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Kumasi Peri-Urban Horticultural Data

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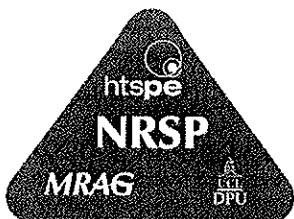
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## **Kumasi Peri-Urban Horticultural Data**

April 1997

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## Summary

This report reviews the fieldwork arising from a study of peri-urban horticultural in Kumasi, Ghana in 1994 by the Crop Utilisation Department of NRI.

The starting point of the research was to conduct rapid rural appraisals using semi-structured interviews in 14 villages in the Kumasi area to assess farming systems. From these surveys three topics were selected for further investigation:

- Wholesaler credit to horticultural producers
- Pest problems in horticultural production
- Soil fertility, current fertiliser practices and the potential for using compost

Two villages were selected for each topic to act as case studies and with the help of staff from the university of Science and Technology (UST), Kumasi farmers were interviewed using checklists. The fieldwork was completed in about three weeks

Although some thought appears to have gone into the design of the checklists the field notes reveal that many questions were either omitted or poorly answered. This was possibly because the enumerators did not understand the questions (and survey techniques) or lacked the technical knowledge to be able talk about fertiliser, pests, diseases, etc. Greater emphasis on training the enumerators including pilot testing the checklists could have prevented this.

Soil fertility survey. Most farmers applied some type of fertiliser to their horticultural crops but never to staple crops. Reasons given for not using chemical fertiliser included the recent increase in price. Knowledge on the use of organic fertilisers was very limited with only a few farmers (who kept poultry) using the manure 'for free' on their horticultural crops. Comments on trends in soil fertility were broadly similar between the two villages with the consensus that soil fertility had declined.

Pest Survey. The incidence of pests and diseases was generally considered to be increasing possibly because more farmers were now growing horticultural crops especially Tomato. Karate was the most commonly used agro-chemical for killing insects such as caterpillar and grasshopper. Farmers appeared to know very little about the diseases affecting their plants. There appear to be very few traditional methods for control of pests and diseases except for manual weeding and uprooting infected plants.

The pest survey would have benefited from more specific questions on the severity of the damage such as farmer's estimates of crop losses and the ranking of problems, pests & diseases, etc. as well as details on the history of horticultural production. Only four farmers were interviewed in Kuntanase compared to 14 in Afari suggesting the fieldwork was never completed.

Credit survey. Little could be gleaned from the marketing study because the assumption that credit was an issue requiring further investigation proved unfounded. For example, only three out of the 15 farmers interviewed had contract agreements with traders and for these three this was the first year in which they have tried such an

arrangement. Formal credit was generally considered to be unavailable because farmers lacked the necessary collateral. No community profile could be found for Krapa.

## Introduction

This report reviews the fieldwork arising from a study funded by the Overseas Development Administration (ODA) entitled **Improving peri-urban horticultural production in Sub-Saharan Africa** (project No. A0409) that was undertaken in Kumasi, Ghana in 1994 by the Crop Utilisation Department (now known as the Food Security Department) of NRI.<sup>1</sup> NRI was commissioned by the production systems leader for peri-urban interface research, part of ODA's Natural Resources Systems Programme (NRSP), to review and consolidate any information this study which might support other research commissioned by NRSP within the Kumasi region.

The original objective and purpose to this project were:

Objective: With specific focus on input and output factors of horticultural crop production, identify an integration of zones between urban and rural farming systems and characterise these zones. Identify the needs and constraints of peri-urban horticultural producers. Place current characteristics and patterns in the context of government and municipal policy towards the sector and any future policy initiatives that are likely to impact on producers.

Purpose:

- i) formulate means of intervention to solve policy constraints in peri-urban horticulture
- ii) develop a strategy for enhanced, sustainable production and marketing of food crops in target areas.

The starting point of the research was to conduct rapid rural appraisals using semi-structured interviews in 14 villages in the Kumasi area to assess farming systems. From these surveys three topics were selected for further investigation:

- a) Wholesaler credit to horticultural producers - its real cost to the farmers and its role as a conduit to inform farmers of consumers demands and preferences.
- b) Pest problems in horticultural production, current pest control practices, constraints to the adoption of extension service recommendations and the role of the private sector in the supply of inputs and information.
- a) Soil fertility, current fertiliser practices and the determination of the potential for using compost in peri-urban horticultural production.

Two villages were selected for each topic to act as case studies and with the help of staff from the university of Science and Technology (UST), Kumasi farmers were interviewed using checklists. The fieldwork was completed in about three weeks

Although the fieldwork for the three topics was completed the results were never written up until now. The results for each topic are presented separately. Appendix 1 contains edited community profiles of the two villages originally prepared by Dr. Andrew Hall, the project leader. Appendix 2 presents summaries of the field data and Appendix 3 lists the three checklists used for the farmer interviews.

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<sup>1</sup> This publication is an output from a research project funded by the Overseas Development Administration of the United Kingdom. However the ODA can accept no responsibility for any item provided or views expressed. The author of this review was not involved in the design or implementation of the fieldwork.

## **Soil fertility, current fertiliser practices and the potential for using compost**

The objective of the survey was to determine the current fertiliser practices of farmers and to examine the potential of using compost and/or introducing compost methods to utilise farm and household organic waste. Two villages were selected: Mim village and Kodie village (see Appendix 1 for community profiles). Semi-structured interviews were conducted with farmers using staff from the Departments of Horticulture and Agricultural Economics, University of Science and Technology, Kumasi (See Appendix 2 for summary of field data and Appendix 3 for checklist used).

### **Results**

The majority of the 15 farmers interviewed in Mim and 14 in Kodie were male and considered farming to be their primary full-time activity. The most common horticultural crops grown by the farmers were:

<b>Crop</b>	<b>Plot size range (acres)</b>
Tomato	0.5 - 10
Okra	0.25 - 3
Eggplant	0.25 - 2
Cabbage	1 - 2
Green pepper	1

Horticultural crops are usually monocropped and grown mainly as a source of income. The most common staple crops (where given) were:

<b>Crop</b>	<b>Plot size range (acres)</b>
Cassava	1-3
Plantain	0.25 - 1.5
Maize	0.5 - 5
Cocoyam	0.75 - 3
Cowpea	1 - 2



### *Fertiliser usage*

Most farmers applied some type of fertiliser to their horticultural crops (especially tomato) but never to staple crops. NPK (various strengths) was by far the most popular form of chemical fertiliser although a handful used Ammonium Sulphate and Urea. Where applied, chemical fertiliser was reportedly used at regular intervals (such as every two weeks) during the growing season according to advice given either by extension officers or fellow farmers. All the farmers who used chemical fertiliser on their horticultural crops reported that it had a noticeable impact in terms of speed of growth and yields.

Reasons given for not using chemical fertiliser included the recent increase in price which had forced farmers to reduce the number of horticultural crops they apply the fertiliser to (although Tomato was always a priority crop for fertiliser) or prevented them from using fertiliser altogether. Some farmers said they did not know how to use chemical fertiliser.

Chemical fertiliser was never applied directly to staple crops because of the cost constraints although some said it had little affect on yields or the soils were already 'good enough' for staple crops. However many farmers made the comment that there was a residual effect from the chemical fertiliser used for horticultural crops if staple crops were planted on the land in the next cycle. Farmers reported that they usually bought the fertiliser from Kejetia (Kumasi) and it was applied either by themselves or their hired labour.

Knowledge on the use of organic fertilisers was very limited with only a few farmers (who kept poultry) using the manure 'for free' on their horticultural crops. Reasons given for not using organic fertilisers included: lack of knowledge, no access to manure, not as effective as chemical fertilisers and too bulky to carry to the farms.

Questions on the use of the different types of organic waste revealed that waste from land clearance was always burnt (as part of the slash and burn farming system). Crops residues were either left to rot, used as mulch or if from staples such as Cassava, replanted. Household refuse was either fed to livestock or taken to the local refuse dump. Nightsoil was never used as fertiliser and many farmers doubted whether consumers would wish to buy food from farms where it was used as fertiliser. Given the present limited use of organic waste there may be potential to encourage its adoption in the future.

### *Soil fertility*

Comments on trends in soil fertility were broadly similar between the two villages. Generally the consensus was that soil fertility had declined due to a combination of a reduction in the fallow period (suggesting an increase in the intensity of the farming system) and the lack, or decline in use, of fertiliser. The comment was made that the shortening of the fallow period had more of an impact on the yields of horticultural crops than staple crops.

### *Yield constraints*

Farmers reported the main factors affecting staple yields as being: incidence of weeds; lack of fertiliser; low soil fertility; and pests/lack of pesticides. For horticultural crops pests and the lack of pesticides were considered to be the main problem as well as the problem of weeds.

## **Pest problems in horticultural production and current pest control practices.**

The objective of the survey was to determine the pest problems in horticultural production and the current pest control practices. Two villages were selected: Afari and Kuntanase villages (See Appendix 1 for community profiles). Semi-structured interviews were conducted with farmers using staff from the Departments of Horticulture and Agricultural Economics, University of Science and Technology, Kumasi (See Appendix 2 for summary of field data and Appendix 3 for checklist used).

### **Results**

14 farmers were interviewed in Afari village and only 4 in Kuntanase. The main pests and diseases are listed in the table below. Without additional information (such as their Latin names) it is not possible to summarise the findings any further. There is also no indication of the relative importance of the pests and diseases as farmers were not asked to rank them.

<b>Name</b>	<b>Control method</b>
Beetle (various)	Karate, Cymbush, replanting
Caterpillar (various)	Karate, Cymbush,
Cricket (brown)	Karate
Grasshopper (various)	Karate
Nematodes	None, remove infected plant
Other insects (lice, other larvae, )	Karate
Blight	None, remove
Disease 1 (black spots on fruit)	None, remove
Disease 2 (brown patches on fruit)	None, remove

It is also unclear as to whether the pests and diseases attack only the crops named by farmers or whether this is because the farmer only grows these crops, ie the farmer is saying that only Tomato is affected by the pest because he/she only grows Tomato.

For similar reasons the number of years given by farmers on how long these pests, disease, etc have been a problem may relate more to the length of time farmers have been growing these crops rather than the original emergence of these pests and diseases, ie caterpillars have been a problem for 5 years because the farmer has been growing Tomato for 5 years.

#### *Control method*

There appear to be very few traditional methods for control of pests and diseases except for manual weeding and uprooting infected plants. A couple of farmers said

they used to cover plants with ash to kill small insects but that this was no longer effective.

Karate was the most commonly used agro-chemical for killing insects such as caterpillar and grasshopper but others included Cymbush, Dursban, and Furadon.

Less appears to be known about the diseases and many could not be named. Dithane and Caocobre, both fungicides, were the most common for diseases referred to as blight (or the fungus or aphid causing it) but those which failed to respond or could not be treated with agro-chemicals were dug up to prevent the spread of the infection. Agro-chemicals were usually kept on the farm in containers or in the home under polythene sheets.

### *Trends*

The incidence of pests and diseases was generally considered to be increasing possibly because more farmers were now growing horticultural crops especially Tomato. In terms of effectiveness the agro-chemicals used were described as being very effective but for the duration of the season only. Pests and diseases would return the following season and the agro-chemicals would have to be reapplied.

### *Equipment*

Agro-chemicals were administered either by a knapsack sprayer or motorised mist sprayer/blower. Most farmers owned the former but generally rented or borrowed the latter (from friends usually without charge). When spraying little use was made of safety equipment such as masks. The final spraying was usually three to seven days prior to harvesting. Generally there were no perceived health problems associated with using agro-chemicals or eating food on which they had been applied.

### *Labour use*

The use of the knapsack sprayer or mist blower was usually by the men with women and children involved in collecting the water for diluting the agro-chemicals and weeding with hoes and cutlasses. Some use hired labour for weeding. Farmers buy the agro-chemicals themselves with some receiving advice on what to buy from extension workers.

## **Wholesalers credit to horticultural producers**

The objective of the survey was to discover the details about wholesaler credit to horticultural producers such as its real cost to the farmers and its role as a conduit to inform farmers of consumers demands and preferences. Two peri-urban communities were selected: Aduman and Krapa, (see Appendix 1 for community profile of Aduman). Semi-structured interviews were conducted with farmers. (See Appendix 2 for summary of field data and Appendix 3 for checklist used).

### **Results**

Seven farmers were interviewed in Aduman and eight in Krapa. Only three out of the 15 had contract agreements with traders and for these three this was the first year in which they have tried such an arrangement. It appears traders either provide a cash loan or agricultural inputs such as fertiliser and fungicides on condition that the farmer grows a specified crop and sell all the harvest back to the trader.

Formal credit was generally considered to be unavailable because farmers lacked the necessary collateral. The banks were also considered to be too inflexible because they required payment on loans even if the crops, for which the loans were required, failed. The bureaucracy involved in applying for a loan was also cited as a problem. Informal credit from friends and family appeared to be more widely available.

## Appendix 1 Community profiles:

### A. Community profile of Kodie village, Kwabre district.

#### PHYSICAL PROFILE

<b>Location :</b>	20km from Kumasi on the Kumasi Offinso road. Village spread on both sides of main road
<b>Infrastructure :</b>	Market, clinic, schools, electricity, pipe-borne water, police station, post office, churches.
<b>Market (Access) :</b>	20km from Kumasi Market. 13kms from Offinso Market, Local Market.
<b>Types of land cultivated :</b>	Middle and lower slopes and valley bottoms. Lowlands generally and good agricultural land.
<b>Soil Type :</b>	Mainly sandy, sandy-loam and clay-loam.
<b>Rivers &amp; Water Supply :</b>	Traversed by four rivers.
<b>Density of Dwellings :</b>	Evenly spread along both sides of the main Kumasi - Offinso road. The houses are clustered together.
<b>Type of land cultivated :</b>	To the east is gravel and soil not so fertile, however, as one moves further east outside the town, one comes to valley bottoms served by 2 streams and with relatively fertile soils. The 2 streams are perennial therefor enhancing the production of vegetables.

The western side of the village has the most fertile soil since most of the land is in a valley bottom. It is served by one stream. The major agric. activity is concentrated in this area. However, horticultural activities are restricted because the stream dries up during the dry season, so farmers have to gamble as to whether to plant with the view of irrigating during the dry season.

To the northern side of the town, there are relatively average fertile soils suitable for growing all types of crops. The biggest river in the area runs across the Northern Zone, and offers good opportunity for horticultural activities.

The southern sector has the least fertile soils, because it is stony & rocky and offers opportunity for sand winning.

#### AGRICULTURAL PROFILE

##### **Crops Grown :-**

In the Community the various crops under cultivation are listed below :-

- i. Tree crops - cocoa, citrus, oil palm
- ii. Food crops - plantain, cassava, cocoyam, maize, yam
- iii. Vegetables - a) Traditional - tomato, pepper, egg plant, okra

b) Exotic - cabbages, carrots, watermelon

Ranked in order of importance -

1. Cassava
2. Tomato
3. Maize
4. Cocoyam
5. Egg plant
6. Peppers
7. Others (pineapple, cocoa, onions, citrus, cowpea)

\* Importance was judged according to 3 factors -

- a) Income obtained.
- b) Number of persons involved in cultivation.
- c) Areas devoted to production of the crop.

**Inputs used -**

Fertiliser  
Agro-chemicals  
Credit  
Hired labour/family labour.

**End use of crops -**

Food crops  
a) Cassava & maize - 2/3 to market - 1/3 for home consumption.  
  
b) Plantain & cocoyam - 100% home consumption  
  
c) Horticultural crops (tomato, pepper, egg plant) - almost 100% for the market.

**FARMER / GROWER PROFILE**

**Historical Profile -**

1960's                      More plantain and cocoyam mostly forest and very fertile soils. Higher yields and low prices. Not so profitable business, only export growers built houses.

1970's                      More people introduced cassava and maize into the farming systems. A gradual decline in the production of plantain and cocoyam. Increased subsidisation of farm production. Low prices for farm products.

1980/90's                      An upsurge of production for the market, a total decline in the production of cocoyam and plantain, maize and cassava become major cash earners and vegetable production gained some importance in the farming system. Soil fertility at its lowest. Increased use of agro-chemicals.

**Constraints -**

- i. Non-availability of production credit
- ii. Pest and disease problems.
- iii. Problems with storage and preservation of harvested produce
- iv. Lack of leadership/association.
- v. Soil infestation (Nematode, termites, etc.)
- vi. Periodic labour shortage.
- vii. Low prices for horticultural produce.
- viii. Activity of middlemen.
- ix. Inadequate irrigation water in dry periods.

## VILLAGE PROFILE

Total population .....	Approx. 6,000
Farming population .....	70% of population above 15 years of age.
Proportion of men .....	50%
Proportion of women.....	50%
House ownership .....	70% live in family houses.
.....	30% live in rented accommodation.
Type of housing.....	75% live in landcrete houses.
.....	25% live in block-moulded houses.

## OTHER OCCUPATION

I) Off-farm employment - fitting, trading, welding.

## **B. Community profile of Mim village, Atwima district.**

### PHYSICAL PROFILE

<b>Location :</b>	16 Kms from Kumasi on the Kumasi - Nkawie road.
<b>Infrastructure :</b>	Schools (Primary), Electricity, Pipe borne water, Church, Cocoa Shed.
<b>Market (Access) :</b>	16 Km from Kumasi Market.
<b>Types of Land :</b>	Generally lowlands cultivated.
<b>Vegetation /Climate :</b>	Secondary forest interspersed with elephant grasses. Rainfall is bi-modal with major season rain from April to July and Minor rains August to October.
<b>Soil types :</b>	Mainly clay and clay loam.
<b>Rivers &amp; Water Supply :</b>	Traversed by one river

### AGRICULTURAL PROFILE

In the Community the various crops under cultivation are listed below :-

- (i) Tree Crops : Cocoa, Coffee, Citrus, Oil Palm.
- (ii) Food Crops : Plantain, Cassava, Cocoyam, Maize.
- (iii) Vegetables :
  - a) Traditional :- Tomato, Okra, Pepper, Egg Plant.
  - b) Exotic :- Cabbage, Carrot, Cucumber.

Ranked in order of importance :-

- i. Okra
- ii. Cassava
- iii. Tomato





- Low prices for horticultural produce in times of glut.

### **VILLAGE PROFILE**

Total population Approx. 2000  
 Farming population Approx. 1600

Proportion of men farmers 45%  
 Proportion of women farmers 55%

Education : 90% visited school.  
 House Ownership : 80% live in family houses.  
 20% live in rented accommodation.

Type of Housing : 75% are landcrete houses.  
 25% are block-moulded houses.

## **C. Community profile of Afari-Atwima district**

### **PHYSICAL PROFILE**

**Location:** 18km west of Kumasi on the Kumasi-Nkawie road

**Infrastructure:** Market, schools, electricity, pipe-borne water, churches.

**Access to Market:** 18km from Kumasi market 4½km from Nkawie market.

**Types of Land Cultivated:** Middle and lower slopes and valley bottom. Flat lands as well.

**Vegetation/Climate:** Secondary forest. Two rainy seasons (Feb-July and Aug-Dec) and two peaks (Jul and Oct).

**Soil Types:** Mainly sand loam, clay loam and scattered clay areas.

**Rivers/Water Supply:** Three streams. Pipe-borne water.

**Density of Dwelling:** Partly scattered and partly clustered.

### **AGRICULTURAL PROFILE**

Ranked in order of:

<b>Acreage</b>	<b>People involved</b>	<b>Income</b>	<b>*Benefit (Consumption needs)</b>
1. Maize	1. Cassava	1. Tomato	1. Cassava
2. Cassava	2. Maize	2. Okra	2. Maize
3. Okra	3. Plantain	3. Maize	3. Plantain
4. Tomato	4. Cocoyam	4. Cassava	4. Cocoyam
5. Garden-egg	5. Okra		
	6. Tomato		
	7. Egg-plant		

## 8. Pepper

### Inputs used:

#### Food Crops

1. Cutlass
2. Hoe
3. Baskets
4. Hired Labour
5. Family Labour
6. Poultry Manure

#### Vegetables

1. Cutlass
2. Hoe
3. Fertilisers
4. Agro-Chemicals
5. Hired Labour
6. Family Labour
7. Poultry Manure

### End use of crops:

Food crops	Sales	Home Consumption
Cassava	2/3	1/3
Plantain	1/3	2/3
Cocoyam	1/3	2/3
Yam	-	1
Maize	3/4	1/4
Tomato	1	-
Okra	1	-

### FARMER/GROWER PROFILE

#### Historical Profile

1960's	More plantain and cocoyam. Very fertile soils. Rain forest vegetation. High yields without fertiliser. Bigger farm sizes. Small population; no vegetable production. Older farmers; mainly shifting cultivation.
1970's	Maize and cassava production increases in the farming systems. Decline in cocoyam and plantain production. Decline in soil fertility. Population increase at a faster rate. No vegetable production in commercial quantities.
1980/1990's	Increased production for the market. More younger farmers involved. Increase in the use of fertilisers and agro-chemicals. Secondary forests. Smaller farm sizes. Decline in soil fertility. Higher yields due to new technologies, but very low yields without new technologies. Farming mainly on permanent land with crop rotation.

### **Constraints:**

1. Non-availability of production credit.
2. High credit cost, where available, ie from 50-100%.
3. Pest and diseases.
4. Labour/tractor scarcity, particularly between February and March.

### **VILLAGE PROFILE**

Total Population: .....approx. 5,000  
Farmers Population: .....90% of adult population  
.....60% of farmers are women  
.....40% of farmers are men  
Education: .....80% of population visited school  
.....70% of farmers can read/write  
House Ownership: .....90% family or self  
.....10% rented  
Type of Housing: .....50% mud  
.....30% brick  
.....20% block  
Land Ownership: .....70% family land  
.....30% other tenure arrangements

**Other Occupation:** Government Service, pottery, trading, carpentry, driving, shoe-making, private sector employment eg poultry farms.

## **D. Community profile of Kuntanase district**

### **PHYSICAL PROFILE**

**Location :** Kuntanase is located 25km southwest of Kumasi. It is located on a hilly area with the surrounding farmlands on gentle slope and in valleys.

**Infrastructure :** There are five schools: two primary schools, one junior secondary, a vocational school and one international school.

There is a market which operates every day but depends on Kumasi market for the purchase of inputs and the sale of farm produce. There is electricity in the town and the source of water is a borehole fitted with pump.

**Types of land cultivated :** Cultivated areas are on the gentle slopes and in the valleys with secondary forest as the vegetation. Along the valley is the river Bankro which dries out in the dry season. The farms are about 500m from the river.

**Soil Type :** The soil is loamy.

### **AGRICULTURAL PROFILE**

There are about four hundred households with an average of six persons. Most people are farmers. Crops grown include Maize, Cassava, Vegetables, Plantain, Yam, Cowpea and Plantation crops, such as Cocoa and Oil Palm. Inputs used by farmers are obtained from the Kumasi Market. These include

cutlasses, hoe, fertiliser and pesticides but seeds are mostly collected from other farmers and the previous year's crop. Vegetables are produced for the Kumasi Market and virtually all the produce is sold at the Kumasi Market. Very little horticultural production is for home consumption. Staples such as Plantain, Yam and Cassava are for home consumption but some of these crops are also sold in Kumasi. Land is owned by the family head and distributed to individual members of the family for farming.

### **GROWER PROFILE**

Farmers in the Community are between the ages of twenty-eight and fifty-five years. Most of the farmers have been to school. Generally there are more younger farmers in the Community than older farmers. Most of the vegetable growers are members of a group or association but these are not functioning effectively. Most farmers have their own houses made of bricks. The vegetable production is limited to the young farmers because of its higher labour demands.

#### **Input use :**

Older farmers do not use fertiliser and pesticides because they do not have the money to buy them and also regard their land as being fertile enough for staples. A greater number of young farmers, who are mostly vegetable growers, use chemical fertilisers and pesticides because they use their land more intensely. Maize, cassava, egg plant and tomato are the major income earners for the farmers. But in terms of importance farmers consider cassava as being the most important, followed by egg plant, tomato and maize, because they use cassava for home consumption as well as for cash.

#### **Constraints :**

- (1) Higher cost of labour and shortages of labour.
- (2) High cost of fertiliser and pesticides.
- (3) Lack of water during the dry season periods.
- (4) Lack of credit facilities.

### **FUTURE ASPIRATIONS**

Most of the young farmers plan to expand their vegetable farms especially egg plant and tomato when they have access to credit, because they believe it will generate more income.

## **E. Community profile of Aduman community**

### **PHYSICAL PROFILE**

**Location:** Aduman is located 25 kilometres north east of Kumasi off the Kumasi-Offinso road.

**Infrastructure:** There are 3 schools in the Community, these include a primary school, a junior secondary and a secondary school. There is a post office, pipe-borne water for domestic use. Half the town is supplied with electricity from a generating plant at the secondary school but only works during the night between the hours of 6 p.m. and 10 p.m. There is no market and the

community depends upon the Kumasi and Offinso market for the purchase of farm inputs and the sale of produce. The Offinso market is 17km from Aduman and Kumasi is 25km.

**Type of Land Cultivation:** The topography is undulating but the farmlands are found in the middle slope and the valley bottoms. There are more than 10 rivers and streams within the farmlands. These include Nwabe, Awumasu, Pinkyeme, Anunsu, Praah, Aboabo, etc. The soil type is sandy and clay loam.

The vegetation is secondary forest and the climate is bi-modal rainfall with the peak periods being June and the minor peak September-October. The density of dwelling is 2 clustered - 5% bricks, 20% blocks and 30% mud.

### **AGRICULTURAL PROFILE**

Most of the people in the Aduman Community are farmers.

**Crops Grown:** plantain, cassava, maize, horticultural crops such as tomato, cabbage, pepper (hot), cucumber and watermelon.

Inputs used by farmers: hoes, cutlasses, chemical fertilisers, poultry manure and pesticides, crates, buckets and sacks. Young vegetable farmers use chemical fertiliser, poultry manure and pesticides for production, but older staple farmers do not use fertilisers and pesticides. Vegetable production is mainly for the Kumasi Market, but staple crops like cassava, plantain and maize are for home consumption, but half is sold at Kumasi and half used for home consumption.

### **FARMER PROFILE**

Crops grown are vegetables and staples. Most of the young farmers are vegetable producers who entered the business in the 1990s but the older staple farmers started activities in the 1960s some thirty years ago. The farms were initially cocoa but due to land pressure and bush burning, staple crops took over. Most of the young vegetable farmers have been to school but most of the older staple farmers are illiterate and most of the staple farmers are females. Very little of vegetable is produced by the older farmers for home consumption. Some of the vegetable farmers get some credit from traders who purchase the produce without interest.

#### **Constraints:**

1. Lack of credit for expansion and hired labour.
2. Scarcity of land and acquisition problems.
3. High cost of Agro-chemicals.
4. Bad roads affects transportation of farm produce.
5. High cost of spraying equipment.
6. Pest infestation on vegetables such as watermelon, cucumber and cabbage in recent times.

#### **Future Aspiration:**

The vegetable farmers plan to expand production if there is money because of its lucrative nature.

#### **Village Profile:**

50% of houses are brick.  
20% of houses are blocks.  
30% of houses are mud.  
All the houses are tin roof.

There is no farmer association in the Community, more or the farmers are illiterate but most of the younger vegetable farmers are educated.

Population: 5,000

Family houses.

Some rent lands.

A. SOIL FERTILITY SURVEY: KODIE VILLAGE

Farmer:	Sex	Full or part-time	crops grown	Area (acres)	Fertiliser usage Details	Q2 Factors affecting yields from staples	Trends in soil fertility	Q9 Effectiveness of fertilisers used	Q10 Use of organic wastes: Land clearance	Crop residues	Nightsoil
1	M	Full	Tomato Cassava Cowpea	2.5 3 2	Yes NPK, 2 wks after transplanting No Fertiliser does not improve yields of cassava and cowpea No	weeds Soil moisture (-ve) Fertiliser Pesticides	Decline in fertility	Essential for tomato	Burnt Left to rot	n/a	
2	M	Full	Tomato Cassava	1.5 1	Yes NPK, regular intervals No No organic manure. No reason to apply fertiliser to Cassava	Weeds			Burnt left to rot	Never used	
3	M	Part-time	Tomato Cowpea Cassava	2 2 2	Yes NPK, several applications No Poultry manure (keeps chickens) No Chem fert has a 'quicker effect'	Low soil fertility Pests	Decline in fertility	Vigorous growth	Burnt	Burnt	
4	M	Part-time	Tomato Pineapple Cassava	1.5 3 1.5	Yes NPK, during nursery stage, wk 2 No after transplanting and wk 4 No No organic fertilisers. Lack of funds prevent fert. applic to Cassava and pineapple	Weeds Spacing Soil fertility	Decline in fertility	Tomato is v. responsive to fert.	Burnt	Local refuse dump	n/a
5	W	Full	Okra Eggplant Plantain Cassava Cocoyam	0.5 0.25 1.5 3 3	Yes NPK, 2 wk intervals. Lack of funds prevents fert. usage on other crops. No No No	Residue effect of fert used for hort crops.	Drastic decline in fertility	Speeds up development	Mulch	n/a	
6	M	Full	Tomato Eggplant Cowpea	1 1 1	Yes NPK, no organic fertiliser Yes Other crops benefit from residue effects of fert No	Weeding Continuous cropping Spraying Watering Fertiliser	Decline in yield due to short fallow periods (affects hort. more than staples)		Burnt	Left to rot	n/a
7	M	Full	Tomato Eggplant Groundnut	1.5 2 3	Yes NPK, no organic fertiliser Yes Regular intervals No	Weeding Fertiliser Close spacing Watering	Decline in yield over past 5 yrs. because of increase in fert. price	Compensates for decline in soil fert	Burnt	Left to rot	Pit latrine
8	M	Full	Tomato Eggplant	2 1.5	Yes NPK, Sulphate of ammonia Yes All stages of prod cycle No organic	Residual effect of fert. used on hort.	Increase in yields as farmer becomes more experienced		Burnt	Left to rot	Pit latrine
9	M	Full	Tomato	0.5	Yes NPK, regular intervals Staples (maize & cassava) benefit from residual fertiliser Organic manures are bulky to carry to the farm	Weeding Fertiliser	Increase in fertility	V. effective	Burnt	Mulch	Pit latrine
10	M	Part-time	Tomato Eggplant	3 0.5	Yes NPK, Urea, regular intervals Yes Fertiliser is not good for cassava	Weeding Fertiliser	Increase in fertility				Not feasible
11	M	Full	Tomato	2.5	Yes NPK, regular intervals Fertiliser is not good for cassava	Rainfall			Burnt	Mulch	Impossible
12	M	Full	Tomato Eggplant Cassava/maize	1 1.5 2	Yes NPK, Ammonia sulphate Yes Chicken manure on Eggplant because it is free. No	Pests Disease	Decline in soil fertility	Not good for Cassava	Burnt	Mulch	Bush
13	M	Full	Tomato	10	Yes NPK, regular intervals No organic fertiliser Residual effect on food crops	Soil fertility Disease	Decline in soil fertility		Burnt	Mulch	Pit latrine
14	M	Full	Tomato Cabbage	1 1.5	Yes NPK, Urea, regular intervals Yes No organic fertiliser Residual effect on food crops	Soil fertility Pests	Decline in soil fertility due to increase in intensity of cropping		Burnt	Mulch	Pit latrine



A. SOIL FERTILITY SURVEY: MIM VILLAGE

Sex	Full or part-time	Crops grown	Area (acres)	Fertiliser usage	Details	Q2 Factors affecting yields from: staples horticulture	Q3 Trends in soil fertility	Q9 Effectiveness of fertilisers used	Q10 Use of organic wastes: Land clearance Crop residues	Nights/soil
1	M Full	Cucumber Carrots Cabbage Green pepper Watermelon		Yes Yes Yes Yes Yes		Fertiliser Pesticides			Burnt, ash used on land used for compost bush	
2	M	Tomato Pepper Eggplant	2 1 1.5	Yes Yes Yes	NPK on all crops. 2 wks after transplanting	Fertiliser Pesticides	Annual shifting cultivation		Burnt Left to rot (plot is hired and has to leave)	Pit latrine
3	M Full	Okra/Ayoyo Cassava Plantain	1 1 1	No No No	Doesn't know how to use chemical fertiliser and no access to manure	insects (-ve)	Decline in fertility	Mulch	Left to rot	Pit latrine
4	M Full	Maize Okra Tomato	5 2.5 1	No No Yes	NPK for tomato only. Cannot afford for other crops. Regular intervals			Increases yield	Left to rot	No use
5	M Full	Okra Cassava Cocoyam/ Plantain	0.75 1 0.75 No	No No No	Fertiliser is unnecessary		Practices shifting cultivation	Burnt	Left to rot Cassava & cocos are replanted	No use
6	M Full	Maize Cassava Plantain Okra Pepper	3 3 2 3 1	No No No No No	Stopped using chem. fertiliser because of the high price. No knowledge of organic fertiliser.	For Okra/Pepper: Soil fertility (-ve) Pests Diseases	Decline in fertility after stopping fertiliser applic.	Mulch	Left to rot Cassava is replanted	No use
7	F	Okra/ Eggplant/ Leafy veg	1	No No No	Lack of funds and know-how.	Decline in fertility due to shorter fallow	Decline in fertility due to shorter fallow/ lack of fert.	Burnt	Left to rot	No use
8	F	Okra Plantain Maize Cocoyam Avokete (?)		No No No No No		Pests	Decline in fertility due to shorter fallow	Burnt		
9	M Full	Tomato Eggplant Okra	1 1 3	Yes Yes Yes	Regular intervals	Disease	Decline in soil fertility	Burnt	Left to rot	Pit latrine
10	M Full	Cabbage Okra	2 1	Yes Yes	NPK after 2 wks. No organic fertiliser.	n/a		Burnt	Burnt	Pit latrine
11	M Full	Tomato Plantains/ Cocoyam	5 1.5	Yes No	Do not use fert. on staples as soil is very good.	Avail of fertiliser & pesticides		Burnt	Left to rot	Pit latrine
12	M Full	Tomato Cabbage	2 1	Yes yes	NPK & Ammonia for tomato Chicken manure for cabbage because of increase in fert. price		No change	Burnt	Left to rot	Pit latrine
13	M Part-time	Okra Maize Plantain Cassava Tobacco	0.5 0.5 0.25 1.25 0.25	No No No No No	First year of farming					
14	W	Okra/ Maize	0.25	No	Lack of funds and know-how.	Weeds (+ve)	Decline in fertility	Mulch	Mulch	Pit latrine
15	M	Tomato/ Okra/ Eggplant/ Pepper Cassava/ Cocoyam	4	Yes	Poultry manure for Okra, NPK for rest. Play the same role but cannot afford to buy NPK for Okra	Pests Weeds Fertiliser (+ve)		Burnt	Burnt	Pit latrine

The few responses obtained from questions 4-8 are covered in the 'details' column. Questions where the response was always the same (questions 10 (in part), 11 and 12) are not included

B. PEST SURVEY: AFARI VILLAGE

Farmer:	Pest/disease/ weed	Details	Control method	Equipment used	Labour	Sell/eat crops x wks after spraying	Trends in pests, etc. over past 5 years
1	Caterpillar: Red beetle: Black beetle:	2 types: green and black ones. 2" long. Attack Okra. Common problem, come every year. Attacks Okra, common. every year Attacks Okra seeds before germination, destroys 30% of seeds planted. Common, every year.	Agrochemicals: Karate and cymbush every 10 days. As above Replant seeds that have been destroyed.	Knapsack sprayer & mistblower. Owns.	Men	Stops spraying 2 wks before harvesting	Red beetle has become more common.
2	Caterpillar: Grasshopper: Disease: Disease:	Green. Attacks Tomato. Can destroy plant. Common Attacks Tomato. Small (<25"). Deep green. Common, every year. Brown patches on Tomato fruit. Common. Seen for the first time this year. Black spots on Tomato. Uncommon, first year seen.	Apply Karate every 5-7 days (@22,000/litre) As above None. Throw away infected fruit. None. Throw away infected fruit.	Knapsack sprayer & mistblower. Rented.	Men (himself)		Increasing incidence of disease
3	Caterpillar: Disease Pest Disease ? ?	Green. Attacks Tomato. Destroys whole plant. If seen early can kill with spray Raised black lesions on Tomato fruit. Very common but only started 2 yrs ago. Root knot nematode. Causes plant to wilt. Attacks Okra and Tomato. Vascular wilt (blight?). Rots stem, kills plant. V. common for past 2 yrs. Attacks Tomato. No name for it. Kills flowers. Very common for at least 10 years. No name for it. Brown patches on Tomato. Seen for the first time this year.	Karate. Sprays 2 wks after transplanting and every wk for 12 wks. 15,000/litre Tried spraying with a fungicide but not effective. Dig up root and throw away. No chemicals used. None. Diebery.	Knapsack sprayer & mistblower. Owns.	Men (himself)	The day after.	Increase in diseases
4	Disease  Caterpillars Tomato lice Pest	Blight. Attacks Tomato.  Attacks Tomato. Very small green insects. Eat leaves. Seasonal problem, appear after rains from Sep-Nov until the end of the harvest season. V. Common. Always been Root knot nematode. Causes plant to wilt. Attacks Okra and Tomato.	None. Dig up affected plants.  Karate. Every 5 days. None. Dig up affected plants.	Knapsack sprayer & mistblower. Rented.	Men	3 days before harvesting	Pest problems are increasing but can be controlled through spraying (increase in No. not dosage).
5	Caterpillar  Crickets ? ? Grasshopper Disease	Green. Attacks Okra and garden egg. Common for past 5 yrs.  1 inch brown. Attack garden egg and Okra. Common, for at least five years. Wilting of eggplant (possible termites). Kills plant. Common, for at least 5 yrs. Disease? Fruits of Pepper fail to mature. Common, every yr for past 5. V, small. Green. Feed on flowers of Okra & Pepper. Common, always been around No name. Stunts Okra. Common, always been	Spray with Karate every wk.  Karate every week. None. Tried applying fertiliser to root of plant but no luck. Fungicide every wk. Karate every week. Remove diseased plants.	Mist blower - motorised sprayer. Rented.	Men	Stop spraying wk before.	Pest infestation (esp caterpillars and crickets) are increasing, now using more pesticides, increased
6	Red beetle  Insect	Small holes in leaves of Okra & Garden egg. Common  Soft body. Eats leaves of Cucumber. Common, only over last five years.	Formerly ash but no longer effective. Now uses chemical (doesn't know name). As above	Mist blower, rented.	Hired labour, some use masks.	4 days before harvesting.	Pests are increasing and reappear quickly after spraying.
7	Insect  Insect ? Ninsin'	V. small. Orange & black. Eats Okra leaves.  Bright brown/black. Attacks Okra. Common for past 10 yrs. Plants die for no apparent reason, can wipe out whole areas. Developed in past 4 years. Weed. Common for at least last 10 yrs.	Formerly used wood & ash but now Karate and Dursban weekly  Karate (7,000/250ml) or Dursban (15,000/litre). Use weekly. None Hoe & cutlass	Knapsack (owned) & motorised sprayer (rented).	Men (farmer), 4 days Women (for weeding - hired)		No change
8	Grasshopper  Caterpillar Disease Elephant grass	Several types (green, brown, multi-coloured). Attack cabbage. Common for past 10 years.  Greenish. Attack growing point of cabbage. Common for past 10 years. No name. Kills cabbage ( leaves turn yellow and wilt) Common for past three years. Hard to clear. Common.	No local control methods. Use Karate, weekly (7,000/250mls)  No local control methods. Use Karate, weekly. None Hoe	Knapsack sprayer. Rented	Farmer does the pest control, hired male labour the weeding.	3 wks	
9	Caterpillar  Cricket Grasshopper Disease Pest/disease	Green, 3" long. Common for past 4 years. Attacks Tomato  Known as 'Ketechise'. Thumb size. brownish. Attacks Tomato. Not Common. 2 yrs only. Yellowish brown. 1" long. Attacks Tomato. Black spots on Tomato fruit results in rotting. Common for past 2 years. 'Abduro' in Akan. Pest? Disease? Attacks Tomato causing them to wilt & die. Common since last year.	Karate every 10 day @ 15,000/litre  None. Use Cocobre every 10 days @ 250/sachet. Use Cutlasses. No agro-chemical used. Affected plants are uprooted and destroyed.	Knapsack sprayer. Rented Motorised sprayer, rented.	Pest control self. Weed control, hired men.	3 days	Increase in Tomato pests over last 5 years.
10	Blight  Anonom (rot)	Affects Tomato. Uncommon. Past 5 years.  Affects Tomato. Rots. Uncommon. Observed first 1 year ago.	Dithane @ 3,000/kg and Cocobre @200/pint. Use weekly. As above.				

	Nematode	Attacks Tomato. Plant wilts and dies. Uncommon, for past 3 years.	Traditionally uprooted infected plants. Now use Furadom, once only. If not effective plant is uprooted.				
	Weed	Name? Affects Tomato. Uncommon.	Control by manual weeding by farmer and hired labour.				
	Weed	Adanko Mille. Affects whole farm. Very common.	As above.				
	Caterpillar	Essa. Larvae bore into Tomato fruit. High infestation if not controlled early. Uncommon, for past 5 years.	Karate.	Knapsack sprayer, borrowed free of charge from friends. Motor blower is rented @ 84,000/growing season.			
11	Disease	'Ntofala'. Black spots on stem of Tomato plant, eventually killing it. Common in past 12 months.	Cocobre, Dithane and Karate, every 2 weeks.	Motor blower, owned.	Farmer himself.	3 days.	
	Disease	Blight. Spots on Tomato leaves, can kill. Common in last 12 months.	Dithane, every 2 wks after transplanting.				
	Disease	Mosaic virus. Upper leaves of Tomato becomes thin and wrinkled. Uncommon, past year.	Cocobre is mixed in with fertiliser.				
	Caterpillar	'Essa'. Bores into Tomato fruit. Common for past	Karate and Dithane, wky after transplanting.				
	Aphids	Attack Tomato. V. Common.	As above				
12	Cricket	Attacks Tomato, Common for many years.	Karate. Every 5 days after transplanting.	Knapsack sprayer, borrowed from friends for free.	Himself, wife fetches water.		Pests, disease, etc are increasing
	Grasshopper	Abebe. Common for many years. Attacks Tomato.	As above				
13	Termites	Attacks Pepper. Common for many years	Furadan. Once/season. One sachet/acre @2,500/sachet.	Knapsack sprayer (a friend's for free) for v. young plants and Motorised sprayer for older plants (own).	Farmer (himself)	3 days	No changes
	Grasshopper	Yellow head, green body. Attacks Tomato. Common for many years.	Karate, weekly.				
	Caterpillar	Green 2.5", Attacks garden eggs.	Traditionally use woodash but now use Karate/wkly.				
	Weeds	Enphobia (?). Competes with all crops. Common for past 8 years.	Hoe or Cutlass. Also use Atrazine once/season.				
	Disease	Tomato plant turns black. Common for past six	Cocobre/twice/season.				
14	Caterpillar	Attacks Okra, common for many years	Karate, weekly	Motorised sprayer, rented	Family & hired labour	1 day	Increasing
	Pest	Name? Attacks Okra	As above				

Farmer:	Pest/disease/ weed	Details	Control method	Equipment used	Labour	Sell/eat crops x wks after spraying	Trends in pests, etc. over past 5 years
1	Disease	Blight. Attacks Tomato. Leaves start yellowing with black streaks. Common for many years.	Dithane, weekly	Knapsack sprayer, Motor blower - both hired	Himself, women fetches water		Increase in disease, pests and weeds as more farmers have moved into Tomato production.
	Disease	Apasos. Attacks Tomato. Leaves curly. Isolated cases every year.	Topsin M. & Karate & Dithane.				
	Disease	White streaks on Tomato roots. Eventually plant dies. Uncommon.	None				
	Pest	Crickets. Attacks Tomato. Common every year.	Karate as and when detected.				
	Pest	Bush frog. Eats Tomato leaves.	Karate as and when detected				
	Pest	Grasshopper. 'Abebe'. Attacks Tomato in scattered areas. Common, every year.	As above				
2	Pest	Flies. Larvae eat Egg plant and pepper. V. Common for past five years.	No local methods. Use Karate every 2 weeks.	Knapsack sprayer and motorised mist blower (hired).	Himself.	7 days	Increasing
	Pest	Caterpillar. Black & hairy. Attack Egg plant and pepper. V. common for past five years.	Karate and Dipel every 2 wks.				
	Disease	Name? Causes wilting. V. common. Attacks egg plant for past 5 yrs since started farming.	Karate, Dithane at 2 wk intervals.				
	Weed	Grass type. Competes with Egg plant and pepper. V. common.	Weeding with cutlass. Also uses a herbicide twice/season.				
	Weed	Vine-like leguminous weed. V. common.	Weeding with cutlass. Herbicide is				
	Pest	'Atee'. Attacks pepper. V. common for past 5 years.	Karate and Dipel.				
	Disease	Curled leaves. Less peppers produced. V. common.	Karate, Dithane and Kocide.				
3	Disease	Attacks Egg plant and Tomato. Leaves yellow and roots swell and rot.	Dithane	Knapsack sprayer and motorised mist blower (hired).	Himself	7 days	Increasing
	Pest	Worm or caterpillar attack stems of eggplant killing plant.	Karate				
4	Disease	Attacks Tomato. Black spots on leaves and stem. Inhibits fruiting. Noticed since starting production 4 years ago.	Topsin & Dithane	Knapsack, owned.	Himself	6 days.	No change
	Pest	Aphids and Caterpillars attack Tomato. Common throughout the year.	Thiodin and Karate				
	Disease	Attacks garden egg. Yellow leaves with black spots. Common.	Topsin and Karate				
	Pest	Larvae. Attacks garden egg. Common.	As above				

## C. CREDIT SURVEY: ADUMAN AND KRAPA VILLAGES

Farmer	Income in Cedi (1994)	Horticulture	Staple	Tree	Main use	Marketing details	Contract arrangement details	Other credit details
Aduman								
1	600,000		90,000		Farm materials, rent	Regular customers for tomato.	No	Formal credit not avail. because has no collateral. No informal credit
2	500,000				Savings, school fees and food.	Buyers come to farm. Regular customers for cabbage, carrot, sweet pepper and water melon.	No	
3	1,200,000		300,000		Travel and farming	Has contract to produce cabbage, sells tomato and water melon himself. Regular customers for all 3.	Yes. Trader provides cash loan to produce cabbage. Started this year. Price agreed is no different to without contract sales. Trade meets transport costs	Only has access to informal sources.
4	700,000		150,000		Ploughed back into tomato production	Regular customers for tomato and cabbage	Yes. Trader provides fertiliser and fungicide to grow tomato. Started this year	Formal credit is unavailable because there is no association through which credit can be channeled.
5	1,108,000		300,000		Farming, health, education, transport and savings	Has contract to produce tomato. Sells eggplant and water melon. to traders.	No written contracts. Lower prices under contract.	No formal credit because has no collateral.
6	200,000				Food, school fees, health and funeral expenses.		No.	
7	150,000				Trading and buying	Regular customer for tomato.	No.	
Krapa, Ejisu Juabeu district								
1	100,000		150,000		Health, clothing and shelter	Regular customers for tomato.	No	Yes, but banks are too inflexible.
2	150,000		120,000		Food, clothing and rent	Regular customers for tomato.	No.	
3	60,000					Regular customers for tomato.	No.	Yes but too much bureaucracy involved.
4	142,000				Food and farming	Regular customers for tomato and Okra buying directly from farm.	No.	Can only borrow from friends.
5	No profit made						Yes, contract to grow Tomato. Cash loan used to buy pesticide on condition all tomatoes are sold to the trader. First season. Trader sold tomato variety to farmer. Farmer pays	Banks loans are not feasible as they will insist on repayment even if the crop fails.
6	800,000				Travel	Regular customers for tomato.	No.	
7	800,000				Health	Sells in markets. Regular customers for tomato.	No.	
8	1,300,000				Food, education and health.	Sells in markets.	No.	

## **Appendix 3 Checklists:**

### **A. Fertiliser practice and potential for compost**

1. List the crops that you grow, the area that you grow and indicate if you use fertiliser. By crop list type of fertiliser (chemical or organic), season which you apply it, at what stage of growth and amount.
2. List the factors in order of importance which are reducing the amount of yield that you get from staple and horticultural crops.
3. What has been the trend in soil fertility over the last 5 years. If it has changed why do you think this is so?
4. If you are using both chemical and organic fertiliser/poultry manure on your farm, why do you use both and how do you see the different roles of these two types of fertiliser?
5. Which crops don't you use any fertiliser on and why don't you use it?
6. If there are crops where you use only chemical fertiliser or only organic fertiliser, why do you do this?
7. Do you use certain types of fertiliser at certain times of the year, if so when and for what crop? Why?
8. Do you use certain types of fertiliser at certain stages of crop growth, if so at what stage and for what crop? Why?
9. For the different types of chemical fertiliser and organic fertiliser, how effective are they in terms of the yields you get, or in other ways that you have observed?
10. For each of the following organic wastes, explain what is done with it, and if it is not used for agriculture, explain why it does not get used in this way: organic material from land clearing, crop residues, manure, household refuse, and nightsoil.
11. For the different types of chemical fertiliser and organic fertiliser/poultry manure, where do you buy it from?
12. Who buys the fertiliser? Who decides what to apply and who applies it?

## **B. Horticulture pests, diseases, weeds and current control practices**

1. Provide brief description of each pest or disease, explanation of the damage, local control method and agro-chemical control method.
2. What equipment do you have for applying -chemicals? Is it rented or owned? Safety equipment used?
3. Who does what? Hired labour? Who buys the chemicals?
4. Are the agro-chemicals that you use effective?
5. How long after spraying you crop do you sell or eat your crops?
6. What are the trends in pests and diseases over the last five years? Do you always use the same chemicals?
7. Do you know of cases in you family or village in which people have suffered health problems form using agro-chemicals or eating food on which agro-chemicals have been used? Explain what happened?
8. How do you store your agro-chemicals? In what place and in what container?

### **C. Wholesaler credit**

1. Details of production costs.
2. What is the size of your family and do they help you with agricultural production?
3. How many crates/bags/etc of your crop is produced and marketed through contract agreements and what proportion is marketed through other arrangements (by crop and season)?
4. How much income do you think you earned in 1994 from: horticulture, staple crops or tree crops? Estimate the proportion of your income spent of different things.
5. In which ways do you market your horticultural produce? Do you have regular customers?
6. Do you produce and market any of your crops through contract arrangements in which market traders provide you with inputs on credit or cash on credit?
7. What other forms of credit are available to you, include both formal and informal sources?
8. For the crops you grown using credit from the trader are you required to grow any specific variety?
9. Other than the crops you grow on credit/contract arrangements what requirements do traders expect for crops you grow?
10. Are there any costs you have to pay to the trader in return for contract credit/
11. What benefit is there to the trader from giving you credit?
12. How is the price affected when you sell the crop you have produced through a contract agreement? How does this compare with crops you sell without a contract agreement?