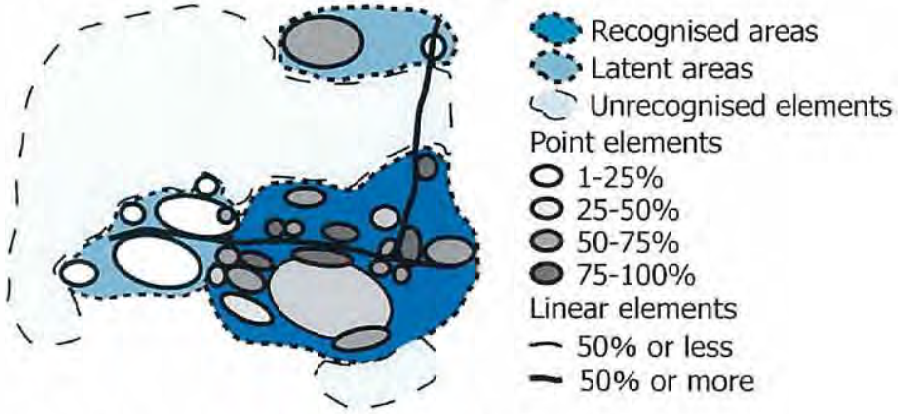

Fig. 6-15b. Mention rations and living areas

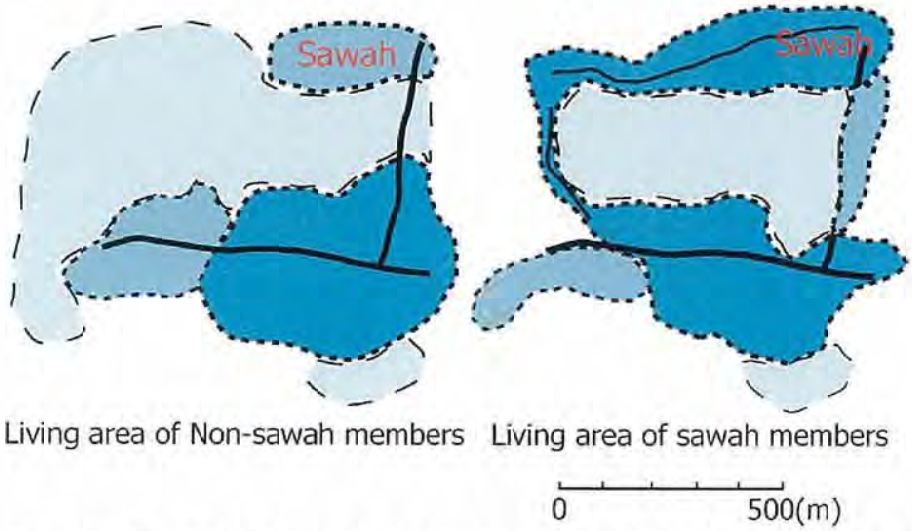

Fig. 6-15c. Living areas of sawah member and non-sawah member

Table.6-30 The spatial elements and mention ratios

Component elements	Mention ratio(%)	
	Sawah members	Residents
Road	100	100
Cocoa board building	100	100
church B	75	89
Market	75	89
Water pump A	25	89
Own farm	50	67
Shop	25	67
school B	80	56
Water pump B	50	56
Water pump C	50	56
House, next to the Cocobod	50	56
church C	50	56
Palace	50	56
Play ground B	50	56
sawah	100	37
Bar A	25	56
Bar B	25	56
Bridge	50	33
Zongo	50	33
River	50	33
Trees in front of Zongo	25	33
Houses on the other side of the bridge	25	33
Houses facing Zongo	50	11
Playground	25	11
Upland in front of sawah	50	0
canal	50	0
Bamboo groves	50	0
Dike	50	0
Country road from the dyke to town	0	0

6-9-6 How do the sawah members evaluate sawah development?: future of sawah and a tentative proposal for sawah development

6-9-6-1 Purpose and method

This subsection summarizes the survey of the participating farmers from Biemso No.1 and Adugyama on the tentative proposal for the development of sawah at valley bottom by the Biemso No.1 method (Foot note 2). This method is describing as "Eco-technology approach" in this report. By investigating the sawah members' views of the proposal, it attempts to get a grasp of the ideas of the members about sawah. For all of the participants in the project from Biemso No.1 and Adugyama (hereinafter referred to as the "sawah members"), the following sessions were held: 1. Explanation of the tentative proposal; 2. Report of the situations of sawah in Biemso No.1; 3. Questions from the sawah members; 4. Interviews using a questionnaire; and 5. Discussion.

6-9-6-2 Result and discussion

The discussion with the respondents can be summarized as follows:

"The tentative proposal is a very attractive one especially to us, the members of the sawah group. In fact, those interested in sawah are rapidly increasing not only in Biemso No.1 but also in nearby areas. Everybody who has experienced upland rice growing can see that sawah are better than the traditional cultivation system of upland rice. Another attraction of the proposal is the loan provided to purchase power tillers, water pumps and other machines. Though we have to pay it back, it is very attractive because we will be able to own these machines in the future when we finish repayment. In addition, the proposal will realize what has never been possible and allow us to change our lifestyle from a nearly self-sufficiency one into one in which we will get something from the outside. In these respects, too, the proposal is a very interesting one.

However, we have taken part in the sawah development project and consider that it will be impossible for us to construct dikes and canals and open up 1.5ha of sawah in the first year without wages. We worked so hard but were unable to develop even 1.5ha of sawah, and other people would be unable to achieve the goal at all. Another problem would arise if our power tillers break down. If they become out of order in the first year, we will be unable to continue the project. Moreover, what will happen if our crops fail even in one year during the eight-year repayment period? We are satisfied with the profit planned but we will not be able to agree on the proposal entirely considering the hard labor required. We have been able to continue working for the project because we have had financial aid from the Japanese staff and it would not be too much to say that it was impossible without the assistance.

Table 6-31. Answers to the questions (%)

	Question	B1 *1	Ad *2	Av *3	Np *4
1	Do you think people in Biemso No.1 and other areas are interested in this tentative proposal?	83	82	83	87
2	If you had not been a member of the sawah group, do you think you would have participated in this proposal?	80	63	72	93
3	Do you think the number of the group's members is appropriate?	91	27	59	37
4	Have you ever got a loan?	0	0	0	9
5	Do you agree about obtaining the proposed loan?	100	55	76	96
6	Do you think the amount of the proposed loan is appropriate?	66	45	56	-
7	Do you think you can continue to work for the project without any wages and allowance for food expenses?	0	27	14	90
8	Will it be possible to reclaim 1.5ha of sawah in the first year?	25	45	35	86
9	Do you think the five-year target of 5ha of sawah is appropriate?	50	100	75	70
10	10 Do you agree about repaying the loan in eight years?	16	55	36	94
11	In the tentative proposal, the target output is 3.5 tons/ha for the first five years and 4.5 tons/ha for subsequent years. Do you think it possible to increase the output in the sixth year and after as planned?	58	64	61	70
12	Are you satisfied with the proposed profit?	100	100	100	90
13	Are the labor required for the project and the profit earned from it well balanced with each other?	16	75	46	80
14	Do you think the tentative proposal estimates the profit accurately ?	42	36	39	-
15	If you had not been a member of the sawah group, do you think you would have participated in this proposal?	0.8	45	23	93

*[1]Sawah members from Biemso No.1 No.1, *[2]Sawah members from Adugyama, *[3]Average, *[4]Non-participants (The data for non-participants are cited from Inkoom 2000.)

The proposal we can offer is to reduce the area of sawah to be reclaimed in the first year and to pay us wages, at least allowance for food expenses. But we would like the Japanese side to remember that sawah development is a very interesting proposal to us."

Advantages:

* Granting of loans and other investment from the outside are attractive.
* It is possible to learn sawah techniques.
* Cash income and employment opportunities are attractive.
* The proposal will become the first step to the solution of poverty problems.

Problems:

* Measures to be taken when power tillers break down; maintenance of power tillers.

* Decrease in income due to falls in rice price.
* Guarantees in the case where rice cannot be sold and a crop failure occurs.
* Measures for repayment of loans in the event of a crop failure.
* Wages and allowance for food expenses for the first year.
* Worries about the labor need for harvesting in the fourth year and after.
* Will those having no experience in sawah be possible to carry out the project only with technical guidance?

The tendency of answers of the three groups of sawah members sometimes differed greatly from each other and this is probably because of differences in the composition of the groups and the background of farmers. In particular, many members of the Adugyama group who were in the third year of the project expressed a desire to take part in the tentative draft proposal despite the strict conditions, such as repayment of loans and no wages. This attitude was not observed among the members of the Biemso No.1 group who were only in the first year of the project and may reflect the attachment to sawah of the farmers in Adugyama who continued to work for the project for three years.

The same question (2 and 15) was given to the respondents twice: just after they got an explanation of the tentative proposal by the Biemso No.1 method and at the end. Great differences arose between the first and second time in the ratios of affirmative answers, and there is the tendency that as the respondents answer other questions one after another, their views of the proposal become gradually negative. Though this may partly be the result of the psychological action on the respondents that produced by the way of asking of the questioner, its main reason may be came from method of interviews. If we showed the proposal and the questions advance, they might have time to think the proposal more theoretically and concretely and to take account of their experience more. Because of this, their answers at the second time will be more reliable ones. As evident from Table 6-31, non-participants tend to take a more optimistic view of sawah than sawah members. If we are to propagate the concept of sawah further in the future, we will have to spend time and have residents understand it more.

6-9-6 Conclusion

The residents in Biemso No.1 and Adugyama are well aware of the sawah development project and have a favorable image of sawah. While they recognize sawah as profitable and intensive and have impressions that they are more beautiful, newer, wetter and more intensive than other types of farmland (cacao farms, mixed-crop fields and upland rice farms). The degree of interest is affected more by experience in rice growing than by sex and birthplace and the knowledge and awareness of sawah increase as more years have passed since the start of sawah development. But established knowledge of sawah does not directly leads to people's desire to take part in the project; rather, their interest in sawah is promoting the establishment of the knowledge. In general, non-participating residents tend to look on the bright side of sawah and some of them may jump at just the name of sawah development and run away soon after, finding that they have to do unexpected work and that the conditions are very strict. To avoid such a situation, there will be the need to give them opportunities to listen to the opinions of those with experience in sawah and to have them understand the proposal better.

Sawah members also have a good image of sawah and evaluate their scenery and appearance better than non-participants. They believe sawah are more beautiful and intensive than other types of farmland and have some kind of pride in their sawah. While they understand the advantages and disadvantages of sawah concretely, they conclude that sawah are a good system and want to continue to use them for rice production.

Sawah, which are a newly added scenic element, leave very strong impressions on residents and are regarded by them as special spaces. This tendency is stronger among sawah members than non-participating people. Sawah are being established in the subconscious of residents as a new scenic element.

Finally, it should be emphasized that these surveys aim at examining residents' opinions about sawah and the effects the fields have had on people and do not attempt to study their evaluation and judgment of the fields. This is because at the present stage where no concrete figures are available for a comprehensive evaluation of sawah in the socioeconomic, crop scientific and other related fields, it is impossible to ask residents to evaluate. One of the future tasks is to examine the reasons that sawah members continue (or discontinue) their participation, referring to the data obtained by the present surveys. This is an important problem in exploring the possibility of sawah development in Africa in the future and we would like to lay emphasis on this major theme.

Footnotes:

(1) The interview survey on the opinions about sawah for a total of 220 residents in the two villages in the project site (Biemso No.1 No.1, Adugyama).

(2) Tentative proposal for the development of sawah at valley bottoms by the Biemso No.1 method (This proposal was at the March of 1999. A shown in page 9 the propsal on the end of August 2001 has slight modifications). In this report the Biemso No.1 method was described as "Eco-technology approach".

1. Some groups, each composed of about 11 farmers positive about sawah development, are organized.
2. A loan of $5,000 ($2,000 for a small power tiller; $1,000 for two small water pumps; $500 for farm machines; $500 for dike constriction materials; $1,000 for operating costs (fertilizers, gasoline, spare parts, agricultural chemicals, etc.)) is granted to each group.
3. The group constructs a dike and canal and develops sawah without pay. The technical cooperation group offers technical advice only, and the local counterparts from the Ghanaian government design the dike, canal and sawah.
4. The target is to develop 5ha of sawah in five years. The loan is paid back by a progressively increasing method during the first four years. In the first and second years, 1/40 of the principal, in the third year, 1/20 and in the fourth year, 1/10 will be repaid. In the fifth to eighth year, 1/5 of the principal will be paid back. The interest for eight years is 40% of the principal or $2,000, which is repaid in the same method. The amount to be paid is $175 in the first and second year, $350 in the third year, $700 in the fourth year and $1,400 in the fifth to eighth year.
5. The target of sawah developed is 1.5ha in the first year, 3hs in the second year, 4ha in the third year and 5ha in the fifth year.

6. First year: Supposing the yield of rice to be 3.5 tons/ha, sales from 1ha will be about $950 and the total sales, $1,425. If the sales of off-season crops, such as tomato, okro and cowpea, are conservatively estimated at about 20% of those of rice, the combined sales from sawah will be $1,853.
7. The sales in the second year will be $3,700; of this, $600 will be reserved as operating expenses.
8. The sales in the third year will be $4,930; of this, $800 will be reserved as operating expenses.
9. The sales in the fourth year will be $6,160; of this, $1,000 will be reserved as operating expenses.
10. In the fifth year and after, if the yield of rice is increased to about 4.5 tons/ha and the output of vegetables is raised similarly, the sales will be 47,920. The net profit will be 47,920-$1,400-$1,000=$5,520. Annual income per member will be about $500.
11. If this method is continued in the sixth year and after and each group develops two to four sawah, about 10-20ha and about 1.2ha per household, it will be possible to raise income from sawah only to over $1,000 a year. The present yearly income is about $250.
12. During the project period, plots of multipurpose tree species and other useful trees are enlarged. Fishponds are constructed and tilapia, catfish, etc. are cultured there.
13. This technical cooperation will be carried out through JICA for the time being. As movements for sawah development expand in Africa, the project will be transferred to the association of national agricultural cooperative, state farmers' organizations, NGOs and other volunteer groups, etc.

6-10 Current Situation of Participated Sawah group farmers: One year after project terminated

This section described the current situation of sawah group rice farmers participated at 5 sites in project area. The data was collected by informal and formal survey during the period between 3rd and 15th August, 2001.

6-10-1 Adugyama Club

6-10-1-1 About members

After the harvest in 2000, 5 people resigned. Current number of Adugyama Club C is therefore 5, of which all are male. Table 6-32 shows the data on the members.

6-10-1-2 Incomes in 2000

In 2000, total paddy production from 3 sites was 3800kg (65tins[1]), of which 5 tins of milled rice (about 290kg) was for self-consumption. The rest, which is 3800kg of paddy rice, was sold during the period between December and January. The sale was 6 million cedis (US$857) of which 1.8 million was deducted as the repayment of running cost in 2000[2]. The remaining 4.2 million cedis were divided into 10 equally, and therefore the

[1] The tin varies in size depending on the place.
[2] In 2000, 1.8 million cedis were in debt for the running cost. Mr. Tawiah borrowed

income per person was 420,000 cedis, which is equivalent to US$60. This even distribution sometimes discourages the members. Most of members (except the leader) insist that the profit should be distributed by the manual evaluation on the contribution to sawah activities just like what Biemso No.1 group did. This amount may not be sufficient for them, but the total income from sawah was not low since they were able to use sawah site effectively during dry season. According to the members, total sales from the vegetables were higher than that from sawah rice[3]. Most popular crops during dry season were okra, followed by garden eggs, tomatoes, pepper and cabbages.

6-10-1-3 Situation

Nicholas and Fish pond site was transplanted by the end of July. Presently, they work at their own farms and do not do any sawah activities. The rest of the site, Gold Valley (0.29 ha) is not yet developed due to financial problem and therefore the group is strongly requesting the loan of 1 million from the projects. They have no plan for development of Gold Valley site if they failed to obtain the loan.

6-10-1-4 Land tenure

Nicholas site belongs to one of Nicholas's family. Mr. Tawiah's family own the Fish pond and Mr. Nana Owusu' s possesses Gold Valley. Therefore, the problem of land tenure may not occur as long as they continue to use the land. Nicholas, Tawiah, and Nana gave some of the rice after the harvest to their families to express their gratitude.

6-10-1-5 Management

There are two power tillers in Adugyama site, which are well maintained. The leader of the group, Mr. Tawiah is in charge of the maintenance since he has some connection to the parts of agricultural machine. The operators of the power tiller are Nicholas and Afrie, and therefore have no problems with operation and maintenance.

The group is well organised due to the existence of the strong leader. Also, another reason is that the members composed of only 3 families. Gyanfi is a nephew to Nana, and Tawiah is a brother to Afriyie.

6-10-1-6 Withdrawal

As shown in Table 6-33, five people resigned. Amongst them, 2 are due to health problem, and the other 3 people are unsatisfied with the profit and complain of the members being less seriously. Another reason is delay of the rains. They have started concentrating on their own farm by the time they were told to start sawah activities. Those 3 desire to develop sawah at a new site next year. And those who are ill are willing to come back to the group as before.

6-10-1-7 Problems and constraints

---

from one of his family members.

[3] According to some members, the profit ranged from 700,000 cedis to 1 million. But the precise data were not available.

The sawah has financial problems for effective sawah activity. This may be due to the decrease in number of farmers who contribute money for sawah activity. In 2001, 500,000 cedis were collected from 5 people but this was not sufficient to develop all three sites. So far, to develop two sites, 458,000 cedis were used of which, 150,000 cedis was used for fuel and engine oil and 308,000 cedis was used for labour and food.

6-10-2 Biemso No.1 Old Site: The first Sawah group

6-10-2-1 About members

The number of sawah farmers of Biemso old site is 7, of which one is a female. These new members have just joined. Amongst the members, only three people have been taking part in the sawah development since in 1999. At that time, they were 12 in number. Two of the former members joined the new site group in 2001. Three of the original members who are female stopped due to discriminatory treatment from male (especially uneven distribution of the profit). Thus, the members are not stable. Currently, the relation among the members is satisfactory. Table 6-34 shows the detail information of the members.

6-10-2-2 Incomes and Situation

Total paddy production was 6100kg, of which 250kg was given to the landlord, 130kg, for consumption by farmers, and the rest 5,720kg were sold. Total sales were 14 million cedis (US$2057). Total sales per ha 3,389kg is US$1,220. Income per person varies in the manual evaluation on the contribution to sawah activities, ranging from 1.4 million to 880,000 cedis (for more information, see the previous report on 24th March, 2001). The income from sawah, which was more than 1 million, encouraged the members and has become the talk of the village.

1.8 ha of the area was cultivated in 2001 (1.2 ha for the first year and 0.6 ha for the second year). By 23 August, about two-third of the total area of the site has been transplanted. By 1 September rice has transplanted in the whole sawah developed. Although the group has no idea of expansion due to the delay of the rains and the failure of the machine, since local extention office offered special loan for the renewal of power tiller, the group wants to expand about 0.5ha by the end of September. Because of weir and canal system, Sawah in Biemso No. 1 sustains rice to harvest by January.

6-10-2-3 Land tenure

The old site of Biemso No.1 is owned by two landlords. One of them is uncle to the leader, Mr. Osei, and another is family of former members, Mr. Atta Poku. The group leader rented the land to the group and signed a six years lease agreement. The terms of payment is a yearly rent in the form of rice produced (3.5 tin to Mr.Osei's family site, 7 tin to Mr. Atta family site) on the land.

6-10-2-4 Management

Machines such as power tillers and water pumps are partly under project control due to the lack of machines. During May to August, because of the failure of power tiller in Biemso No.1, one million cedis were used for repairing and it was sought from the

project. This amount is considerable sum and it is impossible to be sought from the group if the machine was under farmers' control. It is therefore necessary to consider the problem of maintenance.

Dyke and canal were also repaired and that fund was provided by the project because those facilities are utilised by the new group also at the new site, which is currently under constructed in 2001[4]. During May to July, 100 sand bags were provided to repair the dyke. Thus, the self-reliance of management has not yet been established due to external factor. But water control, fertiliser, food and fuel expenses have been managed. By the beginning of August 2001, 950,000 cedis were spent for running cost, of which 172,000 cedis were used for food expenses and 220,000 cedis were spent as fuel expenses (Figure 6-16).

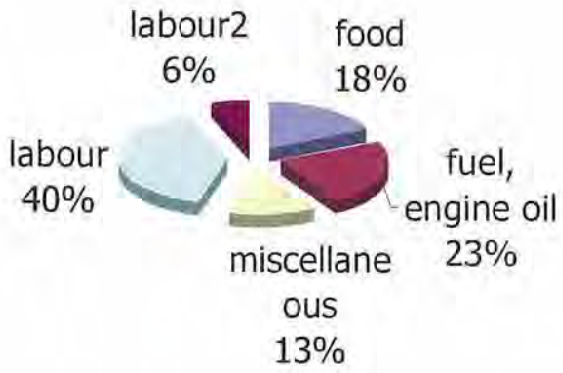

Figure 6-16 Distribution of expenses in Biemso No.1

* "Labour" includes expenses for transplanting, weeding, other necessary work for sawah development, and food expenses for labourer. "Labour 2" is expense for hiring operators of power tiller, including food expenses.

6-10-2-5 Withdrawal

After the harvest in 2000, four farmers resigned. Table 6-35 shows their name and the reason. According to the table, nobody complained about sawah activity itself. Those who were forced to resign realised themselves that they were not hard working and therefore not suitable for being sawah members. Nevertheless, they were satisfied with the profit, which were unevenly distributed.

6-10-2-6 Problems and constraints

As mentioned earlier, the progress of sawah activities were delayed due to the delay of rains and a failure of power tiller. The failure of power tiller is serious problem, which is not yet solved.

[4] All expenditure for the development for the first year is to be supported by the project.

The district assembly under Village Infrastructure Project is offering Biemso No.1 old site group a facility on credit to purchase a power tiller with accessories, such as water pump. The group is to deposit 3 million with payment of the rest within 3 years. All the members are very interested in it and requesting to lend them 3 million deposits.

Water right is also one of the problems. There was conflict between old and new sites. This followed the refusal of new group to join old group to repair the dike on July 2001 despite new site group earlier promise to join the activity. The old site members got angry with new site group because they failed to join, and closed the gate of canal to stop water. The relation between old and new sites had been strained until new site group apologised.

6-10-3 Biemso No.1 New Site

In 2001, sawah development trials were established just beside Biemso No.1 old site. Nine farmers including one female constitute the group for this site. An area of approximately 1.2 ha of sawah as well as 110 m of canal was constructed. It is a good result of "competition" with Biemso old site.

6-10-3-1 About members

The number of the member is 9, of which 2 were former members of Biemso No.1 old site group, who resigned in 2000. Table 6-36 shows the data of the members. Most of them are Ashantis and have experience in rice cultivation. The number of migrant people is inclined to increase.

6-10-3-2 Situation

Presently, by 10 September, approximately 1.5 ha of sawah was developed. About 85% of the area have been transplanted to rice by the beginning of September. Because of the first year, the running cost, such as food and fuel expenses was supported by the follow up team of sawah project.

6-10-3-3 Land tenure

The land at new site belongs to Mr. Osei's uncle. The agreement has not completed yet, due to the difficulty of negotiations. The group requests a six years lease agreement while landlord insists three years agreement. Finally 6 years of the first contract was signed between landlord and the group. So far, the terms of payment is a yearly rent in the form of rice produced (7 tins) on the land.

6-10-3-4 Management

The fund of all kind of expenditure has been provided by the project because it is the first year of the sawah development trial. Food expenses (1,500 cedis/ person/day) and other necessary tools such as shovel, head pans and boots were provided.

6-10-3-5 Problems

Due to the lack of and the failure of power tiller and the delay of the rains, there was little time to devote to train farmers in the power tiller operation. So far, the members

are well organised, under the leadership of Mr. Kwame Tawiah, a former member of the Biemso old site.

6-10-4 Biemso No.2 Site

6-10-4-1 Number of members

The number of Biemso No.2 group members is 3. Among the members, 2 of them have been the members since 2000. One of them was former secretary in 2000 last year and is now the leader in 2001. The former leader has resigned. Another, who is a brother to the one who joined in 2001, is the operator of the power tiller. Table 6-37 shows the personal data.

6-10-4-2 Incomes in 2001

The total sales of the rice in 2000 were 2,4 millions (sold 1 tin at 70,000 cedis, in November, 2000) which is estimated at 34 tins. (No exact data for total rice production, approximately 1,630 kg[5]) The profit was distributed equally, and income per person is 300,000 cedis. The total selling per was 4.1 million cedis, i.e., US$585 per ha.

6-10-4-3 Situation

On 26th of July, transplanting was started. According to the leader, transplanting at each one plot is to be done within a day, i.e., 9 days is in need for transplanting since they have 9 plots, which were constructed in 2000. Presently, they plan to develop 3 more plots. Necessary running cost, such as fuel for power tiller and water pump and fertiliser, was supported by the project. Food expenses were borne by the group.

6-10-4-3 Management

The group is well organised due to its size. The relationship between them is like a "family" or "employer and employee", rather than "group -leader and others-". The leader supplies the food expenses. Other running cost such as fertiliser and fuel expenses is borne by the project. Maintenance and operation of machines are also well managed by the group. Unlike Biemso No1 old site, trained operator remains in the group, and presently, he trains a colleague. Even though majority of people resigned, the remaining sawah members believe its profitableness and sawah will give the good results. They also think that if it becomes successful, the number will increase next year.

6-10-4-4 Land tenure

The land belongs to the family of the leader, Mr Charles. It is therefore not necessary to pay the rent.

6-10-4-5 Withdrawal

After harvesting of the previous year (2000), 5 people resigned. The following Table

---

[5] In November 2000, 1 tin was 70,000 cedis by Biemso No.2 standard. Assuming 1 tin of Adugyama size is 58.46 kg, which was sold with 90,000 cedis.

3-38 shows their name and main reasons.

6-10-4-6 Problems

According to the leader, only problem is delay of the work. This is because power tiller was kept by CRI since January in 2000 and returned by August. If it came earlier, the leader said, the work would have been done more smoothly.

6-10-5 Biemso No 2 new group and Fedeyeya

6-10-5-1 Member

In 2001, a new sawah development trials were established at Fedeyeya. Eight farmers formed a group for this site as shown in Table 6-39. An area of approximately 0.5 ha of sawah was constructed. Most of the members are immigrant and have experience in rice cultivation. Main reason to join sawah group is to get support from the project (They call the project "company") and they are interested in new technology.

6-10-5-2 Situation

About 90% of the area has been transplanted to rice by the beginning of August. The place is located just beside the housing area, giving a beautiful view. Even though it was a first year, the group did not sacrifice time for their farm due to easy access to the sawah site.

6-10-5-3 Management

The fund of all kind of expenditure was provided by the project because it is the first year of the sawah development trial. Food expenses (1,500 cedis/ person/day) and other necessary tools such as shovel, head pans and boots were provided.

6-10-5-4 Land tenure
The land belongs to by Queen Mother of Biemso No.2. She has not agreed with lending the land to the project until she saw the "sawah" in Biemso No.2. The group leader rented the land on the behalf of the group and signed a three-year lease agreement. The terms of payment is a yearly rent in the form of rice produced (3 tins) on the land.

6-10-5-5 Problems
Lack of machines is a main problem. Because of this and the delay of the rain, they had no time to be trained for the operation and maintenance of the machine. Another problem is river water pollution (water getting muddy), caused by water pumping machine. The river that is used for sawah development is also used for domestic proposes. Therefore, some people in the village complain about it.

6-10-6 Discussions

6-10-6-1 Problems
Provision of power tiller is the biggest problem within the sawah groups. For this

moment, there are three available power tillers (so-called old and new[6] power tiller) at Adugyama, 1 at Biemso No.2. Since the power tiller that was used at Biemso No.1 was out of order, the groups at Biemso No.1 were struggling with obtaining the machine. In July, the project hired a power tiller from Kumasi, however, the condition of the machine was not satisfactory and it was returned without making enough progress. Presently, the old power tiller was released to Biemso No.1 new and old site. Other problems are negotiation with Adugyama and No.2 group for power tiller; Adugyama members insisted they couldn't release the machine without operator. Finally, they agreed to release it with an operator from the project (Mr. Kojo). Another problem is farmers had no opportunity to be trained for the operation and maintenance.

6-10-6-2 a future form of groups

Some sawah farmers began to realise that it is only first year that needs lots of labour. After the construction, even only one person/family could sustain more than one hectare of sawah with labour cost. They also realised that organising the groups was one of issues to be solved. The larger numbers they have, the more difficult to organise. It is therefore not important to form such a big group, and sawah would be developed by "family unit", not by a "group". At present, there are 3 types of group. 1. Family type, 2. Semi family type, and 3 Co-operative society-type. The first one goes for Biemso No.2, composed of small numbers. The second one goes for Adugyama, composed of few families although they are many in numbers. The third one applies to Biemso No.1 and Fedeyeta, composed of large numbers from different families. In the future, the first one, family unit type may be major form.

6-10-6-3 Incomes

It is only Biemso No.1 sawah members who were really happy about the profit. The gap of the profit between No.1 and other group are considerable. This is because of the size of sawah and good/poor marketing price. According to some sawah members at Adugyama, the vegetables during dry season are more profitable. But the concrete data were not available.

[6] The old power tiller was bought by project member just before JICA project officially started, and the new one was bought by JICA.

Table. 6-32 Personal data of Adugyama members

	Name	Age	Tribe	Sex	Family	Crops last year	Crops this year	Land ownership	Time of join
1	Tawiar Adu	-	Ashanti	M	single	maize, plantain, citron, yam, cocoyam	maize, plantain, citron, yam, cocoyam, peper, okra, garden eggs	Y	1999
2	Nana Owus	36	Ashanti	M	wife, son (3), mother, father, brother (2)	maize, cassava, cocoyam, plantain	okro, maize, plantain, cassava, cocoyam	Y	1997
3	Nicolas Donkor	46	Ashanti	M	wife, daughter (2), sister (1), brother (2)	plantain, cassava	plantain cassava, garden eggs, okro	Y	1997
4	Kwame Gyanfi	36	Ashanti	M	-	-	-	Y	1999
5	Kwabena Afrie	32	Ashanti	M	wife, daughter (1)	maize, cassava, plantain	okro, cavages, yam, maize, plantain, cocoyam	Y	1997

Table. 6-33 Reason for quitting (Adugyama)

	Name	Age	Tribe	Sex	Main reason
1	Kwasi Ntiamoa	45	Ashanti	M	Unhappy with the income. Wants to form another sawah group next yr.
2	Wireko Peter		Ashanti	M	Unhappy with the income. Wants to form another sawah group next yr.
3	Aboagye Dakos	32	Ashanti	M	Unhappy with the income. Wants to form another sawah group next yr.
4	Kwabena Agyei	77	Ashanti	M	Healthy problem. Wants to come back to the group next year.
5	Joseph Afreh	52	Ashanti	M	Healthy problem. Wants to come back to the group next year.

Table 6-34 Biemso1 Old Group

	Name	Age	Tribe	Sex	Family	Crops last year	Crops this year	Rice experience	Land ownership	Time of join
1	Osei Mensah	55	Ashanti	M	wife, son (4), daughter (3)	maize, cassava, yam, palm tree, cocoyam, plantain, cocoa	maize, cassava, yam, palm tree, cocoyam, plantain, cocoa	Y	Y	1999
2	Kwabena Larbi	29		M	father, mother, brother (2), sister (2)	cocoyam, cassava, plantain, maize, yam	maize, cocoyam, cassava	N	N	1999
3	Kwaneba Owusu	25	Ashanti	M	mother, sister (2), nephew (2)	No data	No data	Y	Y	1999
4	Kwasi Nkrma	21	Ashanti	M		No data	No data	Y	Y	2000
5	Fuseini Seidu	23	Moshi	M	mother, brother (6), sister (3)	maize	maize	Y	N	2001
6	Amankor Mathias	25	Ashanti	M	mother, brother (3), sister (3)	cassava, maize, plantain, cocoyam, yam, sweet potatoes	cassava, maize, cocoyam	Y	Y	2001
7	Abena Dwomo	24	Ashanti	F	mother, sister (2)	maize, cassava, plantain, cocoyam	maize, cassava, plantain	Y	N	

Table 6-35 Reason for quitting (Biemso1)

	Name	Age	Tribe	Sex	Main reason
1	Ata Poku Dickson	32	Ashanti	M	Forced to be resigned due to lack of seriousness. Less hard worker
2	Akosua Konadu	32	Ashanti	F	Bad relationship with members (especially with leader.) Complain with discrimination against women in division of profit.
3	Kofi Kyere	29	Ashanti	M	Forced to be resigned due to lack of seriousness. Less hard worker
4	Gabler Ado	32	Ashanti	M	Want to rest this year because got enough money from sawah. Satisfied with the profit.

Table 6-36 Biemso1 New Group

	Name	Age	Tribe	Sex	Family	Crops last year	Crops this year	Rice experience	Land ownership	Time of join
1	Kwame Tawiah	26	Ashanti	M	wife, daughter (1)	maize, plantain, cassava	maize, cassava, cocoyam	Y	Y	2001
2	Frempong Augustine	30	Ashanti	M	mother, wife, daughter (1), son (1)	rice, maize	maize, cassava, cocoyam, plantain	Y	-	2001
3	Emmanuel Haimen	21	Ashanti	M	mother, father, sister (5), brother (1)	maize, cassava	maize	N	-	2001
4	Issac Yaw	34	Ashanti	M	mother, father, sister (1), brother (3)	cocoyam, cassava, plantain	maize, cassava	Y	-	2001
5	Zakkari Seidu	26	Moshi	M	mother, brother (6), sister (3)	rice, maize	-	Y	N	2001
6	Francis Yaw Dabanka	28	Ashanti	M	wife, daughter (1), father, ground mother, sister (2), brother (6)	maize, cassava, yam, onions, peper	maize, cassava, cocoyam, plantain, beans, okro	Y	-	2001
7	Agyemang K. Bediakon	32	Ashanti	M	wife, son (2), daughter (1)	maize, cassva, cocoyam, peper	maize, cassava	N	-	2001
8	Jackson Yeboa	23	Ashanti	M	mother, grand mother, sister (4), brother (4)	maize, cassava, plantain, cocoyam	maize	Y	-	2001
9	Joyce Mensah	21	Ashanti	F	mother, grand mother, sister (3), brother (2), son (1)	-	-	N	-	2001

Table 6-37 Personal data (Biemso No.2)

	Name	Age	Tribe	Lodger	Crops last year	Crops this year	Rice experience	Land ownership	Time of join
1	Charles Adu Sei	45	Ashanti	none	rice (sawah), garden eggs, Maise, Tomatoes, and Okro	Maize, local rice	Y	Y	2000
2	Shabtyl Alhassan	30	Kotokori (Togo)	father, mother, brother (6) and sister (2)	Maise	tomatoes, okro, gardeneggs	Y	N	2000
3	Basiro Alhassan	26	Kotokori (Togo)	wife, father, mother, brother (6) and sister (2)	Maize, local rice	local rice	Y	N	2001

Table 6-38 Reason for quitting (No.2)

	Name	Age	Tribe	Sex	Main reason
1	Steaven Dapah	50	Ashanti	M	Bad relationship with other members. Leader of Fedeyea from this year.
2	Bawa Basare Karin	34		M	Unhappy with the income. Back to his own rice farm. Complain with hardness of the work, but still has some interes, and have idea of joinig again next year
3	Kofi Badu	-	Ashanti	M	Complain with low profit and hardness of the work. Move to Batinko to be rice
4	Ama Serwaa		Ashanti	F	Marriage. Move to Mankranso, her husband's town.
5	Akua Bonsu	16	Ashanti	F	Pregnant.

Table 6-39 Personal data (Fedeyeya)

	Name	Age	Tribe	Lodger	Crops last year	Crops this year	Rice experience	Land ownership	Time of join
1	Steeven Dapah	56	Ashanti	wife, son (3), girls (5)	rice (sawah), cocoa, plantain, cassava	plantain, maize, cassava	N	Y	2000
2	Emanuel Savor	67	Ewe	wife, son (1), tenant (3)	rice, maize, plantain, cocoa	maize, plantain, cassava, cocoa, cocoyam	Y	N	2001
3	Kwaku Jaly	24	Benin	mother, father, sister (2), brother (2)	cassava, maise, rice, cocoyam	cassava, maise, rice, cocoyam	Y	N	2001
4	Paul Amponsah	30	Ashanti	wife, daughter (1), son (1), tenant (1)	cassava, cocoyam, plantain	cassava, plantain, cocoyam	N	Y	2001
5	Yaw Aturugu	35	Grusi	brother (7), sister (1)	rice, cocoa, maize	cocoa, plantain, cocoyam	Y	N	2001
6	Issa Kusasi	35	Kusasi	tenant (1)	plantain, maize	plantain, maize	Y	N	2001
7	Yaw Grusi	38	Grusi	wife, daughter (4), son (3)	maize, cassava, plantain, rice, palm oil	maize, plantain, cassava, cocoyam, rice	Y	N	2001
8	Kwaku Asiedu	28	Ashanti	wife, daughter (1), mother	cassava, maise, cocoyam	cassava, yam, ,maize, cocoyam	Y	Y	2001