

ANNEX D ATTACHMENT
BRIEFING NOTE AND AGENDAS
FOR
PUBLIC MEETING

BRIEFING NOTE

EXPLANATION OF PUBLIC MEETING

IDA has a plan on rehabilitation of the existing small irrigation projects in the country, which will contribute to the food security improvement. In addition, IDA has envisaged handing-over of all irrigation project to the societies (farmers) after the rehabilitation of the irrigation facilities.

The purpose and components of the rehabilitation projects should satisfy not only the policies and programmes of the government for agricultural development but also the needs of farmers, in order to expect the successful performance of the projects after rehabilitation. Particularly, it will be necessary to formulate the plan for O&M of the reactivated projects and for establishment of the farmers organisations in consideration of farmers' intentions and requests.

In this context, the public meeting is held at the project site, aiming to collect farmers' intentions and requests to the rehabilitation project. The rehabilitation projects are finally formulated on the basis of the result of public meeting.

The public meeting is held at the following five (5) priority areas which were selected through the master plan study: (i) Ashaiman, (ii) Aveyime, (iii) Kpando-Torkor, (iv) Mankessimu, and (v) Okyereko. These areas are not yet selected finally, and its final selection of the development areas to be implemented the project will be made on the basis of the result of public meeting and the feasibility study which will be carried after the meeting. The programme of the public meeting is shown in attached paper.

OUTLINE OF THE PROJECT

1. Objectives of the Project

The objectives of the project are as follows.

- 1) Rehabilitation and improvement of agricultural production infrastructures
- 2) Increase and stabilisation of agricultural productivity
- 3) Improvement of farmers living standard

2. Component of the Project

The project consists of the following six components. For improvement of social welfare like construction of clinics and nursery schools and supply of equipment used privately such as motor cycle and TV, these are all not included in the rehabilitation project.

- 1) Rehabilitation and improvement plans for agricultural production infrastructures including pumps, sprinklers, canals, farm roads, storage houses, etc.
- 2) Improvement plan for crop production.
- 3) Strengthening plan for farmers' societies
- 4) Improvement plan for agricultural supporting services including agricultural extension, marketing, agricultural credits, etc.
- 5) Promoting plan for women's participation in development.
- 6) Training plan for farmers' societies and farmers themselves.

3. Outline of the Project

The rehabilitation projects are outlined in attached table. These plans will be revised finally based on the result of public meeting as mentioned earlier.

OUTLINE OF THE PROPOSED REHABILITATION PLAN

These are draft and not final plans. All these plans will be revised based on further study and farmer's intention obtained from this public meeting.

Items	Projects	Ashaiman	Aveyime	Kpando-Torkor	Mankessim	Okyereko
1. Existing Condition	(1) Project area	148 ha	150 ha	356 ha	256 ha	111 ha
	a) Potential area (ha)	130 ha	63 ha	40 ha	17 ha	40 ha
	b) Developed area (ha)	120 families	62 families	118 families	89 families	68 families
	(2) No. of farm family					
2. Rehabilitation Plan	(3) Present agriculture					
	a) Cropping season & main crops	Rainy season : Rice Dry season : Okra	Rainy season : (Rice) Dry season : (Rice)	Rainy season : - Dry season : Okra	Rainy season : Sweet potatoes Dry season : Vegetables	Rainy season : - Dry season : Rice
	b) Total irrigated area/ven. (ha)	59.0 ha	-	13.0 ha	26.4 ha	21.6 ha
	c) Total irrigated area/fan. (ha)	0.49 ha/family	-	0.11 ha/family	0.30 ha/family	0.32 ha/family
3. Project Effects	d) Cropping intensity	45%	-	33%	155 %	54 %
	(1) Agricultural development plan					
	a) Proposed crops	Rainy season : Rice, Cowpea, Groundnuts, Maize Dry season : Rice, Onion, Okra, Tomato	Rainy season : Rice, Maize, Cowpea, Groundnuts Dry season : Rice, Tomato, Okra, Onion	Rainy season : Cowpea, Groundnuts, Maize Dry season : Okra, Tomato, Onion	Rainy season : Cowpea, Maize, Sweet potatoes Dry season : Watermelon	Rainy season : Rice, Maize, Cowpea, Groundnut Dry season : Rice, Tomato, Okra, Onion
	b) Cropping intensity	200%	200%	200%	200 %	200 %
2. Rehabilitation Plan	c) Land allocation	All lands in the irrigation project will be allocated to farmers in accordance with L.I. 1350 of GIDA.				
	(2) Rehabilitation plan of facility					
	a) Irrigation plan	- Gravity irrigation - Continuous irrigation	- Intake by pump - Gravity irrigation - Continuous irrigation	- Pumps - Main pipeline : fixed - Movable sprinkler - Rotational irrigation	- Fixed pump station - Main pipeline : fixed - Movable sprinkler - Rotational irrigation	- Gravity irrigation - Fixed pump station - Continuous irrigation
	b) Irrigable area	44 ha	63 - 90 ha	70 - 280 ha	100 ha (Ex. Company)	40 - 80 ha
2. Rehabilitation Plan	c) Rehabilitation plan of facility	- Irrigation system - Drainage system - Farm road network	- Pump & pump station (fixed+movable) - Irrigation system - Drainage system - Farm pond - Farm road network	- Pumps & foundation works - Sprinkler system - Soil conservation works	- Pump - Sprinkler system	- Pump & pump station - Irrigation system - Drainage system - Related structures
	(3) Strengthening of GIDA					
	(4) Strengthening of farmers' society	The existing farmer's society will be improved and strengthened as an executing body of O&M of the project and for improvement of agricultural support services.	Improvement and strengthening of the GIDA head office as well as the project offices, including training of the staff will be executed for successful transfer of O&M to the Societies.			
	(5) Transition period of O&M transfer	5 years	5 years	5 years	5 years	5 years
2. Rehabilitation Plan	(6) Required equipment for O&M					
	a) Pump station	-	1 no.	4 nos.	2 nos.	1 no.
	b) GIDA project office	106 m2	175 m2	175 m2	175 m2	175 m2
	- New	-	1 no.	4 nos.	3 nos.	1 no.
2. Rehabilitation Plan	c) Storage (pipes, materials, etc.)	-	1 no.	1 no.	1 no.	1 no.
	d) Garage	-	1 no.	-	-	1 no.
	e) Dry Yard	1 no.	1 no.	4 no.	3 nos.	-
	f) Storage for farming	1 no.	1 no.	1 no.	1 no.	1 no.
2. Rehabilitation Plan	g) Equipment for O&M	L.S.	L.S.	L.S.	L.S.	L.S.
	h) Equipment for extension	L.S.	L.S.	L.S.	L.S.	L.S.
	3. Project Effects	IDC is essential as a core instital for research and extension works training for successful implementation of O&M transfer and strengthening of GIDA as well as farmers' societies.	Project activities are stopped, and farm income of farmers is low. Farmers strongly request possible early rehabilitation of project, and could be used as a model for combined farming of rice and cash crops.	Recommended as a model for irrigated farming of upland crops, and will be stable supply centre of vegetables to urban areas.	Improvement of present low farm income and living standard of farmers by rehabilitation is essential.	High increase in crop production from 111 ha of expanded area. Recommended as a model for improved irrigated farming.

1. EXPLANATION OF THE REHABILITATION PLAN

These are draft and not final plans. All these plans will be revised based on further study and farmer's intention obtained from this public meeting.

	Project	Okyereko
1. Existing Condition	(1) Project area	
	a) Potential area	111 ha
	b) Developed area	40 ha
	(2) No. of farm family	68 families
	(3) Present agriculture	
	a) Cropping season & main crops	Rainy season : - Dry season : Rice
	b) Total irrigated area/year	21.6 ha
c) Total irrigated area /family	0.32 ha/family	
d) Cropping intensity	54 %	
2. Rehabilitation Plan	(1) Agricultural development plan	
	a) Proposed crops	<u>Rainy season</u> <u>Dry season</u> 50% - Rice 50% - Rice 25% - Maize 25% - Onion 25% - Cowpea & Groundnut 25% - Okra & Tomato
	b) Cropping intensity	200 %
	c) Land allocation	All lands in the irrigation projects will be allocated to farmers in accordance with L.I. 1350 of GIDA.
	(2) Rehabilitation plan of facility	
	a) Irrigation plan	- Gravity irrigation - Fixed pump station - Continuous irrigation
	b) Irrigable area	40 - 80 ha ha
	c) Rehabilitation plan of facility	- Pump & pump station - Irrigation system - Drainage system - Related structures
	(3) Strengthening of GIDA	Improvement and strengthening of the GIDA head office as well as the project offices, including training of the staff will be executed for successful transfer of O&M to the Farmers' Societies.
	(4) Strengthening of farmers' society	The existing farmer's society will be improved and strengthened as an executing body of O&M of the project and for improvement of agricultural support services.
	(5) Transition period of O&M transfer	5 years
	(6) Required equipment for O&M	
	a) Pump station	1 no.
	b) GIDA project office - Rehabilitation - New	- 175 m2
	c) Storage (pipes, materials, etc.)	1 no.
	d) Garage	1 no.
e) Dry yard	1 no.	
f) Storage for farming	-	
g) Equipment for O&M	L.S.	
h) Equipment for extension service	L.S.	
3. Project Effects	High increase in crop production from 80 ha of expanded area. Recommended as a model for improved irrigated farming.	

2. STRENGTHENING PLAN OF FARMERS' SOCIETY

(1) Objectives of Farmers' Society

The main objective of a farmers' society is to operate and maintain the irrigation facilities. In addition, other objectives such as marketing and credit services are also included in order to meet with the farmers' intention and to improve present agricultural support services.

(2) Organisational Structure and Activities

The proposed organisation consists of Type-A and -B, as shown in Figure. Type-A is for small projects having less than 100 farmers, and Type-B is for larger projects with over 100 farmers. In the case of Type B, the farmers are divided into several groups by each irrigation block or each village, and each group is linked separately with the executive committee.

The society consists of following four (4) components; (i) general meeting, (ii) executive committee, (iii) audit, and (iv) service sections including O&M, agriculture, marketing and credit, and women's group. Their main functions and activities are as follows :

1) General Meeting

The general meeting is held at least annually, and has the following main activities :

- Election of the members of the executive committee and auditor,
- Acknowledgement of the result of auditing,
- Acknowledgement of the annual management plan and budget,
- Determination and revision of the amount of irrigation service charge,
- Revision and enactment of articles and bye-laws, and so on.

2) Executive Committee

The committee is composed of the following members; chairman, vice chairman, general secretary, treasurer, and several members who are representatives of the service sections. The main tasks of the committee are as follows:

- to prepare annual management plans and budget,
- to instruct and supervise activities of the service sections,
- to manage complaints and grievances from the farmers,
- to manage accounting and general affairs, and so on.

3) Service Sections

Under the instruction and supervision of the executive committee, the routing service works are implemented by the following four (4) sections; (i) O&M, (ii) agriculture, (iii) marketing and credit, and (vi) women's group. These sections employ several volunteers, and their main activities are as follows :

- a) O&M Section
 - Preparation of irrigation schedule,
 - O&M of irrigation facilities,
 - Management of communal works such as canal clearing and maintenance of farm roads, etc.
- b) Agricultural Section
 - Transmission of information for extension implemented by the PM Office,
 - Information services for new farming practices and varieties,
 - Arrangement of farmers' meeting on agricultural extension,
 - Providing machinery services, etc.
- c) Marketing and Credit Section
 - Implementation of co-operative purchasing and shipping,
 - Arrangements for storing of farm inputs and products,
 - Arrangements for agricultural credit, etc.
- d) Women's Group
 - Promotion for women's agri-business and cottage industry,
 - Promotion for homestead development,
 - Improvement of social welfare and health care of the farmers, etc.

4) **Audit Section**

At present, the society has no auditing system in its accounting operations, and this is one of the society's problems. To solve this problem, it is proposed to establish the auditing system.

(3) Office and Facilities

An office of the society shares the floor space in the PM Office. All necessary administrative works including typing, printing, photo copying, communication, etc. should be supported by the PM Office.

(4) Training of Farmers' Society

The PM Office prepares training programmes and trains periodically the leaders of the farmers' society and the farmers themselves, in co-operation with the Department of Co-operatives. The training items are (i) O&M of irrigation facilities, (ii) administrative works including book keeping, (iii) accounting, (iv) marketing and credit services, etc.

(5) Irrigation Service Charge

All O&M costs of irrigation facilities are covered by the irrigation service charges (ISC) collected from the farmers. The amount of ISC includes (i) operation and maintenance cost, (ii) personnel cost for gate operators/pump attendants, and (iii) replacement cost of facilities and equipment, etc.

ISC is collected before each cropping season. All members of the executive committee collect ISC directly from the farmers, and the collected amount is deposited immediately in the society's bank account. To achieve smooth collection of ISC, it is recommended to adopt the following punishment rule and incentive to the farmers.

- 1) The society fines the farmers who are not able to pay on time, some percentage of the total ISC amount per month during the non-payment period.
- 2) If farmers pay the ISC amount in full and on time, some percentage of the full ISC amount is reimbursed to them as an incentive.

(6) Articles and Bye-Laws

The existing article and bye-laws of the society are for administrative management, and articles required for the O&M of the irrigation system are not available at all. Therefore, it is proposed to enact several new articles. These are listed below.

- 1) The society has the right to collect ISC from the beneficiary who receives irrigation services from the society, and the beneficiary has the duty to pay its ISC to the society.
- 2) The society inflicts a punishment on the beneficiary who uses irrigation water and facilities illegally or who fails to pay ISC.
- 3) The farmers have the duty to participate in the communal O&M works to be planned by the society.
- 4) The tenant beneficiary has the right to join the society and to be elected to executive member, and is bound to pay ISC and membership fees as same as the owner beneficiary .

3. IMPROVEMENT OF AGRICULTURAL CREDITS (GROUP LOAN SYSTEM)

At present, several credits have been let by the Banks in and around the project areas. These credits have however serious problems. To overcome these problems, group loan system is proposed to be introduced in the project area. This is a comprehensive system including marketing, agricultural credit, technical guidance, and so on. The group loan system is outlined below, and a schematic figure is presented in Section 4.

- 1) The loan is limited only to the purchase of farm inputs, and its ceiling amount is set depending on crops.
- 2) For borrowing loan, the farmers form a group and select a representative. The members of a group are jointly and severally responsible for repayment of loan for defaulters.
- 3) Farm input requirement is estimated by the group together with the required loan

amount. At this time, the extension officer of the PM Office gives technical guidance such as recommended fertilisation and pest and diseases control, and agro-chemicals to be used.

- 4) The bank provides a loan for the group on a lump sum basis or dividing into several portions, after examination. The group purchases farm inputs in one lot.
- 5) The bank releases the loan amount only to the suppliers of farm inputs, and the group receives farm inputs from the suppliers. In other wards, the group and its representative do not touch cash money, except for the bank cheque to be issued to the suppliers.
- 6) The representative collects the loan payment amount from each farmer, and repay it to the bank in a lump sum. The bank does not collect the loan payment amount from individual farmers.

A characteristic of the group loan that this system is closely connected with the farm guidance, improvement of farm input supply and strengthening of farmer organisations, and this loan system has following merits:

- 1) The lending operation is very simple and easy as compared with it to individual loan.
- 2) The loan payment collection is also very easy, because collection from individual farmers is carried out by the representative, and the bank stays only in contact with him for the collection.
- 3) The introduction of joint and several liability by the farmers living in a same place brings about a good result to improvement of loan repayment.
- 4) The farm input suppliers can allow some discount for a blanket purchase, and the group under the loan system can purchase farm inputs on these discount prices.

This group loan system is proposed to be managed by the societies. At present, the societies in Tanoso and Akumadan have borrowed some loans from the banks under joint and several liability of the members, which is similar to the proposed loan system. It seems that all societies can manage such a new credit system without problems.

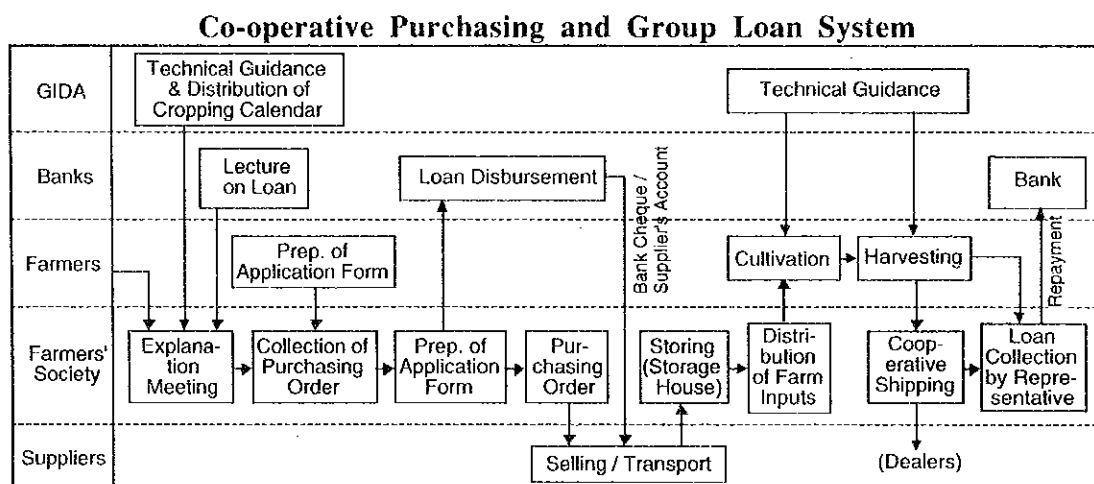
4. IMPROVEMENT OF MARKETING

To allow smooth supply of farm inputs, a co-operative purchasing system is recommended to be introduced in the project areas. This system is closely connected with loan services, technical guidance and organisations' activities as mentioned earlier, and has the following merits :

- 1) Through this system, the farmers can arrange all necessary farm inputs before the crop season, and they can use those inputs on time according to the necessity;
- 2) Under a blanket purchase system, the farmers can purchase farm inputs at discount prices;

- 3) By directly purchasing from suppliers, the farmers can obtain necessary and enough quantity of farm inputs with farm guidance from the PM Office.

The overall flow of co-operative purchasing system to be introduced to the societies is presented in the chart below along with the group loan system.



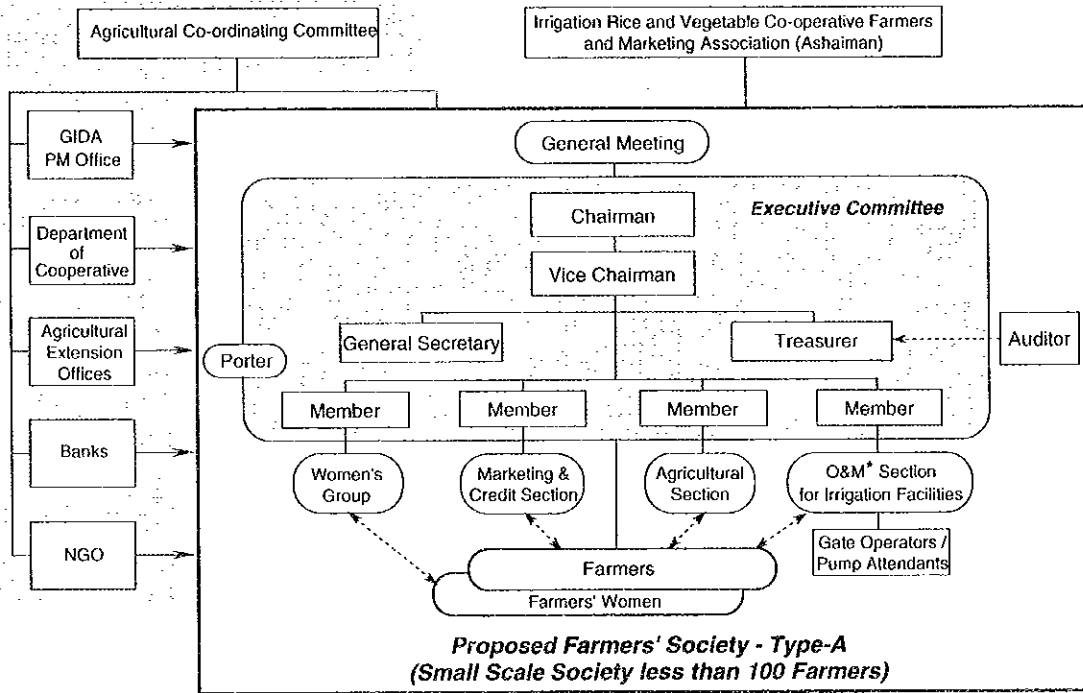
5. ROLE OF WOMEN IN DEVELOPMENT

The Project will induce activation and strengthening of the crop production, marketing of farm inputs and products, post harvest, transportation, societies' services, etc. In parallel with such economic and social development in the rural area, the women's farmers will have much opportunity to join these activities. The following measures are proposed for the women in development.

- 1) In order to encourage greater participation of women in public affairs, it is recommended to appoint women's leaders in the farmers' societies. The appointment of women's auditor of the societies is ideal.
- 2) Groundnuts and tomatoes are recommended in the cropping pattern. To solve the problem of women unemployment in the project areas and improve their income source, it is proposed to promote value-added processing of these crops by women's groups. The PM Office provides technical guidance for them, and the society makes necessary arrangements for bank loans to purchase the extracting and processing equipment.
- 3) In addition, homestead development and livestock raising of chicken, rabbit, etc. by the women's groups are also proposed for the women in development.

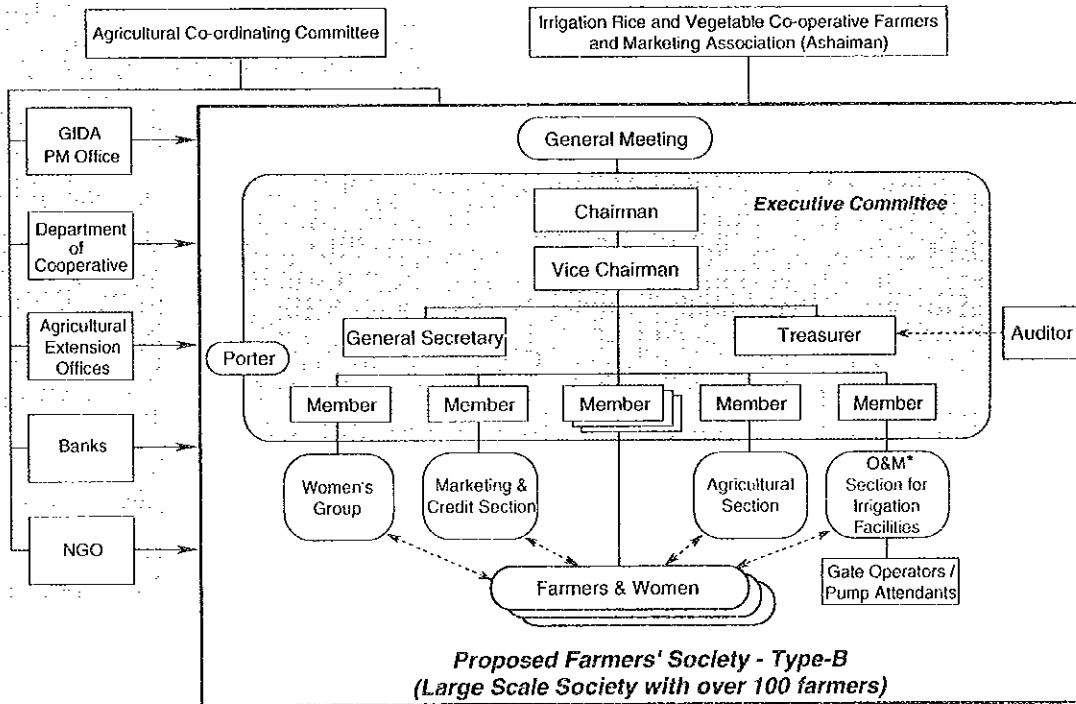
The farmers' society should play an important role in promoting these activities. In this context, the establishment of women's group in the societies is proposed. A representative of a women's group joins the executive committee as its member, and participates in all the society's management.

Supporting Agencies



* : O&M = Operation and Maintenance

Supporting Agencies



* : O&M = Operation and Maintenance

Proposed Organisational Structure of Farmers' Societies

THE REHABILITATION OF IRRIGATION PROJECTS
IN THE REPUBLIC OF GHANA

PUBLIC MEETING - OKYEREKO

AGENDAS

Q-1 General

Date : _____ Place : _____

Attendance (Farmers)

	Male	Female	Total
Leaders of society			
Chairman			
Vice chairman			
Secretary			
Committee's members			
Village Chief			
Farmers			
Others			
Total Attendance			

Attendance (IDA & Study Team)

Q-2 Farmers' Intention to the Rehabilitation Plan for Irrigation Facilities

(Refer "1. Rehabilitation Plan" on page E-1.)

(1) Total irrigable area after rchabilitation 40 - 80 ha

Do you agree to total irrigable area ? (Show one's hand.)

Yes Persons

No Persons → Reason: _____

(2) Rehabilitation plan of facilities

- Pump & Pump station	- Drainage system
- Irrigation system	- Related structures

Do you agree to the rehabilitation plan of irrigation facilities ? (Show one's hand.)

Yes Persons

No Persons → Reason: _____

Do you have any other request for the rehabilitation of irrigation facilities ?

(3) Irrigation plan (method)

- Gravity irrigation	- Continuous irrigation
- Fixed pump station	

Do you agree to the irrigation plan (method) ? (Show one's hand.)

Yes Persons

No Persons → Reason: _____

(4) Required equipment and building for O&M			
a) IDA project office		c) Garage	1 no.
- Rehabilitation	None	d) Dry yard	1 place
- New	175 m2	e) Storage house for farming	None
b) Storage house (pipes, materials, etc.)	1 no.	f) Equipment for O&M	L.S.

Do you agree these plan ? (Show one's hand.)

Yes Persons

No Persons → Reason:

Do you have any other request for the equipment and building ?

Q-3 Farmers' Intention for Farming Plan

(1) Agricultural development plan			
a) Proposed crops	<u>Rainy season</u>	<u>Dry season</u>	
	50% - Rice	50% - Rice	
	25% - Maize	25% - Onion	
	25% - Cowpea & Groundnut	25% - Okra & Tomato	
b) Cropping intensity	200%		
c) Land allocation	All lands in the irrigation project will be allocated to farmers.		

3.1 Do you agree to the crops proposed ? (Show one's hand.)

Rainy Season

Yes Persons

No Persons



Reason:

Dry Season

Yes Persons

No Persons



Reason:

3.2 Do you agree with that "all lands in the irrigation project will be allocated to farmers in accordance with L.I. 1350 of IDA" ? (Show one's hand.)

Yes Persons

No Persons → Reason:

3.3 Farmers' intention for the holding area in the irrigation system after rehabilitation.

Present holding area per farmer in the existing irrigation system	0.80 acre/farmer
Holding area per farmer of the land allocation plan after the rehabilitation	0.80 acre/farmer

Do you agree ? (Show one's hand.)

Yes Persons

No Persons → How many acre do you need ? (Show one's hand.)

0.8 acre Persons

2.0 acres Persons

1.0 acre Persons

2.5 acres Persons

1.5 acres Persons

3.0 acres Persons

Why do you need its area ?

3.4 Do you have any opinion or suggestion about the proposed farming plan ?

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Q-4 Farmers' Intention to the Strengthening Plan for Farmers' Society

(Please explain "2. Strengthening Plan of Farmers' Society (1) - (6)" on page E-2 to E-4.)

IDA want to handing-over all of operation and maintenance function of irrigation facilities to the farmer's society. The purposes of this farmers' society are to operate and maintain the irrigation facilities. The members of this society consist of the farmers who receive irrigation water. The cost required for operation and management will be covered by irrigation service charge which is collected from the members. The collection of irrigation service charge will be carried out by the members themselves.

4.1 IDA will propose a new organizational structure as shown in attached figure. Do you agree its proposed structure ? (Show one's hand.)

Yes Persons
No Persons → Reason:

4.2 Farmers' intention to the society's activities (Answer by clapping of hands)

(1) Operation and maintenance activities

The society operates and maintains all of irrigation facilities, and these activities are managed by the O&M section under the executive committee. Do you agree these activities ? ▶ Yes No

(2) Activities of the women's group under the executive committee.

This group under the executives committee promote the women's activities such as processing of products and health care in order to encourage greater participation of women in public affair. Do you agree these activities ?▶ Yes No

(3) Marketing services of farm inputs

These services are managed by the marketing and credit section under the executive committee. Do you agree these activities ?▶ Yes No

(4) Agricultural credit services (group loan system)

These services are managed by the marketing and credit section under the executive committee. Do you agree to this activity ?▶ Yes No

(5) Supporting activities of agricultural extension

These services are managed by the agricultural section under the executive committee. The extension activity it self is carried out by the government's extension office. The farmers' society support its activities in order to make smooth communication between the farmers and the extension office. Do you agree to these activities ?▶ Yes No

4.3 If IDA hands over the operation and maintenance of the irrigation facilities after rehabilitation:

(1) Do you agree ? (Show one's hand.)

Yes Persons
No Persons → Reason:

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- (2) As the conditions to the handing-over of the irrigation facilities, which items do you request to IDA ? For instance, "IDA should repair all facilities before handing-over" or "IDA should train to the farmers on the operation and maintenance."

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- 4.5 After the handing-over of the irrigation facilities, all of the operation and maintenance costs are covered by irrigation service fees collected from the farmers. For the irrigation service fees, if its amount will increase more after the rehabilitation, do you agree ?

(Show one's hand.)	Present: CD	/acre
(a) 20% up from the present fees
(b) 50% up from the present fees
(c) 70% up from the present fees
(d) 100% up from the present fees
(e) No increase

- 4.6 The following articles will be proposed to include in the "Articles and By-laws" in your society at present. Do you agree ?

(Answer by clapping of hands)

Article-1 The society has the right to collect irrigation service charge from the beneficiary who received irrigation services from the society, and the beneficiary has the duty to pay its service charge to the society.
 Yes No

Article-2 The society inflicts a punishment on the beneficiary who uses irrigation water and facilities illegally and is not able to pay irrigation service charge.
 Yes No

Article-3 The farmers have the duty to participate in the communal works on O&M to be planned by the society.
 Yes No

Article-4 The tenant beneficiary has a right to join the society with the election to the executive members, and is in duty bound to pay irrigation service charge and membership fees, as well as the owner beneficiary .
 Yes No

Q-5 Improvement of Agricultural Credits (Group Loan System)

(Please explain "3. Improvement of Agricultural Credits (Group Loan System)" on page E-4.)

- 5.1 Do you think that your society can manage the proposed loan system ?

(Answer by clapping of hands)

- | |
|---|
| (1) Yes. It is possible without any support from the Government. |
| (2) Yes. If IDA or other agency support to the society, it is possible. |
| (3) No. It is impossible. |

- 5.2 In the case of "Yes", do you participate to this loan system ?

(Answer by clapping of hands)

Yes No

**CONFIRMATION FOR SPECIFIC ITEMS
OKYEREKO**

1. Irrigation area to be developed newly

There are following two (2) development alternatives in the Okyereko irrigation area:

- Alternative 1 : Existing area (Red Colour)
- Alternative 2 : Existing area + Extension area (Green Colour)

Question and confirmation:

- 1) Land tenure : Existing area (Red Colour)
- Extension area (Green Colour)

2) Development method:

The project provides land clearing to the extension areas (Green Colours). But no final levelling is carried out to this area, and it is entrusted to the farmers. Do you agree to this method (final levelling by the farmers) ?

- Yes Persons
- No Persons

↳ Reason

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3) Which alternative do you agree ?

- Alternative 1: Persons
- Alternative 2: Persons

4) The number of existing farmers in the extension areas

Extension area (Green Colour)

5) The number of farmers to be allocated in the extension areas after construction

Extension area (Green Colour)

6) The existing area will be excluded from the project, because the soils in this area are not suitable for vegetable cultivation. Do you agree to this rejection of existing area.

- Yes Persons
- No Persons

↳ Reason

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2. Farmers' participation to the rehabilitation works

- Objective : Training of rehabilitation works
- Methods : Farmers who will received irrigation water participates the rehabilitation and construction works. No labour charge is paid to these works.
- Merits : Farmers will have some knowledge and practices on maintenance work of the facilities.

Farmers' intention

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3. Women's participation to the activities of farmers' societies

- Objective : Promotion of women's participation in the development
- Methods : The farmers' societies will appoint women's committee members. (Especially women's auditors are recommended.)

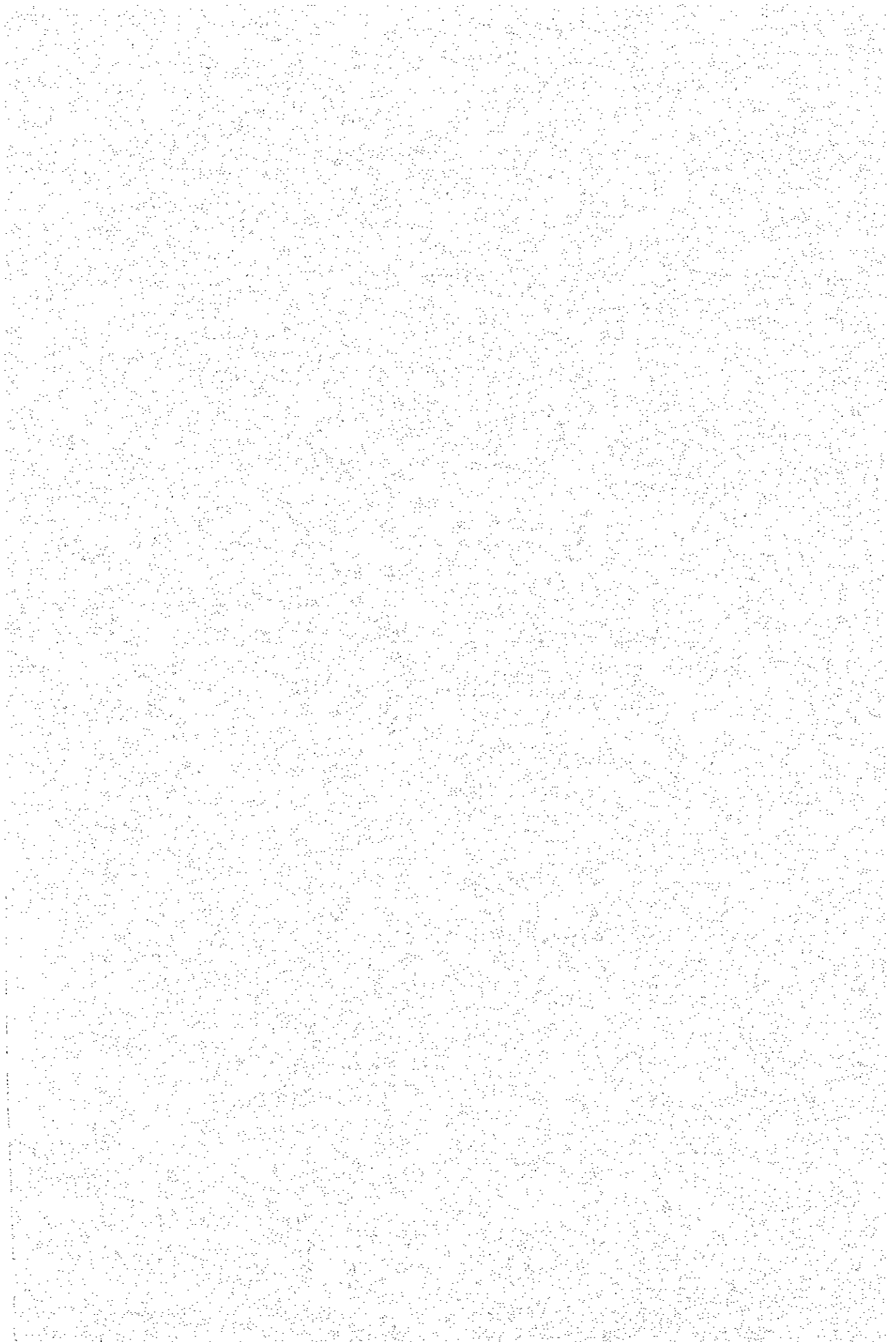
Farmers' intention

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***** NOTE *****

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ANNEX-E
AGRICULTURE AND AGRO-ECONOMY



ANNEX - E AGRICULTURE AND AGRO-ECONOMY

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ANNEX - E AGRICULTURE AND AGRO-ECONOMY

1. PRESENT AGRICULTURE

1.1 Project Area

Potential and developed areas in each of the five (5) priority projects under the present conditions have been examined based on the available information obtained from GIDA and site inspection made by the study team. The results are as follows :

Projects		Ashaiman	Aveyime	K-Torkor	Mankessim	Okyereko	Total
Population	(persons)	850	470	770	580	450	3,120
No of Household	(No.)	120	62	118	89	68	457
Family size	(persons)	7.1	7.5	6.5	6.5	6.6	6.8
% of labour force*1		70%	51%	57%	50%	52%	58%
Labour/family*2	(persons)	5.0	3.8	3.7	3.2	3.4	3.9
Total labour force*3	(persons)	600	240	440	290	230	1,800

*1 Percentage of the age group covering 15-59 year old to the total population.

*2 For instance in the Ashaiman, an average family member is 7.1 persons. 70.2 % of the family member are economically active person. This group regard as labour force.

*3 Out of the total population, 70 % (600 persons) are estimated as labour force in the Ashaiman Project.

Most of lowland is used for cultivation of rice with gravity irrigation from the reservoirs, except for Aveyime project which is served by pump irrigation. In upland, vegetables such as okra, watermelon, egg plant, etc. are cultivated by sprinkler irrigation because of undulating topography.

Most of the projects have not been fully developed as originally planned, mainly due to financial constraint. In some projects such as Kpando-Torkor and Okyereko projects, actually irrigated areas in recent years were further less than the developed areas because of lowering of pump efficiency and deterioration of pipeline and sprinkler systems. The actually irrigated areas in these projects are reported to be 13 ha in Kpando-Torkor and 22 ha in Okyereko, respectively. In Aveyime project, no irrigation was compelled since 1995 due to totally damaged pumps and much water leakage from canals.

1.2 Population and Land Holding

1.2.1 Population and Farm Households

On the basis of the farm interview survey, the population, number of farm household, and average family size are estimated as follows:

Projects		Ashaiman	Aveyime	K-Torkor	Mankessim	Okyereko	Total
Population	(persons)	850	470	770	580	450	3,120
No of Household	(No.)	120	62	118	89	68	457
Family size	(persons)	7.1	7.5	6.5	6.5	6.6	6.8
% of labour force*1		70%	51%	57%	50%	52%	58%
Labour/family*2	(persons)	5.0	3.8	3.7	3.2	3.4	3.9
Total labour force*3	(persons)	600	240	440	290	230	1,800

*1 Percentage of the age group covering 15-59 year old to the total population.

*2 For instance in the Ashaiman, An average family member is 7.1 persons. 70.2 % of the family member are economically active person. This group regard as labour force.

*3 Out of the total population, 70 % (600 persons) are estimated as labour force in the Ashaiman Project.

The total population and the number of farm household in the whole project is estimated to be 3,120 and 457, respectively. The size of farm family averages 6.8 persons in the whole project.

The age group structure by each project is estimated as follows. In the whole projects, about 38% of total population are fourteen years old and under, and only 4% are sixty years old and over. In the assumption that an age group of labour force is between 15 and 59 years old, the family labour force per a farm household in the whole projects was estimated to be 3.9.

(Unit: %)

Age group	0-14	15-29	30-44	45-59	60<	Total	15-59
Ashaiman	27	41	13	16	3	100	70
Aveyime	44	24	19	8	5	100	51
Kpando-Torkor	39	32	17	8	4	100	57
Mankessim	47	27	14	9	4	100	50
Okyereko	42	29	18	5	6	100	52
Average*	38	32	16	10	4	100	58

* Weighted average

Source: Farm interview survey by the Study Team (December 1995)

1.2.2 Farm Management Size

Farm management size of irrigation area varies with the projects and ranges from 0.11 ha in Kpando-Torkor area to 0.49 ha in Ashaiman area, as shown below.

Projects	Project Areas					No. of Farm Household (ha)	Irrigated Area per a Farmer (ha/farmer)	Farm Size Including Outside Project Area*2 (ha/farmer)
	Potential Area (ha)	Developed Area (ha)	Annual Total Irrigated Area (ha)	Cropping Intensity *1 (%)				
Ashaiman	148	130	59.0	45	120	0.49	1.37	
Aveyime	150	63	-	-	62	-	2.21	
Kpando-Torkor	356	40	13.0	33	118	0.11	1.34	
Mankessim	256	17	26.4	155	89	0.30	0.95	
Okyereko	111	40	21.6	54	68	0.32	1.42	
Total/Average	1,021	290	120.0	41	457	0.26	1.40	

*1 Annual total irrigated area / Developed area

*2 Including farm land located at outside project areas. Data obtained from the farm interview survey by the Study Team (December 1995).

As seen in the above table, the farmers in the project area have a lot of farm lands located at outside project areas, which average 1.4 ha per a farm household. It means that they have obtained a considerable farm income not only from the project area but also from the outside farm lands.

1.3 Main Crops and Cropping Patterns

(1) Ashaiman Project

Although the developed area at this project is 130 ha at the both left and right bank of drainage, crop production with irrigation is limited only at the left bank at present. It is mainly because of irrigation water shortage and canal breakage. The crops cultivated are paddy rice in both the dry and wet season and okra in the dry season. The paddy rice varieties are GK88 (110 days), ITA222 (120 days) and GRUG7 (125 days). The okra variety is Labadi. Regarding with soil condition, clay soil is distributed at downstream area (40%) of the left bank. The area has high production potential of paddy rice. Okra is adapted to clay soil and

used as rotation crop of paddy rice. Sandy soil (30%) and sandy clay soil (30%) are distributed at upstream area of left bank. The area are rather suitable to upland crops including vegetables, although paddy rice and okra are also grown at present.

The average crop area, crop yield and crop production is presented in Table E-1, and cropping pattern is shown in Figure E-1. They are summarised as below. The crop area of paddy rice is 18.8 ha and 18.6 ha in the dry and wet season, respectively. Average yield is low, 3.35 - 3.40 ton/ha, because of sandy soil, irrigation water shortage and poor in farming practices. Lodging of paddy rice at harvesting time is frequently observed in the wet season. It is because of overseeding by broadcasting farming. Okra is cultivated 17.0 ha in the dry season. The yield is low, 6.00 t/ha. Cropping intensity at Ashaiman project is 0.42, which means low level of land use.

Crop	Ave. Crop Area		Ave. Crop Yield		Ave. Crop Production	
	ds (ha)	rs (ha)	ds (ton/ha)	rs (ton/ha)	ds (ton)	rs (ton)
Paddy rice	18.8 (15%)	18.6 (14%)	3.35	3.40	62.98	63.24
Okra	17.0 (13%)	-	-	6.00	102.00	-
Total	35.8 (28%)	18.6 (14%)				

Note : 1) ds; dry season, rs ; rainy season.

2) Figure in parenthesis indicates percentage of crop area in developed area (130 ha) in the dry or rainy season.

The right bank is used to grow rainfed maize, okra and cassava by the farmers. Cultivation of okra with irrigation and fertiliser in the wet season is not able to compete in price with rainfed okra without fertiliser cultivated in outside the project area.

The present land allocated for the research works by IDC at Ashaiman is about 1.0 ha, mainly for the trials of variety evaluation and seed multiplication. When the research activities are accelerated, two to three hectares of land will be necessary in the future.

(2) Aveyime Project

Paddy rice in both the dry and wet season is the only one crop cultivated so far at this project. Crop production record is available only from 1990 wet season to 1993 wet season, because of the breakage of pump station in 1993 dry season. The soil condition of this project is rather poor because sandy soil is distributed in most of the area. Clay soil suitable to paddy rice production is limited in the downstream area of drainage.

The average crop area, crop yield and crop production is presented in Table E-2, and cropping pattern is shown in Figure E-2. They are summarised as below. Average crop area is 28.9 ha and 28.5 ha in the dry and wet season, respectively. Average crop yield in the dry season is very low, 2.55 t/ha. It may because of sandy soil and poor in farming practices. Cropping intensity at Aveyime project is 0.91, which means low level of land use.

Crop	Ave. Crop Area		Ave. Crop Yield		Ave. Crop Production	
	ds (ha)	rs (ha)	ds (ton/ha)	rs (ton/ha)	ds (ton)	rs (ton)
Paddy rice	28.9 (46%)	28.5 (45%)	2.55	4.08	72.68	117.91
Total	28.9 (46%)	28.5 (45%)				

Note : 1) ds; dry season, rs ; rainy season.

2) Figure in parenthesis indicates percentage of crop area in developed area (63 ha) in the dry or rainy season.

Farmers grow rainfed maize, cassava, groundnut, cowpea and hot pepper in and outside of the project area in the wet season.

In 1996 wet season, paddy rice production has started again at this project. Twelve ha (10.5 ha by broadcasting and 1.5 ha by transplanting) of paddy rice is grown with irrigation water from small streak using farmer's private small pump.

(3) Kpando-Torkor Project

Okra in the dry season is the only one crop cultivated at this project. The soil and topology at this project are sandy and slightly slop so that suitable to grow upland crops including vegetables. The problem is the protection of soil from erosion.

The farming practice and yield level of okra are very superior at this project. Okra is applied foliar liquid spraying once in a week for the top dressing of nitrogen fertiliser from 85 days after germination till final harvesting, in order to ensure long duration of harvesting time. Okra plant grows as high as 180- 200 cm at final harvesting. The field of okra is rotated every year by the rotation system of three year's cycle, to avoid the damage by continuous cropping. These are the reason why average crop yield is very high, 10.0 t/ha, at this project.

The average crop area, crop yield and crop production at Kpando-Torkor project is presented in Table E-3, and cropping pattern is shown in Figure E-3. They are summarised as below. Average crop area is 13.0 ha, 33% of developed area. The okra varieties are Labadi and Lolobi. Cropping intensity at Kpando-Torkor is 0.33, very low level of land use.

Crop	Ave. Crop Area		Ave. Crop Yield		Ave. Crop Production	
	ds (ha)	rs (ha)	ds (ton/ha)	rs (ton/ha)	ds (ton)	rs (ton)
Okra	13.0 (33%)	-	10	-	130	-
Total	13.0 (33%)	-				

Note : 1) ds: dry season. rs : rainy season.

2) Figure in parenthesis indicates percentage of crop area in developed area (40 ha) in the dry or rainy season.

Since very small area (0.1 ha) is allocated to the farmers by the project, they grow maize and okra with fertiliser, and sweet potato, groundnut and yam without fertiliser in rainfed condition in their own land in the wet season.

The present agriculture at Kpando-Torkor project has two problems, mono-culture in upland field and marketing of okra. Okra is distributed to Kpando, Hohoe and Ho by market mammals, middlemen. No market mammals come from Accra at present, because the transportation cost becomes higher than before. Therefore, over production will take place if farmers grow only okra after rehabilitation.

It is made clear that the damage of okra by continuous cropping is caused by the infection of certain soil born disease and nematode. Crop rotation is most practical method to alleviation of the damage.

In 1996 dry season, crop area of okra will be reduced to 8.0 ha, half of last year, because one of irrigation pump is destroyed.

(4) Mankessim Project

Main crops at this project are watermelon intercropped with egg plant and/or okra in the dry season. Sweet potato is cultivated in the wet season. The soil and topology are sandy and undulating so that upland crops including vegetables are suitable to the condition. The average crop area, crop yield and crop production are presented in Table E-4, and cropping pattern is shown in Figure E-4. They are summarised as below. The crop area of watermelon is 13.8 ha, 81% of developed area. Egg plant and okra are seeded in between hills of watermelon after one

month of watermelon seeding. Since the fruits of watermelon are harvested all at once, the field changes to egg plant or okra field. The watermelon variety is Sugar Baby, the ones of egg plant are Local variety (purple) and White Beauty, and the one of okra is Lady Finger. Cropping intensity at Mankessim project is 1.09, which means medium level of land use.

Crop	Ave. Crop Area		Ave. Crop Yield		Ave. Crop Production	
	ds (ha)	rs (ha)	ds (ton/ha)	rs (ton/ha)	ds (ton)	rs (ton)
Watermelon	13.8 (81%)	-	9.5	-	131.0	-
Egg plant	10.7 (62%)	-	12.1	-	129.8	-
Okra	4.9 (29%)	-	5.1	-	25.1	-
Sweet potato	-	4.7 (28%)	-	9.0	-	42.3
Total	25.8 (28%)	18.6 (14%)				

Note : 1) ds; dry season, rs ; rainy season.

2) Figure in parenthesis indicates percentage of crop area in developed area (17 ha) in the dry or rainy season.

Different growing stage of sweet potato is observed in the wet season. Nursery of sweet potato is located aside of the reservoir to take vine for transplanting at any time. It may be favoured for dispersion of marketing period.

Farmers grow rainfed maize, cassava and groundnut in their own farm in the wet season.

In 1996 wet season, watermelon is scheduled to be planted in 17 ha of land. Egg plant and of okra will be planted in 10 ha and 7 ha of land as an intercrop of watermelon, respectively. Intercropping is favourable for farmers whose holding is small. The problem is continuous cropping of egg plant and okra under present cropping system. Therefore separate cultivation of watermelon, egg plant and okra are recommendable after the rehabilitation of this project.

(5) Okyereko Project

Paddy rice in the dry season is the only one crop cultivated at this project, because of very severe water shortage. The soil condition is mostly sandy and sandy clay. Clay soil is distributed limited area of the downstream of drainage.

The average crop area, crop yield and crop production are presented in Table E-5, and cropping pattern is shown in Figure E-5. They are summarised as below. Crop are of paddy rice is 21.1 ha, 53% of developed area. The paddy rice varieties are ITA222, GK88 and GRUG7. Average yield is low, 3.75 ha, because of severe water shortage, minimum application of farm input, and poor in farming practice. Broadcasting dry seed is the traditional method of paddy rice farming. It looks a sort of dry farming. They do not use any agro-chemicals. Cropping intensity at Okyereko project is 0.53, which means low level of land use.

Crop	Ave. Crop Area		Ave. Crop Yield		Ave. Crop Production	
	ds (ha)	rs (ha)	ds (ton/ha)	rs (ton/ha)	ds (ton)	rs (ton)
Paddy rice	21.1 (53%)	-	3.75	-	79.50	-
Total	21.1 (53%)	-				

Note : 1) ds; dry season, rs ; rainy season.

2) Figure in parenthesis indicates percentage of crop area in developed area (40 ha) in the dry or rainy season.

Usually, farmers grow their rainfed maize, cassava, groundnut, okra and cabbage without fertiliser in the wet season in their own farm located outside the project.

As mentioned above, paddy rice is grown only in the dry season at the project. The reason why the farmers do not grow any crops at the project are in the wet season is as follows : (a) farmers want to grow crops in their own land without any fertiliser in the wet season ; (b)

farmer do not have enough money to buy seed and fertiliser for the next dry season, and they will collect money from their wet season harvest ; and (c) project tractor is very old and not powerful to plough the wet and heavy soil in the wet season.

1.4 Farming Practices and Farm Inputs

1.4.1 Farming Practices

(1) Farming practices

Detailed information on farming practice of crops (field preparation, seeding, transplanting, irrigation and drainage, fertiliser and agro-chemical application, weeding, harvesting, use of agricultural machinery and labour force), post-harvest practice and marketing practice at the projects are collected. The crops surveyed are broadcasting and transplanting paddy rice, egg plant, okra, watermelon and sweet potato.

Information on farming practices of tomato and onion at Amate project is also collected because these crops are not cultivated on a large scale at the priority projects at present. Tomato and onion at Amate project are very profitable cash crops in both the dry and wet seasons. Farming practice of transplanted paddy rice at Dawhenya project is also collected, where advanced farming practice is adopted to aim the high yield level, 6.0 t/ha, after the recent rehabilitation. The detail are presented in Table E-6 - Table E-16 and summarised as follows.

Land preparation of lowland field is usually done by project tractor at Aveyime and Okyereko projects, and rented power tiller at Ashaiman project. The project tractor is also used for land preparation of upland field at Kpando-Torkor and Mankessim projects. Seeding, transplanting, ridging, fertilising, weeding and harvesting are usually done by man power. Nap sack sprayer is used for agro-chemicals application at all projects.

It is traditional agriculture that basic fertilisers (N-P-K compound fertiliser) is applied two to three weeks after seeding or transplanting. The basic fertiliser should be applied, at least a half rate, before seeding or transplanting in order to use fertiliser effectively, especially P and K fertiliser, by crops. This method of fertiliser application is already practised at Dawhenya project.

Regarding agricultural machinery, power tiller with operator rented from private companies is very powerful and handy for ploughing and harrowing at Ashaiman project. The old project tractor of 44 - 65 Hp are limitedly used for ploughing and harrowing at other four projects. Project activity will be stopped if the project tractor is broken away.

Regarding manual labour requirement for farming, maize, groundnut and cowpea are the most labour saving crops. Broadcasting paddy rice is less laborious than transplanting paddy rice. Vegetables are, in general, more labour intensity crops than food crops. Onion and tomato are the most labour intensity crops among vegetables. Therefore, one acre or one and a half acre of field may be optimum size of area for vegetable cultivation for a standard family size of farmer without any powerful agricultural machinery.

(2) Rainfall pattern and Harmattan calendar in relation to farming practices

Farming practice is affected by weather condition, especially rainfall pattern and harmattan in the respective areas. The month starting and ending of major wet season, short dry spell, minor wet season and dry season at the project are shown in Figure E-6. The month attacked by harmattan is also included in the figure. In Kpando-Torkor, rainfall pattern is uni-model, and hot sun shine comes in February and March in the dry season. Rainfall pattern is bi-model in the other four Projects. Irrigation starts at the beginning of dry season at Kpando-Torkor, and ploughing starts in short dry spell at Okyereko.

1.4.2 Farm Inputs

(1) Seed and seedling supply

The following are the crop varieties grown at the projects:

Crop	Project	Variety
Paddy rice	Ashaiman, Aveyime, Okyereko	GK88, GK9, ITA222, GRUG7
Okra	Ashaiman, Mankessim	Labadi, Lolobi, Lady finger
Egg plant	Mankessim	White Beauty, Local Variety
Watermelon	Mankessim	Sugar Baby
Sweet potato	Mankessim	Local Variety (White)

Paddy rice seed is obtained from the previous crop at Ashaiman, Aveyime and Okyereko projects. When the cultivated variety is contaminated with the seed of other varieties and the purity is lost, new seed will be obtained from the seed multiplication plot of Ashaiman research project. Among vegetables, egg plant seed is obtained from the previous crop. Watermelon seed is mainly purchased from seed shop in market. Okra seed is purchased from seed shop in market and other farmers. Vine of sweet potato for transplanting at Mankessim project is taken from the nursery plot at the project.

(2) Fertilisers

At present, the 15-15-15 compound fertiliser is commonly used as basal fertiliser of all crops at all of the projects. Urea is used for top dressing of paddy rice, while sulphate ammonium (SA) is popularly used for top dressing of maize and vegetables. Groundnut and cowpea are not applied fertiliser at all, because short growing period. Present application rate at the projects are presented in Table E-17 and summarised below. Higher rates of nitrogen fertiliser are applied to paddy rice, egg plant, okra and watermelon. The medium rates of nitrogen are applied to maize and other vegetables. Number of split application of basic fertiliser and top dressing is in 2 to 4 times.

Application Rate	Crop
High rate (N: 100-80 kg/ha)	Paddy rice, Egg plant, Okra, Watermelon
Medium rate (N: 70-50 kg/ha)	Maize, Tomato, Hot pepper, Onion
No fertilization	Groundnuts and Cowpea

The application rate of fertiliser is generally low, because of the expensive price of fertiliser in comparison with the price of agricultural products. Organic manure is not applied at the most of the projects except a part of Ashaiman project, although it is very important for increase soil fertility and productivity, and saving chemical fertilisers.

(3) Agro-chemicals

1) Serious diseases and pests

Serious diseases, insect pests, wild birds and animals observed at the projects are presented in Table E-18 and summarised below. For paddy rice, blast and brown leaf spot is common disease, while stem borer, rice hispa, case worm and leaf roller are serious insect pest at the projects. Stem borer is also common insect pest on maize. Caterpillars and paudadrica cause serious damage to okra plant. Nematode is serious to tomato and okra.

Crop	Disease
Disease	
Paddy rice	Blast, Brown leaf spot
Maize*	Streak, Leaf spot
Cowpea & Groundnut*	Root rot
Tomato*	Nematode, Early leaf blight, Fruit rot
Egg plant	Leaf curl
Hot pepper*	Fusarium wilt, Nematode, Dumping off
Okra	Nematode, Fusarium wilt, "Soil born disease"
Onion*	Bulb rot
Watermelon	Wilt
Sweet potato	no serious
Insect Pest	
Paddy rice	Stem borer, Rice hispa, Case worm, Leaf roller
Maize*	Stem borer, Caterpillars, Weevil, Army worm
Cowpea & groundnut*	Weevil, Caterpillars, Grass hopper
Tomato*	Stem borer, Aphid
Egg plant	Caterpillars, Leaf minor
Hot pepper*	no serious insect pest
Okra	Caterpillars, Poudadrica, Fly beetles
Onion*	Thrips, Grass hopper
Sweet potato	Poudadrica
Watermelon	Poudadrica

Wild birds reduce the yield of cereal crops. Paddy rice is attacked by *Quelea quelea*, weaver bird and sparrow. Maize is also damaged by weaver bird. Partridge, another wild bird, damages maize and cowpea. The major animal damages are caused by grass cutter (big rat), mice (small rat), squirrel, and toad. Grass cutter damages maize, cowpea, groundnut and cassava, while mice attack paddy rice, maize, tomato, egg plant and sweet potato. Squirrel attacks young fruits of watermelon at Mankessim, and toad (a kind of frog) attacks okra seed in the soil at Kpando-Torkor.

2) Agro-chemicals

The use of fungicide, insecticide, herbicide and rodenticide are presented in Table E-19 and summarises as below. To control many serious diseases of pest, various kind of agro-chemicals are applied at present. High rate of various fungicide for tomato are applied. Egg plant and hot pepper also need high rates of insecticide to control insect pests. Paddy rice is the only crop applied herbicide to control their weeds. Rodenticide to grass cutters and mice is used frequently for paddy rice, and infrequent for tomato, hot pepper and okra.

Agro-chemicals	Commercial Name
(a) Fungicide	Diathine M45, Topsin, Kocide, Fuji One
(b) Application rate	
High	Tomato*
Medium	Egg plant, Onion*, Watermelon
Low	Paddy rice, Okra, Hot pepper*
no application	Maize*, Cowpea*, Groundnut*, Sweet potato
(a) Insecticide	Karate 2.5E, Dursban, Furadan, Diazinon, Elsan
(b) Application rate	
High	Tomato*, Okra, Egg plant, Hot pepper*
Medium	Paddy rice, Cowpea*, Groundnut*, Onion*, Watermelon
Low	Maize*
no application	Sweet potato
(a) Herbicide	Basagran PL2, Satunil, Arrosolo 3-3E
(b) Application frequency	
Frequent	Paddy rice
no application	Maize*, Cowpea*, Groundnut*, Tomato*, Egg plant, Okra, Hot pepper*, Onion*, Sweet potato, Watermelon
(a) Rodenticide	Yasodion, Warafin
(b) Application frequency	
Frequent	Paddy rice
In frequent	Tomato*, Hot pepper*, Okra
no application	Maize*, Cowpea*, Groundnut*, Egg plant, Onion*, Sweet potato, Watermelon

Plant protection from diseases, insect pests, weed grass, and wild animals and birds are important to ensure high yield and quality of farm products. The present application rate of agro-chemicals are not so high, because of expensive prices of agro-chemicals. Hand weeding to clean field is an effective method for minimising diseases and pests proliferation, and save agro-chemicals.

1.5 Crop Yield and Crop Production

Crop area, average yield and crop production of main crops at the priority projects are presented in the former table of Table E-20. The original data are taken from the crop production records from 1990 wet season to 1996 dry season, when available, at the projects. The overall average yield of major crops at the five (5) priority projects and the ones at the twelve (12) projects in Phase-I Study for comparison are shown below:

Crop	Average Crop Yield (ton/ha)	
	Phase-II Study	Phase-I Study
Paddy rice	3.43	4.47
Maize	-	2.59
Cowpea	-	1.52
Groundnut	-	1.36
Tomato	-	8.17
Egg plant	12.13	12.78
Hot pepper	-	5.30
Okra	7.04	7.86
Onion	-	14.50
Watermelon	9.50	11.86
Sweet potato	9.00	9.00

Average yield of paddy rice and watermelon is 3.43 and 9.50 t/ha, respectively, and they are lower than the ones of Phase-I Study. Average yield of egg plant, okra and sweet potato is almost same as the ones in Phase-I Study.

1.6 Animal Husbandry and Fishery Production

Since the project activities concentrated to crop production and marketing at present, as mentioned before, there is no direct relation of crop production and animal husbandry. Livestock and poultry raise by farmer in their home are surveyed. A few cattle is found surrounding area raised by the farmers of Aveyime project. Goat and sheep are very popular livestock at Mankessim, but they are only a few at the other project. Chicken is the most common poultry at all the projects except Ashaiman. Little duck is found at Aveyime project.

Animal husbandry is important not only for supplying protein food to the farmers working at the projects, but also as source of organic manure for the projects to increase soil fertility and save chemical fertilisers. Trials using chicken and cattle waste for vegetable production have already started at Ashaiman project.

Fish pond is constructed at the Ashaiman project, but not belong to the project. There are no fish pond at Mankessim and Okyereko project.

1.7 Post-harvest Facilities and Marketing

1.7.1 Post-harvest Facilities

Drying floor is essential for post-harvest of paddy rice. The floor is available at Ashaiman, Aveyime and Okyereko projects, but the floor at Aveyime is very old and narrow.

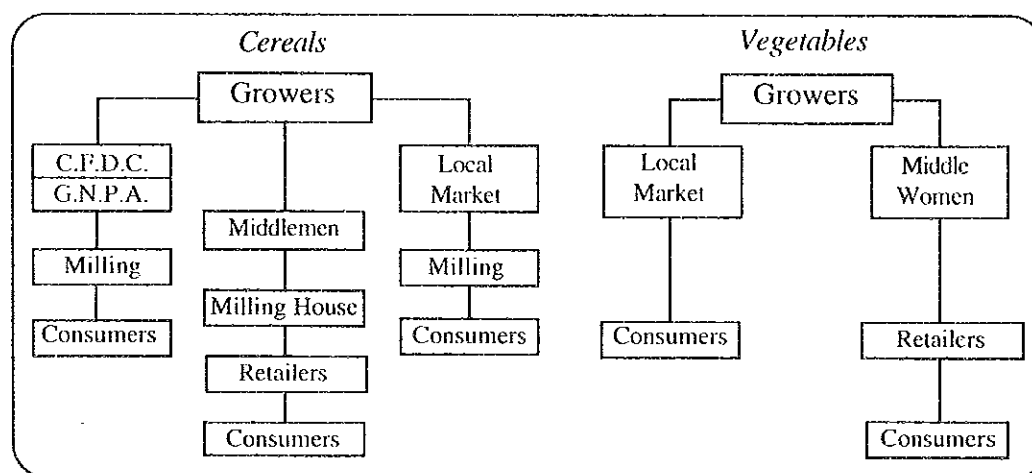
Store house is also available at Ashaiman project, but none at other projects. There is no facility for selecting marketable products of vegetables at all projects.

Presently, almost of vegetables are sold to market in fresh products at the projects. Dried hot pepper is commonly sold and dried okra is seldom observed in local markets. Tomato paste processing in very small scale are observed at local markets. There were some tomato processing factories in rural area, but they were closed because of unsuccessful business.

1.7.2 Marketing of Farm Products

(1) Marketing of Farm Products in the Country

The prevailing channels of farm products in the country are illustrated as shown below:



The marketing rout of cereal are separated to three (3) channels. The main rout is a rout from the procedures through middlemen or market mammies, milling house and retailers, and to reach the consumers, as its terminal. Rice and maize are marketed through the Cereal Food Distribution Corporation, National Procurement Authority, milling house, and family to the consumers. The retailers is not included in this channel. The Cereal Food Corporation and National Procurement Authority are both incorporation bodies. Therefore, they have no function to control market prices.

In case of vegetable, fresh vegetables are sold by market women at the local markets. The market channel of root vegetable and fruit vegetables, such as yam, cassava, onion, shallot, tomato, eggplant, etc. is through market mammies and retailers. The retailers take part of marketing services between market women and consumers.

(2) Marketing of Farm Products in the Project Areas

Farm gate sell of products to market mammies, middlemen, is very popular way of marketing at the most of the projects. At Ashaiman project, all farm products of paddy rice and okra is sold to market mammies at farm gate. At Aveyime project, paddy rice harvested is immediately sold to market mammies, while some farmers stores rice at their house and sell to market mammies when the price is up. At Kpando-Torkor, okra is sold in every other day at farm gate to the market mammies from Kpando, Ho, Hohoc. At Mankessim, watermelon is sold to market mammies from Accra, Cape Cost and Sekondi. Egg plant, sweet potato and okra, however, are sold at local market by farmers when no market mammies comes. GIDA track is used for transportation of farm products from farm to local market. Paddy rice at Okyereko project is sold at farm gate to market mammies who come from Accra.

According to the Regional Director in Volta Region, okra is exporting to London. For example, a farmer of this region exported 435 tons of fresh okra to London market in 1995 from his farm with pump irrigation. Okra is also exported to neighbouring countries like Togo and Burkina Faso by land transportation. There is no problem in marketing of okra production in this area.

The location of the major markets related to the projects are listed as follows:

Projects	(1)	(2)	(3)	(4)
Kpando	Ho	Hohoe	Kpond market	KpandoTorkor
Ashaiman	Tema	Ashaiman	Kpondo	Suhum
Aveyime	Kasseh	Aveyime	Battor	Ashaiman
Mankessim	Mankessim	Keneahi	Agbogboloahie	La, Trad fair area
Oyereko	Swedry	Aki oda	Winneba	Kasoa

Note: The order of the major markets are ranked on the table above.

One (1) means the most important market and four (4) the less important market.

1.7.3 Marketing of Fertiliser and Agro-chemicals

The marketing channel of fertiliser and agricultural chemical are each individually. The imported fertilisers are handling by importer at the sea port. Then, fertilisers are transported through local agent and wholesalers. The marketing routes of imported fertilisers are separated into two routs at the wholesaler. The first rout is a route from farmers groups, and to reach the consumers as its terminal. The second route is a rout from retailers to the consumers.

The marketing channel of agricultural chemicals are the same as the imported fertilisers. Only, importer license is difference.

1.8 Crop Budget and Farmers' Economy

1.8.1 Crop Budget

Crop budget for 1994/1995 crop year is analysed for selected major crops grown in the project areas. The result is summarised as follows, and the details are presented in Table E-21.

Net Return per Hectare (Cedis 1,000)

(Unit: Cedis 1,000)

Projects	Crops	Gross Income	Production Cost	Net Return
Ashaiman	Maize	138	181	-43
	Paddy	1,813	892	921
	Okra	2,160	1,094	1,066
Aveyime	Cassava	779	375	404
	Maize	228	298	-70
	H. Pepper	750	1,292	-542
K-Torkor	Cassava	700	307	393
	Yam	2,173	464	1,709
	Maize	700	520	180
	Okra	6,300	2,214	4,086
Mankessim	Cassava	2,080	229	1,851
	S. Potato	2,500	361	2,139
	Maize	627	345	282
	Eggplant	3,712	772	2,940
	Okra	1,835	1,184	651
	H. Pepper	2,500	936	1,564
	Tomato	308	411	-103
	Watermelon	2,301	630	1,671
	Sugarcane	813	231	582
Okyereko	Cassava	572	418	154
	Maize	667	459	208
	Paddy	2,250	752	1,498
	Tomato	1,100	515	585
	Groundnut	338	466	-128

Source: Farm Interview Survey by the Study Team

As seen in the above table, the highest net income, 4.1 million Cedis per ha, is obtained from the cultivation of okra in Kpando-Torkor area and followed by 2.9 million Cedis of net income by eggplant in Mankessim area. In case of Subinja area, the highest net income comes from the cultivation of egg plant. Also in other project areas, higher net incomes are expected from the cultivation of vegetables in general.

1.8.2 Farmers' Economy

The main farm income of average farm family in three (3) gravity irrigation projects, Ashaiman, Aveyime and Okyereko, is derived from rice cultivation and supplemented by vegetables production. In the remaining two (2) pump-sprinkler irrigation projects, the major income sources depend on vegetable production of onion, okra, water melon, tomato and so on. The farm household budget is studied on gross income, gross outgo and net revenue. The gross income includes crop income, livestock income and off-farm income. The gross outgo covers crop production costs and living expenses. The farm household budget of average farming size is summarised as follows, and the details are presented in Table E-22.

Farm Budget Analysis - Present Condition

Items		Ashaiman	Aveyime	K-Torkor	Mankessim	Okyereko
(Farm Management Size)*1	(ha)	0.55	1.10	0.64	0.82	1.30
Irrigated	(ha)	0.49	-	0.11	0.30	0.32
Rainfed	(ha)	0.06	1.10	0.53	0.52	0.98
1) Gross Income		<u>2,994</u>	<u>2,129</u>	<u>2,588</u>	<u>2,277</u>	<u>2,487</u>
- Farm Income*2		981	722	1,200	1,548	1,403
- Non farm income		2,005	1,403	1,387	729	1,072
- Loans		8	4	1	-	12
2) Gross Outgoing		<u>2,994</u>	<u>2,129</u>	<u>2,588</u>	<u>2,277</u>	<u>2,487</u>
- Production Cost*3		404	119	341	280	220
- Living Expenses*4		2,581	2,003	2,245	1,997	2,243
- Loan Repayment		9	7	2	-	24
3) Net Revenue		<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>	<u>0</u>

*1 Including not only the farm lands in the project areas but also the farm land located at the outside project areas.

*2 Including farm incomes obtained from the outside project areas.

*3 Excluding family labour force.

*4 Including products consumed at home.

*5 According to the farm interview survey, minus values of net revenues were obtained from 5 projects. It seems that figures of non-farm income obtained from the farmers have indicated lower side, because they could not make the answer on its actual amount due to no record. As actual situation on the farmers economy in the project areas it seems that the farmers have almost no or a little revenue.

Source: Result of farm interview survey by the Study Team.

Farmers are getting their income mainly from farming, side job such as labour in other farms, remittance from their relatives and others. According to the farm survey, the farmers in Ashaiman area gains more than two million Cedis of income from off-farm works. In case of farmers in Ashaiman area, some of family members are working in Tema, the main industrial zone of Ghana.

2. AGRICULTURAL DEVELOPMENT PLAN

2.1 Basic Concepts for Agricultural Development

The policy and strategy for profitable agricultural development in connection with the projects rehabilitation for the five priority projects are (i) increase and stabilisation of agricultural productivity, and (ii) rehabilitation and improvement of agricultural production infrastructure.

The increase and stabilisation of agricultural productivity through elimination or alleviation of various constrains that currently exist at the project areas is considered to be the most of important factor in contributing to the achievement of the key policy in the MTADP. The essential policies to achieve this purpose will be (i) intensification of farming and crop production, (ii) crop diversification, and (ii) extension of improved farming. The direct measures in line with these policies will include:

- 1) Establishment of an integrated agricultural base station or more effective use of existing station such as IDC for field trial of crop variety, fertiliser use, pest and disease control, etc. as well as for demonstration of improved farming practices for the purpose of increasing crop production in both lowland and upland.
- 2) Promotion and extension of crop diversification particularly in both lowland and upland.
- 3) Improvement and strengthening of extension services, especially for transfer of packaged farming information and technology, necessary actions on how to encourage the farmers for increase in crop production, and on how to promote the farmers' participation in crop diversification.

The practical and productive agricultural development plan suited to the rehabilitated projects will be formulated in consideration of the following main items:

- 1) The priority in formulating proposed crops and cropping patterns will be given the production increase of paddy rice and vegetables so as to meet the policy for agriculture development shown in MTADP.
- 2) The optimum combination of food crops and vegetables as cash crops to expect higher returns which result in the increase in farm income of the farmers.
- 3) Full and effective land use of rehabilitated project areas, especially in the wet season.
- 4) Consideration will be given to optimum crop rotation systems to avoid crop damage due to continuous cropping. It is recommended to cultivate upland crops including vegetables in the proposed crop rotation systems by four year's cycle.
- 5) Formulation of proposed crops and cropping patterns will be made in consideration of available storage and processing facilities of farm products.

2.2 Proposed Cropping Pattern

After completion of the Project, most of the farm field in each project areas will be fully irrigated and more intensive use of the farmland will become possible. The proposed future land use in each project area is summarised as follows, and the details are shown in Table E-23. These studies were made, taking into account the land suitability for irrigation farming.

Total Area (ha)	Present Land Use (ha)		Proposed Land Use (ha)		Remarks
	Paddy Field	Upland Field	Paddy Field	Upland Field	
Ashaiman Existing Area	56	-	11	45	Irrigation area for paddy is only 11 ha, because of limited water resource. Of total areas, 2 ha are allocated to IDC as the experimental farm, and remaining 54 ha are located along the main drainage canal.
Total	56	-	11	45	
Aveyime Existing Area	63	-	48	15	Of total existing paddy fields, the lands of 15 ha are proposed to cultivate upland crops taking into account the soil condition. From the stand point of easy water management, it is proposed to divide the lands into two blocks; paddy field and upland field. A farmer holds two plots separately.
Extension Area - 1	-	16	-	16	
Extension Area - 2	-	1	-	1	
Extension Area - 3	-	15	-	15	
Total	95	32	48	47	
Kpando-Torkor Existing Area	-	40	-	40	All lands in the project area are suitable for cultivation of upland crops, and all farmers have requested to the cultivation of these crops under the sprinkler irrigation.
Extension Area	-	115	-	115	
Total	155	155	-	155	
Mankessim Existing Area	-	29	-	29	The land productivity in the existing area is relatively lower than the other areas, but the farmers strongly requested to include this area in the rehabilitation project.
Extension Area	-	57	-	57	
Total	86	86	-	86	
Okyeroko Existing Area	39	-	39	-	The existing paddy fields are used for paddy cultivation after the rehabilitation, and all extension areas are for cultivation of upland crops. A farmer holds two plots; paddy field and upland field.
Extension Area - 1	-	24	-	24	
Extension Area - 2	-	18	-	18	
Total	81	42	39	42	
Grand Total	473	315	98	375	

2.3 Proposed Crops, Cropping Patterns and Crop Rotation Systems

Although the number of the proposed alternative plans of the comparative studies of project study area are none (fixed) at Ashaiman, four (4) at Aveyime, four (4) at Kpando-Torkor, two (2) at Mankessim, and three (3) at Okyeroko project, the maximum rehabilitated area of these plans are summarised as follows:

Project	Potential Area (ha)	Max. Rehabilitated Area (ha)	Lowland Area (ha)	Upland Area (ha)
Ashaiman	148	56	11	45
Aveyime	150	95	48	47
Kpando-Torkor	356	186	-	186
Mankessim	256	86	-	86
Okyeroko	111	81	39	42
Total	1021	504	98	406

(1) Ashaiman Project

Crops being grown at present at this area are paddy rice and okra. Paddy rice is cultivated in both the dry and wet season, and okra in dry season. Sandy soil is distributed almost of upstream area and clay soil suited to paddy rice is limited to the downstream area of drainage. This project has severe water shortage problem, and the project study area to be rehabilitated will be restricted to those on left bank only, covering 56 ha of land. This means for the farmers that land holding size of a family will be reduced to one acre (0.4 ha) after rehabilitation. More profitable crops such as vegetables will be necessary to introduced to recover the reduction of land holding size. Introduction of vegetables will also contributed to the saving of irrigation water, especially during in dry season.

The project study area at this project is proposed where 11 ha of lowland and 45ha of upland, totalling 56 ha, as mentioned above. The proposed crops and cropping pattern are presented in the former figure of Figure E-1, and proposed crop rotation system shown in Table E-24. They are summarised as below. In lowland, okra is cultivated in the dry season and paddy

rice in the wet season with irrigation every year. In upland, vegetables such as tomato, onion and watermelon will be cultivated with irrigation in the dry season. To avoid damage by continuous cropping, the upland field is divided into four blocks, and tomato, onion and watermelon will be planted in one, one and two blocks of field every year, respectively. These crops will rotate the blocks by four year's cycle. Food crops such as maize and groundnut/cowpea will be cultivated in the wet season. Maize and groundnut/cowpea will be cultivated in two and two blocks every year, respectively. These crop will rotate the blocks by four year's cycle.

Field condition	Crop Area (ha)	Dry season	Rainy season
Lowland	11	Okra (20%)	Paddy rice (20%)
Upland	45	Tomato (20%), Onion (20%) Watermelon (40%)	Maize (20%) Groundnut/Cowpea (40%)
Total Area	56	100%	100%

Note : Figure in parenthesis indicate percentage of crop area to reactivate project area (56ha).

Proposed main crops and cropping pattern are basically accepted by project staff. Groundnut is more common than cowpea in this area. Regarding with the proposed vegetables, watermelon is very profitable crop and suitable to short season cultivation. Though bacterial wilt disease is severe, price of tomato is higher than egg plant. The labour intensity of onion cultivation is higher than the other crops. Cultivation of vegetables in dry season and food crops in wet season in upland is recommendable as superior rotation system to avoid damage by continuous cropping, to control fungus disease and nematode damage, and to increase soil fertility.

The proposed crops and cropping pattern are discussed with farmers at the public meeting and basically they are accepted by the farmers.

(2) Aveyime Project

Presently, paddy rice in both dry and wet season is the only one crop grown at this project. Sandy soil is distributed in most of area and clay soil is limited to downstream area of drainage. The both of the expanded area after rehabilitation have sandy soil, and adapted to upland crops including vegetables.

There are three alternative plans of project study area. A part, 15 ha, of the up stream area where presently used to grow paddy rice will be modified into upland field because the soil condition is sandy so that upland crops will be suitable. The maximum land use plan has 48 ha of lowland and 47 ha of upland, totalling 95 ha. The proposed crops, cropping pattern of the plan are presented in the former figure of Figure E-2, and proposed crop rotation system for the plan are shown in Table E-25. They are summarised as below. In lowland, paddy rice will be cultivated in both dry and wet season every year. In upland, vegetables such as tomato/hot pepper, okra and onion will be cultivated in the dry season. To avoid damage by continuous cropping, , the upland field is divided into four blocks, and tomato/hot pepper, okra and onion will be planted in one, one and two blocks every year, respectively. These crops will rotated the blocks by four year's cycle. Food crops such as maize and groundnut/cowpea will be cultivated in the wet season. Maize and groundnut/cowpea will be planted in two and two blocks every year, respectively. These crops will be rotated blocks by four year's cycle.

Field condition	Crop Area (ha)	Dry season	Rainy season
Lowland		Paddy rice (50%)	Paddy rice (50%)
Upland		Tomato/Hot pepper (13%) Okra (12%), Onion (25%)	Maize (25%) Groundnut/Cowpea (25%)
Total Area	95	100%	100%

Note : Figure in parenthesis indicate percentage of crop area to reactivate project area (95ha).

The proposed crops and cropping pattern are basically acceptable by projected staff.

There is no experience so far in growing vegetables, maize, cowpea and groundnut in the project area. However, the farmers are familiar with planting rainfed okra, hot pepper, maize, and groundnut in their own land in wet season. Onion is rather new crops to farmers, so that they have to be educated the farming practice of onion before starting of onion cultivation. Other new vegetable like cabbage and watermelon will not be suitable at beginning time in terms of marketing.

The proposed crops and cropping pattern are also discussed with farmers at the public meeting and basically they are accepted by the farmers.

(3) Kpando-Torkor Project

Okra in the dry season is the only one crop grown at this project at present. The soil and topology at this project are sandy and slightly sloping so that suited to upland crop production. The farmers are requested one acre (0.4 ha) of land holding at least after rehabilitation, in order to grow vegetables as cash crop with irrigation in the dry season. They also wanted to grow their rainfed food crops such as maize and groundnut mainly under rainfed condition at outside of rehabilitated area in the wet season.

Although there are four alternative plans of project study area regarding with different design of pump station, the study area is fixed, 186 ha of all upland in the alternative plans. Proposed crops and cropping pattern are presented in the former figure of Figure E-3, and proposed crop rotation pattern is shown in Table E-26. They are summarised as below. Vegetables such as okra, tomato/hot pepper and onion/shallot will be cultivated with irrigation in the dry season. To avoid damage by continuous cropping, the upland field is divided into four blocks, and okra, tomato/hot pepper and onion/shallot will be planted in one, one and two blocks every year, respectively. These crops will be rotated blocks by four year's cycle. Food crops such as maize and groundnut will be cultivated with supplement irrigation in the wet season. These crops will be planted in two and two blocks every year, respectively. These crops will be rotated blocks by four year's cycle.

Field condition	Crop Area (ha)	Dry season	Rainy season
Upland	155	Okra (25%), Tomato/Hot pepper (25%) Onion/Shallot (50%)	Maize (50%) Groundnut (50%)
Total Area	155	100%	100%

Note : Figure in parenthesis indicate percentage of crop area to reactivate project area (155ha).

The proposed crops and cropping pattern are basically accepted by the project staff. Diversification of crop is important at this project. Hot pepper and egg plant can be planted along with tomato. Groundnut is favourable than cowpea, because cowpea does not produce fruits after flowering in this area, although the reason is not clear so far. Onion is produced in northern part of Volta Region in wet season. Dry season onion may be competitive with the onion in the Northern Region like Bontanga project. However, Kpando-Torkor project have advantage of marketing in term of shorter transportation to Accra and Tema than Bontanga. Shallot is another alternative of onion. It is very short season crop and suited to small area production. It can grow twice in a dry season. Problem is expensive price of seed bulb for large scale cultivation.

Proposed expansion area is suitable to upland crops including vegetables. Presently some crops are planted spottedly. Since the land slope is about 3%, protection to soil erosion is very important at this project. Construction of green belt, contour line cultivation, soil mulcting by dried wild tall grass are advisable to protect from gully soil erosion.

The proposed crops and cropping pattern are discussed with farmers at the public meet-

ing and basically they are accepted by the farmers.

(4) Mankessim Project

The main crops at this project are watermelon intercropped with egg plant and/or okra in the dry season. In addition, onion cultivation is also recommended in this area, which having a good profitability as well as those vegetables. Sweet potato is cultivated in the wet season. The soil and topology are sandy and undulating so that upland crops including vegetables are suitable to the conditions.

Although two alternative plans of project study area are proposed, field condition of the both plans are upland. The proposed crops, cropping pattern for the maximum land use plan are presented in the former figure of Figure E-4, and proposed crop rotation system is shown in Table E-27. They are summarised as below. Vegetables such as watermelon, egg plant and okra will be cultivated in the dry season. To avoid damage by continuous cropping, the upland field is divided into four blocks, and watermelon, egg plant and okra will be planted separately in two, one and one blocks every year, respectively. These crops will be rotated blocks by four year's cycle. Food crops such as maize and groundnut/cowpea will be cultivated with sweet potato in the wet season. Maize, groundnut/cowpea and sweet potato will be planted in one, one and two blocks every year, respectively. These crops will be rotated blocks by four year's cycle.

Field condition	Crop Area (ha)	Dry season	Rainy season
Upland	86	Watermelon (25%) Onion (25%) Egg plant (25%) Okra (25%)	Maize (25%) Groundnut/Cowpea (25%) Sweet potato (50%)
Total Area	86	100%	100%

Note : Figure in parenthesis indicate percentage of crop area to reactivate project area (86ha).

Proposed crops and cropping pattern are basically accepted agreed by project stuff, since the proposal are mostly similar to those in the present agriculture. This project is located near to main road and short transportation to Cape Coast. According to the project manager, large amount of products after rehabilitation is more attractive to market mummies than small amount of products at present.

The proposed crops and cropping pattern are discussed with farmers at the public meeting and basically they are accepted by the farmers.

(5) Okyereko Project

The present crop at this project is paddy rice in dry season, because of severe water shortage problem. The soil condition is mostly sandy to sandy loam soil. Clay soil is distributed only at downstream area of drainage. Both of the expanded areas after rehabilitation has sandy soil which is suited to upland crops including vegetables. Presently cabbage with private pump irrigation and rainfed maize are planted in spot in these area.

There are three alternative plans of project study area, as mentioned above. The proposed crops, cropping pattern for the maximum land use plan are presented in the former figure of Figure E-5, and proposed crop rotation system is shown in Table E-28. They are summarised as below. In lowland, paddy rice will be cultivated in both dry and wet season every year. In upland, vegetables such as tomato, okra and onion will be cultivated with irrigation in the dry season. To avoid the damage by continuous cropping, the upland field is divided into four blocks, and tomato, okra and onion will be planted in one, one and two blocks every year, respectively. These crops will be rotated blocks in four year's cycle. Food crops such as maize

and groundnut/cowpea will be cultivated with supplement irrigation in the wet season. Maize and groundnut/cowpea will be planted in two and two blocks every year, respectively. These crops will be rotated blocks in four year's cycle.

Field condition	Crop Area (ha)	Dry season	Rainy season
Lowland	39	Paddy rice (48%)	Paddy rice (48%)
Upland	42	Tomato (13%), Okra (13%) Onion (26%)	Maize (26%) Groundnut/Cowpea (26%)
Total Area	81	100%	100%

Note : Figure in parenthesis indicate percentage of crop area to reactivate project area (81ha).

The farmers grow rainfed maize, cassava, groundnut and cowpea in and out of project area in the wet season.

Proposed crops and cropping pattern are accepted by project staff. Onion, okra and tomato cultivation are very popular in this area. There are no problems on marketing of these vegetables, because the project is located near to main road and short access to Accra.

The proposed crops and cropping pattern are discussed with farmers at the public meeting and basically they are accepted by the farmers.

2.4 Proposed Farming Practices and Farm Inputs

2.4.1 Proposed Farming Practices

Details of proposed farming practices such as land preparation, seeding, transplanting, fertiliser and agro-chemicals application, weeding, irrigation and drainage, use of labour force and agricultural machinery, and harvesting are presented in Table E-29 - Table E-34. The crops included are paddy rice, tomato, onion, okra, watermelon and sweet potato.

Among the various farming practices, land preparation should be made very carefully in both lowland and upland. Since cultivation of paddy rice by broadcasting is preferable of labour-saving practice, land levelling after ploughing and harrowing is one of important farming operations in order to ensure uniform and perfect germination and healthy seedling growth, to assist weed control, and to use irrigation water effectively. Careful levelling is also essential to expect higher crop yield, because uniform and perfect germination and seedling growth will reflect directly to high standability, lodging resistance and higher yield at harvest.

Weeding is also one of important farming practices to expect higher crop yield. Manual weeding should be practised especially when crops are at young growing stage, which will also be effective for control of the incidence of diseases and insect pests.

Harvest at optimum time is essential to reduce field loss of products of cereals and legume crops and vegetables, particularly for paddy rice and cowpea which easily fall down when they are over-ripened. Care should also paid for harvesting time of vegetables to ensure qualified marketable products.

2.4.2 Proposed Farm Inputs

(1) Fertiliser

Proposed application rates of for crops on N:P:K kg/ha and compound and nitrogen kg/ha at each project are presented in Table E-35, and summarised below. The rates are increased up to 20-30% more than present ones, in order to ensure higher yields and high quality farm products.

Crop	Proposed Application Rate of Fertilizer				
	N:P:K (kg/ha)	Compound (kg/ha)		Nitrogen (kg/ha)	
Paddy rice	152:60:60	15-15-15	300	Urea	200
Maize	98:45:45	15-15-15	150	SA*	125
Groundnut / Cowpea	no application	no application			
Tomato	123:45:45	15-15-15	400	SA	300
Egg plant	117:45:45	15-15-15	300	SA	250
Onion	98:45:45	15-15-15	300	SA	250
Okra	117:45:45	15-15-15	300	SA	300
Watermelon	98:45:45	15-15-15	300	SA	250
Sweet potato	15-15-15	15-15-15	100	no application	

Note *: sulphate ammonium

The importance point of fertiliser application is the time as well as the rate. It is recommended that a half amount of basic fertiliser, 15-15-15 compound, be applied just before the ploughing and harrowing, and another half amount after seeding or transplanting in the proposed farming practices. Likewise, a half amount of top dressing fertiliser, urea or sulphate ammonium, is proposed to be applied at seedling stage, and another half at full-growing and flowering stage. Presently, traditional application time of basal fertiliser is two to three weeks after seeding or transplanting. It causes low efficiency in use of fertiliser, especially P and K.

(2) Agro-chemicals

Proposed application rates of agro-chemicals such as fungicide, insecticide, herbicide and rodenticide to protect crops from serious diseases and pests at the projects are presented in Table E-36. The rates of are almost the same level as the present ones.

2.5 Anticipated Crop Yield and Crop Production

Anticipated crop yields at the projects after rehabilitation would increase through introduction of improved irrigation farming, effective use of farm inputs as well as more intensive supporting services from IDC and other government institutes concerned. The anticipated crop yields of are shown below, basing on the analysis of present crop yields, data from Phase-I Study in 1995, and data available from the institutes concerned.

Crop	Present Yield (ton/ha)	Anticipated Yield (ton/ha)
Paddy rice	3.4	6.0
Maize	2.6 *	3.0
Groundnut / Cowpea	1.5 *	2.0
Tomato	8.2	15.0
Egg plant	12.1	15.0
Okra	7.0	12.0
Onion	14.5 *	18.0
Sweet potato	10.0	15.0
Watermelon	9.0	20.0

2.6 Post-harvest, Agro-processing and Storage

Drying floor is one of the essential facilities for post-harvest of paddy rice, maize, groundnut and cowpea. New construction of drying floor will be necessary at Aveyime, Kpando-Torkor and Mankessim projects where drying floor is very old and narrow, or none.

Presently, almost of vegetables are sold to markets in fresh products at the projects. A house for selecting vegetables selecting house will also be required for post-harvest and marketing of vegetables at all the projects. The house which has appropriate floor space and simple roof can be used for grading products by size and for selecting marketable products. At Amate

project, for example, tomato and onion harvested from field are graded by size, and selected as marketable fruit or bulb. At Weija project, the fruits of Asian vegetables such as tinda and long marrow with optimum size, color and maturing stage, and the fruits without the scar of diseases and pests infection are severely selected at the vegetable selecting house, in order to meet market requirement of London community.

Rice miller is important post-harvest equipment for paddy rice production. Rice miller will be necessary at Aveyime and Okyereko where the main crop is rice.

Storage house for storing farm products is the other essential facility for storing food grains and legumes for at the projects. The house is also used for storing fertiliser and agro-chemicals which should be prepared to apply at optimum stage of crop growing or incidence of diseases and pests. The small equipment such as nap-sack sprayer will be also stored in the house.

2.7 Marketing of Farm Product

Most of farm products are at present sold to market mammals, middlemen, at farm gate of the projects. According to the Phase-I Study and the present field survey made in this year, okra at Kpando-Torkor project is sold to market mammals from Kpando, Ho, Hohoe. Watermelon at Mankessim project is sold to market mammals from Accra, Cape Coast and Sekondi. Market mammals know the detail of the season, volume and characteristics of farm products, consumer's request, transportation costs, and seasonal and regional fluctuation of local market prices, etc.

Exporting of tropical fruits such as banana, pineapples and papaya is increasing in Ghana. Asian vegetables are exporting to London market from farmer-exporter of Weija project. In Volta Region, okra is exporting to neighbouring countries such as Togo and Burkina Faso by middlemen using land transportation, and to London market using air cargo by a farmer-exporter.

The market prices of farm products vary with the seasons and the location of the markets. They reflect the demand-supply situations of the commodities. The prices of paddy rice, maize, groundnut and cowpea do not fluctuate so much as compared with those of vegetables. Since vegetables can only be produced with irrigation in dry season, it is expected that the farm gate prices of tomato, okra, onion and watermelon in dry season at the projects will be much higher than the those of rainfed vegetables in wet season. Recently private pump irrigation is gradually increasing, technology transfer of improved irrigation farming from IDC to farmers at the projects will be much more of importance than before.

The demand-supply situation at the markets is the basic information in order to decide the crops to be grown, crop areas and crop patterns at each of the projects. The market research is therefore essential for marketing of farm products as well as farm inputs. Under the free marketing system, it is also essential to produce the products with good quality and optimum quantity to meet the market requirement. For these purposes, more active services by the existing farmers' societies will be required to control quality and quantity of products so that the farmers can negotiate with the middlemen on appropriate prices of products as well as of inputs through the societies.

2.8 Crop Budget and Farmers' Economy

2.8.1 Crop Budget

In order to grasp the profitability of proposed crops and total net production value under the future with project condition, crop budget analysis is made as shown below. The details are presented in Table E-37.

Crop Budget per Hectare - With Project

(Unit: Cedis 1,000)

Projects	Crops	Gross Income	Production Cost	Net Return
Ashaiman	Wet Paddy	2,940	1,273	1,667
	Okra	4,320	1,258	3,062
	Tomato	9,000	1,217	7,783
	Onion	9,360	2,344	7,016
	Watermelon	4,500	1,061	3,439
	Maize	690	417	273
	Cowpea/Groundnut	760	361	399
Aveyime	Wet Paddy	2,760	1,246	1,514
	Dry Paddy	2,760	1,246	1,514
	Maize	1,140	626	514
	Cowpea/Groundnut	760	393	367
	Tomato/H. Pepper	8,400	1,170	7,230
	Okra	3,000	1,415	1,585
	Onion	9,360	2,099	7,261
K-Torkor	Okra	7,560	1,845	5,715
	Tomato/H. Pepper	9,000	1,124	7,876
	Onion/Shallot	10,800	2,030	8,770
	Maize	1,050	594	456
	Cowpea/Groundnut	760	378	382
	Watermelon	4,500	978	3,522
Mankessim	Egg Plant	4,350	1,108	3,242
	Okra	4,560	1,509	3,051
	Onion	10,800	1,993	8,807
	Maize	990	667	323
	Cowpea/Groundnut	760	337	423
	Sweet Potato	5,000	488	4,512
Okyereko	Wet Paddy	3,600	1,322	2,278
	Dry Paddy	3,600	1,322	2,278
	Tomato	3,750	918	2,832
	Okra	4,560	1,500	3,060
	Onion	9,360	2,217	7,143
	Maize	870	754	116
	Cowpea/Groundnut	760	400	360

Note: Excluding irrigation service fees
1996 Constant Prices

As seen in the above table, the cultivation of onions and tomatoes indicate the higher net return under the irrigated condition, followed by okra and watermelon. The paddy cultivation shows moderately good income, and maize is less profitable crops as compared with vegetable and paddy cultivation. However, these are prerequisite crops as one of the staple food as well as cassava and yam.

2.8.2 Farm Budget

After implementation of the irrigation facilities, year round irrigation would be provided to all farmers in each project area, thereby, making possible an increase in yield and production of crops. As a result, a significant increase in farm income would be expected in the future with project condition. On the other hand, no substantial increase in farm income would be incurred in the future without project condition. The typical farm budgets for the future with project conditions in the project areas were analysed as shown in Table E-38, and are summarised in the following table. These analyses were made under the following conditions and assumptions.

- 1) Constant prices at 1996 level were used in the farm budget analyses.
- 2) Non-farm income of the farmers will be decreased to 50% from the present level to the future with project condition.
- 3) Living expenses will be increases to 30% from the present level to the future with project condition.
- 4) Under the future with project condition, almost all farmers will borrow a considerable amount of agricultural loan for land preparation by farm machinery and purchasing of fertilisers and agro-chemicals.

Farm Budget - With Project

(Unit: Cedis 1,000)

Items	Ashaiman	Aveyime	K-Torkor	Mankessim	Okyeroko
(Holding Size: ha)	(0.45)	(1.00)	(0.40)	(0.40)	(0.60)
1) Gross Income	<u>4,761</u>	<u>9,037</u>	<u>5,221</u>	<u>4,243</u>	<u>5,730</u>
- Farm Income	3,398	7,139	4,208	3,596	4,505
- Non farm income*1	1,003	702	694	365	536
- Loans	360	1,196	319	282	689
2) Gross Outgoing	<u>4,478</u>	<u>5,989</u>	<u>4,002</u>	<u>3,487</u>	<u>4,955</u>
- Production Cost*2	695	1,962	703	555	1,219
- Living Expenses*3	3,355	2,604	2,919	2,596	2,916
- Loan Repayment	428	1,423	380	336	820
3) Net Reserve	<u>283</u>	<u>3,048</u>	<u>1,219</u>	<u>756</u>	<u>775</u>

*1 50% of present condition.

*3 30% up from present condition

*2 Excluding family labour force

Note: 1996 Constant Prices

The farm incomes of farmers under the future with project condition would be expected to increase remarkably as compared with the present condition, and the net reserves would also be improved to Cedis 283,000 in Ashaiman and Cedis 3,048,000 in Aveyime. The increase in net reserve will offer incentives to the farmers, and will enable them to pay the water charge, if it is imposed on the farmers.

TABLES

Table E-1 Crop Area, Average Yield and Crop Production at Ashaiman Project

Crop Area (ha)																	
Project	Crop	1990 Rny	1991 Dry	1991 Rny	1991 Dry	1992 Rny	1992 Dry	1993 Rny	1993 Dry	1994 Rny	1994 Dry	1995 Rny	1995 Dry	1996 Rny	1996 Dry	Wet ave.	Rny ave.
Ashaiman (130ha)	Paddy rice							32.0		32.0		13.5		11.0		18.6	18.8
	Maize							0.2									
	Pepper									0.5							
	Okra							26.0		17.0		8.0		3.0			17.0
	Cucumber							0.3									
	Watermelon							0.2									
	Total area						32.2	59.0	13.5	30.5	11.0	19.0	20.9	not yet	18.6	35.8	

Crop Yield (t/ha)																	
Project	Crop	1990 Rny	1991 Dry	1991 Rny	1991 Dry	1992 Rny	1992 Dry	1993 Rny	1993 Dry	1994 Rny	1994 Dry	1995 Rny	1995 Dry	1996 Rny	1996 Dry	Wet ave.	Rny ave.
Ashaiman	Paddy rice							4.00		4.00		3.40		2.66		3.40	3.35
	Maize							no record									
	Okra									6.00		6.00		no record			6.00
	Pepper									no record							
	Cucumber									no record							
	Watermelon									no record							

Crop Production (t)																	
Project	Crop	1990 Rny	1991 Dry	1991 Rny	1991 Dry	1992 Rny	1992 Dry	1993 Rny	1993 Dry	1994 Rny	1994 Dry	1995 Rny	1995 Dry	1996 Rny	1996 Dry	Wet ave.	Rny ave.
Ashaiman	Paddy rice							128.00		128.00		45.90		29.26		63.24	62.98
	Maize							no record									
	Okra									156.00		102.00		no record			102.00
	Pepper									no record							
	Cucumber									no record							
	Watermelon									no record							

Table E-2 Crop Area, Average Yield and Crop Production at Aveyime Project

Crop Area		(ha)															
Project	Crop	1990 Rny	1991 Dry	1991 Rny	1991 Dry	1992 Rny	1992 Dry	1993 Rny	1993 Dry	1994 Rny	1994 Dry	1995 Rny	1995 Dry	1996 Rny	1996 Dry	Wet ave.	Rny ave.
Aveyime (63ha)	Paddy rice	40.0	30.0	27.3	0.0	37.0	29.7	28.0						12.00		28.91	28.5
	Total area	40.0	30.0	27.3	0.0	37.0	29.7	28.0						12.00		28.91	28.5
Crop Yield		(t/ha)															
Project	Crop	1990 Rny	1991 Dry	1991 Rny	1991 Dry	1992 Rny	1992 Dry	1993 Rny	1993 Dry	1994 Rny	1994 Dry	1995 Rny	1995 Dry	1996 Rny	1996 Dry	Wet ave.	Rny ave.
Aveyime	Paddy rice	3.80	2.50	4.80	-	3.22	2.60	4.50						not yet		4.08	2.55
Crop Production		(t)															
Project	Crop	1990 Rny	1991 Dry	1991 Rny	1991 Dry	1992 Rny	1992 Dry	1993 Rny	1993 Dry	1994 Rny	1994 Dry	1995 Rny	1995 Dry	1996 Rny	1996 Dry	Wet ave.	Rny ave.
Aveyime	Paddy rice	152.00	75.00	131.00	0.00	119.10	77.32	126.00						not yet		117.91	72.68

Table E-3 Crop Area, Average Yield and Crop Production at Kpando-Torkor Project

Crop Area		(ha)															
Project	Crop	1990 Rny	1991 Dry	1991 Rny	1991 Dry	1992 Rny	1992 Dry	1993 Rny	1993 Dry	1994 Rny	1994 Dry	1995 Rny	1995 Dry	1996 Rny	1996 Dry	Wet ave.	Rny ave.
Kpando-Torkor (40ha)	Okra								16.0		11.3		11.6		not yet	13.0	
	Total area							16.0		11.3		11.6		not yet	13.0		
Crop Yield		(t/ha)															
Project	Crop	1990 Rny	1991 Dry	1991 Rny	1991 Dry	1992 Rny	1992 Dry	1993 Rny	1993 Dry	1994 Rny	1994 Dry	1995 Rny	1995 Dry	1996 Rny	1996 Dry	Wet ave.	Rny ave.
Kpando-Torkor	Okra								8.00		10.00		12.00		not yet	10.00	
Crop Production		(t)															
Project	Crop	1990 Rny	1991 Dry	1991 Rny	1991 Dry	1992 Rny	1992 Dry	1993 Rny	1993 Dry	1994 Rny	1994 Dry	1995 Rny	1995 Dry	1996 Rny	1996 Dry	Wet ave.	Rny ave.
Kpando-Torkor	Okra							128.00		113.00		139.20		not yet		130.00	

Table E-4 Crop Area, Average Yield and Crop Production at Mankessim Project

Project	Crop	(ha)														Wet ave.	Rny ave.
		1990 Rny	1991 Dry	1991 Rny	1992 Dry	1992 Rny	1993 Dry	1993 Rny	1994 Dry	1994 Rny	1995 Dry	1995 Rny	1996 Dry	1996 Rny			
Mankessim (17ha)	Egg plant				10.5		11.0		11.0		11.0		11.0		10.0		10.7
	Pepper				0.2												4.9
	Okra				3.0		3.5		4.0		6.0		7.0		7.0		4.7
	Sweet potato								5.2		6.0		3.0				
	Watermelon				11.2		11.0		14.0		16.0		17.0		17.0		13.8
	Total area				24.9		11.0		5.2		14.0		16.0		17.0		13.8

Project	Crop	(t/ha)														Wet ave.	Rny ave.
		1990 Rny	1991 Dry	1991 Rny	1992 Dry	1992 Rny	1993 Dry	1993 Rny	1994 Dry	1994 Rny	1995 Dry	1995 Rny	1996 Dry	1996 Rny			
Mankessim	Egg plant				13.00		12.50		13.00		10.00		not yet		not yet		12.13
	Pepper				12.00		4.50		6.00		6.00		not yet		not yet		5.13
	Okra				4.00		10.00		10.00		10.00		7.00		9.00		9.00
	Sweet potato				7.00		8.00		8.00		15.00		not yet		not yet		9.50
	Watermelon																

Project	Crop	(t)														Wet ave.	Rny ave.
		1990 Rny	1991 Dry	1991 Rny	1992 Dry	1992 Rny	1993 Dry	1993 Rny	1994 Dry	1994 Rny	1995 Dry	1995 Rny	1996 Dry	1996 Rny			
Mankessim	Egg plant				136.50		137.50		143.00		110.00		not yet		not yet		129.79
	Pepper				2.40		15.75		24.00		42.00		not yet		not yet		25.14
	Okra				12.00		52.00		60.00		21.00		not yet		42.30		42.30
	Sweet potato				78.40		88.00		112.00		240.00		not yet		not yet		131.10
	Watermelon																

Table E-5 Crop Area, Average Yield and Crop Production at Okyereko Project

Project	Crop	(ha)														Wet ave.	Rny ave.
		1990 Rny	1991 Dry	1991 Rny	1992 Dry	1992 Rny	1993 Dry	1993 Rny	1994 Dry	1994 Rny	1995 Dry	1995 Rny	1996 Dry	1996 Rny			
Okyereko (40ha)	Paddy rice				7.3		30.9		17.0		0.0		28.0		28.0		21.2
	Total area				7.3		30.9		17.0		0.0		28.0		28.0		21.2

Project	Crop	(t/ha)														Wet ave.	Rny ave.
		1990 Rny	1991 Dry	1991 Rny	1992 Dry	1992 Rny	1993 Dry	1993 Rny	1994 Dry	1994 Rny	1995 Dry	1995 Rny	1996 Dry	1996 Rny			
Okyereko	Paddy rice				3.50		3.70		3.80		0.00*		not yet		not yet		3.75

Project	Crop	(t)														Wet ave.	Rny ave.
		1990 Rny	1991 Dry	1991 Rny	1992 Dry	1992 Rny	1993 Dry	1993 Rny	1994 Dry	1994 Rny	1995 Dry	1995 Rny	1996 Dry	1996 Rny			
Okyereko	Paddy rice				23.55		114.33		64.60		0.00		not yet		not yet		79.50

**Table E-6 Present Farming Practice of Broadcasting Paddy Rice
Cultivation at Ashaiman Project (Paddy Variety : GK 88)**

Day after sowing	Day after germination	Field practice
- 12 days		Thrashing weeds (power tiller : 4 days / ha)
- 8 days		Irrigation water supply (2 days)
- 6 days		Ploughing, tilling and crossing (power tiller : 2 days / ha)
- 4 days		Irrigation water supply ---- Soak seed into water for 24 hrs
		Put seed under wet rice straw for 2 to 3 days for pregermination
- 2 days		Hand picking weeds (manual : 2 days / ha)
0 day		Leveling --- Broadcasting seed (seed amount : 100 kg / ha)
7 - 10 days	0 day	Germination
(in case of using herbicide)		
	14 days	Herbicide application
	17 days	Irrigation water supply
	19 days	First fertilizer application ; 4 bags (200 kg) / ha of 15 - 15 - 15 compound
	21 days	First fungicide and insecticide application
	33 days	Second fertilizer application ; 2 bags (100 kg) / ha of 15 - 15 - 15 compound and 2 bags (100 kg) / ha of sulphate ammonium Hand weeding when necessary
	35 days	Second fungicide and insecticide application
(in case of not using herbicide)		
	14 days	First fertilizer application ; 4 bags (200 kg) / ha of 15 - 15 - 15 compound
	16 days	First fungicide and insecticide application
	28 days	Second fertilizer application ; 2 bags (100 kg) / ha of 15 - 15 - 15 compound and 2 bags / ha (100 kg / ha) of sulphate ammonium
	30 days	Second fungicide and insecticide application
	20 - 30 days	Starting hand weeding when necessary
	60 days	Third fertilizer application ; 2 bags (100 kg) / of sulphate ammonium
	105 days	Final draining water
	110 days	Harvesting

Post-harvest and marketing practice

1. Harvesting ---- Heaping paddy straw and panicles at the corner of field (2 days)
2. Threshing by beating
3. Drying at dry floor normally for 3 days (grain moisture content : 14.5 - 15.0 %)
4. Winnowing ---- Bagging
5. Farm gate sell to market mummies (middle man)

**Table E-7 Present Farming Practice of Transplanting Paddy Rice
Cultivation at Ashaiman Project (Paddy Variety : GK 88)**

Day after sowing	Day after germination	Field practice
- 10 days	- 24 days	Thrashing weed (power tiller : 4 days / ha)
- 6 days	- 20 days	Irrigation water supply (2 days)
- 4 days	- 18 days	First field ploughing (Power tiller : 1 day / ha)
- 3 days	- 17 days	Soak seed into water for 24 hrs ---- Put seed under wet rice straw for 2 to 3 days for pregermination
0 day	- 14 days	Preparing nursery bed ; puddling by hoe
4 days	- 4 days	Seeding to nursery bed (seed amount : 80 kg/ha) Second field ploughing (power tiller : 1 day / ha)
14 days	0 day	Draining water ---- Hand picking weed (manual : 2 man days / ha) Transplanting
(in case of using herbicide)		
	14 days	Herbicide application
	17 days	Irrigation water supply
	19 days	First fertilizer application ; 4 bags (200 kg) / ha of 15 - 15 - 15 compound
	21 days	First fungicide and insecticide application
	33 days	Second fertilizer application ; 2 bags (100 kg) / ha of 15 - 15 - 15 compound and 2 bags (100 kg) / ha of sulphate ammonium Hand weeding when necessary
	35 days	Second fungicide and insecticide application
(in case of no using herbicide)		
	14 days	First fertilizer application ; 4 bags (200 kg) / ha of 15 - 15 - 15 compound
	16 days	First fungicide and insecticide application
	28 days	Second fertilizer application ; 2 bags (100 kg) / ha of 15 - 15 - 15 compound and 2 bags (100 kg) / ha of sulphate ammonium
	30 days	Second fungicide and insecticide application
	20 - 30 days	Starting hand weeding
	60 days	Third fertilizer application ; 2 bags (100 kg) / ha of sulphate ammonium
	105 days	Draining water
	110 days	Harvesting

Post-harvest and marketing
Same as the case of broadcasting

**Table E-8 Present Farming Practice of Broadcasting Paddy Rice
Cultivation at Aveyime Project (Paddy variety : GK 88)**

Day after sowing	Day after germination	Field practice
- 1 day		Ploughing field (tractor : 4 - 5 hrs /ha)
0 day		Harrowing field (tractor : 2 - 3 hrs / ha) Broadcasting seed (manual : 1 - 1.5 hrs /ha)
7 - 10 days	0 day	Germination
	28 days	Herbicide application (in case of not using herbicide, hand picking weed on 28 - 35 days after germination)
		First fertilizer application : 2 bags (100 kg) / ha of 15 - 15 - 15 compound and 1 bag (100 kg) / ha of urea
	32 - 34 days	Irrigation water supply *
	44 days	Second fertilizer application : 2 bags (100 kg) / ha of 15 - 15 - 15 compound and 1 bag (100 kg) / ha of urea
	49 - 56 days	Second hand picking weed (manual)
	63 - 70 days	Third fertilizer application : 2 bags (100 kg) / ha of 15 - 15 - 15 compound and 1 bag (100 kg) / ha of urea
	84 - 91 days	Start bird scaring (heading stage). Scaring period : 35 - 40 days continuation
	120 days	1- Final draining of water Harvesting

* Irrigation water supply is 3 - 3.5 weeks interval, and drainage is as and when necessary

Post-harvest and marketing practice

1. Harvesting
2. Heaping straw with panicles at many locations on farm for 2 days
3. Thrush panicles against side of threshing box - 2 days
4. Dry panicles on drying floor normally 3 days
5. Winnowing ---- Bagging
6. Store panicles at farmer's house for 4 - 5 months
7. Sell to market mammals (middle man)

**Table E-9 Present Farming Practice of Broadcasting Paddy Rice
Cultivation at Okyereko Project (Paddy Variety : ITA 222)**

Day after sowing	Day after germination	Field practice
- 1 days		Ploughing field (tractor : 1 day / ha)
0 day		Harrowing field ---- Seed broadcasting (not pregerminated seed*) Harrowing to cover seed
10 days	0 day	Germination
	11 days	Irrigation water supply
	14 days	Draining water
	15 days	First fertilizer application : 5 bags (250 kg) / ha of 15 - 15 - 15 compound Irrigation water supply
	16 days	Hand picking weed
	80 days	(booting stage) Second fertilizer application : 2 bags (100 kg) / ha of sulphate ammonium
	120 days	Harvesting

Agrochemical: No fungicide and insecticide are applied at Okyereko Project because disease infection and insect infestation are no so serious

Post-harvest and marketing practice

1. Harvesting
2. Bring paddy to farmers house and dry on the sheet of tarpaulin for 3 days
3. Threshing panicles into threshing box
4. Winnowing ---- Bagging
5. Farm gate sell to market mammals (middle man)

Table E-10 Present Farming Practice of Transplanting Paddy Rice Cultivation at Dawhenya Project (Paddy Rice Variety : ITA 222)

Day after sowing	Day after germination	Field practice
- 5 days	- 20 days	First field ploughing (power tiller : 1 man-day / ha)
		Preparing nursery bed allocated at a corner of field
- 4 days	- 19 days	Soak seed in water for 2 days --- Put seed under wet grass straw for 1 day for pregermination
0 day	15 days	Seeding to nursery bed
		Irrigation water supply
8 days	- 7 days	First fertilizer application ; 4 bags (200 kg) / ha of 15-15-15 compound
		Second field ploughing and leveling (power tiller : 1 man-day / ha)
13 days	- 2 days	Draining water
15 days	0 day	Transplanting (manual : 10 man-day) : 20 cm x 20 cm, 2-3 plants / hill
	13 days	Draining water
	15 days	Herbicide application ; (Baragram, Satunil, Herbit Plus 5 l / ha)
	17 days	Irrigation water supply
	20 days	Second fertilizer application ; 3 bags (150 kg) / ha of 15-15-15 compound
	35 days	Third fertilizer application ; 4 bags (200 kg) / ha of sulphate ammonium or 2 bags (100 kg) / ha of urea
	56 days	Fourth fertilizer application ; 4 bags (200 kg) / ha of sulphate ammonium or 2 bags (100 kg) / ha of urea
	70 days	Start heading
	125 days	Draining water
	130 days	Harvesting

Post-harvest and marketing practice

1. Harvesting --- Heaping paddy straw and panicles at corner of field for 2 days
2. Threshing by beating
3. Drying at dry floor normally for 3 days
4. Winnowing --- 1 day
5. Drying at dry floor for 1 day --- bagging and weighting
6. Dividing paddy bags into two portions ; One portion of paddy bags is for production inputs cost to sell mainly to GNPA (Ghana National Procurement Agency) and receive money to pay back the loan to bank (AIB). The other portion of paddy bags is farmer's surplus after balancing and farm gate sell to market mammals.
7. Rice mill can use by everybody including market mammals.

Table E-11 Present Farming Practice of Tomato cultivation at Amate Project (Tomato Variety : Demah)

Day after sowing	Day after germination	Field practice
- 8 days	- 29 days	Ploughing and harrowing field for nursery (tractor : 1 hour 15 minutes / ha)
- 7 days	- 28 days	Ridging nursery bed (manual : 5 man-day / ha)
0 days	- 21 days	Sowing seed (manual : 2.5 man-day / ha)
14 days	- 7 days	Ploughing and harrowing / ha
		Sprinkler irrigation ; three times in a week
21 days	0 day	Transplanting to field (manual : 12.5 man-day / ha)
	14 days	Fertilizer application ; 5 bags (250 kg) / ha of 15-15-15 compound and 2.5 bags (125 kg) / ha of sulphate ammonium
		Sprinkler irrigation ; two times in a week
		Three times hand weeding until last harvesting
	70 days	First harvesting
		Harvesting by manual ; 5 man-day / ha, two times in a week, three weeks
	100 days	Last harvesting

Post-harvest and marketing practice

1. Harvesting
2. Grading by size (normal size and very small size) and rotted fruits are throw away
3. Farm-gate sell to market mammals

Table E-12 Present Farming Practice of Onion cultivation at Amate Project (Onion Variety : Bauku Red)

Day after sowing	Day after germination	Field practice
- 15 days	- 67 days	Ploughing and harrowing field for nursery (tractor : 1 hour 15 minutes / ha)
- 14 days	- 66 days	Ridging nursery bed (manual : 17.5 man-day / ha)
0 day	- 42 days	Sowing seed (manual : 2.5 man-day / ha)
		Sprinkler irrigation ; three times in a week
	- 15 days	Ploughing field for transplanting (tractor : 1 hour 15 minutes / ha)
	- 14 days	Start harrowing by manual (manual : 20 man-day / ha)
42 days	0 day	Transplanting to field (manual : 50 man-day / ha)
		Sprinkler irrigation ; three times in a week
	14 days	Fertilizer application ; 5 bags (250 kg) / ha of 15-15-15 compound and 2.5 bags (125 kg) / ha of sulphate ammonium
		Hand weeding ; three times until harvest
	77-84 days	Harvesting, stem and root cutting (manual : 50 man-day / ha)

Post-harvest and marketing practice

1. Harvesting, stem and root cutting
2. Grading by size (normal and very small) and throw away rotted onion
3. Farm-gate sell to market mammals

Table E-13 Present Farming Practice of Okra Cultivation at Ashaiman Project (Okra Variety : Labadi)

Day after sowing	Day after germination	Field practice
- 8 days		Ploughing field (power tiller : 2 - 3 hrs / ha)
- 1 day		Rotavating field for fine tillage (power tiller : 1 hr / ha)
0 day		Planting seed (manual : 1 man / day) : 75 - 90 cm X 60 cm, 3 seed / hill (seed amount : 1.5 kg / ha)
5 days	0 day	Germination
	14 days	First insecticide application*
		First fertilizer application : 5 bags (250 kg) / ha of 15 - 15 - 15 compound and 3 bags (150 kg) / ha of sulphate ammonium
	21 days	Weeding with hoe when necessary
	28 days	Second fertilizer application : 1.5 bags (75 kg) /ha of sulphate ammonium
		First flower comes out
	42 - 72 days	Third fertilizer application : 1.5 bags (75 kg) / ha of sulphate ammonium
		Start harvesting ; harvesting time should be in early morning before bees visit flower to pollinate after the sun rise. Six days after flowering is suitable to pick young pod for sale. Harvesting period will continued in 6 - 8 weeks.

* Continuous spraying insecticide until final harvest, depending on incidence of insect. Spraying is frequent in wet season and infrequent in dry season. Amount of insecticide (Elsun) at once is 240 cc/ha, and total amount is about 5 lit. /ha.

Post-harvest and marketing practice

1. Harvesting
2. Farm gate sell to market mammals (middle man)

Table E-14 Present Farming Practice of Okra Cultivation at Kpando-Torkor Project (Okra Variety : Labadi and Lolobi)

Day after sowing	Day after germination	Field practice
	- 22 days	Thrashing weeds by cutlass (manual : 20 man-day / ha)
	- 12 days	Burn out all dried weeds
	- 11 days	Ploughing field (tractor : 3 hrs / ha)
	- 10 days	Harrow field by hoe (manual : 20 man-day / ha)
0 day		Planting seed : 60 cm x 60 cm, 2 seed / hill (manual ; 20 man-day / ha)
3 days		First irrigation water supply *
5 days	0 day	Germination
30 days	25 days	First fertilizer application : 5 bags (250 kg) / ha of 15 - 15 - 15 compound
60 days	55 days	Second fertilizer application : 5 bags (250 kg) / ha of sulphate ammonium
		First harvesting **
90 days	85 days	First folier liquid (Phosotrogen) application by knapsack sprayer ***
		Insecticide application when incidence of insect pest is severe
120 days	115 days	Final harvesting

* Irrigation water supply will be continued in 5 - 7 days interval until final harvest

** Harvesting will continued in 3 days interval until final harvest

*** Folier liquid application will be continued in 1 week interval until final harvesting

Post-harvest and marketing practice

1. Harvesting
2. Farm gate sell to market mammals (middle man)

**Table E-15 Watermelon Cultivation with Interplanting of Egg plant and Okra
at Mankessim Project (Watermelon Variety : Sugar Baby, Egg Plant
Variety : White Beauty, Okra Variety : Lady Finger)**

Day after sowing	Day after germination	Field practice
- 4 days		First ploughing field (tractor : 3 hrs / ha)
- 2 day		Second ploughing field (tractor : 3 hrs / ha)
- 1 day		First irrigation water supply (1 hr / ha)
0 day		Planting seed : 150 cm x 150 cm, 2 seed / hill (manual, 2 man-day / ha) Cover seed (manual)
1 day		Second irrigation water supply (1 hr / ha) Egg plant seeding at nursery
3 - 5 days	0 day	Germination
	14 -21 days	First fertilizer application : 2 bags (100 kg) / ha of 15 - 15 - 15 compound (manual : 2 man-day / ha) First hand picking weed before or after fertilizer application
	15 - 22 days	Just after first fertilizer application to watermelon, seedling of egg plant is transplant and okra seed is sown in between hills of watermelon
	35 - 42 days	Second fertilizer application : 1.5 bags (75 kg) / ha of sulphate ammonium (manual : 2 man-day / ha) Mixture of fungicide and insecticide application in 1 week interval until harvesting Irrigation water supply once a week if no rain
	110 - 120 days	Harvesting egg plant in 7 days interval, and okra in 2 - 3 days interval Harvesting watermelon fruits all at once (manual : 6 man-day / ha)

Post-harvest and marketing practice

1. Harvesting
2. Farm gate sell to market mammals

**Table E-16 Present Farming Practice of Sweet Potato Cultivation at
Mankessim Project (Sweet Potato Variety : Local Variety)**

Day after sowing	Day after germination	Field practice
- 5 days		First ploughing field (tractor : 3 hrs / ha)
- 4 days		Making mound (manual : 8 man-day / ha)
0 day		Transplanting vine * : 60 - 90 cm x 60 - 90 cm, 2 vine / hill (manual : 8 man-day / ha) No fertilizer, fungicide and insecticide application. Hand picking weed whe necessary
	28 - 42 days	Training vine for not spreading too wide area Harvesting by hoe (manual, 12 man-day / ha)

* Nursery of sweet potato is located aside the reservoir to take vine for transplanting at any time

Post-harvest and marketing practice

1. Harvesting
2. Farm gate sell to market mammals, or farmers bring harvest to local market by the project tractor and sell.

Table E-17 Present Application Rate of Fertilizer at the Projects

Crop	Project	Total Amount of Fertilizer			No. of		Stage of Fertilizer Application			
		Compound kg/ha	N:P:K kg/ha	Contents kg/ha	Split Dressing	First Dressing	Second Dressing	Third Dressing	Fourth Dressing	
Paddy rice	Ashaiman	SA/Urea	150-250	69:23:23	3	4 wks after germination	2-3 wks after	2 wks after		
		Urea	100	-- 81:38:38						
		Urea	300	111:45:45	3	5 wks after broadcasting	2 wks after	before booting stage		
Tomato	Amate	SA	150	65:38:38	2	4 wks after germination	1 month after			
		SA	250	59:38:38	1	2 wks after transplanting				
Egg plant	Mankessim	SA	250	91:38:38	2	2-3 wks after germination	8 wks after			
		SA	250							
Okra	Ashaiman	SA	150	65:23:23	2	2 wks after germination	3 wks after			
		SA	200							
Onion	Amate	SA	250	91:38:38	2	2-3 wks after germination	8 wks after			
		SA	250							
Watermelon	Mankessim	SA	250	91:38:38	3	2-3 wks after germination	1 month after	first flowering stage		
		SA	250							
Sweet potato	Mankessim	no	no	no	0					

Note : SA ; Salphate Ammonium

Source : Interview to the project manager, agronomist and extension officer in charge of agronomy at each project

Table E-18 Serious Diseases, Insect Pest, Wild Bird and Animals at the Projects

Crop	Disease	Insect Pest	Wild Birds and Animals
Paddy rice	Blast,	Stem borer	Quelea quelea
	False smut	Rice hispa	Weaver bird
Maize	Brown leaf spot	Case worm	Sparrow
	Streak	Stem borer	Partridge
Groundnut	Leaf spot	Catapillars	Weaver bird
	Root rot	Weevil	Mice (small rat)
Cowpea	Root rot	Weevil	no serious bird damage
		Catapillars	Grass cutter (big rat)
Tomato	Fusarium wilt	Stem borer	Rizard
	Nematode	Aphid	
	Early leaf blight	Boll worm	
	Root rot	Army worm	
	Bacterial wilt	Grass hopper	
	Fusarium rot		
Egg plant	Fruit rot		
	Fusarium wilt	Leaf miner	Mice (small rat)
Hot pepper	Cercospora leaf spot	Ball worm	
	"Fusarium disease"	Catapillars	
Okra	Fusarium wilt	Aphid	
	Dumping off	Stem borer	no serious bird damage
Onion	Nematode	Catapillars	
	"Fungus disease"	Aphid	Toad (frog)
Watermelon	Downy mildew	Catapillars	
	Fruit rot	Podagraca	no serious bird damage
Sweet potato	Wilt	"black insect"	
	no serious disease	Thrips	Cricket
		Grass hopper	
		Lady bird beetle	
		Poudradica	
		Poudradica	
			Squirrel
			Mice (small rat)

Table E-19 Present Application Rate of Fungicide, Insecticide, Herbicide, Rodenticide at the Projects

Crop	Project	Fungicide	Insecticide	Herbicide	Rodenticide
Paddy rice	Ashaiman	no application	Karate 2.5l 1 l/ha Dursban 1 l/ha	Basagran 5 l/ha Satunil 5 l/ha	Yasodion 10 kg/ha
	Aveyime	Fuji One 3 l/ha	Diazinon 4 l/ha	Satunil 5 l/ha Arrosolo 3-3E 5 l/ha	Warafin 5 kg/ha
	Okyereko	no application	no application	no application	no application
Tomato	Amate	Diathine M45 2 kg/ha	Elsan 2 l/ha	no application	Warafin
Egg plant	Mankessim	Kocide 5 kg/ha	Dursban 5 l/ha	no application	no application
Okra	Ashaiman	no application	Furdan 10 kg/ha Actellic 1 l/ha	no application	no application
	Kpando-Tork	no application	Actellic 5 l/ha	no application	no application
	Mankessim	Kocide 5 l/ha	Durseban 5 l/ha	no application	no application
Onion	Amate	Dithine M45 2 kg/ha	Elsan 2 l/ha	no application	no application
		Topsin 0.5 kg/ha			
Watermelon	Mankessim	Kocide 5 kg/ha	Dursban 5 l/ha	no application	no application
Sweet potato	Mankessim	no application	no application	no application	no application

Source : Interview to the project manager, agronomist and extention officer in charge of agronomy at each project site

Table E-20 Average Crop Area, Crop Yield and Crop Production at the Projects

Project	Crop	Average Crop Area (ha, %)		Average Crop Yield (t/ha)		Average Crop Production (t)			
		Rainy Season	Dry Season	Rainy Season	Dry Season	Rainy Season	Dry Season		
Ashaiman (130ha)	Paddy rice	18.6 (14.3)	18.8 (14.5)	3.40	3.35	63.24	62.98		
	Okra		17.0 (13.1)					6.00	102.00
	Total	18.6 (14.3)	35.8 (27.5)						
Aveyime (63ha)	Paddy rice	28.9 (45.9)	28.5 (45.2)	4.08	2.55	117.91	72.68		
	Total	28.9 (45.9)	28.5 (45.2)						
Kpando-Torkor (40ha)	Okra		13.0 (32.5)		10.00		130.00		
	Total		13.0 (32.5)						
Mankessim (17ha)	Sweet potato	4.7 (27.6)		9.00	9.50	42.30	131.10		
	Watermelon		13.8 (81.2)					12.13	129.79
	Egg plant		10.7 (62.9)					5.13	25.14
	Okra		4.9 (28.8)						
	Total	4.7 (27.6)	13.8 (81.2)						
Okyereko (40ha)	Paddy rice		21.1 (53.0)		3.75		79.50		
	Total		21.1 (53.0)						

Table E-21 Crop Budget per Hectare - Present Condition (1/3)

Projects:	Ashaiman				Aveyime				Kpando			
	Maize	Paddy	Okra	Cassava	Maize	Cassava	Hot Pepper	Cassava	Yam	Maize	Okra	
	Q'ty (CD1,000)	Value (CD1,000)	Q'ty (CD1,000)	Value (CD1,000)	Q'ty (CD1,000)	Value (CD1,000)	Q'ty (CD1,000)	Value (CD1,000)	Q'ty (CD1,000)	Value (CD1,000)	Q'ty (CD1,000)	Value (CD1,000)
1. Gross Income												
(1) Unit Yield (t/ha)	0.6	3.7	6.0	4.1	0.6	0.5	7.0	4.1	2.0	10.0		
(2) Unit Price (CD/kg)	230	490	360	190	380	1,500	100	530	350	630		
(3) Gross Income (CD1,000)	<u>138</u>	<u>1,813</u>	<u>2,160</u>	<u>779</u>	<u>228</u>	<u>750</u>	<u>700</u>	<u>2,173</u>	<u>700</u>	<u>6,300</u>		
2. Gross Outgoing												
(1) Seed (kg)	25	14	7	600	18	8	1,015	23	506	100	24	114
(2) Fertilizers												
Urea (kg)	-	98	18	-	14	8	-	-	-	29	20	20
Ammonium sulfate (kg)	-	93	32	-	6	3	-	-	-	83	53	168
Compound fertilizers (kg)	42	25	211	20	13	20	-	-	-	74	51	262
(3) Agro-chemicals												
Herbicide (lit.)	-	5.29	45	-	-	-	-	-	-	0.33	5	0.29
Insecticide (lit.)	-	1.47	20	-	-	-	-	-	-	0.13	3	22.35
Fungicide (lit.)	-	-	0.25	-	-	-	-	-	-	-	-	2.47
(4) Farm Machinery												
Own machine (hr)	8.33	11.76	7.06	1.71	2.02	20.00	2.50	2.35	2.35	4.21	5.06	-
Hired machine (hr)	8.33	41	7.06	1.71	2.02	20.00	2.50	2.35	2.35	0.58	8	-
(5) Labour Requirement												
Family (man-day)	25.2	103.9	164.8	95.9	78.4	365.0	94.8	124.4	111.5	361.4	508	
Exchange (man-day)	15.8	35.2	48.3	86.2	78.0	305.0	56.8	48.5	73.0	191	193.4	
Hired (man-day)	9.4	34	112.5	9.7	0.4	60.0	8.0	21	3.7	10	13.2	
Miscellaneous 5%												
(7) Irrigation Service Fees												
Total	<u>181</u>	<u>892</u>	<u>1,094</u>	<u>375</u>	<u>298</u>	<u>1,292</u>	<u>307</u>	<u>464</u>	<u>520</u>	<u>2,214</u>		
3. Net Return	<u>-43</u>	<u>921</u>	<u>1,066</u>	<u>404</u>	<u>-70</u>	<u>-542</u>	<u>393</u>	<u>1,709</u>	<u>180</u>	<u>4,086</u>		

Source: Farm interview survey and field investigation by the Study Team and data obtained from the PM Offices.

Table E-21 Crop Budget per Hectare - Present Condition (2/3)

Projects:	Mankessim									
	Cassava	S. Potatoes	Maize	Egg Plant	Okra	Hot Pepper	Tomatoes	Water Melon	Sugarcane	
1. Gross Income										
(1) Unit Yield (t/ha)	16.0	10.0	1.9	12.80	4.83	1.0	2.2	7.67	62.5	
(2) Unit Price (CD/kg)	130	250	330	290	380	2,500	140	300	13	
(3) Gross Income (CD1,000)	<u>2,080</u>	<u>2,500</u>	<u>627</u>	<u>3,712</u>	<u>1,835</u>	<u>2,500</u>	<u>308</u>	<u>2,301</u>	<u>813</u>	
2. Gross Outgoing										
(1) Seed (kg)	500.0	375.0	22.6	0.5	2.2	1.0	0.3	1.0	34	49
(2) Fertilizers (kg)	-	-	-	-	-	-	-	-	-	-
Urea (kg)	-	-	-	101	77	50	-	69	36	-
Ammonium sulfate (kg)	-	-	-	110	77	50	-	75	46	-
Compound fertilizers (kg)	-	-	-	-	-	-	-	-	-	31
(3) Agro-chemicals (lit.)	-	-	-	-	-	-	-	-	-	-
Herbicide (lit.)	-	-	-	2.55	3.22	1.63	0.09	2.84	38	-
Insecticide (lit.)	-	-	-	0.64	0.36	-	0.14	2.57	28	-
Fungicide (lit.)	-	-	-	11.11	15.00	8.75	5.45	10.28	-	-
(4) Farm Machinery (hr)	-	14.69	2.67	-	-	-	-	-	-	-
Own machine (hr)	-	-	0.49	-	-	-	-	-	-	-
Hired machine (hr)	-	14.69	2.18	11.11	15.00	8.75	5.45	10.28	34	-
(5) Labour Requirement (man-day)	81.6	81.9	117.1	174.4	312.9	265.3	145.0	134.0	60.1	73
Family (man-day)	13.5	51.9	48.1	83.5	211.9	88.4	78.6	79.0	28.8	-
Exchange (man-day)	-	-	2.9	-	25.5	-	7.3	1.2	3	-
Hired (man-day)	68.3	30.0	66.1	90.9	75.5	176.9	59.1	53.8	31.3	79
(6) Miscellaneous 5%	11	17	16	34	52	40	20	28	11	-
(7) Irrigation Service Fees	-	-	-	50	100	100	-	50	-	-
Total	<u>229</u>	<u>361</u>	<u>345</u>	<u>772</u>	<u>1,184</u>	<u>936</u>	<u>411</u>	<u>630</u>	<u>231</u>	
3. Net Return	<u>1,851</u>	<u>2,139</u>	<u>282</u>	<u>2,940</u>	<u>651</u>	<u>1,564</u>	<u>-103</u>	<u>1,671</u>	<u>582</u>	

Source: Farm interview survey and field investigation by the Study Team and data obtained from the PM Offices.

Table E-21 Crop Budget per Hectare - Present Condition (3/3)

Projects:	Okyeroko												
	Cassava			Maize			Paddy			Tomatoes		Groundnuts	
	Qty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	
1. Gross Income													
(1) Unit Yield (t/ha)		4.4		2.3		3.75		4.4		1.3		1.3	
(2) Unit Price (CD/kg)		130		290		600		250		260		260	
(3) Gross Income (CD1,000)		<u>572</u>		<u>667</u>		<u>2,250</u>		<u>1,100</u>		<u>338</u>		<u>338</u>	
2. Gross Outgoing													
(1) Seed (kg)	558.3	40	24.3	19	59.9	21	1.5	19	45	50			
(2) Fertilizers													
Urea (kg)	-	-	-	-	13	6	-	-	-	-			
Ammonium sulfate (kg)	-	-	9	4	113	51	-	-	-	-			
Compound fertilizers (kg)	-	-	18	11	225	135	156	94	-	-			
(3) Agro-chemicals													
Herbicide (lit.)	-	-	-	-	-	-	-	-	-	-			
Insecticide (lit.)	-	-	-	-	-	-	3.13	88	-	-			
Fungicide (lit.)	-	-	-	-	-	-	-	-	-	-			
(4) Farm Machinery	2.50		8.10		10.85		5.00		2.05				
Own machine (hr)	-	-	-	-	-	-	-	-	-	-			
Hired machine (hr)	2.50	24	8.10	53	10.85	65	5.00	61	2.05	26			
(5) Labour Requirement	106.7		112.0		124.7		72.6		117.3				
Family (man-day)	106.7	334	80.5	251	39.3	123	57.6	180	84.3	264			
Exchange (man-day)	-	-	-	-	-	-	-	-	-	-			
Hired (man-day)	-	-	31.5	99	85.4	268	15.0	48	33.0	104			
(6) Miscellaneous 5%		20		22		33		25		22			
(7) Irrigation Service Fees		-		-		50		-		-			
Total		<u>418</u>		<u>459</u>		<u>752</u>		<u>515</u>		<u>466</u>		<u>466</u>	
3. Net Return													
		154		208		1,498		585		-128		-128	

Source: Farm interview survey and field investigation by the Study Team and data obtained from the PM Offices.

Table E-22 Farm Budget Analysis - Present Condition

Projects:	Ashaiman	Aveyime	K-Torkor	Mankessim	Okyereko	Average
No. of Farmers (Household)	120	62	118	89	68	457
Farm Management Size*1 (ha)	0.55	1.10	0.64	0.82	1.30	0.9
Total Irrigated Area (ha)	59.0	-	13.0	26.4	21.6	120.0
Irrigated Area per a Farmer (ha)	0.49	-	0.11	0.30	0.32	0.26
Size of Household (Persons)	7.1	7.5	6.5	6.5	6.6	6.8
1. Gross Income (Cedis 1,000)	2,994	2,129	2,588	2,277	2,487	2,495
(1) Farm Income	981	722	1,200	1,548	1,403	1,172
a) Crop Income*2	955	532	1,154	1,528	1,319	1,099
Irrigated						
- Okra	347	-	694	72	-	223
- Egg Plant	-	-	-	450	-	90
- Water melon	-	-	-	313	-	63
- Hot pepper	-	-	-	0	-	-
- Paddy	600	-	-	-	715	263
Rainfed*3						
- Cassava	-	397	49	63	69	116
- Groundnuts	-	-	-	-	75	15
- Hot pepper	-	-	-	101	-	20
- Maize	8	135	280	132	374	186
- Sugarcane	-	-	-	33	-	7
- Sweet Potatoes	-	-	-	346	-	69
- Tomatoes	-	-	-	18	87	21
- Yam	-	-	131	-	-	26
b) Livestock Income	11	95	13	10	61	38
c) Income from Homestead*4	15	95	33	10	23	35
(2) Non farm Incomes and farm incomes from the outside project areas*5	2,005	1,403	1,387	729	1,072	1,319
(3) Loan*6	8	4	1	-	12	5
2. Gross Outgoing (Cedis 1,000)	2,994	2,129	2,588	2,277	2,487	2,496
(1) Crop Production Cost*7	404	119	341	280	220	274
Irrigated*8	397	0	184	150	22	152
Rainfed	7	119	157	130	198	122
(2) Living Expenses	2,581	2,003	2,245	1,997	2,243	2,214
Foods*9	1,565	1,405	1,406	1,276	1,389	1,408
Other than foods	1,016	598	839	721	854	806
(3) Loan Repayment	9	7	2	0	24	8
3. Net Revenue (Cedis 1,000)	-	-	-	-	-	-

*1 Including not only the farm lands in the project areas but also the farm land located at the outside project areas.

*2 Including crop incomes obtained from the project areas.

*3 Including crops cultivated at outside project area.

*4 Incomes from crops cultivated at homestead area, and those figures indicate those net incomes excluding production cost.

*5 Including farm incomes obtained from the outside project areas. With the exception of the Weija project area, the farmers have a lot of farm lands at the outside project area and have obtained a considerable amount of farm incomes from these lands.

*6 Estimated on the basis of repayment amount of loan (2.(3) of the above table) and following interests obtained from the farm interview survey; 5% for Ashaiman and 100%/year for other projects.

*7 Excluding family labour force.

*8 Including irrigation service charge.

*9 Including products consumed at home.

Source: Result of farm interview survey by the Study Team.

Table E-23 Proposed Land Use

Area (ha)	Present Land Use (ha)	Main Crops at Present				Land Suitability*1						Crops requested by the Farmers at Public Meeting		Proposed Land Use (ha)		Remarks	
		Rainy Season		Dry Season		For Paddy		For Upland Crops		Rainy Season	Dry Season	Paddy Field	Upland Field				
		Rice	Okra	A	B	A	B	C	A	B	C	(ha)	(ha)	(ha)	(ha)		
56	56	Rice	Okra	50	6	50	6							11	45	- Irrigation area for paddy is only 11 ha, because of limited water resource. - Of total paddy areas, 2 ha are allocated to IDC as the experimental farm, and remaining 9 ha are located along the main drainage canal.	
Ashaiman	63	Maize	-	55	8	63								48	15	- Cultivation of paddy and upland crops is recommended to the Aveyime project area, taking crop profitability and farmers' intention into account. - In view point of easy water management, it is proposed to divide the lands into two blocks: paddy field and upland field. A farmer holds two plots separately. - Of total existing paddy fields, the lands of 15 ha are proposed to cultivate upland crops taking into account the soil condition. As for the water management of upland crops in these areas, there is no problem, because these lands are located at the upper area of the existing paddy fields. - All extension area are used for cultivation of upland crops throughout a year.	
	16	Maize	Cassava	16		16									16		
	1	Maize	-		1										1		
Aveyime	15	Maize	-	3	12	15									15		
	40	Okra	-				40										
	115	Maize	Cassava			91	24										
Kpando-Forkor	29	Sweet Potato	Vegetables			29									29		- All lands in the project area are suitable for cultivation of upland crops, and all farmers have requested to the cultivation of these crops under the sprinkler irrigation. - There is no change in the land use between the present and proposed one. All lands in the area is used for cultivation of upland crops.
	57	Maize	Cassava			54	3								57		
Mankessim	39	Rice	-	31	8	38								39		- At the public meeting with the farmers, the introduction of the following crops were decided: watermelon, egg plant and okra for the dry season and groundnut/cowpea, maize and sweet potato for the rainy season. - All lands in the project area are used for these crops. The land productivity in the existing area is relatively lower than the other areas, but the farmers strongly requested to include this area in the rehabilitation project. - Both paddy and upland crops are recommended to be introduced in the project area. The existing paddy fields are used for paddy cultivation after the rehabilitation, and all extension areas are for cultivation of upland crops. - A farmer holds two plots: paddy field and upland field. - Although the best crop for the extension areas is paddy, the upland crops are also possible. In the Afife area, vegetables such as eggplant are now cultivating at the lands having same soil condition with the Okyereko extension areas.	
	24	Maize	Cassava	20	4	24									24		
Okyere	18	Maize	Cassava	18		18									18		

*1 A = Suitable, B = Restricted Suitable, C = Non-suitable

Table E-24 Proposed Rotation System at Ashaiman Project

Year	Field Type	Block	Crop	
			Dry Season	Rainy Season
1	Lowland	all	Okra	Paddy rice
	Upland	1	Tomato	Maize
		2	Watermelon	Groundnut / Cowpea
		3	Onion	Maize
	4	Watermelon	Groundnut / Cowpea	
2	Lowland	all	Okra	Paddy rice
	Upland	1	Watermelon	Groundnut / Cowpea
		2	Onion	Maize
		3	Watermelon	Groundnut / Cowpea
	4	Tomato	Maize	
3	Lowland	all	Okra	Paddy rice
	Upland	1	Onion	Maize
		2	Watermelon	Groundnut / Cowpea
		3	Tomato	Maize
	4	Watermelon	Groundnut / Cowpea	
4	Lowland	all	Okra	Paddy rice
	Upland	1	Watermelon	Groundnut / Cowpea
		2	Tomato	Maize
		3	Watermelon	Groundnut / Cowpea
	4	Onion	Maize	

Table E-25 Proposed Rotation System at Aveyime Project

Year	Field Type	Block	Crop	
			Dry Season	Rainy Season
1	Lowland	all	Paddy rice	Paddy rice
	Upland	Tomato / Hot pepper	Maize	
		2	Onion	Groundnut / Cowpea
		3	Okra	Maize
	4	Onion	Groundnut / Cowpea	
2	Lowland	Paddy rice	Paddy rice	
	Upland	1	Onion	Groundnut / Cowpea
		2	Tomato / Hot pepper	Maize
		3	Onion	Groundnut / Cowpea
	4	Okra	Maize	
3	Lowland	all	Paddy rice	Paddy rice
		1	Okra	Maize
		2	Onion	Groundnut / Cowpea
		3	Tomato / Hot pepper	Maize
	4	Onion	Groundnut / Cowpea	
4	Lowland	all	Paddy rice	Paddy rice
	Upland	1	Onion	Groundnut / Cowpea
		2	Okra	Maize
		3	Onion	Groundnut / Cowpea
	4	Tomato / Hot pepper	Maize	

Table E-26 Proposed Rotation System at Kpando-Torkor Project

Year	Field Type	Block	Crop	
			Dry Season	Rainy Season
1	Upland	1	Okra	Maize
		2	Onion / Shallot	Groundnut
		3	Tomato / Hot pepper	Maize
		4	Onion / Shallot	Groundnut
2	Upland	1	Onion / Shallot	Groundnut
		2	Tomato / Hot pepper	Maize
		3	Onion / Shallot	Groundnut
		4	Okra	Maize
3	Upland	1	Tomato / Hot pepper	Maize
		2	Onion / Shallot	Groundnut
		3	Okra	Maize
		4	Onion / Shallot	Groundnut
4	Upland	1	Onion / Shallot	Groundnut
		2	Okra	Maize
		3	Onion / Shallot	Groundnut
		4	Tomato / Hot pepper	Maize

Table E-27 Proposed Rotation System at Mankessim Project

Year	Field Type	Block	Crop	
			Dry Season	Rainy Season
1	Upland	1	Watermelon / Onion	Sweet potato
		2	Egg plant	Maize
		3	Watermelon / Onion	Sweet potato
		4	Okra	Groundnut / Cowpea
2	Upland	1	Egg plant	Maize
		2	Watermelon / Onion	Sweet potato
		3	Okra	Groundnut / Cowpea
		4	Watermelon / Onion	Sweet potato
3	Upland	1	Watermelon / Onion	Sweet potato
		2	Okra	Groundnut / Cowpea
		3	Watermelon / Onion	Sweet potato
		4	Egg plant	Maize
4	Upland	1	Okra	Groundnut / Cowpea
		2	Watermelon / Onion	Sweet potato
		3	Egg plant	Maize
		4	Watermelon / Onion	Sweet potato

Table E-28 Proposed Rotation System at Okyereko Project

Year	Field Type	Block	Crop	
			Dry Season	Rainy Season
1	Lowland	all	Paddy rice	Paddy rice
	Upland	1	Tomato	Maize
		2	Onion	Groundnut / Cowpea
		3	Okra	Maize
		4	Onion	Groundnut / Cowpea
2	Lowland	all	Paddy rice	Paddy rice
	Upland	1	Onion	Groundnut / Cowpea
		2	Okra	Maize
		3	Onion	Groundnut / Cowpea
		4	Tomato	Maize
3	Lowland	all	Paddy rice	Paddy rice
	Upland	1	Okra	Maize
		2	Onion	Groundnut / Cowpea
		3	Tomato	Maize
		4	Onion	Groundnut / Cowpea
4	Lowland	all	Paddy rice	Paddy rice
	Upland	1	Onion	Groundnut / Cowpea
		2	Tomato	Maize
		3	Onion	Groundnut / Cowpea
		4	Okra	Maize

**Table E-29 Proposed Farming Practice of Broadcasting
Paddy Rice Cultivation (Paddy Variety : GK 88)**

Day after sowing	Day after germination	Field practice
- 12 days	- 19 days	Thrashing weeds when necessary (power tiller : 4 man-day / ha, or tractor : 4-5 hr / ha)
- 8 days	- 15 days	Irrigation water supply
- 6 days	- 13 days	First ploughing and harrowing field (power tiller : 2 man-day / ha, or tractor 2-3 hr / ha)
- 4 days	- 11 days	Soak seed into water for 24 hrs (seed amount : 80-100 kg / ha) Put seed under wet rice or grass straw for 2 to 3 days for pregermination
- 1 day	- 8 days	First fertilizer application : 4 bags (200 kg) / ha of 15-15-5 compound Second ploughing and harrowing and careful leveling and puddling field (power tiller : 2 man-day / ha, or tractor : 2-3 hr / ha)
0 day	- 7 days	Broadcasting pregerminated seed
7 days	0 day	Germination
	7 days	Start increase the depth of water submersion depending on paddy growth
	13 days	Draining water
	14 days	Herbicide application
	17 days	Irrigation water supply
	19 days	Second fertilizer application ; 4 bags (200 kg) / ha of 15-15-15 compound
	21 days	First fungicide and insecticide application
	33 days	Third fertilizer application ; 2 bags (100 kg) / ha of urea, or 4 bags (200 kg) / ha of sulphate ammonium Hand weeding when necessary
	35 days	Second fungicide and insecticide application
	60 days	Fourth fertilizer application ; 2 bags (100 kg) / of urea, or 4 bags (200 kg) / ha of sulphate ammonium
	70 days	Start heading Rodenticide application when necessary
	115 days	Final draining water
	120 days	Harvesting

Post-harvest and marketing practice

1. Harvesting ---- Heaping paddy straw and panicles at the corner of field (2 days)
2. Threshing by beating
3. Drying at dry floor normally for 3 days (grain moisture content : 14.5 - 15.0 %)
3. Winnowing ---- Bagging
5. Farm gate sell to market mammals (middle man)

**Table E-30 Proposed Farming Practice of Tomato Cultivation
(Tomato Variety : Demah)**

Day after sowing	Day after germination	Field practice
- 8 days	- 29 days	Ploughing and harrowing field for nursery (power tiller : 1 man-day / ha, or tractor : 1 hr 15 minutes / ha)
- 7 days	- 28 days	Ridging nursery bed (manual : 5 man-day / ha)
0 days	- 21 days	Sowing seed (manual : 3 man-day / ha) Irrigation water supply to nursery ; three times in a week
14 days	- 7 days	First fertilizer application to field for transplanting ; 4 bags (200 kg) / ha of 15-15-15 compound Ploughing and harrowing field for transplanting (power tiller : 1 man-day ha, or tractor : 1 hr 15 minutes / ha)
21 days	0 day	Transplanting to field (manual : 15 man-day / ha) Irrigation water supply ; twp times in a week
	14 days	Second fertilizer application ; 4 bags (200 kg) / ha of 15-15-15 compound Fungicide and insecticide application when necessary
	42 days	Third fertilizer application ; 4 bags (200 kg) / ha of sulphate ammonium
	70 days	First harvesting ; Harvesting will continued in two times in a week until final harvesting Fourth fertilizer application ; 2 bags (100 kg) of slphate ammonium
	100 days	Final harvesting

Post-harvest and marketing practice

1. Harvesting
2. Grading by size (normal size and very small size) and rotted fruits are throw away
3. Farm-gate sell to market mammals

**Table E-31 Proposed Farming Practice of Onion Cultivation
(Onion Variety : Bauku Red)**

Day after sowing	Day after germination	Field practice
- 15 days	- 67 days	Ploughing and harrowing nursery field (power tiller : 1 man-day / ha, or tractor : 1 hr 15 minutes / ha)
- 14 days	- 66 days	Ridging nursery bed (manual : 15 man-day / ha)
0 day	- 42 days	Sowing seed to nursery (manual : 2 man-day / ha) Irrigation water supply to nursery ; three times in a week
	- 15 days	First fertilizer application to field for transplanting : 4 bags (200 kg) / ha of 15-15-15 compound Ploughing field (power tiller 1 manday / ha , or tractor : 1 hr 15 minutes / ha)
	- 14 days	Start harrowing by manual (manual : 20 man-day / ha)
42 days	0 day	Transplanting to field (manual : 50 man-day / ha) Irrigation water supply ; three times in a week
	14 days	Second fertilizer application ; 2 bags (100 kg) / ha of 15-15-15 compound and 3 bags (150 kg) / ha of sulphate ammonium Fungicide and insecticide application when necessary Hand weeding ; three times until final harvest
	42 days	Third fertilizer application : 2 bags (100 kg) of sulphate ammonium
	77-84 days	Harvesting, stem and root cutting (manual : 50 man-day / ha)

Post-harvest and marketing practice

1. Harvesting, stem and root cutting
2. Grading by size (normal and very small) and throw away rotted onion
3. Farm-gate sell to market mammals

**Table E-32 Proposed Field Practice of Okra Cultivation
(Okra Variety : Labadi and Lolobi)**

Day after sowing	Day after germination	Field practice
- 22 days	- 27 days	Thrashing weeds by cutlass (manual : 20 man-day / ha) and burn out weeds after dry
- 11 days	- 16 days	First fertilizer application : 4 bags (200 kg) / ha of 15-15-15 compound Ploughing field (power tiller : 2 man-day / ha, or tractor : 3 hrs / ha)
- 10 days	- 15 days	Harrow field by hoe (manual : 20 man-day / ha)
0 day	- 5 days	Planting seed : 60 cm x 60 cm, 2 seed / hill (manual ; 20 man-day / ha)
3 days	- 3 days	Irrigation water supply ; 5-7 days interval until final harvesting
5 days	0 day	Germination
30 days	25 days	Second fertilizer application : 2 bags (100 kg) / ha of 15-15-15 compound and 3 bags (150 kg) of sulphate ammonium
60 days	55 days	Third fertilizer application : 2 bags (100 kg) / ha of sulphate ammonium Start harvesting ; Harvesting will continued in 3 days interval until final harvesting
90 days	85 days	First folier liquid (Phosotrogen) application by knapsack sprayer ; Folier liquid application will be continued in 1 week interval until final harvesting Insecticide application when necessary
120 days	115 days	Final harvesting

Post-harvest and marketing practice

1. Harvesting
2. Farm gate sell to market mammals (middle man)

**Table E-33 Proposed Farming Practice of Watermelon Cultivation
(Watermelon Variety : Sugar Baby)**

Day after sowing	Day after germination	Field practice
- 4 days	- 9 days	First ploughing field (power tiller : 2 man-day / ha , or tractor : 3 hrs /ha) First fertilizer application : 4 bags (200 kg) / ha of 15-15-15 compound
- 2 day	- 7 days	Second ploughing field (power tiller : 2 man- day / ha , or tractor : 3 hrs / ha)
- 1 day	- 6 days	First irrigation water supply
0 day	- 5 days	Planting seed : 150 cm x 150 cm, 2 seed / hill (manual, 2 man-day / ha)
1 day	- 4 days	Second irrigation water supply
5 days	0 day	Germination Irrigation water supply ; once in a week
	14 days	Second fertilizer application : 2 bags (100 kg) / ha of 15-15-15 compound and 3 bags (150 kg) / ha of sulphate ammonium First hand weeding when necessary
	35 days	Third fertilizer application : 2 bags (100 kg) / ha of sulphate ammonium Mixture of fungicide and insecticide application once in a week interval until harvesting
	110 - 120 days	Harvesting all at once (manual : 6 man-day / ha)
Post-harvest and marketing practice		
1. Harvesting		
2. Farm gate sell to market mammals		

**Table E-34 Proposed Farming Practice of Sweet Potato Cultivation
(Sweet Potato Variety : Local Variety)**

Day after sowing	Day after germination	Field practice
	- 5 days	Fertilizer application : 2 bags (100 kg) / ha of 15-15-15 compound Ploughing and harrowing field to transplanting (power tiller : 2 man-day / ha, or tractor : 3 hrs / ha)
	- 4 days	Making mound (manual : 8 man-day / ha)
	0 day	Transplanting vine from nursery * : 60 - 90 cm x 60 - 90 cm, 2 vine / hill (manual : 8 man-day / ha)
	14 days	Hungicide and insecticide application when necessary Hand weeding when necessary
	28 - 42 days	Training vine in order to not spread too wide area
	90 - 120 days	Harvesting by hoe (manual, 12 man-day / ha)

* Nursery of sweet potato is located aside the reservoir to take vine for transplanting at any time

Post-harvest and marketing practice

1. Harvesting

2. Farm gate sell to market mammals, or farmers bring harvest to local market by the project tractor and sell

Table E-35 Proposed Crop Area, Anticipated Crop Yield and Crop Production, and Proposed Application Rate of Fertilizer at the Projects

Project	Main crops	Crop area (ha)		Crop yield (t/ha)		Crop production (t/ha)		Application rate of fertilizers			
		Dry season		Wet season		Dry season		Wet season		Compound kg/ha	SA / Urea kg/ha
		Wet season	Dry season	Wet season	Dry season	Wet season	Dry season	N:P:K			
Aschaiman	Okra	11.2	12.0		134		117:45:45	15-15-15	300	SA	300
Lowland	Tomato	11.2	15.0		168		123:60:60	15-15-15	400	SA	300
Upland	Onion	11.2	18.0		202		98:45:45	15-15-15	300	SA	250
Total	Watermelon	20.0	15.0		300		98:45:45	15-15-15	300	SA	250
	Paddy rice	11.2	6.0	6.0		67	152:60:60	15-15-15	400	Urea	200
	Maize	22.4	22.4	3.0		67	98:45:45	15-15-15	150	SA	125
	Groundnut / Cowpea	22.4	2.0	2.0		45	no application	no application	no application	no application	no application
Aveyime	Paddy rice	48.0	6.0	6.0	288		152:60:60	15-15-15	400	Urea	200
Lowland	Tomato / Hot pepper*	11.8	14.0	14.0	165		123:60:60	15-15-15	400	SA	300
Upland	Okra	11.7	12.0	140			117:45:45	15-15-15	300	SA	300
Total	Onion	23.5	18.0	423			98:45:45	15-15-15	300	SA	250
	Paddy rice	48.0	6.0	6.0		288	152:60:60	15-15-15	400	Urea	200
	Maize	23.5	23.5	3.0		71	98:45:45	15-15-15	150	SA	125
	Groundnut / Cowpea	23.5	2.0	2.0		47	no application	no application	no application	no application	no application
Kpando-Torkor	Okra	38.8	12.0	466			117:45:45	15-15-15	300	SA	300
Lowland	Tomato / Hot pepper*	38.8	15.0	582			123:60:60	15-15-15	400	SA	300
Upland	Onion / Shallot**	77.4	18.0	1,393			98:45:45	15-15-15	300	SA	250
Total	Maize	77.5	77.5	3.0		233	98:45:45	15-15-15	150	SA	125
	Groundnut	77.5	2.0	2.0		155	no application	no application	no application	no application	no application
Mankessim	Watermelon	21.5	15.0	323			98:45:45	15-15-15	300	SA	250
Lowland	Onion	21.5	18.0	387			98:45:45	15-15-15	300	SA	250
Upland	Egg plant	21.5	15.0	323			117:45:45	15-15-15	300	SA	300
Total	Okra	21.5	12.0	258			117:45:45	15-15-15	300	SA	300
	Sweet potato	43.0	20.0	20.0		860	15:15:15	15-15-15	100	SA	125
	Maize	21.5	21.5	3.0		65	98:45:45	15-15-15	150	SA	125
	Groundnut / Cowpea	21.5	2.0	2.0		43	no application	no application	no application	no application	no application
Okyeroko	Paddy rice	38.9	6.0	233			152:60:60	15-15-15	400	Urea	200
Lowland	Tomato	10.5	15.0	158			123:60:60	15-15-15	400	SA	300
Upland	Okra	10.5	12.0	126			117:45:45	15-15-15	300	SA	300
Total	Onion	21.1	18.0	380			98:45:45	15-15-15	300	SA	250
	Paddy rice	38.9	6.0	6.0		233	52:60:60	15-15-15	400	Urea	200
	Maize	21.1	21.1	3.0		63	98:45:45	15-15-15	150	SA	125
	Groundnut / Cowpea	21.0	2.0	2.0		42	no application	no application	no application	no application	no application

Note : * Estimated as Tomato. ** Estimated as Onion.

Table E-36 Proposed Application Rate of Fungicide, Insecticide, Herbicide and Rodenticide

Crop	Fungicide	Insecticide	Herbicide	Rodenticide
Paddy rice	no application	Furadan (nursery) Karate 2.5E Dursban	Basagram Satumil Arrosolo 3-3E Ronstar	Yosodion 5 kg/ha
	no application	Diazinon Karate 2.5E Cymbush	Round up 1.5 l/ha	no application
Maize	no application	Karate 2.5E Cymbush	no application	no application
Cowpea	no application	Karate 2.5E Cymbush	no application	no application
Groundnut	no application	Karate 2.5E	no application	no application
	Diathine M45	Furadan (nursery)	no application	no application
Tomato	2.5 l/ha	Karate 2.5E	no application	no application
	5 l/ha	Furadan (nursery)	no application	no application
Egg plant	2.5 l/ha	Karate 2.5E	no application	no application
	5 kg/ha	Cymbush	no application	no application
Hot pepper	2.5 kg/ha	Karate 2.5E	no application	no application
	1.5 kg/ha	Cymbush	no application	no application
Okra	0.5 kg/ha	Actellic	no application	Yosodion 2 kg/ha (if necessary)
	1.5 kg/ha	Karate 2.5E	no application	Yosodion 1 kg/ha (if necessary)
Onion	3 kg/ha	Actellic	no application	no application
	2 kg/ha	Elsan	no application	no application
Sweet potato	no application	Actellic	no application	no application
Watermelon	2.5 kg/ha	no application	no application	no application
	2.5 kg/ha	Karate 2.5E	no application	no application
	Kocide	Cymbush	no application	no application
	Diathine M45	Dursban	5 l/ha	

Table E-37 Crop Budget per Hectare - With Project (1/4)

Items	Ashaiman															
	Wet Paddy		Okra		Tomato		Onion		Watermelon		Maize		Cowpea/ Groundnut			
	Unit	Price (CD)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)		
1. Gross Income	(t/ha)															
Unit Yield			6.0	12.0	15.0	18.0	15.0	15.0	3.0	3.0	3.0	2.0				
Unit Price	(CD/kg)		490	360	600	520	300	300	230	230	690	380				
Gross Income	(CD)		2,940	4,320	9,000	9,360	4,500	4,500	690	690	760					
2. Production Cost																
1) Seed	(kg)		100	49	10	13	1	19	11	493	1	34	25	6	50	19
2) Fertilizers																
- Compound	(kg)		400	236	300	177	400	236	300	177	300	177	150	89		
- SA	(kg)				300	132	300	132	250	110	250	110	125	55		
- Urea	(kg)		200	130	-	-	-	-	-	-	-	-	-	-		
3) Agro Chemicals																
- Herbicide	(lit.)		5.0	94	-	-	-	-	-	-	-	-	-	-		
- Basafran	(lit.)		3.0	75	-	2.5	63	-	-	2.5	63	3.0	75	2.5	63	
- Insecticide	(lit.)															
Krate 2.5E	(lit.)															
Dursban 4 E	(lit.)															
Furadan	(kg)															
Actellic	(lit.)				5.0	103	-	-	2.5	52	-	-	-	-		
- Fungicide																
- Topsion	(lit.)															
- Diathane M45	(kg)															
- Kocide	(lit.)															
- Rodenticide																
- Yosodion	(kg)		5.0	63	1.0	13	-	-	-	-	-	-	-	-		
4) Machinery Power																
- Land preparation	(ha)		3	113	2	75	2	75	2	75	2	75	2	75	2	75
- Carting	(bag)		95	38	20	8	-	-	-	-	-	-	-	-	-	-
5) Labour Requirement																
- Family Labour	(m-m)		39	140	53	191	92	331	103	371	87	313	17	61	5	18
- Exchange	(m-m)		1	4	4	14	13	47	45	162	1	4	-	-	-	-
- Hired Labour	(m-m)		75	270	124	446	65	234	215	774	59	212	10	36	47	169
6) Miscellaneous	(5%)															
Total																
4 Net Return																

Table E-37 Crop Budget per Hectare - With Project (2/4)

Items	Aveyime													
	Wet Paddy		Dry Paddy		Maize		Cowpea/ Groundnut		Tomato/ H. Pepper		Okra		Onion	
	Unit	Price (CD)	Qty	Value (CD1,000)	Qty	Value (CD1,000)	Qty	Value (CD1,000)	Qty	Value (CD1,000)	Qty	Value (CD1,000)	Qty	Value (CD1,000)
1. Gross Income														
Unit Yield	(t/ha)		6.0	6.0	3.0	2.0	14.0	12.0	18.0					
Unit Price	(CD/kg)	460	460	380	380	600	600	250	520					
Gross Income	(CD)	2,760	2,760	1,140	760	8,400	3,000	2,360						
2. Production Cost														
1) Seed	(kg)		100	46	100	46	25	10	50	19	1	19	8	49
2) Fertilizers														
- Compound	(kg)	750	400	300	400	300	150	113	-	400	300	225	300	225
- SA	(kg)	500	-	-	-	125	63	-	-	300	150	150	300	125
- Urea	(kg)	650	200	130	200	130	-	-	-	-	-	-	-	-
3) Agro Chemicals														
- Herbicide	(lit.)	18,800	5.0	94	5.0	94	-	-	-	-	-	-	-	-
Basagran	(lit.)	31,300	3.0	94	3.0	94	2.5	78	2.5	78	-	-	-	-
- Insecticide	(lit.)	6,300	-	-	-	-	-	-	-	-	-	-	-	-
Dursban 4 E	(kg)	3,800	-	-	-	-	-	-	-	-	-	-	-	-
Furadan	(lit.)	20,600	-	-	-	-	-	-	-	-	-	-	5.0	103
Actellic	(lit.)	-	-	-	-	-	-	-	-	-	-	-	2.5	52
- Fungicide	(lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-
Topsion	(kg)	6,300	-	-	-	-	-	-	-	-	-	-	-	-
Diathane M45	(kg)	12,500	-	-	-	-	-	-	-	2.5	16	19	3.0	13
Kocide	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
- Rodenticide	(kg)	12,500	5.0	63	5.0	63	-	-	-	-	-	1.0	13	-
Yosodion	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery Power														
- Land preparation	(ha)	37,500	3	113	3	113	2	75	2	75	2	75	2	75
- Carting	(ha)	400	124	124	124	86	86	72	72	170	170	255	255	363
5) Labour Requirement														
- Family Labour	(m-m)	2,800	39	109	39	109	86	241	36	101	92	258	131	367
- Exchange	(m-m)	2,800	2	6	2	6	-	-	-	13	36	8	22	45
- Hired Labour	(m-m)	2,800	83	232	83	232	0	-	36	101	65	182	116	325
6) Miscellaneous	(5%)		59	59	59	30	30	19	19	56	56	67	67	100
Total				1,246		1,246	626	392	1,170	1,415	2,099			
4 Net Return				1,514		1,514	514	367	7,230	1,585	7,261			

Table E-37 Crop Budget per Hectare - With Project (3/4)

Items	Kpando-Torkor										Mankessim														
	Okra		Tomato/ H. Pepper		Onion/ Shallot		Maize		Cowpea/ Groundnut		Watermelon		Egg Plant		Okra		Onion		Maize		Cowpea/ Groundnut		S. Potatoes		
	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit
1. Gross Income	(/ha)	12.0	15.0	18.0	3.0	2.0	15.0	15.0	15.0	18.0	12.0	12.0	18.0	3.0	2.0	20.0									
Unit Yield	(CD/kg)	630	600	600	350	380	300	290	300	600	380	380	600	330	380	250									
Unit Price	(CD)	7,560	9,000	10,800	1,050	760	4,500	4,350	4,500	10,800	4,560	4,560	10,800	990	760	5,000									
Gross Income	Price (CD)	24	114	119	11	493	25	9	50	19	1	34	0.5	18	2.2	31	11	493	25	8	50	19	375	99	
2. Production Cost	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit	Qty	Unit
1) Seed	(kg)	24	114	119	11	493	25	9	50	19	1	34	0.5	18	2.2	31	11	493	25	8	50	19	375	99	
2) Fertilizers	(kg)	300	400	260	300	195	150	98	-	-	300	195	300	195	300	195	300	195	150	98	-	-	100	65	
- Compound	(kg)	300	400	260	300	195	150	98	-	-	300	195	300	195	300	195	300	195	150	98	-	-	100	65	
- SA	(kg)	300	300	177	300	148	125	74	-	-	300	177	300	148	125	74	-	-	-	-	-	-	-	-	
- Urea	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
3) Agro Chemicals	(lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Herbicide	(lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Baso gran	(lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Insecticide	(lit.)	31,300	2.5	78	3.0	94	2.5	78	2.5	47	2.5	47	2.5	47	2.5	47	2.5	47	2.5	47	2.5	47	2.5	47	
- Krate 2.5E	(lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Dursban 4 E	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Furadan	(lit.)	25,000	5.0	125	2.5	63	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Actellic	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Fungicide	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Topsion	(kg)	7,500	3.0	23	2.5	19	2.0	15	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Diathane M45	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Kocide	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Rodenticide	(kg)	12,500	1.0	13	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
- Yosodion	(ha)	37,500	2	75	2	75	2	75	2	75	2	75	2	75	2	75	2	75	2	75	2	75	2	75	
4) Machinery Power	(bag)	380	170	363	83	72	-	-	-	-	147	192	344	363	363	363	363	363	363	363	363	363	363	363	
- Land preparation	(m-m)	2,600	213	554	92	239	103	268	21	55	36	94	(m-m)	2,500	87	218	92	230	233	583	103	258	53	133	
- Carting	(m-m)	1,600	15	39	13	34	45	117	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
5) Labour Requirement	(m-m)	2,600	170	442	65	169	215	559	62	161	36	94	(m-m)	2,500	59	148	100	250	83	208	215	538	73	183	
- Family Labour	(5%)	88	88	88	54	97	28	28	18	18	18	18	(5%)	47	53	47	53	47	53	47	53	47	53	47	
- Exchange																									
- Hired Labour																									
6) Miscellaneous																									
Total		1,845	1,124	2,030	594	378	978	1,108	1,509	1,993	667	337	488	667	337	488	667	337	488	667	337	488	667	337	488
4 Net Return		5,715	7,876	8,770	456	382	3,522	3,242	3,051	8,807	323	423	4,512	323	423	4,512	323	423	4,512	323	423	4,512	323	423	4,512

Table E-37 Crop Budget per Hectare - With Project (4/4)

Items	Okyereko														
	Wet Paddy		Dry Paddy		Tomatoes		Okra		Onion		Maize		Cowpea/ Groundnut		
Unit	Q'ty	Price (CD)	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)	Q'ty	Value (CD1,000)
1. Gross Income															
Unit Yield	(t/ha)														
Unit Price	(CD/kg)	6.0	6.0	6.0	15.0	12.0	18.0	3.0	520	3.0	290	3.0	380	3.0	760
Gross Income	(CD)	3,600	3,600	3,600	3,750	4,560	9,360	870	2,760	870	870	870	2,760	870	2,760
2. Production Cost															
1) Seed	(kg)	100	60	100	60	1	19	8	49	11	493	25	7	50	19
2) Fertilizers															
- Compound	(kg)	400	300	400	300	300	225	300	225	300	225	150	113	63	-
- SA	(kg)	-	-	300	150	300	150	250	125	250	125	125	63	-	-
- Urea	(kg)	200	130	200	130	-	-	-	-	-	-	-	-	-	-
3) Agro Chemicals															
- Herbicide	(lit.)	5.0	94	5.0	94	-	-	-	-	-	-	-	-	-	-
- Basagran	(lit.)	3.0	75	3.0	75	2.5	63	-	-	-	-	3.0	75	2.5	63
- Insecticide	(lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Krate 2.5E	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dursban 4 E	(lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Furadan	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Actellic	(lit.)	-	-	-	-	5.0	103	2.5	52	-	-	-	-	-	-
- Fungicide	(lit.)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Topson	(kg)	-	-	-	19	3.0	23	2.0	15	-	-	-	-	-	-
Dialhane M45	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kocide	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
- Rodenticide	(kg)	5.0	63	5.0	63	-	-	1.0	13	-	-	-	-	-	-
Yosodion	(kg)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4) Machinery Power															
- Land preparation	(ha)	3.0	113	3.0	113	2.0	75	2.0	75	2.0	75	2.0	75	2.0	75
- Carting	(bag)	380	-	137	-	80	-	255	-	363	-	124	-	72	-
5) Labour Requirement															
- Family Labour	(m-m)	43	133	43	133	63	195	131	406	103	319	89	276	36	112
- Exchange	(m-m)	94	291	94	291	17	53	116	360	215	667	35	109	36	112
- Hired Labour	(m-m)	63	195	63	195	44	132	71	216	106	319	36	109	36	112
6) Miscellaneous	(5%)	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total			1,322	1,322	918	1,500	2,217	754	2,217	1,116	2,217	754	400	400	400
4 Net Return			2,278	2,278	2,832	3,060	7,143	1,116	7,143	1,116	7,143	1,116	360	360	360

Table E-38 Farm Budget Analysis - With Project

Projects:	Ashaiman	Aveyime	K-Torkor	Mankessim	Okyereko	Average
No. of Farmers (Household)	120	95	388	216	135	954
Farm Management Size (ha)	0.45	1.00	0.40	0.40	0.60	0.49
Total Irrigated Area*1 (ha)	54.0	95.0	155.0	86.0	81.0	471.0
Irrigated Area per a Farmer (ha)	0.45	1.00	0.40	0.40	0.60	0.49
Size of Household (Persons)	7.1	7.5	6.5	6.5	6.6	6.8
1. Gross Income (Cedis 1,000)	4,761	9,037	5,221	4,243	5,730	5,798
(1) Farm Income	3,398	7,139	4,208	3,596	4,505	4,569
a) Crop Income	3,377	6,987	4,172	3,580	4,438	4,511
Irrigated						
- Wet Paddy	265	1,395	-	-	1,037	539
- Dry Paddy	-	1,395	-	-	1,037	486
- Okra	389	369	756	454	355	465
- Tomato/Pepper	810	1,043	900	-	292	609
- Egg Plant	-	-	-	433	-	87
- Onion	842	2,315	2,154	1,075	1,463	1,570
- Water melon	810	-	-	448	-	252
- Sweet Potatoes	-	-	-	995	-	199
- Maize	124	282	210	99	136	170
- Cowpea/Groundnut	137	188	152	76	118	134
b) Livestock Income	9	76	10	8	49	30
c) Income from Homestead*2	12	76	26	8	18	28
(2) Non farm Incomes and farm incomes from the outside project areas*3	1,003	702	694	365	536	660
(3) Loan*4	360	1,196	319	282	689	569
2. Gross Outgoing (Cedis 1,000)	3,704	5,388	3,328	2,888	4,282	3,918
(1) Crop Production Cost*5	695	1,962	703	555	1,219	1,027
- Wet Paddy	102	571	-	-	343	203
- Dry Paddy	-	571	-	-	343	183
- Okra	95	126	125	85	83	103
- Tomato/Pepper	76	109	85	-	56	65
- Egg Plant	-	-	-	87	-	17
- Onion	163	417	328	161	275	269
- Water melon	134	-	-	75	-	42
- Sweet Potatoes	-	-	-	69	-	14
- Maize	64	95	108	52	75	79
- Cowpea/Groundnut	62	72	57	25	45	52
(Irrigation Service Charge)	-	-	-	-	-	-
(2) Living Expenses*6	2,581	2,003	2,245	1,997	2,243	2,214
Foods*7	1,565	1,405	1,406	1,276	1,389	1,408
Other than foods	1,016	598	839	721	854	806
(3) Loan Repayment	428	1,423	380	336	820	677
3. Net Revenue (Cedis 1,000)	1,057	3,649	1,893	1,355	1,448	1,880

*1 Excluding 2 ha of IDC experimental farm in Ashaiman area.

*2 Incomes from crops cultivated at homestead area, and those figures indicate those net incomes excluding production cost.

*3 50% of present condition

*4 It was assumed that the farmers obtained the agricultural credits for fertilizers, agro-chemicals and farm machinery.

*5 Excluding family labour force and irrigation service charge.

*6 30% up from present condition

*7 Including products consumed at home.

Note: 1996 Constant Prices