Informal irrigation in the peri-urban zone of Kumasi, Ghana

An analysis of farmer activity and productivity

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Report OD/TN 103
February 2001

HR Wallingford

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DFID Department For International Development

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Contract - Research

This Technical Note is an output from the Knowledge and Research Contract R7132, Improved Irrigation in Peri-Urban Areas, carried out by the Water Management Department of HR Wallingford for the British Government's Department For International Development (DFID). The research aims to improve understanding and knowledge of the productivity and hazards of peri-urban irrigated agriculture, with the objective of identifying measures to improve output whilst minimising risks to health and the environment. Fieldwork has been conducted in and around Kumasi, Ghana, and Nairobi, Kenya.

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Executive Summary

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Cornish and Aidoo (2000), presented a range of new information on informal irrigated crop production based on results of a survey of 410 individuals in 63 communities located in the peri urban zone of Kumasi. The second phase of that study, reported here, was designed to obtain more detailed technical, social and economic data from a smaller number of farmers using daily recording of activities on 21 farms from December 1999 to May 2000.

Selection of villages and farmers for the detailed studies was based on the data obtained in the initial questionnaire survey, using pragmatic selection criteria to ensure inclusion of the range of water application methods, most commonly irrigated crops, and both men and women farmers. This resulted in seven farmers being selected from each of three villages. Farmers had to be willing to keep a simple daily written record of tasks, costs and income, but effort was made to avoid selecting only the younger more literate farmers. (Some farmers relied on younger family members to write down the daily record). Effort was also made to select "typical" rather than "best" farmers. (The basic characteristics of the farms included in the survey are summarised in Table A1.1. in Appendix 1)

The results of the second phase, detailed, studies have generally supported the conclusions drawn from the questionnaire survey, while providing the more detailed information summarised below.

Trading and marketing
In the initial questionnaire survey farmers ranked credit and marketing as leading constraints to irrigated production. This is confirmed by the detailed studies, which showed that returns from Dry Season Vegetable Production (DSVP) are influenced more by good marketing, i.e. selling a large part of irrigated produce at above average prices, than by achieving high crop yields. For many farmers, marketing and credit are linked through the informal system of pre-financing operated by market traders. This ties farmers to a single trader, preventing them from "shopping around" to obtain the best price.

Trading is almost exclusively carried out by women, dominated by the 'market queens' who control the trade of each major food group. Market queens fix prices, settle disputes, and provide credit, support and advice to traders and farmers. Traders include the "traveller-trader" who visit distant production centres to buy on the farm or at local markets, and the armchair trader at Kumasi Central Market,

who has an assured supply from local farmers. Both types are subject to the authority of market queens.

There are complaints that traders cheat farmers by tampering with weights and measures, for example by using bigger sacks to purchase from farmers than they use to sell in the market. Farmers are most vulnerable in the marketing of tomato and garden egg, as these crops have very well organised market systems within Kumasi Central Market which result in very tight price controls and limited opportunities for profit taking on the part of the farmers. Marketing of new or exotic crops such as cucumber, carrots or sweet pepper is less tightly controlled but the demand for these crops is more variable and alternative points of sale such as restaurants, institutional canteens and street eating-places often have to be sought.

Credit
A range of credit mechanisms were identified:

- Formal credit from the rural banks
- Formal micro-credit e.g. Poverty Alleviation Fund from the District Assemblies.
- Mutual credit assistance
- Moneylenders
- Pre-financing from traders

The last, informal credit from traders, is the most widespread and frequently used facility amongst irrigators, as many of the dry season vegetable growers appear to have a crop pre-financier. Traders provide advances at the outset of the season against all produce from the farm. Loans may be cash, or supply of inputs such as fertilisers and agro-chemicals. They attract no interest and require no collateral. They are based on the mutual understanding that the produce will be sold only to the pre-financier. Loan repayment is by gradual deduction by the trader. Outstanding loans from one season may be carried forward against the next season with the farmer also taking a fresh loan. The same traders may also extend financial assistance to cover off-season consumption and emergency demands.

The down side of this form of credit is that it creates a monopolistic condition that ties the farmer to a particular trader for years and gives him or her no say in the determination of the commodity price. This is seen by some as exploitation of farmers. While the research carried out under this project could not demonstrate whether or not exploitation was occurring, there was evidence that those farmers who did not rely on pre-financing were amongst the financially most successful. Not surprisingly, a price, in terms of reduced returns from crops sales, must be paid for access to an easily accessible, interest free, and highly flexible credit service.

Incomes and poverty status of farmers engaged in DSVP
The average profit generated from DSVP, taken here as revenue from sale of crops less the cost of inputs, was $US 153 (¢ 660,000), over a season of 180 days. Average profits were similar for the three villages, but in each village there are

large variations about the average. In all three villages one or more farmers made a profit of more than $US 360 (¢ 1,575,000). One farmer made a net loss.

Using communities' own assessments of wealth and poverty just over two thirds (68%) of households fall into the average wealth category – a group with generally adequate housing and access to sufficient cash and other resources to engage in farming, put their children through school and provide adequate clothing. Of the remaining households 3% are classed by their peers as being of above-average wealth and 29% are of below-average wealth. The last group are characterised by very poor housing, little access to land, are regularly in debt, and are seldom able to pay school fees or communal levies.

Households engaged in DSVP were slightly wealthier than the community as a whole, (80 % in the average category), but this does not necessarily mean that DSVP leads to improved wealth. The requirements for access to land and cash to purchase inputs mean that a certain level of wealth is needed in order to become an irrigator.

Although many irrigators are classed by their peers as being of "average" wealth the average profit of the five most successful farmers in the study was just $US 354. The average household in the sample consisted of six members. Based on the conservative estimate that profit from DSVP represents only 50% of the total annual cash income, the annual income per head of even these best performing households is just $US 118. This is less than a third of Ghana's average GNP/head which is $US 390 and represents an income well below the international poverty indictor of $US 1/head/day.

Crops grown and irrigated areas

The table below ranks the crops grown according to their average percentage contribution to farmer revenue. The data confirm the dominance of garden egg and tomato documented in the initial survey. Garden eggs are grown in all three villages, generating more than 50% of irrigated crop revenue for 15 of the 21 farmers studied. Tomato is also grown in all three villages but although widely grown, tomato frequently contributes less than 25% of revenue for the individual farmers studied.

Crop	Average contribution to farm revenue
Garden egg	57%
Tomato	15%
Cabbage	8%
Seven others contributing	20% (all less than 4%)

The initial survey showed that traditional green leaf vegetables, alefi, ayoyo and suule are not widely grown. However the inclusion of a village that specialises in the irrigation of these crops (Dedesua) meant that they were over-represented in the surveyed farms. These crops did not generally make a large contribution to total revenue.

The size of holdings is generally consistent with those reported in the initial survey. The average plot size is 0.45 ha with individual plots ranging from 0.1 to 0.8 ha.

Farmer expenditure
Farmer expenditure was recorded for a wide range of production and marketing costs. The table below summarises average expenditures on labour, inputs and marketing, in $US / ha. Opportunity costs of family labour are not included. Note that there were large variations between individual farmers, with total expenditure ranging between 35 $US/ha and 511 $US/ha.

	Labour	Equipment Hire	Agronomic inputs	Marketing	Total	Actual spend [1]
$US / ha	123	23	47	22	215	88
% of total	57%	11%	22%	10%	100%	-

1. The average actual expenditure unadjusted for the area cultivated.

Labour costs
Hire of labour constitutes over half the total production costs. For two thirds of the farmers land clearing incurs the greatest labour cost at an average cost of $US 38 / ha. After clearing, weeding and irrigation are generally the most costly, with average costs of $US 31 and $US 15 / ha respectively, but there are wide variations about these figures. For the 9 farmers cultivating with raised beds the cost of forming the beds was usually the second greatest labour cost after land clearing, but use of beds appears to reduce both the cost and time required for weeding.

Other activities including application of fertiliser or agro-chemicals, and crop harvesting use little paid labour.

Use of paid and family labour
Much of the labour used for tasks such as planting, irrigation and harvesting, which together use half the total labour input, are carried out by unpaid (family) labour. Irrigation and weeding require most labour, about 60% of the total. Irrigation uses the greatest amount of labour, but less than 10% of that labour is paid. By contrast the land preparation tasks of clearing, burning and bed formation require only about 10% of the total labour hours, but rely heavily on hired labour and make up 40% of total labour costs. The tasks of land clearing and bed preparation are carried out over a short period at the beginning of the season and involve heavy and strenuous work and are mostly carried out by hired men. By contrast, irrigation continues throughout the season and much greater use is made of unpaid, family labour. (Water carrying is a task traditionally carried out by women).

The high number of labour hours used in irrigation reflects the rudimentary methods used, i.e. manual carrying of buckets or pans from the source to the field. The farmers' views in the initial survey and the data gathered in this detailed study are consistent and indicate that the many hours spent in water carrying do not

necessarily ensure an adequate supply of water to the crop. Without access to better technology most farmers are using a great part of their labour effort simply to keep crops alive. There appears to be great potential to make much better use of these labour hours.

Irrigation costs
Estimates of seasonal irrigation costs based on the initial survey (See Cornish and Aidoo, 2000) were based on the erroneous assumption that a farmer paying labour for water carrying or those hiring a pump would use these methods to provide *all* their irrigation. The detailed studies make it clear that in the case of manual water carrying, farmers normally rely on paid labour for only a small percentage of their total water use.

Seasonal irrigation costs for those hiring pumps are therefore in the range $US 40 –70 when the cost of additional manual carrying is included. For those relying on manual labour the use of paid labour is an occasional event, and for the farmers surveyed the seasonal costs never exceeded $US 11. The total cost of manual irrigation is therefore kept low by avoiding the frequent use of paid labour. However, the little water that is provided by paid labour can come at a very high unit cost, with prices regularly exceeding $US 3 /$m^3$ and in one case reaching $US 6.8 / m^3.

Revenue and profits
The table below shows average costs, revenue and profit data across the sample of twenty-one farmers participating in the study. The figures are not adjusted for plot size.

	Production Costs	Land rent	Revenue	Profit
Average Value ($US)	81	3	236	153

The average profit from DSVP was very similar in the three villages. Access to the Oda River and motorised pumping does not automatically generate high profits as the average costs of production are higher than for villages where water is carried manually. The revenue figure derived from the detailed study indicates that estimates of incomes derived in the initial survey ($US 1,400 / ha see Cornish and Aidoo, 2000) were very optimistic. The detailed study suggests that a more conservative estimate of average income /ha is $US 500.

Factors leading to better than average profits
There is no meaningful correlation between profits achieved by farmers and individual factors that might affect yield such as total labour input, time devoted to weeding, quantities of water applied, or expenditure on fertiliser. Data for farmers who achieved the highest profits shows that securing high profits is linked firstly to securing of better than average prices for the produce sold, and secondly to the avoidance of high costs.

Factors determining crop yields
Accurate determination of crop yields from field data proved difficult as farmers and traders do not use standard weights when buying and selling crops, and

difficulties arose in defining the area of crop being grown due to inter-planting of several crops within a single plot. Despite these constraints estimates of crop yield were made for the four most widely grown crops, cucumber, tomato, garden egg and okra. No meaningful correlation was found between yields and labour hours, expenditure on seed, fertiliser, pesticide and herbicide.

For some crops a significant correlation exists between irrigation amounts (depth of water applied) and yield. However, there is a danger in placing too much emphasis on these data as they are drawn from farmers' field records, rather than a controlled trial. Many factors influence crop yield and these were not constant amongst the farmers.

Accurate assessment of the crop water deficit experienced by different crops is difficult to make from the field data collected but it seems likely that in many situations crops such as garden egg, with a deeper rooting system, obtain an important part of their total water requirement directly from the groundwater. The depths applied through irrigation are small but can be presumed to be important as farmers are unlikely to make such efforts for no perceived benefit. A key feature of the results is the number of farmers, particularly those growing garden eggs, who applied an insignificant depth of water through irrigation, (less than 10mm), yet achieved average or above average yields.

Contents

Contents continued

Tables

Figures

Contents *continued*

Appendices

1. INTRODUCTION

This report is the third in a series on peri-urban irrigation around Kumasi, Ghana. It is an output from the Knowledge and Research Contract R7132, Improved Irrigation in Peri-Urban Areas, carried out by the Water Management Department of HR Wallingford for the British Government's Department for International Development (DFID). Parallel studies have been conducted in Nairobi, Kenya, and are reported separately.

The earlier reports on peri-urban irrigation in Kumasi were Cornish *et al* (1999) which set out the findings of a study on water quality with reference to its impact on the health of irrigators and crop consumers, and Cornish and Aidoo (2000) which reported the findings of a survey of 410 individuals in 63 communities engaged in irrigation. That study was carried out in December 1998 to February 1999 and produced a large amount of new information on:

- The geographic distribution of irrigated cropping in and around Kumasi
- The contribution of irrigated cropping to family welfare and cash income
- The different irrigation practices that exist and their relative importance
- The extent to which irrigated vegetable production has expanded in recent years
- The importance of irrigated farming for men and women
- The extent to which technical issues related to water supply and management are considered serious problems relative to other concerns over land tenure, labour, input supply, marketing etc

The studies reported here follow on from the initial questionnaire survey. By carrying out detailed daily recording of activities on 21 farms from December 1999 to May 2000 this second year of study has provided more detailed and quantitative technical, social and economic data on irrigated production. Because the data are based on daily recording by the farmers themselves more detail can be captured than when relying on a questionnaire and farmer recall and some of the inaccuracy associated with interviews and recall can be avoided. Against this, data from just 21 farmers in three villages cannot automatically lead to revising the conclusions based on the much larger sample of the initial questionnaire. Where there are significant disparities between findings based on the two sets of data, these are highlighted, but in general the detailed studies have validated the conclusions of the questionnaire survey and provide quantitative data where none were previously available.

Alongside the detailed farm studies a study of social stratification (wealth ranking) was conducted in five irrigating communities to provide information on the wealth and social status of households practising irrigation. A number of literature searches, supported by field observation and farmer interviews, were also conducted to obtain information on marketing, credit provision and gender issues relevant to irrigation.

As a technical note the report focuses on presenting the results of this phase of the research project. Broader conclusions and recommendations arising from the work in Kumasi and parallel studies in Nairobi can be found in the final project report, prepared after the project workshop in Kumasi in March 2001.

The report has the following structure:

Section 2 describes the criteria used to select the communities where the detailed farm studies and wealth ranking exercises were carried out.

Section 3 presents quantitative information derived from the farm studies relating to production expenditures, labour requirements and costs, farmer revenues and profits, crop yields and irrigation water use and management. In particular, the section examines the factors that result in some farmers securing profits two or three times greater than the sample average, while others make a loss.

After presenting these detailed findings the subsequent sections set them within a broader framework. Section 4 describes the relative wealth of dry season irrigators compared to the wider village communities in which they live. Using the revenue and profit figures from the farm budgets it puts approximate monetary values on the descriptor "average wealth" used by the villagers.

Section 5 describes the well-developed marketing mechanisms that most growers are reliant upon to sell their produce. This, and the following section on credit provision, (Section 6) demonstrates the extent to which individual irrigators are often dependent on a joint marketing and credit system that prevents them from operating as free agents in the market place. These factors can influence an irrigator's financial profitability to an equal or greater extent than their access to agronomic knowledge or irrigation technology.

Finally, Section 7 reviews information on traditional gender roles in Ghanaian farming systems and uses this to explain the disparities that exist between men and women regarding their control of resources and the tasks they fulfil in dry season vegetable production (DSVP).

Having described the irrigators practices in detail and set them within a broader context with regard to wealth, marketing credit and gender, Section 8 draws together the key findings and conclusions.

2. THE SELECTION OF COMMUNITIES AND FARMERS

In selecting the communities where detailed farm studies were carried out, the need to obtain a representative sample of communities and farmers was balanced against the practical constraints of budget and staff time. Selection was based on data obtained in the initial questionnaire survey. Because the detailed farm studies required weekly visits to the farms over the season communities furthest from Kumasi were ruled out. This was justified because the initial survey did not identify any patterns linking any parameter with distance from Kumasi.

Three villages were sought which, when taken together, provided examples of all the irrigation methods, the commonly irrigated crops and both men and women farmers. Villages with either a very low or very high number of irrigators were avoided; the aim was to select representative communities. Three was considered to be the largest practical number of villages that could be supported with the weekly visits needed to ensure accurate record keeping.

Based on this mix of subjective and objective criteria, the villages in Table 1 were selected:

Table 1 Villages selected for detailed farm studies and wealth ranking

	Dedesua	**Baworo**	**Etia**	***Aduamoa*[1]**	***Abrakaso*[1]**	**Average of all 63 villages**
Water source	Oda river Dug outs	Dug outs	Dug outs Pond	*River* *Dug outs*	*Dug outs* *Pools*	–
% irrigators own a pump	7	0	0	*0*	*0*	5
% irrigators hire a pump	64	0	0	*0*	*0*	44
% irrigators carry water	29	100	20	*100*	*100*	78
% irrigators hire labour to carry	0	0	80	*0*	*0*	55
Number of irrigators in village	70	30	300	*50*	*30*	128
% of farmers that irrigate	30	40	100	*50*	*30*	44
% male irrigators	100	100	71	*60*	*67*	83
% female irrigators	0	0	29	*40*	*33*	17
% irrigators renting land	30	100	5	*70*	*70*	77
% irrigators owning land	70	0	95	*30*	*30*	22

[1] Wealth ranking studies were conducted in Aduamoa and Abrakaso but these communities were not included in the detailed farm studies.

Source: Village data collected during the 1998/99 initial questionnaire survey, (Cornish and Aidoo, 2000)

Seven farmers were selected in each village to ensure a mix of men and women farmers, pump hirers and manual irrigators, hirers and non-hirers of labour to carry water and renters and owners of land. (Pump owners were excluded as they only constitute 5% of irrigators and it was deemed more useful to monitor the performance of a greater number of pump hirers).

The farmers had to be willing to keep a simple daily written record of tasks, costs and income but effort was made to avoid only selecting younger, literate farmers. Several of the study group were illiterate and relied on younger family members to write down the daily record. Effort was also made to identify and work with "typical" rather than "best" farmers. The final selection of farmers and their basic characteristics is summarised in Table 1.1 in Appendix 1.

3. DETAILED FARM STUDIES

The farmers maintained a simple, daily diary where they recorded all activities, expenditures and incomes associated with their irrigated plots. It was decided that the use of a predefined data sheet might be daunting for many users and might cause difficulties in capturing some types of task and labour input. Instead of data recording sheets, the farmers were given A5 notebooks. The types of information required were explained to the farmers at the beginning of the season but they were free to record that information in whatever format they wished. In weekly visits by the research team the data were copied from the diary onto formalised record sheets (See Appendix 2). Any anomalies or inconsistencies could then be immediately clarified in discussion with the farmer.

Farmers were given a cash incentive of 30,000 cedi per week ($US 6.8[1]) to maintain their diaries. This was a generous allowance and the research team observed that it might have led to greater than average use of inputs or hired labour. However, once initiated it was considered counter-productive to reduce the payment.

3.1 Crop choice and plot sizes

Table 2 shows the range of crops grown by the study farmers in the villages and the average plot areas. The percentage values indicate the average percentage of cash revenue from irrigation derived from that crop amongst the seven farmers studied in each village.

Table 2 Contribution of different crops to farmer revenue, summarised by village

	Average Plot area (ha)	Alefi	Ayoyo	Cabbage	Cucumber	Garden egg	Okra	Suule	Tomato	"Several"
Dedesua	0.416	3%	21%	0%	0%	52%	6%	5%	6%	7%
Baworo	0.500	0%	0%	12%	30%	0%	0%	0%	34%	0%
Atia	0.434	0%	0%	0%	0%	95%	4%	0%	1%	0%
Overall	0.450	1%	8%	8%	4%	57%	3%	2%	15%	2%

Note: Individual farmer data can be seen in Table 1.2 in Appendix 1

[1] All price conversions, Cedi to $US, are based on a conversion rate of 4380 Cedi = $US 1.00 which was the average rate applying between March 1st and May 31st 2000 when most crop sales occurred. (The rate between January and March averaged 3700)

The size of holdings is generally consistent with those reported in the initial survey. The "average" reported there was 0.9 ha but this was skewed by a small number of large plots and 68% of all plots were of less than 1 ha. The detailed data show plots ranging from 0.1 to 0.8 ha (1,000 to 8,000 m^2).

The range of crops found in the detailed study has been influenced by the selection of Dedesua, a village that specialises in the irrigation of the traditional green leaf vegetables, alefi, ayoyo and suule. The initial survey showed that these are not widely grown although they were know to be grown in Dedesua. All but one farmer in Dedesua grew one or more of these, although their contribution to total revenue is not always great.

None of the farmers successfully cultivated chilli peppers although the initial survey found these to be the fourth most popular crop, grown by 114 (28%) of the farmers surveyed. Three farmers tried to grow them but all of them failed to reach maturity. Conversely, only 20 farmers or 5% of the initial survey reported growing cucumber but in this study five of the seven farmers from Baworo cultivated them with two earning more than 20% of their income from them.

The data in Table 2 confirm the dominance of the two crops garden egg and tomato. Garden eggs are grown in all three villages generating more than 50% of irrigated crop revenue for 15 of the 21 farmers studied. Tomato is also grown in all three villages, though only by one farmer in Atia. Although widespread, tomato frequently contributes less than 25% of total revenue amongst the farmers studied.

3.2 Expenditure

Farmer expenditure on the following production and marketing costs was recorded:

Concept	**Item**
Labour	Land clearing, Burning, Construction of beds, Planting, Weeding, Spraying, Applying fertilizer (including manure), Irrigating, Harvesting, Bed maintenance, Marketing, Other
Equipment hire or running cost	Knapsack sprayer, Water pump, Petrol
Agronomic inputs	Seed, Fertilizer, Pesticide, Other
Marketing	Transport to market

All costs have been converted to $US / ha to allow comparisons to be made between farmers but as all the farmers irrigate less than 1 ha this conversion can appear to exaggerate the expenditure of farmers.

Table 3 shows the financial expenditure on labour, equipment, agronomic inputs and marketing made by each farmer. Opportunity costs of family labour are **not** included. It is clear that there is a great range in the expenditures made by the different farmers – from $US/ha 35 to 511. In almost every case the greatest expenditure is on labour but in a few cases farmers incur greater expenditure on equipment hire or purchase of agronomic inputs. On average, labour costs make up 57% of production expenditure and inputs 22%.

The very high equipment hire costs of farmers 17 and 14 are the result of irrigation pump hire. Farmer 17 hired a pump on 11 days, for a daily hire of $US 3.4 plus $US 1.14 for petrol. His expenditure was $US 50 to irrigate 0.4 ha. Farmer 14 paid the same daily hire charge and hired on 17 occasions incurring a total hire and fuel cost of $US 64 to irrigate 0.6 ha.

Table 3 Farmer expenditures on labour, inputs and marketing, ($US / ha)

Farmer ID	Labour	Equipment Hire	Agronomic inputs	Marketing	Total /ha	Actual spend [1]
11	61	0	4	0	65	18
12	606	5	77	28	716	101
13	54	31	0	21	107	43
14	62	106	38	1	206	125
15	147	33	5	14	199	113
16	269	44	46	24	382	193
17	214	156	10	35	415	168
21	146	0	14	7	166	34
22	41	0	33	32	107	86
23	51	0	179	56	285	69
24	95	0	31	11	137	193
25	125	0	43	32	200	162
26	63	0	43	25	131	82
27	108	19	120	2	250	101
31	53	0	72	15	140	57
32	18	0	12	5	35	25
33	257	62	131	60	511	52
34	32	9	48	53	142	86
35	19	5	10	14	47	19
36	98	9	38	20	165	67
37	60	5	33	9	106	43
Average	123 57%	23 11%	47 22%	22 10%	215 100%	88

1. The actual expenditure unadjusted for the area cultivated.

Unusually high expenditure on agronomic inputs were made by farmers 23 and 27 – the only two farmers in the sample growing cabbages. These data support the comments made by farmers during the workshop held in December 1999, that the costs of seed, fertilizer and pesticides required for cabbages are very high. Table 4 gives the breakdown of their input costs:

Table 4 Input costs for cabbages compared to sample average ($US / ha)

	Farmer 23	Farmer 27	Average of all farmers
Seed	37	33	8
Fertilizer	73	59	19
Pesticides	48	28	13
Herbicides	0	0	5
Other	21	0	1
Total	179	120	47

The data show that cabbages have input costs approximately 3 ½ times greater than the average for all other crops.

Farmers with the lowest expenditure on agronomic inputs, farmers 11, 13, 15 and 17 are all from Dedesua village. Their main crops are garden eggs and the green leaf vegetables. These farmers are growing these crops on a low input system. The green leaf vegetables are considered to be a low cost cropping option but to grow garden eggs with such low input costs is striking. By contrast farmers 31, 33, 34, 36 and 37, all

from Atia, focused exclusively on garden eggs and used much higher levels of inputs. However, crop yields do not always reflect the level of expenditure on inputs, (See 3.4).

3.2.1 Breakdown of labour costs

Hire of labour constitutes over half the total production costs. Table 5 shows the average expenditure on individual tasks summarised by village. The full data set is shown in Table 1.3, Appendix 1.

Table 5 Average labour costs ($US / ha) for different tasks, summarised by village

	Clearing	Burning	Beds	Planting	Weeding	Spray	Fertilize	Irrigation	Harvest	Other	Maintenance	TOTALS
Dedesua												
Cost	46	8	0	13	56	0	0	34	3	38	3	202
%	23%	4%	0%	7%	28%	0%	0%	17%	2%	19%	1%	100%
Baworo												
Cost	31	0	25	4	12	1	0	5	0	10	2	90
%	35%	0%	28%	5%	13%	1%	0%	6%	0%	11%	2%	100%
Atia												
Cost	36	0	1	2	25	1	0	7	2	2	0	77
%	47%	0%	1%	2%	33%	1%	0%	10%	3%	2%	0%	100%
Overall												
Cost	38	3	9	7	31	1	0	15	2	17	2	123
%	31%	2%	7%	5%	25%	1%	0%	13%	1%	14%	1%	100%

For two thirds of the farmers land clearing incurs the greatest labour cost at an average cost of $US 38 / ha. After clearing, weeding and irrigation are generally the most costly with average costs of $US 31 and $US 15 / ha respectively, but there is wide variation about these figures. Farmer 12 paid $US 245 / ha for weeding and farmer 16 $US 115 / ha for irrigation.

For those farmers using raised beds – 9 of the 21 did so – the cost of forming the beds usually represents the second greatest labour cost after land clearing but use of beds appears to reduce both the cost and effort required for weeding.

Other activities including application of fertilizer or agro-chemicals and crop harvesting use little paid labour.

3.2.2 Labour demands

The initial survey showed that much of the labour used for tasks such as planting, irrigation and harvesting, which together use half the total labour input, are carried out by unpaid labour. Table 6 shows average total hours per hectare (paid or un-paid) used in different tasks. As in the initial survey results, all labour hours have been treated equally, i.e. no labour equivalents have been used to adjust for perceived or actual differences in the amount of work done by a man, a woman or a child.

Table 6 Average labour hours / ha used for different tasks, summarised by village

	Clearing	Burning	Beds	Planting	Weeding	Spray	Fertilize	Irrigation	Harvest	Other	Maintenance	TOTALS
Dedesua												
Hours	186	14	12	261	696	33	12	1378	200	282	12	3087
%	6%	0%	0%	8%	23%	1%	0%	45%	6%	9%	0%	100%
Baworo												
Hours	192	8	127	131	184	82	8	533	66	100	73	1505
%	13%	1%	8%	9%	12%	5%	1%	35%	4%	7%	5%	100%
Atia												
Hours	185	6	4	231	694	106	37	667	141	106	0	2176
%	9%	0%	0%	11%	32%	5%	2%	31%	6%	5%	0%	100%
Overall												
Hours	188	9	48	208	525	74	19	859	135	163	28	2256
%	8%	0.4%	2%	9%	23%	3%	1%	38%	6%	7%	1%	100%

Note: Data for individual farmers shown in Table 1.4, Appendix 1

There are large variations about these average data in any task. Farmer 14 used 76% of his labour on weeding but farmer 21, only 7%. Considering irrigation, only two farmers, 14 and 24, used just less than 15% of their labour to irrigate while 8 farmers used 45% of more of their labour on this one task.

Table 7 shows the average use of paid and unpaid labour in the various tasks.

Table 7 Average use of paid and unpaid labour for different tasks

Task	Average labour hrs / ha	% of hours paid	% of hours unpaid
Clearing	188	63%	37%
Burning	9	22%	78%
Beds	48	61%	39%
Planting	208	11%	89%
Weeding	525	21%	79%
Spray	74	3%	97%
Fertilize	19	0%	100%
Irrigation	859	9%	91%
Harvest	135	5%	95%
Other	163	32%	68%
Maintenance	28	17%	83%
Total	2256	19%	81%

Irrigation and weeding stand out as the tasks requiring most labour, these two tasks requiring about 60% of the total. Although irrigation uses the greatest amount of labour less than 10% of that labour is paid. By contrast the land preparation tasks of clearing, burning and bed formation require only about 10% of the total labour hours, on average, but they rely heavily on hired labour and constitute 40% of total labour costs. Table 8 makes the comparison between monetary and time expenditure on different tasks.

Land clearing and bed preparation are tasks of relatively short duration at the beginning of the season. They involve heavy and strenuous work and much of the work is therefore carried out by hired men. By contrast irrigation continues throughout the season and to continually rely on paid labour for this task would be prohibitively expensive. To avoid this much greater use is made of unpaid, family labour. Repeated lifting and carrying sufficient buckets of water for irrigation is also very strenuous work but as water carrying for domestic consumption is already part of the daily lot of women and children the task can be more easily allocated to them without payment.

Table 8 Comparison of monetary and time expenditure on different tasks

	Average percentage cost	Average percentage time
Clearing	**31%**	**8%**
Burning	2%	0.4%
Beds	7%	2%
Planting	5%	9%
Weeding	25%	23%
Spray	1%	3%
Fertilize	0%	1%
Irrigation	**13%**	**38%**
Harvest	1%	6%
Other	14%	7%
Maintenance	1%	1%

There are some differences in the recorded allocation of labour between this sample of 21 farmers and the initial survey data. The initial survey showed land preparation and harvesting as requiring equal and high labour inputs, (each 21% of the total). Planting, weeding and irrigation were equal in their demand – 15% each – fertilizer application required slightly less (11%) and spraying used just 2% of total labour hours. The detailed study data present quite a different picture. The task of irrigation, on average, uses almost twice as much labour as any other (38% of total). Weeding ranks a clear second using 23% of labour. Land preparation, fertilizer application and harvesting appear to use smaller fractions of the labour input than shown in the initial survey.

There is no obvious explanation for these differences. The initial survey was based on a large sample of 410 farmers distributed over 63 villages relying on recall. The detailed survey is based on only 21 farmers but using daily record keeping.

3.3 Revenue and profits

Tables 9 and 10 set out the average cost, revenue and profit data for each village before and after factoring for plot size. Table 9 gives actual data and Table 10 the same data on a per hectare basis. The data are presented graphically in Figure 1, where the data are sorted to show the range of revenues and profits secured.

Table 9 Average cost, revenue and profit figures ($US) unadjusted for plot size

Village	Cost ($US)	Land rent ($US)	Revenue ($US)	Profit ($US)	Ratio of profit to cost	Plot area (ha)
Dedesua	109	0	247	138	1.27	0.364
Baworo	84	8	261	169	2.00	0.500
Atia	50	0	201	151	3.02	0.434
Overall Av.	81	3	236	152	1.88	0.458

Note: Data for individual farmers shown in Table 1.5, Appendix 1

Table 10 Average cost, revenue and profit figures adjusted for plot size ($US/ha)

Village	Cost ($US/ha)	Land rent ($US/ha)	Revenue ($US/ha)	Profit ($US/ha)	Plot area (ha)
Dedesua	262	0	594	332	0.364
Baworo	168	17	522	337	0.500
Atia	115	0	463	348	0.434
Overall Av.	213	7	559	339	0.458

Note: Data for individual farmers shown in Table 1.6, Appendix 1

The following important observations can be made:

- The average profit from DSVP is very similar in the three villages.
- Access to the Oda river and motorised pumping does not automatically bestow significant advantages on farmers in Dedesua. Their average costs of production are higher than in the other two villages but revenues are not commensurately higher. Farmers 12, 14, and 16 from Dedesua saw the lowest returns to expenditure of all farmers in the sample with the exception of farmer 23 in Baworo. (See Table 1.5, Appendix 1)
- The revenue / ha figures in Table 10 show that the estimates of revenues derived in the initial survey (See Cornish and Aidoo, 2000, Table 10, page 23) were very optimistic, based on farmers' estimates of a single "average" unit price obtained for produce. Those data indicated an average /ha revenue of about $1,400. This detailed study suggests that a more conservative estimate of average revenue /ha is $US 500. If the irrigated area within the 40km radius is 11,500 ha then the value of production is $US 5.7 million.
- Farmers securing profits greater than $US 200 can be found in all three villages. Table 11 lists those farmers and some of their management practices.

3.3.1 Factors influencing profits

Table 11 lists the five farmers in the sample who secured profits greater than $US 200 and those five at the other extreme with profits below $US 50. Both low and high profit farmers can be found in all three villages. There is no meaningful correlation between profit and any of the factors listed in Table 11. Explanation of why one farmer sees very high returns whilst a neighbour secures only average or below average profit does not lie with a single factor of production but is linked to the avoidance of high costs and securing of better than average prices for the produce sold. This can best be demonstrated by considering each farmer on an individual basis.

Table 11 Farmers with profit greater than $US 200 or below $US 50

Farmer ID	Profit ($US)	Profit ($US/ha)	Crop with highest revenue	Weeding (hr/ha)	Irrigation[1] (mm)	Total labour (hr/ha)	Spend on Fert. ($US/ha)
High profit							
11	225	795	Ayoyo (51%)	395	39	1961	0
15	446	787	Garden egg (58%)	387	73	1809	0
25	365	451	Tomato (60%)	147	9	1209	16
27	261	645	Cabbage (99%)	305	32	1537	59
34	473	779	Garden egg (100%)	507	3	1779	8
Low profit							
12	32	228	Garden egg (63%)	2118	266	10085	48
14	19	31	Ayoyo (58%)	838	101	1102	21
16	6	12	Garden egg (51%)	431	125	2618	19
23	-16	-68	Cabbage (78%)	255	24	2538	73
37	45	111	Garden egg (100%)	86	5	1018	14
Average of 21 farmers	**153**	**340**		**525**	**40**	**2256**	**19**

1. These are average values for the whole plot rather than to the specific crop.

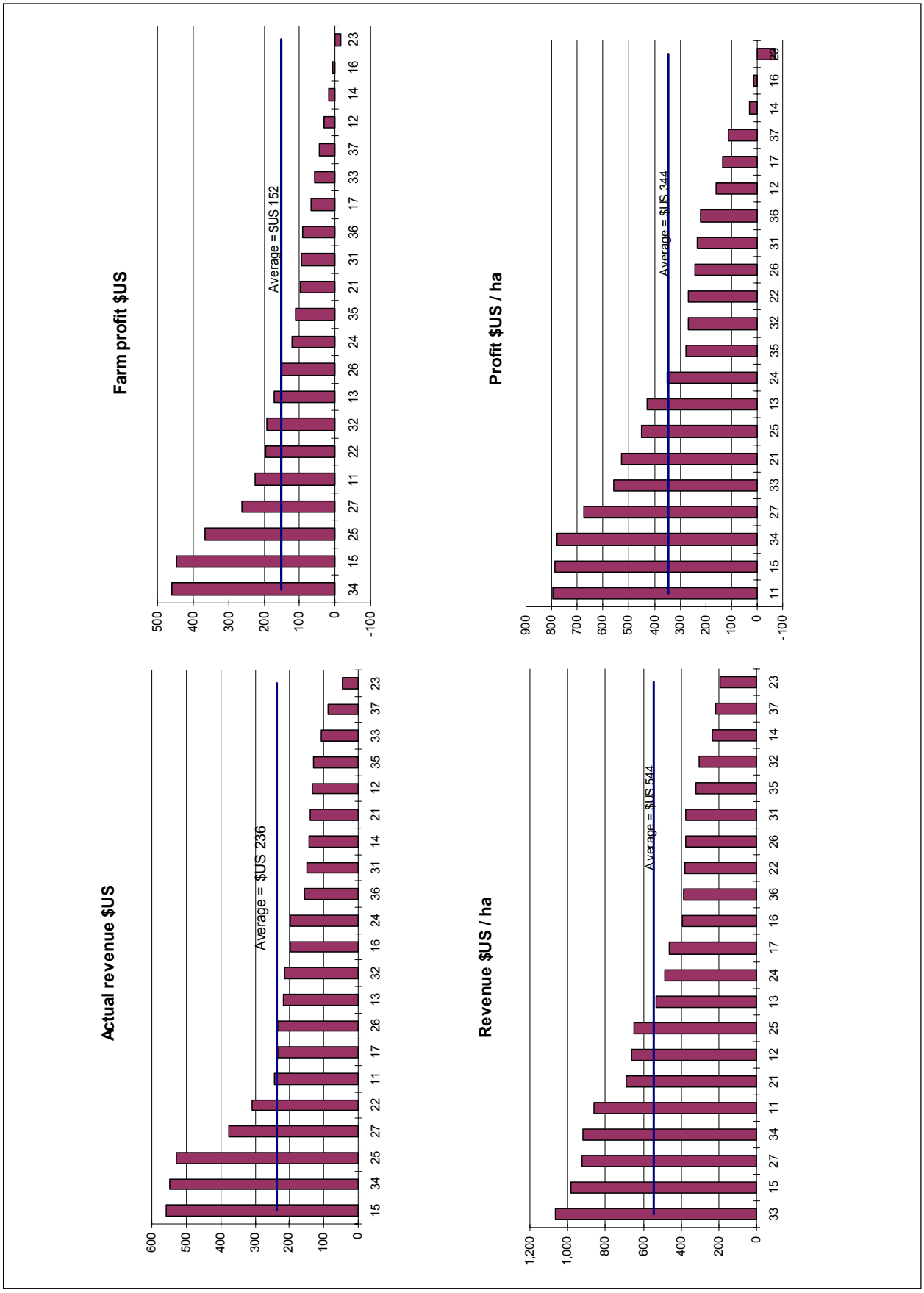

Figure 1 Revenue and profit data – actual and per hectare

3.3.1.1 Farmers with above average profits

Farmer 11 (Loni Grushie, female)
This farmer had recently been widowed. In cultivating a relatively small plot of 0.28 ha she received some support from other villagers who provided labour without charge, but most of the labour was her own, allowing her to keep her labour cost down to $US 61 / ha. She used a minimal amount of purchased inputs, $US 4 / ha, and incurred no costs for equipment hire or marketing.

Dedesua is approximately 12 km south of central Kumasi. Many of the farmers there sell to traders who come to the village offering lower prices than those at Kumasi central market. The attraction is that farmers are spared transport costs or other logistical problems of getting their produce into Kumasi. By contrast this farmer walked the 24 km round trip along the railway line on 50 occasions between January and June carrying a half or full sack of the green leaf crops ayoyo, alefi or suwule. By virtue of this major physical effort she secured higher prices for her crops and avoided transport costs.

Securing better than average prices and keeping production costs very low explain the above average profitability of farmer 11.

Farmer 15 (Ayandoo Grushie, male)
This was a migrant farmer from northern Ghana who lost his left arm through an accident six years ago. The research team was aware of a certain need on the part of this farmer to prove himself to the local community and demonstrate that despite his one hand he could do as well or better than those with two hands. The data presented here suggest that he was successful in achieving this aim.

Farmer 15's production and marketing costs are close to the sample average. 58% of his revenue comes from garden egg and Figure 4 shows that his yield of garden egg, at 8.7 tonnes /ha, is almost 2 ½ times the sample average of 3.7 tonnes / ha. This strikingly high yield may be partly due to good irrigation management as discussed in section 3.5.

The high level of revenue and consequent profit arises from selling $1/6^{th}$ (6 sacks) of his garden egg production during the last part of April at premium prices of more than $US 14 per sack, as Figure 2 and Table 12 illustrate.

Farmers 15 and 34 were the only two to sell more than three sacks of garden eggs during the period of peak prices and they are two of the five securing the greatest profits.

Farmer 15, therefore, secured very high yields of his principal crop, partly at least through good irrigation management. He then secured higher than average prices for a good part of that crop, (17%).

Farmer 25 (Peter Oduro, male)
Farmer 25 has one of the largest irrigated plots in the sample at 0.8 ha (2 acres) and expenditure on production inputs therefore appears high. However, it is only 17% above the per hectare average of $US 171. Marketing costs of $US 32 / ha are well above the average of $US 18 / ha. High profit is therefore not explained by low production costs in this case.

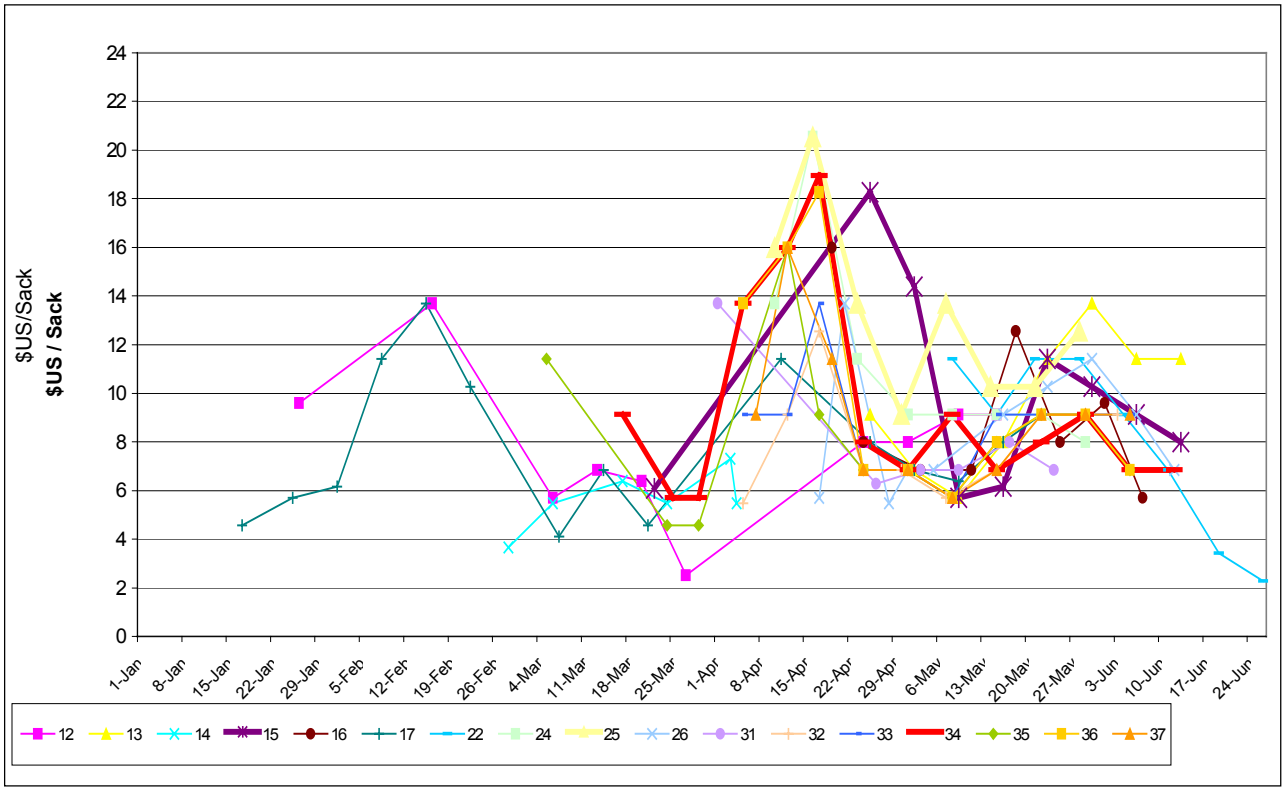

Figure 2 Variations in the prices obtained for garden eggs

Table 12 Number of sacks of garden egg sold and revenue secured between April 5 – 21st

Farmer ID	No. sacks sold in peak	Total no. sacks sold	Av. Price / sack in peak ($US)	Revenue from peak ($US)
12	None	12		
13	None	23		
14	None	3		
15[1]	**6**	**34**	**14**	**96**
16	1	13	16	16
17	0.5	21	11	6
22	None	14		
24	1.25	9	19	24
25	1.5	13	19	29
26	1	17	14	14
31	2.5	19	8	19
32	2.5	21	10	24
33	1.75	14	10	17
34	**11.5**	**62**	**15**	**173**
35	2	16	13	25
36	2.5	19	16	39
37	2	11	12	24

Note: Farmer 15 obtained premium prices for garden egg between 23 April and May 2nd. All other farmers saw prices peak 10 days to 2 weeks before this.

His revenue derives from sale of tomatoes (60%), garden egg (30%) and cucumber (10%). Yield of tomato per hectare is the second highest in the sample as Table 13 shows and farmer 25 secured the second highest average price per box. Furthermore, as Table 13 shows, he sold all 24 boxes at a high price.

Table 13 Tomato yields and average prices obtained by six growers

Farmer ID	Tomato yield (kg / ha)	Average price / box ($US)	No. boxes & % of prod. sold at or above $US 11
16	909	18.2	1 box 54%
17	894	9.9	1 box 28%
21	4,077	8.5	5 boxes 30%
22	1,868	10.4	3½ boxes 46%
25	**2,965**	**13.3**	**24 boxes 100%**
26	2,496	8.3	1 box 16%
Average	2,202		

Farmer 25's yield of garden eggs was below the sample average, but as Figure 2 and Table 14 show, as with tomatoes, he secured good prices throughout the season.

The higher than average prices secured for these crops explain the high profit ($US 451 / ha) realised by this farmer.

Table 14 Garden egg yields and average prices obtained

Farmer ID	Garden egg yield (kg / ha)	Average price / sack ($US)
12	5,397	7.90
13	5,911	9.70
14	771	5.63
15	8,737	9.94
16	1,738	9.19
17	5,268	7.55
22	5,911	8.13
24	1,189	11.27
25	**3,212**	**13.27**
26	2,184	8.54
31	2,377	8.09
32	2,698	8.07
33	5,782	8.79
34	5,268	9.10
35	2,056	8.18
36	2,441	10.05
37	1,413	9.02
Average	3,668	8.97

Farmer 27 (Poku and Kwabena, males)
This was a 0.4 ha (1 acre) plot farmed by two men working in partnership. The plot was planted to cabbage, cucumber and okra but the okra and cucumber failed to thrive and 99% of the revenue came from sale of cabbages.

The irrigation of cabbage must be considered a high-risk venture due to the high cost of the inputs that has been referred to. It is useful to compare the profits of farmers 27 and 23 as they both followed this high-risk strategy. Table 15 shows their investments and returns.

Table 15 Investments and returns of two cabbage farmers

	Farmer 23	Farmer 27
Total labour hours /ha	2538	1537
Irrigation hrs / ha	1133	437
Seed $US /ha	37	33
Fertilizer $US /ha	73	59
Pesticides $US /ha	48	28
Herbicides $US /ha	0	0
Other $US /ha	21	0
Land rental $US / ha	0	31
Revenue $US / ha	193	926
Profit $US / ha	- 68	645

Farmer 23 invested 60% more labour hours than farmer 27, making a major time investment in irrigation. He also spent more on fertilizer and pesticides. Despite this the profit of the farmer 27 partnership was more than 10 times that of farmer 23 who failed to cover his costs.

Because the two farmers report the sale of produce in different units, which are not convertible, it is not possible to compare the yields of the two farmers. Nonetheless, this massive difference in financial performance of the two is unlikely to be attributable to differences in yield. Rather the explanation appears to lie in the way the two farmers marketed their produce and the prices they secured.

Farmer 23 sold all his cabbages by the sack, taking produce to Kumasi on three occasions between 9th March and 20th April. On three subsequent trips 2½ sacks of cucumbers were also sold. Total revenue was $US 47 or $US 193 / ha.

The farmer 27 partnership made one journey into Kumasi, in early February, to sell cucumber and cabbage by the sack. They obtained lower prices on that occasion than farmer 23. No further sales were made until April 30th when they sold 610 individual cabbages, from the field, with prices fixed according to size. That sale brought in $US 85. On May 16th they sold a further 1,000 heads, again priced according to size, and took $US 278.

This comparison suggests that financial success or failure depends more on effective product marketing than on any aspect of production.

Farmer 34 (Osei Tutu, male)
Farmer 34 produced only garden eggs from a larger than average plot of 0.6 ha. The estimated yield of 5.3 tonnes / ha is above average for the sample but not one of the best, (See Table 16). The key factors contributing to the very high profit / ha of $US 779 were:

a) Relatively high yield
b) Selling 18% of production at the peak prices shown in Figure 3 between April 5 – 17th which brought in 30% of his revenue.
c) Seeking markets beyond Kumasi, avoiding the price controls of the traders and market queens (See section 6.2.3)

Table 12 shows to what extent the producers of garden eggs exploited the premium prices of mid to late April. The larger than average plot and early planting of farmer 34 allowed him to sell much more produce during the period of peak prices than any of the other farmers in the sample.

The period for which prices remained high was no more than 2 weeks duration. Further discussion with farmers is needed to determine how predictable this price behaviour is and whether it is practical to plan in advance to harvest part of the crop at the price peak.

Finally, this farmer sold 26 sacks, 42% of his production, in markets beyond Kumasi.

3.3.1.2 Farmers with below average profits

Farmer 12 (Kwasi Asomazono, male)
Table 3 shows that this farmer paid almost 5 times the sample average / ha for labour. This was the only farmer in the sample who made a single payment of 300,000 Cedi ($US 68) at the outset of the season to retain a labourer for the duration of the season. Given the very small area of the plot – 0.14 ha – this was a very high expenditure. Additional payments, which conformed with the "going rate" of 3 – 4,000 Cedi/day ($US 0.68 – 0.91 /day) were also made to other labourers hired on a daily basis. Table 11 and Table 1.3 show that this high expenditure on labour bought a very high number of labour hours with much of that purchased labour used in land clearing and weeding.

Yield of garden egg, his main source of revenue, to some extent responded to this high investment – the yield of 5.4 tonnes/ha was well above the sample average (Table 14). However, the prices obtained were below average so the benefits of the high yield were lost. As a consequence of the very high production costs and low prices overall profit was just $US 32.

Farmer 14 (Nana Kwabena Donkor, male)

This farmer had a relatively large plot of 0.6 ha. Ayoyo and okra account for 88% of his income. He made the greatest use of pumped irrigation of any of the farmers, hiring on 17 occasions at a total cost of $US 57.8 (Table 17). This greater access to pumped irrigation did not result in high yields of either garden egg or okra as Figure 4 shows. His small yield of garden egg was all sold during March when prices were at their lowest such that he secured the lowest average price / sack of the sample. Yield and price figures for ayoyo cannot be calculated because of the mix of units used to record sales of that crop so it cannot be determined if low revenue is due to poor market prices, low yields or a combination of both.

The overall labour input/ha of this farmer is roughly half the sample average. He possibly placed too much reliance on pumped irrigation and did not put enough labour into other cultural practices. As a consequence yields of both garden egg and okra were low and prices secured for these products were never better than average. The same pattern was probably repeated for ayoyo and his final profit was just $US 19.

Farmer 16 (James Ankapong, male)
This farmer had the fourth highest production cost / ha in the group at $US 382 (Table 3) with the greatest expenditure being on hired labour used for irrigation. His spend on irrigation labour was 7 ½ times the average across the sample. Although this expenditure on labour, coupled with pump hire on six occasions (Table 17), bought a higher than average irrigation depth, yields did not respond.

Figure 4 shows that farmer 16's yields of garden egg and tomato were very low and he sold only 1 of his 13 sacks of garden egg (8%) during the period of peak prices, (Table 12). He did secure very good prices for his tomatoes (Table 13) but the quantity sold was so small that it could not off set the high production costs.

Table 16 Okra yields and average prices obtained by four growers

Farmer ID	Okra yield (kg/ha)	Average price /basket ($US)
14	349	4.0
16	536	2.8
31	241	1.0
32	834	2.8

Only four farmers in the sample grew okra and amongst these farmer 16 obtained a relatively good yield and an average unit price.

Despite the relatively good performance in okra and the good price obtained for tomatoes the levels of production and prices secured could not justify the high expenditure on labour and as a consequence profit was just $US 6.

Farmer 23 (Patrick Adusei, male)
The experience of this farmer was set out in the previous section where the contrast is made between the outcomes of farmers 23 and 27 (Table 15). Yield of cabbage cannot be assessed or compared because of the mix of units used to report sales (18 sacks from 0.24 ha while farmer 27 sold 1600 singles plus 5 sacks from 0.4 ha). Overall expenditure / ha on agronomic inputs and labour by farmers 23 and 27 were very similar. However, the evidence suggests that this farmer's very poor financial performance, with a net loss of $US 16, is a consequence of the very low prices secured for his product, sold by the sack.

Farmer 37 (Ignatus Kwadjo Mensah, male)
Much can be learnt by comparing the agronomic and financial performance of farmer 37 with farmer 24. Both have plots of 0.4 ha and irrigated garden egg as their only crop. Both achieved very low yields – farmer 24, 1.2 tonnes / ha, farmer 37, 1.4 tonnes / ha. Both had below average expenditure on production costs with farmer 37 spending less than farmer 24. Despite the lower yield and higher production costs incurred by farmer 24 he made a profit of $US 123, or $US 303 / ha which is close to the sample average. By contrast, farmer 37, with lower production costs and a slightly higher yield only made a profit of $US 45. Both farmers sold a small part of their total production during the period of peak prices in April, obtaining the same income during that period, (Table 12). However, over the season as whole farmer 24 obtained an *average* sack price of $US 11.3 while farmer 37 only obtained $US 9.0. The different prices they obtained are shown clearly in Figure 3.

Price alone allowed farmer 24 to make a profit close to the sample average even with low crop yield while farmer 37, also with a low though slightly better yield, secured consistently lower prices and made a profit of only $US 45.

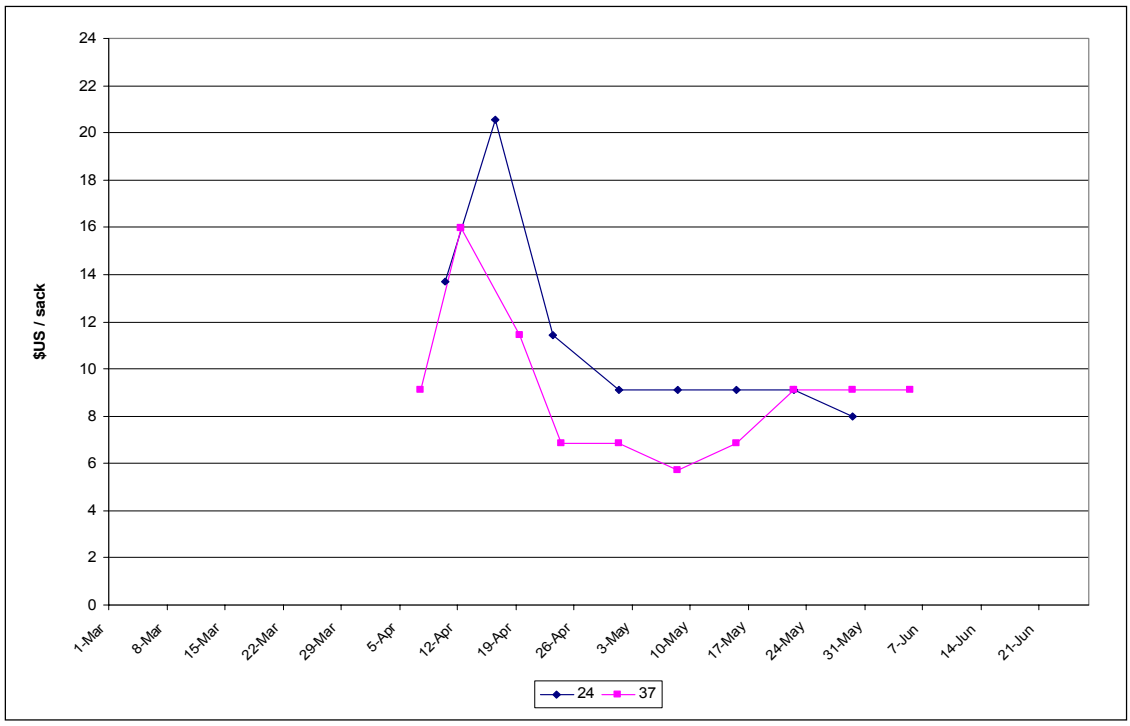

Figure 3 Price per sack for garden egg obtained by farmers 24 and 37

3.3.1.3 The lessons drawn

The evidence from these ten farmers indicates that financial profitability cannot be directly correlated with the use of agronomic inputs, labour or irrigation. Farmers making profits substantially above the average generally have average or above average yields in their dominant crop but the greatest factor influencing their profit is their ability to sell consistently at above average prices. Farmers 12 and 21 are examples of farmers securing good or very good yields but low pricing led to weak profits.

Those farmers making the lowest profits might have had poor yields which are then compounded with low product prices, which possibly reflect the quality of the product. However, this is not the only cause of low profitability. Farmer 12 obtained an above average yield of garden eggs but his production costs were very high and pricing was poor. Farmer 23 growing cabbages saw a net loss over the season apparently because of very poor pricing.

In short, the product price obtained over the season is the single most influential factor determining profit but obtaining at least an average or better yield is the first step to a high financial return.

3.4 Crop Yields

Accurate determination of crop yields from field data has proved difficult for the following reasons:

a) Farmers and traders do not use standard weights when buying and selling crops. Rather quantities are quoted in measures such as baskets, rubbers, pans, sacks (large and small) and boxes (large and small). There is no formal standardisation of these measures and farmers seldom specify if a large or small unit is referred to. Effort was made to convert some of these units to a standard weight by weighing what were claimed to be "standard measures" for each crop type at Kumasi central market. However, problems still arose where farmers reported selling a crop in a non-standard unit. For example, cucumbers sold in sacks rather than as singles; tomatoes sold in pans rather than boxes; okra sold in baskets rather than rubbers.

b) It proved difficult to define accurately the area of crop being grown, as inter-planting of several crops within a single plot was common.

Despite these constraints estimates of crop yield have been made for the four most widely grown crops, cucumber, tomato, garden egg and okra. The objective of this is threefold.

- To allow assessment of the variation in relative yields achieved by different farmers and identify if they achieve consistently better yields for different types of crop.
- To look for meaningful correlation between crop yield and management practice
- To compare the yields with "average commercial" values.

The actual values must be treated with some caution but they are considered sufficiently reliable to allow some general observations.

3.4.1 Farmer performance

Figure 4 shows the calculated yields for the four crops. Within each crop type there is very great variation between highest and lowest yields – an 11-fold difference in the case of garden eggs and between 3 and 4 fold in the other crops. Even the best yields are very low when compared with yields obtained under optimal management conditions.

The yields of the three farmers 22, 25 and 26 can be compared across the three crops cucumber, tomato and garden egg.

- Farmer 22 achieved good or very good yields, compared to those of others, in all three crops. Despite these very good yields farmer 22 ranked only 12th in profit/ha as his crop came to maturity late in the season (May – June) when prices were falling, (See 3.3.1). This underlines the importance of

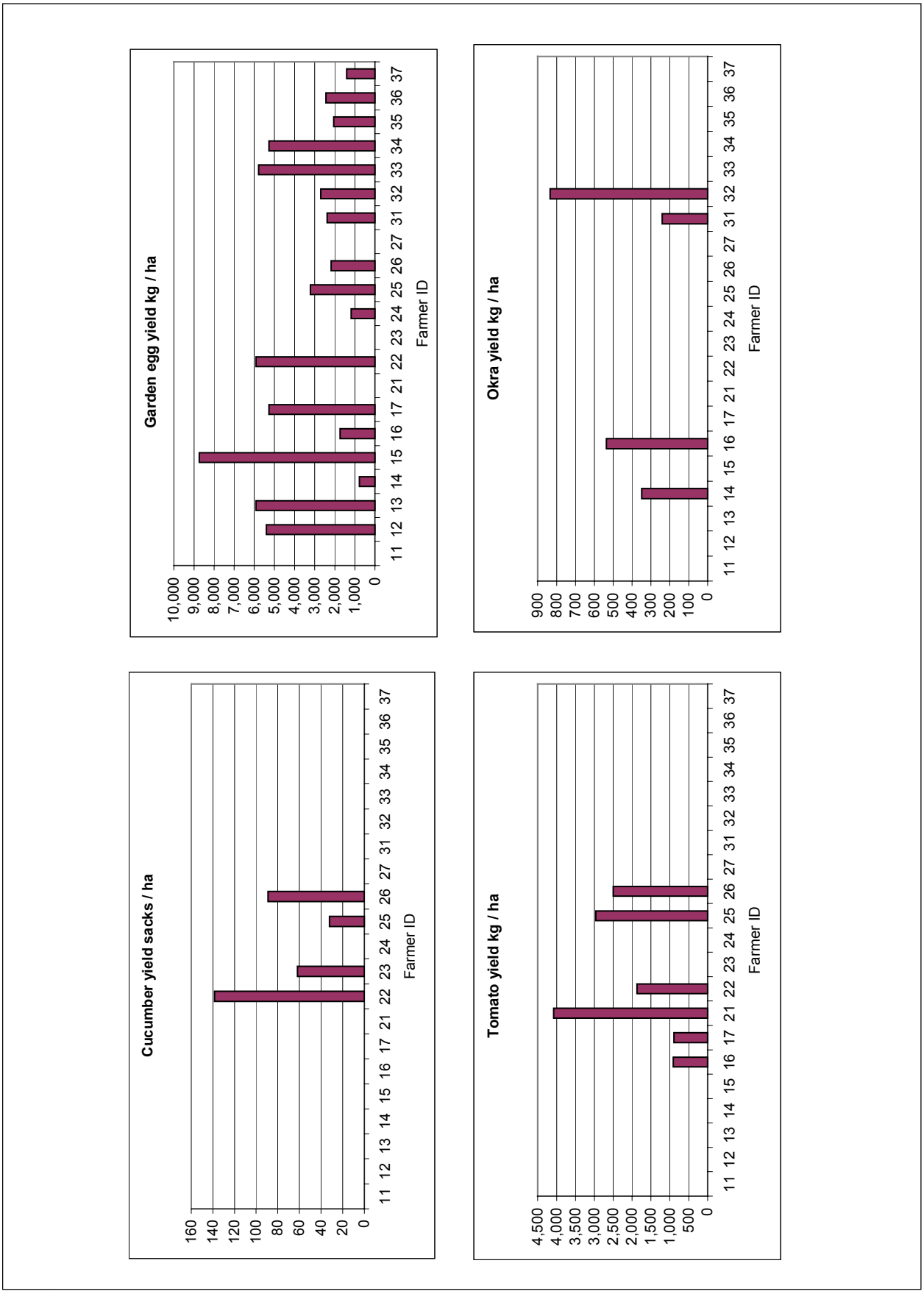

Figure 4 Crop yields

marketing – timing of production and securing good prices – if good agronomic performance is to be converted to financial profit.

- Farmer 25 achieved a very good yield in tomatoes, which generated 61% of his revenue (see Table 1.2, Appendix 1), but only an average yield in garden egg and poor performance in cucumber. Good yields in one crop is therefore no guarantee of good performance across all crops.
- Farmer 26 achieved good yields of cucumber and tomato but these only made up 35% of his revenue as the area devoted to them was small and he secured below average prices for both crops. 65% of his revenue came from garden eggs for which the yield was relatively poor. As this was associated with only average selling prices His profit / ha was below average for the group.

3.4.2 Crop yields and inputs

No meaningful correlation exists between the yield of any of the four crops in Figure 4 and any of the following variables:

- Labour hours on individual tasks or total labour
- Expenditure on fertilizer
- Expenditure on all inputs – seed, fertilizer, pesticide and herbicide.

For some of the crops a correlation can be demonstrated between the depth of water applied and yield. This is discussed in section 3.5.2.

3.5 Irrigation Management

The daily records kept by the farmers recorded the following information on irrigation:

- Date of any irrigation
- Crop or crops irrigated
- Estimate of the area irrigated
- Unit used to apply water, i.e. directly from a bucket, from an oil drum or by motorised pump
- Number of labourers used and hours worked
- Cost of any hired equipment or labour

To estimate the volume of water applied, and from that the depth, (when the area is known), the following assumptions were made.

1. A bucket delivers 17 litres of water to the field
2. Where the unit is an oil drum this delivers 200 litres
3. A pump delivers an average of 5 litre/second over its operating period
4. When water is applied manually (bucket or oil drum), only 40% of the stated crop area is wetted.
5. When water is applied from a motorised pump the efficiency is assumed to be 80%, i.e. 20% is lost to the crop.

Pumps were only used by farmers in Dedesua. In that village all except Farmer 11 (the widow) made some use of a hired pump as Table 17 shows:

Table 17 Use of pumps by farmers in Dedesua village

Farmer ID	No. of hires	Pump operator	Hire cost for each event	Total seasonal charge
12	2	Self	Nil	Nil
13	6	Self & other	3 x nil 2 x $US 3.4 / day 1 x $US 4.6 / day	11.40
14	17	Paid operator[1]	17 x $US 3.4 / day	57.80
15	5	Paid operator[1]	3 x $US 2.3 / day 1 x $US 3.4 / day 1 x $US 3.9 / day	14.20
16	6	Self & other	2 x $US 3.4 / day 6 x $US 1.6 for fuel only	16.40
17	11	Self	11 x $US 3.4 / day + 11x $US 1.1 for fuel	49.50

1. Cost of operator included in hire fee.

3.5.1 Basic irrigation data

Using the assumptions stated, estimates were made of the volume of water applied by each farmer. This and other data are summarised in Table 1.7, Appendix 1. The data show the total volumes and depths applied assuming uniform application across the entire plot. The data in Table 1.7 have not been dissaggregated according to the individual crop irrigated.

By making frequent use of a hired pump farmers 14 and 16 applied greater volumes of water than any of the other farmers. However, what is more striking is that farmers 12 and 15, who both made occasional use of pumps, obtained much greater volumes of water through manual carrying. These two farmers along with 11, 22 and 26, all applied over 100 m^3 through manual carrying alone. The human effort involved in such work should not be under-estimated.

The dates of the "irrigation season" relate specifically to the period when irrigation is given. The length of that period varied from as little as 68 days (about 2 months), for farmer 33, to 130 days (4+ months) for farmer 25, but the most common was about 3 months from mid-December to mid-March. Although irrigation ceased towards the middle or end of March as rainfall increased, the crops established under irrigation were still being sold in May and June as Figures 2 and 3 illustrate.

The rainfall figure is the total depth recorded at Kumasi airport during the "irrigation season" of each farmer. The rainfall experienced in each of the three villages will not be exactly equal to that at the airport but will have followed a very similar trend.

Figure 5 shows that apart from a single storm event of about 50 mm on January 12th very little rain fell between December and the middle of March. Much of the rainfall total appearing in Table 1.7 is therefore rain that fell in the second half of March and first days of April.

The "irrigation frequency" is the average period, in days, between consecutive irrigation events somewhere on the plot. However, where the entire plot is not irrigated in one day the time between consecutive irrigations for any one bed may be greater than the figure shown. Farmer 14 shows a much longer period between irrigations than any of the other farmers. This is consistent with his greater reliance on pumped irrigation which would apply a greater depth of water in a single irrigation.

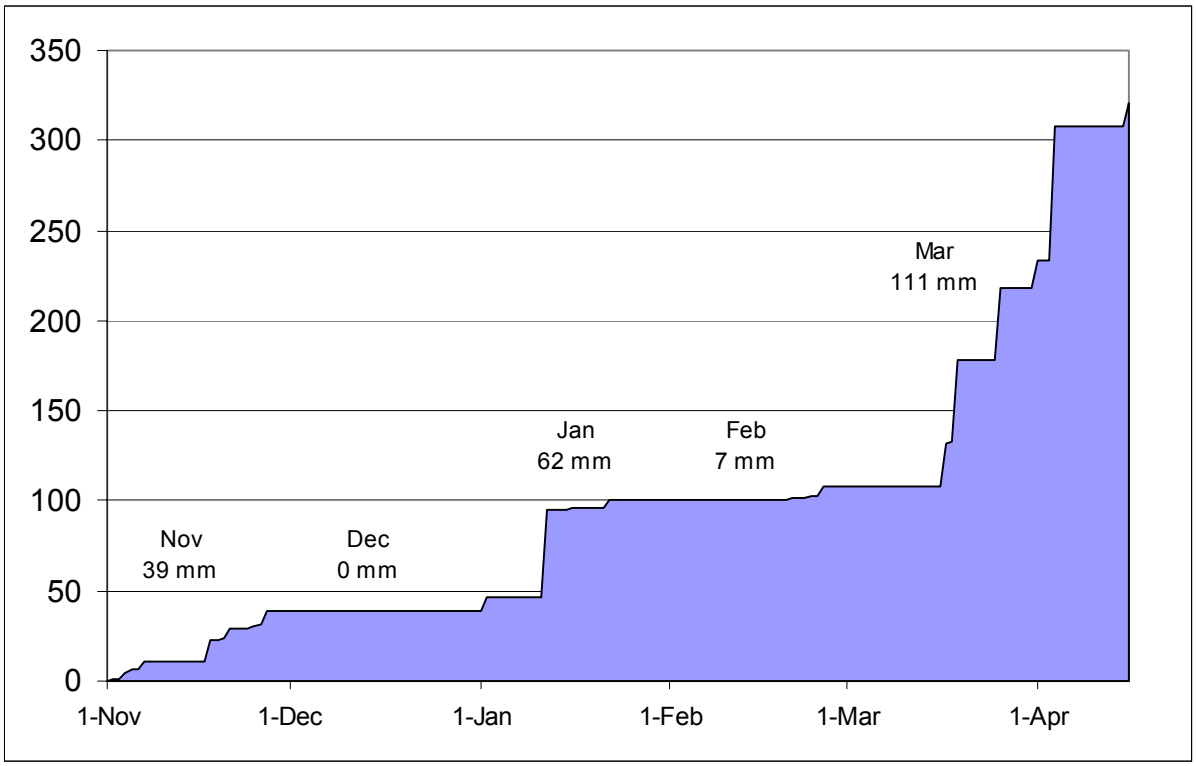

Figure 5 Cumulative rainfall at Kumasi Airport 1st November 1999 – 15th April 2000.

3.5.2 Crop yields and irrigation

In order to identify any meaningful correlation between crop yields and the depth of irrigation applied the farmer records were further analysed to determine the depths applied to three crops for which yield data were available, (Irrigation specific to okra could not be determined). These data are shown in Tables 1.8, 1.9 and 1.10 and Figure 1.1 in Appendix 1.

The correlation coefficient for the garden egg data indicates at least a 95% probability of a linear correlation existing between yield and irrigation depth. The results for tomato and cucumber are based on only a few farmers – 5 for tomato and 4 for cucumber. The outcome for tomato suggests the unlikely result of a negative correlation – more water reduces yield although the value of r is not significant at the 95% level of significance. By contrast the cucumber data show strong, positive correlation that is significant at the 95% level of significance.

There is a danger of placing too much emphasis on these rather erratic data that are drawn from farmers field records rather than any form of controlled trial. Numerous factors other than irrigation influence crop yield and these were not constant amongst the farmers. These factors include soil fertility, incidence of pests and disease, timing of planting, the adequacy of weed control, etc. Factors such as these could easily account for the observation in tomato yields where more or "better" irrigation appears to result in lower yields. They could also enhance or overshadow the apparent effect of irrigation observed in these single factor correlations.

3.5.3 The shortfall between crop water demand and supply

A key feature of the results is the number of farmers, particularly those growing garden eggs, who applied an insignificant depth of water through irrigation (less than 10mm) yet achieved average or above average yields. Any of the following factors, or a combination of them, may account for this:

- Data errors:
  - In the estimation of crop area
  - In recording the number of buckets or drums applied

- Crop obtaining water from an alternative source

For farmers 21, 24, 33, 34, 35, 36 and 37 the apparent crop water deficit accumulated up to the end of February, before rainfall makes any great contribution, is about 250 mm, sufficient to lead to the death of the plant. To suggest that this deficit is the consequence of data recording errors is to suggest an error of between 10 and 20 fold. It is unlikely that an error of such magnitude would be made either in the estimate of area or the recording of the number of bucket or drums, in at least 6 different cases.

It therefore seems more likely that the very shallow groundwater, which is evidenced from the shallow dugout wells used for irrigation, supplies a very large part of the crop's total water demand. The proportion of demand met from the groundwater will depend on the soil type, depth to the groundwater and the crop's rooting depth but some contribution from groundwater is likely to be widespread, given that the low effective irrigation depths shown in Table 1.7 do not result in crop failure. This, however, is not to suggest that the irrigation efforts of the farmers are unnecessary. Poor farmers are very unlikely to invest the levels of human effort and cash that they do in irrigation if it were not needed. Irrigation is certainly needed when crops are in their early development when roots are not deep enough to exploit groundwater and farmers continue to apply small volumes of water once the crop has reached its maximum root depth. Controlled, comparative trials would be needed to determine what yield benefits are secured from continued irrigation after crops reach full canopy development.

3.6 Irrigation costs

Table 1.11 shows the payments made by all the farmers for irrigation. The data show that there is great variation in all the parameters considered – total volume used, total expenditure and the average and peak costs of water.

Considering the volumes of water moved manually, this varies greatly between farmers, from 3 to 99m^3, the sample average being 28m^3. Farmer 15, in Dedesua, who used a pump on 5 occasions also used the greatest volume of manually carried water. Farmers that make occasional use of paid labour to bring water to the field do not necessarily secure more water than those who rely only on unpaid labour.

Amongst the manual irrigators, farmers 23 and 36 stand out for obtaining more water with paid labour. Farmer 23 regularly incurred costs for water carrying between January 3rd and March 10th suggesting a planned, if costly, approach to irrigation. Farmer 36 used no paid labour for irrigation until February 9th but then paid a series of high prices for day labour for irrigation up to March 11th. It is possible that this was an unavoidable struggle to sustain the crop until the rains arrived.

The data show that the estimates of seasonal irrigation costs based on the initial survey (See Cornish and Aidoo, 2000, section 4.4.6) were based on the erroneous assumption that a farmer paying labour for water carrying or those hiring a pump would use these methods to provide *all* their irrigation. Table 1.11 makes it clear that in the case of manual carrying, farmers normally rely on paid labour for only a small percentage of their total water use.

Where pumps were hired in Dedesua the cost per day was considerably lower than the initial survey indicated. That data gave a cost of $US 15.2 /day for hire, fuel and labour, but Table 17 shows farmers paying between $US 3 to 5 /day. Furthermore, it was assumed that a pump would be hired on 20 occasions during a 120 day irrigation season but the detailed data from Dedesua show that the "average" number of hires lies between 5 and 10.

Seasonal irrigation costs for those hiring pumps are therefore in the range $US 40 –70 when the cost of additional manual carrying is included. For those using only manual labour the use of paid labour is an occasional event and in this sample the seasonal costs never exceeded $US 11. The total cost of manual irrigation is therefore kept low by avoiding the frequent use of paid labour. However, the last column of Table 1.11 shows that the little water that is provided by paid labour can come at a very high unit cost, with prices regularly exceeding $US 3 /$m^3$ and in one case reaching $US 6.8 / m^3.

4. THE WEALTH STATUS OF IRRIGATORS WITHIN THEIR COMMUNITIES

The wealth status of five sample villages and the position of the irrigating households within those communities was determined following the method described by Aidoo (2000, a). An initial, rapid participatory census of the village was carried out using key informants to identify all village households and amongst them, those who regularly engage in irrigated vegetable production.

In a second activity informants were asked to define three levels of well-being – Well-off, Average and Below Average – according to the community's own standards. The descriptors used by the five communities to define these three classes are set out in Appendix 3. There is a high level of agreement between the concepts of "wealth" and "poverty" in the five villages.

The rapid census identified a total of 1,415 households in the five villages. Of these, 14 were discarded from the subsequent wealth ranking as the informants could not reach consensus on their rank.

Table 18 Sex and origin of household heads in the three wealth bands – data from 5 villages

	Well off		Average		Below average		Total	
	No.	%	No.	%	No.	%	No.	%
Whole Population								
Male indigene	23	1.6	407	29.0	127	9.1	557	39.7
Female indigene	11	0.8	355	25.3	236	16.8	602	43.0
Male migrant	6	0.4	152	10.8	33	2.3	191	13.6
Female migrant	0	0	38	2.7	13	0.9	51	3.6
Total	40	2.8	952	67.9	409	29.2	1401	100

The percentage of female-headed households amongst the indigenous population is remarkable high at 43%. This can be primarily attributed to the matrilineal system of inheritance practised by the Ashantis. Under this system, in case of divorce women inherit both property and children and return to their maternal home. Ready separation and divorce, with men leaving the household tends to become commonplace under this system. As would be expected, the number of female-headed households is much reduced (3.6%) amongst the migrant population where matrilineal inheritance is not practised.

Taking the five villages together just over two thirds (68%) of households fall into the average wealth category – a group with generally adequate housing and access to sufficient cash and other resources to engage in farming, put their children through school and provide adequate clothing. Of the remaining households just 3% are classed by their peers as being of above-average wealth. The greater number (29% of total) are of below-average wealth, signifying those with very poor housing, little access to land, regularly in debt and seldom able to pay school fees or communal levies.

Table 19 shows that the census identified 157 households in the five villages engaged in dry season vegetable production (DSVP). Of these, 81% were classified by their peers as being of average wealth. As only 68% of all households fall in this class it is clear that a disproportionately larger group of irrigators are in this group. 15% of the irrigators – 23 households – were classed as being of below average wealth, disproportionately less than in the population as a whole.

The difference in distribution between the three classes of wealth for irrigators and all households (averaged across the five villages) is shown in Figure 6. In their discussions with households the survey team found no evidence to suggest that DSVP was the causal factor leading to improved wealth status.

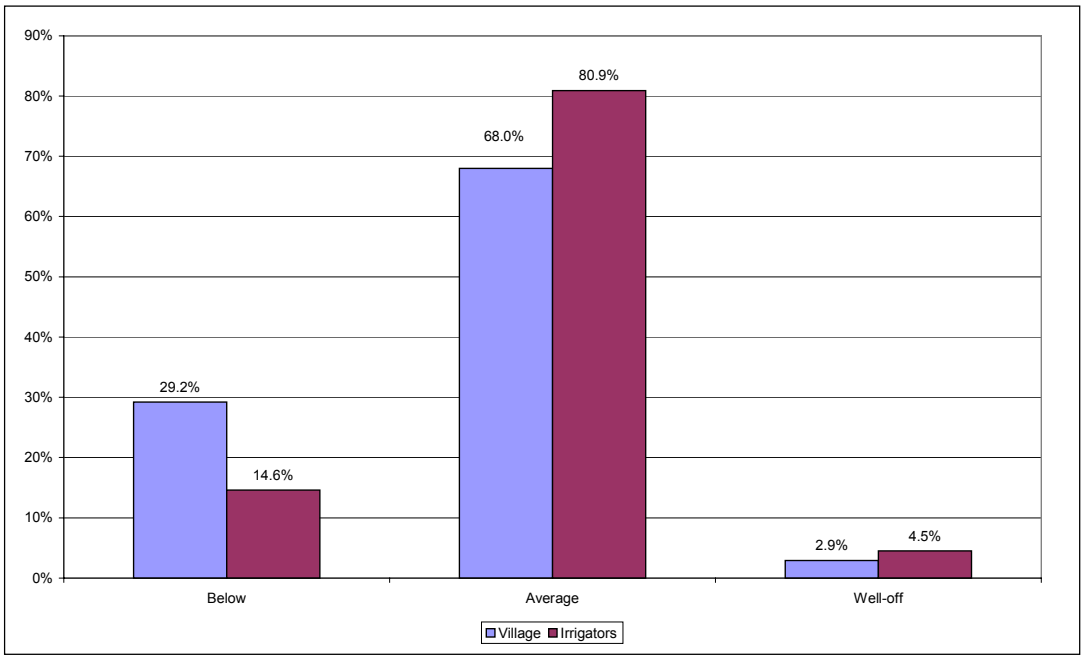

Figure 6 Relative wealth of irrigators and non-irrigators

Rather, the explanation for the disproportionately fewer "below average" irrigators and larger number of "average" than in the community as a whole is because the requirements for access to land and cash to purchase inputs can act as a barrier preventing many of the poorer households from engaging in DSVP. This is not to say that DSVP does not generate wealth. In the initial survey 38% of the respondents described DSVP as their main source of income and a further 26% identified the main purpose of irrigated farming being to raise funds for use in building. However, to reap these benefits some initial capital, i.e. "average wealth" status, is needed.

Table 19 Wealth ranking of all households and irrigators, by village

	Above Average		**Average**		**Below average**		**Total**
	No.	%	No.	%	No.	%	**number**
Baworo all households	10	3	169	56	125	41	304
Baworo irrigators	0	0	10	77	3	23	13
Etia all households	6	2	245	72	89	26	340
Etia irrigators	1	2	54	86	8	13	63
Dedesua all households	4	2	114	66	54	31	172
Dedesua irrigators	3	9	21	64	9	27	33
Aduamoa all households	11	3	306	83	48	13	365
Aduamoa irrigators	2	7	26	93	0	0	28
Abrakaso all households	9	4.1	118	54	93	42	220
Abrakaso irrigators	1	5	16	80	3	15	20
Total all households	40	3	952	68	409	29.2	1401
Total irrigators	7	**4**	127	**81**	23	**15**	157

Where the data are reviewed on a village by village basis (See Table 19, and Figure 1.2) some variations about the average values are observed. However, the general conclusion remains valid that roughly 80% of dry season irrigation is carried out by households of average wealth, 15% is with households of below-average wealth and just 5% lies with households of above average wealth. A greater, but un-quantified, percentage of poor households benefit from informal irrigation by providing paid labour.

4.1 The monetary revenue of an irrigator of "average wealth" ranking

Table 20 shows the average profit obtained from DSVP for the top and bottom five farmers and the central group of 11.

Table 20 Average profit ($US) from DSVP for different farmers

Farmer group	Average profit $US from DSVP
Top 5 farmers	354
Middle 11 farmers	129
Bottom 5 farmers	17

DSVP is reported by 85% of irrigators to be their main source of income. Rainfed cropping is commonly the second greatest source of income. A conservative assumption is that DSVP generates just 50% of the annual income of irrigating households. Using this assumption, and knowing that the average household size amongst the farmers studied was 6, then the annual income per head in these three groups is:

Top:	$US 118 / head/year
Middle:	$US 43 / head/year
Bottom:	$US 6 / head/year

Thus even those households making the highest profit from DSVP have a per capita income only one third the national GNP/head for Ghana which is $US 390 (World bank, 1999). The per capita income per day of even these most successful households is well below the international development indicator of extreme poverty of $US 1 / day.

5. MARKETING OF IRRIGATED PRODUCE

The farm budgets reported in section 3 showed that the financial outcome of DSVP for any farmer depends more on securing a good market price than on maximising yield. Because of the importance of marketing, already identified by farmers in the initial survey as being a major constraint, a review of the factors influencing the sale of fresh vegetables was carried out. This was based on available literature and direct discussion with irrigators and traders.

Marketing of agricultural commodities in Ghana is dominated by the private sector. Cocoa used to be the exception, but with the recent privatization of cocoa purchasing, the public sector is now playing a declining role in both food and cash crop marketing. The private sector can be divided between large-scale and small-scale sectors. Companies such CASPRO, UNICROP, RESHIGA, EQUINOX and GOLDCREST operate on a large-scale and deal in the cash crop sector predominantly in cocoa and coffee. They play no part in the marketing of fresh vegetables. Trade in vegetables is controlled by a complex network of small-scale operators which is reviewed here.

5.1 Small-scale market women and vegetable marketing

In Ghana, as in most West African countries, food marketing is almost entirely the preserve of women, under the control of powerful market queens, (Brown and Kerr, 1997:63; Nikoi 1998:79).

Brown and Kerr report:

> "In Ghana, central urban markets are responsible for most of the inter-regional trade for imports, manufactured good and local foodstuffs. These wholesale yards are predominantly populated by females - 70 % in Kumasi Central Market - and are dominated by groups of women called 'market queens' who trade each major food group. These market queens settle disputes using well-known trading conventions and procedures, but neither they nor the conventions they support have any legal standing. Their power comes from the group and its acceptance and trust of the leader's judgements. Indeed, traders join commodity groups because of the need for quick, impartial dispute settlement that allow a steady flow of business, avoiding the time, cost and risk of complaining to the police or the courts."

The group members depend on each other for credit, advice, looking after each others stalls, and providing support in the event of tragedy - e.g. illness, theft, or fire outbreak. Market queens also perform ceremonial duties (such as officiating funerals of group members, fundraising and attending church services), thus enhancing the status of their group and strengthening its cohesion (Clark, 1994).

Brown and Kerr (1997:65) report that many farmers in their sample complained that the market women cheat them by tampering with measuring cans and scales or by overfilling bags. There is no standard weight system, a factor that benefits market women who use bigger sacks to purchase from farmers than they use to sell in the market. Such complaints and price manipulation by market women are widespread but they are given little attention in the literature on market women and market queens.

Depending on the crop type and the season, marketing of vegetables can take place from the field, at home, in the local market, or through the Kumasi Central Market (KCM), which is one of the largest markets in Ghana and the West African sub-region. Vegetable traders from different regional urban markets in southern Ghana converge on KCM to make purchases.

The initial farmer survey confirmed the role of KCM as the primary market outlet for most farmers and indicated that different crops were sold through different mechanisms.

5.1.1 Marketing cabbage, lettuce, carrots and cucumber

These crops are not well suited to transport over long distances or any extended period of storage. They are also relatively new or exotic crops to the area. As a consequence the Central Market women and their queens tend to avoid trading in these commodities. Instead, farmers, and middlemen who buy directly from the farms, explore market opportunities in restaurants, institutional canteens, and street eating-places. Prices are set by bargaining and depend on the market forces of supply and demand. The lack of formal market mechanisms and trade groups for these crops means that transportation and marketing of produce are undertaken on individual basis although it is not unusual for one farmer to take several growers produce for sale in Kumasi, with each bearing his/her share of transportation charges.

Marketing of these vegetables in Kumasi Central Market occurs on Mondays and Thursdays only when distant traders from Accra, Obuasi, and Takoradi-Sekondi arrive by train to do business and accordingly offer better prices. Once the local market has been satisfied on these two days and the distant traders are gone, the market for exotic vegetables on any other day is small and prices highly erratic. No farmer therefore wants to sell any of these vegetables in Kumasi on the non-specified days.

Farmers in Baworo growing these crops adhered to these two weekdays for selling cabbage and cucumber in Kumasi in virtually all sales. However, Farmer 27 who secured very good profit from the sale of cabbages direct from the field, completed major sales on a Sunday and a Tuesday. By selling single heads priced according to size he bucked the trend of selling in Kumasi on the specified days and profited accordingly.

5.1.2 Marketing ayoyo, alefu and suule

These green leaf vegetables are used extensively for soup and as sauces by people of northern extraction. Because of the large population of northerners in Kumasi there is a strong market for them there and these foods, including the dish *tuozaafi* are gaining popularity amongst the Ashantis. Unlike leaf vegetables such as kale and lettuce these plants can be repeated harvested at two week intervals over a period of several months.

Of the five farmers in the detailed study who grew these crops, three took their produce to Kumasi for sale and two sold to traders coming to the village. The leaves are conventionally sold by the "bundle" – a heap of leaves of no standard weight but judged as an amount that will fill a crooked arm. When sold to traders coming to the village the farmer does not bundle the crop himself/herself. For reasons of tradition this is always left to the trader. Although there is no objective standard for the size of the bundle there was a widely used standard price of Cedi 200 (4 ½ US cents) during this period of study.

Farmer 15, who secured the second highest profits in the sample, sold his green leaf produce in Kumasi but still sold by the bundle at the standard price. It is not known if those "bundles" were smaller than those used by the traders buying in the village. The two other farmers, 11 and 17, who took their produce directly to Kumasi reported sales by the sack or bag. Equally, it is not clear if this secured the same, better or worse returns than selling by the conventional bundle.

5.1.3 Marketing tomato and garden egg

Farmers are more vulnerable to cheating and price manipulation in the marketing of tomato and garden egg than any other crop. These crops have the most well-organized market women's groups in Kumasi who exercise a strategic influence over prices.

The market women / traders are of two types:

- The traveller-trader who treks to distant producing centres to buy on the farm or in local marketing centres
- The armchair trader who is stationed in the Kumasi Central Market yet assured of her supply from farmers.

Both are subject to the authority of the market queen.

The non-existence of similar groupings amongst the vegetable farmers and the pre-financing arrangements that traders have with farmers (provision of inputs on credit), give the traders the upper hand to dictate the sale prices either in the field or in Kumasi Central Market. When garden egg is brought to the Kumasi market, the market woman (trader) consults her queen about the price for the day. Whatever price is quoted for the day prevails for all farmers arriving at the market with their produce. If a farmer is not bound by any pre-financing arrangement, and if he or she can trade their produce before the queen's price is announced, then a better price may be secured. However, this possibility is only open to farmers who have not entered into pre-financing arrangements and who arrive early at the market.

In the case of tomato, the trader in Kumasi Central Market plays the role of a sale's agent, sponsoring a number of farmers and selling their produce for a commission. The commission depends on the price of the commodity - the higher the unit price, the greater her commission. The following commission rates applied for a box of tomatoes during February to May 2000:

Commodity price per box		Commission per box to agent	
Up to $US 4.56	(¢20,000)	$US 1.83	(¢8,000)
$US 4.56 – 9.13	(¢20,000-40,000)	$US 3.42	(¢15,000)
$US 9.13 – 22.83	(¢40,000-100,000)	$US 5.71	(¢25,000)
$US 22.83 – 45.66	(¢100,000-200,000	$US 10.27	(¢45,000)

The nominal price of a box of tomato can go up to $US 34 (¢150,000) and above in January-February, but fall to as low as $US 1.14 (¢5,000) in October-November. In the period March to May when this study was running prices varied between $US 6.8 – 18.2 (¢30,000 – 80,000).

The system means that if a farmer receives a unit price of $US 1.37 (¢6,000) the actual price secured by the trader was $3.2 (¢14,000). Because the commission is fixed within the specified ranges, the market woman negotiates with the visiting trader to secure the best commission for herself but neither has any incentive to push the price higher within the band. Because the farmer is excluded from this negotiation of price he or she is always the loser.

Apart from losing considerably through the commission system, the farmer's losses are compounded through a number of informal levies. In addition to an official market toll the informal levies include:

Landing levy:	For which the owner of the place where the cargo is discharged selects 7 sizeable tomatoes per box.
Carrier fee:	Carriers select 8 big tomatoes per box.
Cleaner's levy:	The cleaners pick 2 big tomatoes per box.
Market Queen's levy:	The market queen selects 8 sizeable tomatoes per every box.

Depending on the number of boxes destined for sale, farmers often carry 1 or 2 boxes as reserve to use as top-ups after these levies have been taken. The traveller-trader is not spared this informal serial levying. On her turn, she pays 2 important levies:

Asantehemaa's levy:	A representative of the Queen mother of the Great Asante Kingdom, the overlord of land, selects 8 big tomatoes per box.

The market woman (agent) selects 4 big tomatoes per box.

5.2 Potential actions to improve the market situation

- Formation of farmer co-operatives capable of negotiating better prices with the traders and market queens. To avoid being undercut the co-operatives would need to be large and gain the support of most farmers. This is very difficult to achieve in practice.
- Establish agro-processing industries to absorb the bulk of vegetable production. This is often talked of by farmer representatives but it is difficult to demonstrate the commercial viability of such a project.
- Establish a parastatal marketing company, similar to GFDC or COCOBOD purposely for the purchase of vegetables at guaranteed prices. As government is disengaging from the marketing of other agricultural commodities such a move is unlikely to have government support.
- Set Government controls over the prices of agricultural *inputs* which are currently deemed to be very high. By reducing the price of inputs farmers profitability may improve. Again, in a climate of liberalisation and structural adjustment programmes such a suggestion is unrealistic.

6. ACCESS TO CREDIT FOR DSVP

37% of respondents in the initial survey reported making use of some form of credit but that survey showed that farmers ranked problems associated with credit as the single greatest constraint to improved production. Further study was therefore carried out to understand the institutional arrangements that either hinder or aid informal irrigators in their quest for effective credit.

Given the findings presented here it seems likely that the figure of 37% does not reflect the true extent of farmer dependency on pre-financing arrangements entered into with traders. It is possible that farmers did not immediately associate their pre-financing arrangements with the concept of "credit" used in the questionnaire and so the practice was overlooked when the farmers were questioned directly on their use of credit. However, when asked about their greatest constraints the problems of pre-financing immediately came to the fore under the simple heading "access to credit".

6.1 General farm credit arrangements in Ghana

The flow of credit generally, and to small-scale farmers in particular, is dominated by informal and semi-formal institutions. Formal credit from commercial and development banks under the supervision of the central bank is very limited and further restricted by the fiscal reforms under the structural adjustment programme. For all banks, loans and advances made to agriculture, forestry and fishing, as a proportion of total loans, decreased from 31% in 1984 to 11% in 1996 (Howard *et al*, 1998).

The factors normally regarded as preventing the rural poor from accessing formal credit are:

- Lack of collateral security
- Fragmented nature of farms
- The risk that they will divert loans to consumption items.

The nature, characteristics and requirements of these formal financial institutions can inhibit access to banks by small-scale borrowers. Clientele's illiteracy can be a social barrier, and many rural folk see the banks as inflexible, operating in restricted hours with bureaucratic procedures, and insensitive to consumption and emergency credit demands.

With access to formal credit effectively blocked, small-scale borrowers look to informal institutions for credit. These informal institutions include:

- Moneylenders
- *Susu* thrift collectors
- Credit unions
- *susu* thrift groups (i.e. savings and credit associations - SCAs)
- Co-operatives (i.e. savings and credit cooperatives - SCCs)
- Personal and mutual assistance groups (i.e. *nnoboa*, landlords, neighbours, friends and family members).

The *nnoboa* facility was originally a traditional mutual labour-exchange arrangement but is now extended to the provision of credit. According to Adjetey (1978), the *susu* thrift can be a rotational or mobile facility for its members. In addition to these, there exists credit from traders, often in the form of a supplier's credit or an advance payment from a middleman against future produce (Offei, 1965, Howard, et *al* 1999). Similarly processors and input suppliers will pre-finance a customer's activities, usually for a specific cash crop.

The informal sector offers the following attractive characteristics for the small farmer: easy physical and social access for the rural poor, small loan and multiple loan provision, low non-interest borrowing costs, flexible in loan use, rapid processing, and locally suited collateral requirements. However, the sector also carries problems, in particular, moneylender interest charges are relatively high lending is limited in size and duration, and operations are often highly localized, (Zeller *et al*., 1997). These problems notwithstanding, informal credit continues to be popular in the rural and farming communities.

Also in operation are semi-formal micro-credit schemes accredited to NGOs. Brown and Kerr (1997) have identified the following:

Global 2000
IFAD
The Smallholder Credit Input and Marketing Programme (SCIMP)
The December 31st Women's Movement
Enhancing Opportunities for Women in Development (ENOWID)
Citi Savings and Loans Company (CITI)
Freedom From Hunger (FFH).

TechnoServe is another NGO that is promoting farm inventory credit in Ghana (Londner, *et al*, 1999).

Their formal counterparts are the Poverty Reduction and Poverty Alleviation Funds, under the control of the District Assemblies.

6.1.1 The example of farm inventory credit by TechnoServe

Small-scale farmers are often driven by immediate cash needs to sell their produce shortly after harvest, when market prices are at their lowest. To overcome this problem the NGO, TechnoServe, pioneered inventory credit in Ghana.

The scheme entails pledging stored goods as collateral for loans, and in the case of Ghana, maize was used. Londner *et al* (1999) report that farmers participating in the inventory credit programme in the Brong Ahafo Region (1992-1996), received an effective sales price premium of 36 % over what they would have earned had they sold their maize immediately after the harvest. This is the net gain after retiring their debt and paying storage/treatment fees. The programme is also assisting the farmers to expand their activities into non-traditional farming and value-adding agro-processing enterprises.

Although inventory credit is a laudable idea, its application to DSVP is doubtful because of the highly perishable nature of vegetables.

6.2 DSVP credit arrangements

Dialogue with key informants in the five villages where wealth ranking was carried out (See Table 1) indicated use of the following institutional arrangements for DSVP and other farming activities:

- Formal credit from the rural banks.
- Formal micro-credit - i.e. Poverty Alleviation Fund from the District Assemblies.
- Mutual credit assistance.
- Moneylenders.
- Pre-financing from traders

6.2.1 Formal credit

Out of the five study communities, only Atia reported using formal credit from the Rural Bank. Here the beneficiary vegetable growers belong to the village's two Co-operative Rice Growers and Marketing Societies. There are 10 men and women in each group, receiving ¢2 million (about $US 450) for the cropping season at an interest rate of 38 %. Apart from this one case vegetable farmers in the study communities had in one way or the other applied *individually* to various banks for loans without success. They appear not to have tried to come together as co-operative bodies to improve their chances of getting formal assistance from the banks.

6.2.2 Formal micro-credit

Formal micro-credit facilities come from the Ministry of Local Government either through the District Assemblies or the Regional Administration. The local banks serve as intermediaries in the payment and recovery of the loans. Again, the vegetable growers in the Atia Co-operative Rice Growers and Marketing Societies were the only exception to have received support from the Youth in Agriculture Credit Scheme. The scheme was initiated by the Ashanti Regional Administration in support of its policy to encourage the youth to go into farming. Each beneficiary was entitled to ¢200,000 ($US 45) paid through the Agricultural Development Bank at an interest rate of 10 %.

All the communities were aware that the Poverty Alleviation Fund (PAF) was in operation, but only one community reported that some members had benefited from the programme. The overall observation was that the disbursement of the fund has been politicized to the extent that an applicant has to identity himself/herself with the ruling party to be able to benefit from PAF. In Abrakaso (the poorest community

according to the wealth ranking), two groups of 15 members each applied to the District Assembly for the fund. One of the groups, which was also the first to apply, was not successful and it was later detected that they failed because all the group members were aligned with the opposition party.

The PAF loan to Abrakaso was disbursed through the Sekyere Rural Bank. Each beneficiary was entitled to ¢200,000 at a very high interest of 75 %. In effect, each person received ¢180,000, the difference of ¢20,000 presumably deducted as a processing fee. Although the repayment deadline had passed 5 months before the interview, the beneficiaries showed no indication that they were going to repay.

6.2.3 Informal credit

a) Mutual credit assistance

Mutual assistance amongst farmers appears to be a common practice in DSVP areas. Assistance is not in terms of cash alone, but often growers borrow seeds, implements, agro-chemicals and fertilizer from co-growers. It is also not uncommon for farmers to fall on their co-growers who make early harvests for financial assistance. What is significant about this informal credit is that it carries no interest.

b) Moneylenders

Credit from moneylenders is important for DSVP. However, because of the high interest rates of 50-100 % and the risks involved in DSVP (i.e. watering problems and market uncertainties), the rate of patronage is said to be low.

c) Traders (Market women)

Informal credit from traders for DSVP is the most widespread and frequently used facility. The traders / market women, provide credit or advances at the outset of the season against all produce from the farm. Many of the dry season vegetable grower appears to have a crop pre-financier.

The arrangement may be cash but it could also be purchase and delivery of farm inputs such as fertilizers and agro-chemicals. The trader's money attracts neither interest nor collateral. It is based on the mutual understanding that the produce would not pass to any other buyer except the pre-financier. Loan repayment is by gradual deduction by the market woman. If the season's harvest is unable to defray the loan, the outstanding amount is carried forward against the next season with the farmer also taking a fresh loan.

Apart from production credit, market women extend financial assistance to cover off-season consumption and emergency demands as well. This makes it a most unique offer open to the vegetable growers. The down side of this form of credit is that it creates a monopolistic condition that ties the farmer to a particular trader for years and gives him or her no say in the determination of the commodity price. Manipulation of farmers by the traders has become pervasive and is difficult to avoid under the present circumstances. A further drawback is that of the traders seeking to "service" as many farmers as possible. As most farmers require credit support at the same crucial periods, it is not unusual for the farmers' needs to outstrip what the trader can supply. As a consequence the use of a given input is delayed or foregone with damaging consequences on the timing and amount of production.

6.3 Conclusions concerning access to credit

- If farmers could have reliable source(s) of credit, they could time the planting and marketing of their produce to avoid the manipulation of market women that currently exists.
- All the communities shared a common opinion that the vegetable farmers should form co-operative associations to strengthen their bargaining powers for formal financial assistance. A well-organized association could mobilize revolving funds and resources for disbursement to its members. Although this opinion was stated in interviews and discussion there are only a few cases where this approach has been successfully adopted.
- The consensus opinion was that the much-politicized micro-credit provided through the District Assemblies does not go to assist needy and genuine farmers. Because beneficiaries see it as party

monies, loan recovery is always low or even zero. Such a mind set relating to loan repayment should not be encouraged.

- Credit could be better provided through formal and semi-formal micro-credit purposely tuned for DSVP and channelled through the banks or well-established NGOs. Impartial monitoring and control are required to ensure that the facility achieves its purpose.
- Provision of credit to the poorest community members of below average wealth status carries particular dangers as they may use cash credit to meet immediate consumption needs. Where inputs rather than cash are provided there remains a danger that the poorest farmers may try to sell those inputs to other farmers so as to meet their immediate cash needs. Assisting the poorest through credit provision may therefore not be a practical option.

7. GENDER ISSUES IN DSVP

The initial survey (Cornish and Aidoo, 2000) identified DSVP as an important source of cash income but the same survey showed that only 17% of the growers deriving direct income from the activity were women. Nonetheless large numbers of women and children are engaged in various tasks on the vegetable farms. Since this and other surveys (GLSS, 1993 & 1999; Nikoi, 1998; Aidoo, 2000) identity Ghanaian women as generally being poorer than the men, it is important to understand the gender barriers associated with DSVP, and how such barriers can be removed to enable more women benefit from DSVP. To achieve such understanding it is important to review the traditional gender roles in farming in Ghana.

7.1 Traditional gender role differentiation in farming

The traditional bush fallow or shifting cultivation systems in Ghana, are commonly seen as woman's farming systems (Boserup, 1970), as women carry out most activities on the farm. Men's role is generally limited to heavy land clearing, and historically they also played a military role in defending and acquiring land, a relatively frequent requirement with shifting cultivation. This left women with the major farming tasks of breaking up the soil, planting, weeding, harvesting, and carrying the harvest home - with little or no male help (Hay and Sticher, 1984).

Throughout the literature, it is firmly established that women, in indigenous forms of agriculture, tend to concentrate on crops needed for family maintenance (Aidoo, 2000; Brown and Karr, 1997, Hay and Sticher, 1984). This transforms into gender role differentiation as cultivation becomes more intensive and cash oriented - the women clustering around the food crops whilst the men take up the cash crops.

Where men and women work together on the same plot as in the case of husband and wife, labour division according to crop “importance” or type commonly occurs. For example, Quisumbing *et al* (1998) noted that whereas women and children contribute between 41 – 51 % of the total labour hours per hectare in young cocoa fields, they account for only 15 % of the labour hours required, when the cocoa trees mature. Young cocoa trees are normally inter-planted with food crops such as plantain, cocoyams, yams, and local vegetables, but these complementary crops are essentially for household consumption. Thus, in the initial growing stage, when the young cocoa plants need a lot of weeding round them, it is the woman and the children who provide that labour, especially if the household cannot afford paid labour. The men, however, assume control as the cocoa trees reach maturity.

Equally, in northern Ghana, women divide their time between working on their husbands' farms, which are usually planted to yams, millet and maize - crops that are destined for the market - and working separately on small vegetable plots to meet their household needs (Aidoo, 2000).

In effect, whereas the food security of the household is the primary concern of the woman, before any other issue, the men focus on wealth generating crops. These same priorities are apparent in DSVP.

7.2 Gender and labour division in DSVP

DSVP is a cash crop activity, and like other cash cropping systems in rural Ghana, the men dominate the activity. Whilst couples may work together on the dry season vegetable farm, there are also situations where the man will concentrate on DSVP whilst the wife looks after a food crop farm or engages in another non-farm activity. Under the latter circumstance, woman household members come into the picture only during harvesting of the vegetables, when more hands are needed for a short period.

Job descriptions and gender placement in DSVP are summarised in Table 21.

Table 21 DSVP Activity by Sexes

Task {x = usually applicable; - = less applicable}	Men	Women and Children
Clearing the bush	x	-
Raising beds	x	-
Nursery preparation	x	-
Nursery watering	x	-
Planting/transplanting	x	x
Weeding	x	x
Fertilizing	x	-
Spraying	x	-
Bed re-dressing	x	-
Construction of well	x	-
Manual Watering (conveyance from source to a medium, usually a barrel)	-	x
Manual Watering (direct application to plants using bucket and can)	x	x
Mechanical Watering (use of pump)	x	-
Harvesting	x	x
Marketing	x	-

Whilst some farm tasks are naturally arduous and therefore reckoned as men's tasks, others are merely stereotyped according to gender. Initial land preparation, comprising land clearing, burning and the raising of beds, is certainly classified as a male activity. Whereas the male operator can take these activities upon himself or supplement his efforts with that of paid labour, the independent female operator has to rely entirely on paid labour. It is unusual for women to undertake land clearing and raising of beds. Paid labour could be on hectare-contract basis or on daily paid ("by-day") arrangement. The greatest use of paid labour occurs in this initial stage as Section 3.2.1 and Table 7 show.

Some activities require special knowledge and skills, and these are handled by men. Nursery management, for example, is not an arduous task but it requires knowledge in detecting early pest/disease attack and careful study of seedling growth, which women have generally not acquired. Accordingly, nursery management has become a male task, occasionally assisted by women and children for watering. The other tasks such as re-dressing of beds, fertilizer application, chemical spraying and motorized irrigation of crops are all deemed to be either too arduous or requiring special skill and are therefore considered as men's tasks.

Tasks such as weeding and carrying water to barrels, require no special technique, and therefore are dominated by women and children. It is important to note that these are the traditional activities of women and children. As noted earlier, weeding of food crop and around young tree crops has been shouldered largely by women and children. Still in the traditional home, the boy child on passing adolescence (18

years onwards) also passes the stage for fetching water from the riverside for household use. He is therefore exempted from carrying water whilst the girl child has no such customary privilege - she carries on with this duty through her marriage life and sometimes to her old age.

These traditional practices have been extended to DSVP. Where water is first drawn manually from a river, pond or dug out into barrels before application to the vegetable plants, the responsibility rests primarily with the woman and children. Often a paid woman may be brought in to assist the wife and children in carrying water. The man's role in manual watering is to draw water from the filled barrels for application onto the crops.

Men, women and children do the weeding. However, women and children account for a great share of weeding in DSVP not only because they are traditionally associated with it, but more importantly because they have the patience and tenderness to handle the closely planted and delicate vegetable plants. Not surprisingly, male DSVP operators prefer to pay female labourers rather than male when it comes to weeding. An added bonus for the "employer" is that female labour is commonly cheaper than male labour, even when both labour types work for the same number of task-hours.

Whilst men, women and children undertake harvesting, marketing of produce is usually restricted to the men themselves. This conforms to the traditional practice of the men controlling the marketing of high income generating cash crops such as cocoa. The women are left to concern themselves with the marketing of basic food crops of lower financial worth.

These are the generally applying norms of gender roles in DSVP but the 17% of respondents in the initial survey and the 3 women farmers in the detailed study demonstrate that these conventional patterns can be over-ruled.

The challenge from the foregoing is that given the necessary resources for women to cater for initial land preparation, and given the necessary training in the other technical activities listed in the table above, women can actively participate in DSVP to improve their lot.

8. SUMMARY OF PRINCIPAL FINDINGS AND CONCLUSIONS

8.1 Wealth ranking and incomes from DSVP

- Using villagers' own perceptions of wealth and poverty between 50 – 70% of village households, in the study area, are of average wealth status. This is a group with basic but adequate housing, access to land for the cultivation of food and sometimes cash crops and sufficient cash resources to clothe all family members and put their children through education up to junior secondary school level. The great majority of dry season irrigators (80%) come from this class.

- Only a very small number of households (about 3% of the community) in any village are considered to be of above average wealth. They have often derived their wealth from cocoa or oil palm farms. They may own a house of concrete block construction which is moderately furnished and includes some electrical equipment such as a TV and fridge. Less than 5% of dry season irrigators are drawn from this group.

- Between 30 – 40% of households in any village are classed by their peers as being of below average wealth status. They may have access to land but where they do it is under utilized, cropping only cassava. Their accommodation is of a very poor standard and often in a state of partial collapse. They are often large families with up to 16 children in the household. Clothing is very poor and cash is very limited so school fees cannot be readily paid and money must be borrowed for simple medicines or other medical needs. They are usually in chronic debt. Some members of this group are prevented from engaging in any sort of productive agriculture other than cassava cultivation as they cannot afford

even basic inputs. Nonetheless, 15 – 20% of irrigators are drawn from this class. A larger number provide hired labour to other farmers.

- The *average* profit made from vegetable irrigation is $US 150 (¢ 660,000) over an average total season length (first planting to last harvest) of 180 days. These average values are relatively constant in the three villages studied. However, in each village there are large variations about the average. In all three villages one or more farmers made a profit of more than $US 360 (¢ 1,575,000) but one farmer made a net loss.

- Even amongst the five most profitable farmers studied the average profit was only $US 354 (¢ 1,550,000). Dividing this amongst a household of six members and assuming that DSVP generates half the annual household revenue, the annual per capita income of even the most successful irrigators is just $US 118 – much less than $US 1/day.

- Financial profitability is influenced more by good marketing – selling a large part of the irrigated produce at above average prices – than by securing high crop yields. There is some evidence that better prices were obtained by farmers who were not tied by any pre-financing deal to a single trader, but insufficient information is available to draw firm conclusions in this regard.

8.2 Use of labour – paid and unpaid

- The detailed study indicates that across the sample group irrigation uses the greatest share of labour hours (38%) but only a small part of this labour is paid. Weed control is the second greatest consumer of labour, using 23% of the total hours. 20% of the weeding labour is hired. The initial survey indicated that women, and to a lesser extent children, provide just less than half the labour used for irrigation and weeding.

- Land preparation – clearing, burning and bed formation – uses the greatest share of paid labour (40% of the total) and is a task carried out almost entirely by men.

- The high number of labour hours used in irrigation reflects the rudimentary methods used, i.e. manual carrying of buckets or pans from the source to the field. The farmers' views in the initial survey and the data gathered in this detailed study are consistent and indicate that the many hours spent in water carrying do not ensure an adequate supply of water to the crop. Without access to better technology most farmers are saddled with using a great part of their labour effort simply to keep crops alive.

8.3 Crop Yields

- Yields have been calculated using approximate conversions from the commonly used measures of volume for each crop to kilograms together with estimates of crop areas obtained during farm visits. The results permit comparison with optimal farm yields, comparison between farmers and the assessment of correlation between yield and management practice.

- For the crops for which data are available there exists a great range in the yields obtained. Garden egg showed an 11-fold difference between worst and best (0.7 – 8.7 t/ha) while cucumber, tomato and okra had variations of 3 ½ to 4 ½ fold.

- One farmer stood out as achieving good or very good yields in three crops. Despite this good agronomic performance that farmer only ranked 12th amongst the 21 farmers in profit per hectare. Good agronomic performance is therefore no guarantee of good financial profit – marketing opportunities, and the skills and freedom to exploit them, are crucial.

- No significant correlation exists between crop yield and either labour inputs (by task or total) or expenditure on fertilizer or other inputs. For garden egg and cucumber correlation was found, which

was significant at the 95% confidence level, between the depth of irrigation water applied over the season and yield.

8.4 Irrigation water use and management

- Limited time and strength and the prohibitive cost of paying labour on a regular and frequent basis effectively limit the depth of water applied to any crop. Where labour is paid to carry water the cost per m^3 can be as high as $US 6 although $US 2 – 3 /$m^3$ is nearer the average.

- Accurate assessment of the crop water deficit experienced by different crops is difficult to make from the field data collected but it seems likely that in many situations crops such as garden egg, with a deeper rooting system, obtain an important part of their total water requirement directly from the groundwater. The depths applied through irrigation are small but can be presumed to be important for farmers are unlikely to make such efforts for no perceived benefit.

- Although there is a positive correlation between the depth of water applied and yield response in garden egg the magnitude of the response is small. This indicates that those farmers who have occasional access to pumps allowing them to apply much greater depths might see improved yields if their timing of pump usage and the in-field management of the water provided were improved through better extension advice.

8.5 Crop marketing and credit provision

- A number of different but well developed marketing systems are in place for the range of different irrigated vegetable crops. Farmers are on the bottom rung of these systems and are to some degree exploited by them. However, because of the strong linkage that exists between credit provision and marketing it is often difficult for farmers to find alternative, better markets.

- The prevailing source of credit for DSVP is through the informal credit system of pre-financing operated by the market traders. This is seen by some as trapping the users into an unfair system of exploitation. The research carried out under this project did not find clear evidence of this but it is true that the farmers with the highest profits operated independently of any pre-financing agreement. Some price must surely be paid for what is otherwise an interest free and highly flexible credit service. It is not clear just how high the present price is.

- Systems of micro credit operated through the Ministry of Local Government are discredited amongst farmers as they are too highly politicized.

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Appendices

Appendix 1

Additional Tables and Figures

Appendix 1 Additional tables and figures

Table 1.1 Summary of farmer characteristics

	Dedesua		Baworo		Etia		Total	
	male	Female	male	Female	male	Female	male	Female
No. of pump hirers	6	-	-	-	-	-	6	-
No. of manual water carriers	-	-	4	-	1	2	5	2
No. hiring to carry water	-	1	3	-	4	-	7	1
No. renting a plot	-	-	4	-	-	-	4	-
No. owning a plot	6	1	3	-	5	2	14	3
Crops grown	Eggplant Tomato Okra Ayoyo Alefi Suwule		Eggplant Tomato Cucumber Cabbage		Eggplant Tomato Okra			

Table 1.2 Crops and their contribution to the income of the 21 study farmers

Farmer No. & sex	Plot area (ha)	Alefi	Ayoyo	Cabbage	Cucumber	Garden egg	Okra	Suule	Tomato	"Several"
11 f	0.283	8%	51%			3%		23%		15%
12 m	0.142	11%	26%			63%		1%		
13 m	0.405					100%				
14 m	0.607		58%			12%	30%			
15 m	0.567	3%	15%			58%		4%	6%	13%
16 m	0.506					51%	31%		18%	
17 m	0.405		17%			64%			15%	4%
21 m	0.202								100%	
22 m	0.809				37%	38%			25%	
23 m	0.243			78%	22%					
24 m	0.405					100%				
25 m	0.809				10%	30%			60%	
26 m	0.627				12%	65%			23%	
27 m	0.405			99%	1%					
31 f	0.405					90%	2%		7%	
32 m	0.708					77%	23%			
33 m	0.101					100%				
34 m	0.607					100%				
35 f	0.405					100%				
36 m	0.405					100%				
37 m	0.405					100%				

Table 1.3 Labour costs ($US / ha) for different tasks

Farmer ID	Clearing	Burning	Beds	Planting	Weeding	Spray	Fertilize	Irrigation	Harvest	Other	Maintenance	TOTALS
11	44	0	0	0	14	0	0	2	0	2	0	61
12	114	54	0	54	245	0	0	19	0	120	0	606
13	25	0	0	2	0	0	0	5	0	22	0	54
14	0	0	0	7	36	0	0	18	0	0	0	62
15	17	0	0	10	33	2	0	40	12	21	12	147
16	47	0	0	17	47	0	0	115	8	28	7	269
17	75	0	3	5	20	0	0	36	1	75	0	214
21	47	0	34	17	14	7	0	0	0	27	0	146
22	19	0	10	0	4	0	0	3	0	3	2	41
23	9	0	0	0	10	0	0	31	0	0	0	51
24	47	0	30	0	0	0	0	0	0	17	0	95
25	24	0	59	14	22	0	0	0	0	5	2	125
26	17	0	13	0	8	0	0	2	0	15	7	63
27	54	0	27	0	24	0	0	0	0	0	3	108
31	29	0	6	0	16	0	0	0	0	2	0	53
32	5	0	0	0	13	0	0	0	0	0	0	18
33	158	0	0	0	72	0	0	18	0	9	0	257
34	14	0	0	2	9	0	0	2	6	0	0	32
35	8	0	0	0	11	0	0	0	0	0	0	19
36	2	0	0	11	38	7	0	25	11	2	0	98
37	36	0	0	0	17	0	0	7	0	0	0	60
Av	38	3	9	7	31	1	0	15	2	17	2	123
%	31%	2%	7%	5%	25%	1%	0%	13%	1%	14%	1%	100%

Table 1.4 Labour hours / ha used for different tasks

Farmer ID	Clearing	Burning	Beds	Planting	Weeding	Spray	Fertilize	Irrigation	Harvest	Other	Maintenance	TOTALS
11	198	0	0	145	395	7	14	914	154	134	0	1961
12	184	85	0	692	2118	85	0	5588	572	762	0	10085
13	209	0	0	162	316	16	15	642	58	279	0	1698
14	0	0	0	46	838	25	0	155	39	0	0	1102
15	78	0	0	81	387	14	16	820	246	125	42	1809
16	346	0	0	314	431	32	18	990	157	287	43	2618
17	287	12	84	389	390	54	20	535	175	388	0	2333
21	217	10	126	217	112	42	0	294	153	173	277	1622
22	90	6	70	56	125	39	0	688	99	22	35	1229
23	222	21	21	255	354	264	37	1133	29	169	33	2538
24	388	5	240	101	157	37	12	163	22	143	12	1281
25	80	0	240	87	147	36	7	452	109	45	5	1209
26	77	11	98	54	84	22	0	564	41	80	84	1116
27	269	2	96	148	305	137	2	437	5	69	64	1537
31	128	25	25	180	382	52	49	1322	84	12	0	2260
32	35	7	0	156	556	0	0	478	86	16	0	1334
33	761	0	0	385	2352	356	168	1147	321	553	0	6044
34	82	0	0	397	507	138	7	317	323	8	0	1779
35	57	0	0	143	526	89	15	369	61	37	0	1297
36	22	0	0	247	447	77	22	551	61	72	0	1499
37	210	7	0	106	86	32	0	486	48	42	0	1018
Av.	188	9	48	208	525	74	19	859	135	163	28	2256
	8%	0.4%	2%	9%	23%	3%	1%	38%	6%	7%	1%	100%

Table 1.5 Cost, revenue and profit figures (US$) unadjusted for plot size

Farmer ID	Cost ($US)	Land rent ($US)	Income ($US)	Profit ($US)	Ratio of profit to cost	Plot area (ha)
11	18	0	244	225	12.19	0.283
12	101	0	134	32	0.32	0.142
13	43	0	216	173	4.00	0.405
14	125	0	144	19	0.15	0.607
15	113	0	559	446	3.95	0.567
16	193	0	199	6	0.03	0.506
17	168	0	235	67	0.40	0.405
Dedesua Av.	*109*	*0*	*247*	*138*	*1.27*	*0.364*
21	34	9	140	98	2.91	0.202
22	91	19	307	196	2.16	0.809
23	63	0	47	-16	- 0.26	0.243
24	55	18	196	123	2.21	0.405
25	162	0	527	365	2.25	0.809
26	82	0	234	152	1.85	0.627
27	101	13	375	261	2.58	0.405
Baworo Av.	*84*	*8*	*261*	*168*	*2.00*	*0.500*
31	57	0	150	94	1.65	0.405
32	25	0	215	190	7.63	0.708
33	52	0	108	56	1.09	0.101
34	86	0	559	473	5.50	0.607
35	19	0	130	111	5.86	0.405
36	67	0	156	89	1.34	0.405
37	43	0	88	45	1.05	0.405
Atia Av.	*50*	*0*	*201*	*151*	*3.04*	*0.434*
Overall Av.	81	3	236	153		*0.458*

Table 1.6 Cost, revenue and profit figures adjusted for plot size ($US/ha)

Farmer ID	Cost ($US/ha)	Land rent ($US/ha)	Income ($US/ha)	Profit ($US/ha)	Plot area (ha)
11	65	0	861	795	0.283
12	716	0	944	228	0.142
13	107	0	533	427	0.405
14	206	0	237	31	0.607
15	199	0	986	787	0.567
16	382	0	394	12	0.506
17	415	0	581	165	0.405
Dedesua Av.	*262*	*0*	*594*	*332*	*0.364*
21	166	45	693	483	0.202
22	112	24	379	242	0.809
23	261	0	193	-68	0.243
24	137	45	485	303	0.405
25	200	0	652	451	0.809
26	131	0	373	242	0.627
27	250	31	926	645	0.405
Baworo Av	*168*	*17*	*522*	*337*	*0.500*
31	110	0	292	182	0.405
32	35	0	303	268	0.708
33	511	0	1067	557	0.101
34	142	0	920	779	0.607
35	47	0	322	275	0.405
36	165	0	386	221	0.405
37	106	0	217	111	0.405
Atia Av.	*115*	*0*	*463*	*349*	*0.434*
Overall Av.	*213*	*7*	*559*	*340*	*0.458*

Table 1.7 Basic irrigation data of sample farmers

Farmer ID	Irrigation season	Effective Vol. Applied (m^3) [1]		Mean irrigated area (m^2)	Average irrigation frequency (days)	Effective irrigation depth (mm)	Rainfall (mm)	Total depth of water supplied (mm)	Average crop water demand (mm)	Distance to water source (m)
		Pump	Manual							
11	25 Nov – 18 March 114 Days	Nil	110	2,800	1.6	39	105	144	350	20 m
12	2 Dec – 31 March 120 days	29	343	1,400	2.4	266	180	446	350	36 m
13	22 Dec – 15 March 84 days	144	45	4,000	2.9	47	69	116	330	12m
14	15 Dec – 17 March 93 Days	604	4	6,000	4.8	101	93	194	350	20m
15	22 Dec – 17 March 86 Days	172	247	5,700	2.1	73	93	166	330	10m
16	13 Dec – 29 March 107 Days	547	77	5,000	1.5	125	180	305	360	20 m
17	15 Nov – 27 March 133 Days	338	42	4,000	2.5	95	207	302	360	90 m
21	20 Dec – 13 March 84 Days	Nil	7	2,000	3.3	3	69	72	330	-
22	1 Dec – 28 March 118 Days	Nil	230	8,100	1.6	28	180	208	370	180 m
23	24 Dec – 3 April 101 Days	Nil	49	2,000	2.8	24	194	218	330	40 m
24 [2]	17 Dec – 6 April 111 days	Nil	10	4,000	2.4	2	268	270	360	10 m
25	20 Nov – 29 March 130 days	Nil	77	8,100	1.1	9	196	205	400	20 m
26	24 Dec – 6 April 104 days	Nil	113	6,200	1.4	18	268	286	330	20 m
27	19 Dec – 3 April 106 days	Nil	39	1,200 [3]	2.6	32	195	227	360	15 m

Table 1.7 Basic irrigation data of sample farmers - continued

Farmer ID	Irrigation season	Effective Vol. Applied (m^3) [1]		Mean irrigated area (m^2)	Average irrigation frequency (days)	Effective irrigation depth (mm)	Rainfall (mm)	Total depth of water supplied (mm)	Average crop water demand (mm)	Distance to water source (m)
		Pump	Manual							
31	17 Dec – 5 April 110 days	Nil	80	4,000	1.5	20	268	288	360	20 m
32	6 Dec – 26 March 111 days	Nil	33	6,000 [4]	1.6	5	179	184	360	50 m
33	10 Dec – 16 Feb 68 days	Nil	17	1,000	2.2	17	62	79	350	300 m
34	10 Dec – 1 March 82 days	Nil	20	6,100	2.7	3	69	72	330	25 m
35	3 Dec – 14 March 102 days	Nil	11	4,000	2.0	3	69	72	350	150 m
36	25 Nov – 13 March 109 days	Nil	22	4,000	1.4	5	79	84	360	300 m
37	25 Dec – 14 March 80 days	Nil	21	4,000	1.6	5	69	74	330	180 m

1. This is the volume after adjustment for assumed efficiency and area wetted. It therefore differs from the true volumes shown in Table 24
2. Much of farmer 24's irrigation was of nursery beds for garden egg. Little irrigation occurred after planting out as the plot was on marshy ground with a very high water table.
3. Farmer 27's area planted to cucumber was abandoned. The area here is the area under cabbage.
4. Farmer 32 planted 0.25 acre to tomato which was abandoned. The area here is that under garden egg and okra.

Table 1.8 Garden egg – yields and irrigation depths

Farmer ID	Crop area (m^2)	Crop yield (kg / ha)	Irrigation depth (mm)
11	Minimal		
12	1,000	5,397	182
13	2,000	5,911	93
14	2,000	771	N/a
15	2,000	8,737	196
16	3,400	1,738	93
17	2,000	5,268	104
21	None		
22	1,200	5,911	4
23	None		
24	4,000	1,189	2
25	2,000	3,212	7
26	4,000	2,184	6
27	None		
31	4,000	2,377	18
32	4,000	2,698	7
33	1,000	5,782	17
34	6,100	5,268	3
35	4,000	2,056	3
36	4,000	2,441	5
37	4,000	1,413	5

Table 1.9 Tomato – yields and irrigation depths

Farmer ID	Crop area (m^2)	Crop yield (kg / ha)	Irrigation depth (mm)
16	1,000	909	99
17	2,000	894	72
21	2,000	4,077	3
22	1,200	1,868	98
25	4,000	2,965	12
26	4,000	2,496	16

Table 1.10 Cucumber – yields and irrigation depths

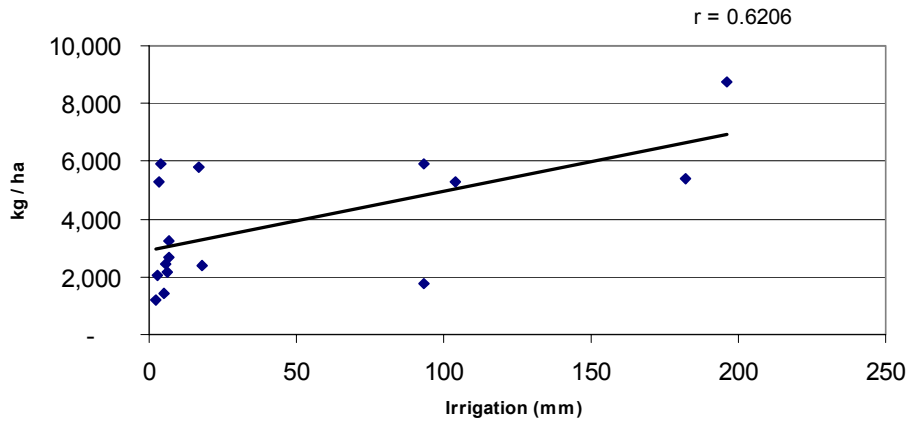
Farmer ID	Crop area (m^2)	Crop yield (Sacks / ha)	Irrigation depth (mm)
22	2,000	138	52
23	400	62	12
25	2,000	32	8
26	1,000	89	23

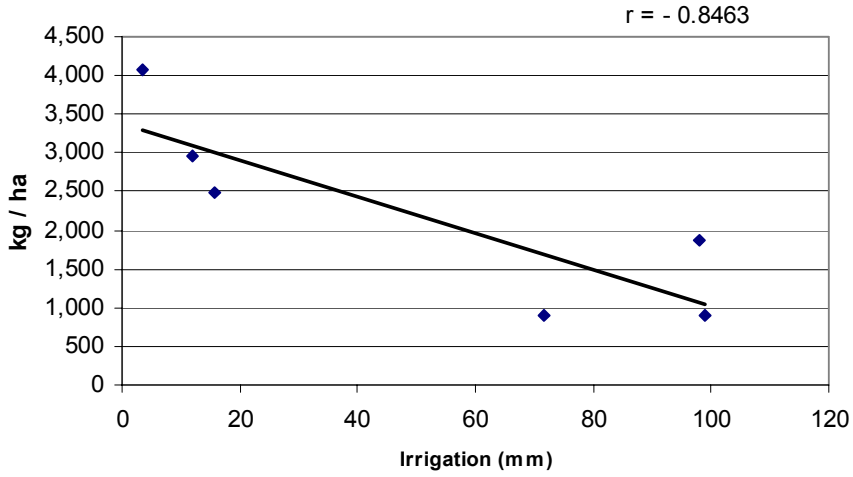
Table 1.11 Farmers' expenditure on irrigation

Farmer ID	Total volume [1] (m^3) Pump	Manual	Volume paid for (m^3)	Paid as % of total	Total cost [2] $US	Average cost / m^3 $US	Maximum paid / m^3 $US [3]
11	0	44	0.5	1.1%	0.57	1.142	1.14
12	36	65	41	40.5%	2.74	0.067	0.60
13	180	18	181	91.4%	13.45	0.074	3.42
14	756	1	756	99.8%	68.99	0.091	2.24
15	216	99	259	82.2%	36.92	0.143	3.58
16	684	31	705	98.6%	74.62	0.106	4.57
17	423	17	430	97.7%	64.00	0.149	5.04
21		3	None		-		
22		93	1.4	1.6%	2.74	1.896	2.30
23		20	3.8	19.5%	7.53	1.983	3.42
24		8	None		-		
25		31	None		-		
26		46	0.9	2.0%	1.37	1.465	1.47
27		16	None		-		
31		32	None		-		
32		15	None		-		
33		7	0.6	8.2%	1.83	3.044	4.57
34		9	0.6	6.5%	0.91	1.522	1.52
35		6	None		-		
36		11	2.6	24.3%	10.27	3.921	6.85
37		10	0.6	5.7%	2.74	4.566	4.57

Notes:

1. Actual volume applied before adjustment for irrigation efficiency
2. Cost of labourers for manual carrying or pump operation plus pump hire and fuel costs where appropriate
3. Calculated from rate paid to a labourer and the volume of water carried.





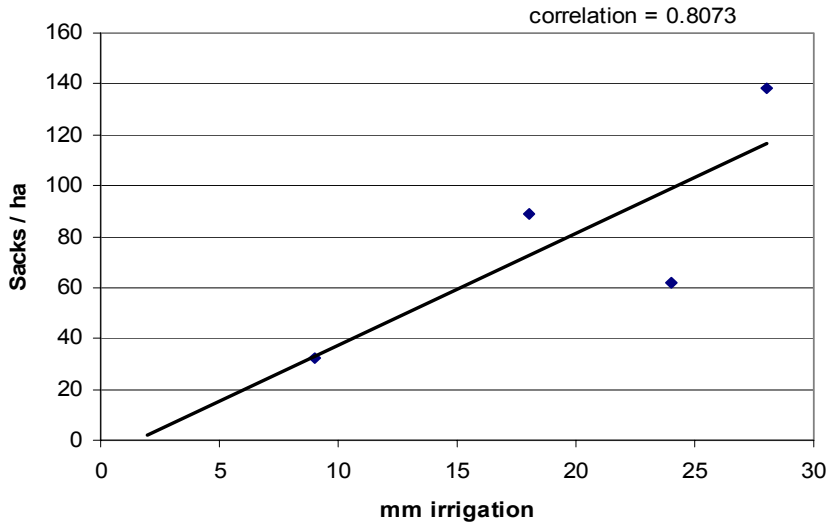


Figure 1.1 Yield of garden egg, tomato and cucumber in response to total irrigation depth

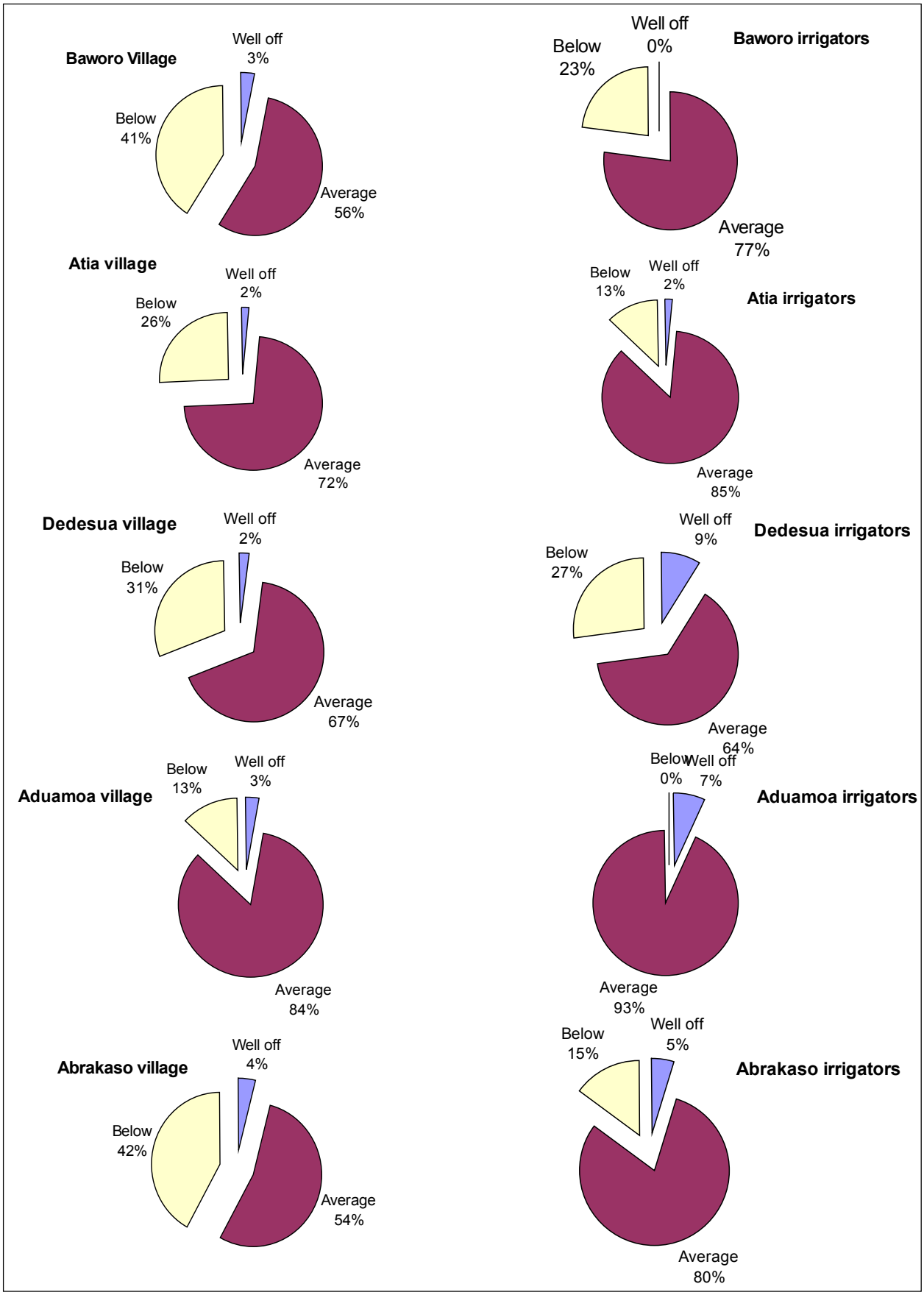


Figure 1.2 Wealth status of all village households and irrigators

Appendix 2

Data recording categories used to monitor and analyse detailed farm studies

Appendix 2 Data recording categories used to monitor and analyse detailed farm studies

1. LABOUR (EXCLUDING IRRIGATION LABOURERS)

DATE	PLOT	LAB. TYPE	ACTIVITY	CROP	NO. UNITS	UNIT	UNIT COST	LAB. HRS.	TOTAL COST

Labour Type: 1:self 2:spouse 3:other hh 4:paid man 5:paid woman 6:partner 7:other

Activity: 1:clearing 2:burning 3:bed raising 4:planting/transplt 5:weeding 6;spraying 7:m'tce 8:fertilizing 9:harvesting 10:other

Unit: 1=manday 2=contract (for task)

2. EQUIPMENT HIRE AND OPERATION COST

DATE	PLOT	TYPE	NO. UNITS	UNIT COST	TERM (DD or MM)	TOTAL COST

Type: 1. Sprayer 2 Pump 3 Petrol 4 Machete

3. AGRONOMIC INPUTS

DATE	PLOT	TYPE	CROP	QTY.	UNIT	UNIT COST	TOTAL COST

Type: 1 Seed 2 Fertiliser 3 Insecticide/Pesticide 4 Herbicide 5 Other

Unit: 1sacket 2 Rubber 3 Milk Cup 4 Margarine Cup 5 Litre 6 Bag 7 Other 10-Tin

4. APPLICATION OF WATER (IRRIGATION WATER USE)

DATE	PLOT	CROP	CROP AREA	NO. UNITS	UNITS	HRS. USED	LAB. TYPE	NO. USED	TERM	UNIT COST	TOTAL COST

Unit: 1 Bucket 2 Barrel/Drum 3 Pan 4 Pump 5 Other

Labour type: 1:self 2:spouse 3:other hh 4:paid man 5:paid woman 6:partner 7:other

5. MARKETING OF FARM PRODUCE

DATE	PLOT	CROP	MKT. LOC.	MKT. COST	UNITS	QTY.	UNIT PRICE	TOTAL VALUE	VALUE. AFTER	Notes

Appendix 3

Wealth ranking indicators used in the five study villages

Box 1
Wealth Ranking Indicators – Dedesua

Well-off

A businessman / business woman.

i. Owns a vehicle or a store.
ii. Rears animals - goats (30+), sheep (10+), and may have a pig or rabbit farm.
iii. Owns and resides in a house exclusively occupied by his nuclear family.
iv. House is concrete block built with metal roofing, cemented and painted with necessary utilities - toilet and bath facilities within.
v. Has generator-powered electricity in the absence of the electricity from the National Hydropower Grid.
vi. Able to look after all children in school up to University and grown-up children are well-placed in employment or working overseas.
vii. The post of Nkosohene (Chief in-charge of Progress) can be conferred on such a person.
viii. Always appears well dressed at public gatherings always.
ix. Makes the highest contribution towards community development projects.

Below Average

i. May have land but is lazy.
ii. May have no land and may be providing farm labour for others.
iii. Occupies a building or room in a very deplorable state, sometimes on the verge of collapse.
iv. House might have been inherited in good condition but failed to take care of it.
v. Where he/she owns a house, it is mud-built, thatch roofing, no concrete floor or wall plastering.
vi. Often children are not in school, and when they are, they do not use the prescribed school uniform. They go bare footed and the school fee is always an unpleasant problem.
vii. Children are either in tattered clothing or virtually without clothing.
viii. Wife may have no clothing for public outings, and on such occasions she has to feign sickness to avoid any embarrassment.
ix. Often defaults on payment of levies for community development.

Average

i. Farmer with cassava or plantain farms.
ii. Often, a dry season vegetable grower.
iii. Rears animals and has 5 goats and 4 sheep on the average.
iv. Owns say two-bedroom house, plastered concrete floored and roofed with zinc or aluminum sheets.
v. May have a bicycle.
vi. Female household heads are industrious and able to take good care of children.
vii. Generally, household members appear in public in good dresses or clothing, but certainly not as would be the case of the well-off household.
viii. Able to pay children's school fees, even if it means asking for a period of grace from the school authorities before payment.
ix. Some of the average-standard households send their children to private international schools outside the community. In Ghana, the private schools are said to perform better than the public schools.
x. Children go to school in footwear.
xi. Able to look after children in school up to the primary or junior secondary school (JSS) level.
xii. Enrolls children in apprenticeship, e.g. carpentry, masonry, or tailoring/seamstress-trade, or finds land for the child to do cocoa farming.

Box 2
Wealth Ranking Indicators – Atia

Well-off

i. Main occupation is farming.
ii. Often are returned migrant cocoa farmers with cocoa farms elsewhere in the country.
iii. Owns land (200-300 acres) in the locality and rents-out land every year.
iv. In the locality, has large cropped land, 20 acres of different cropped fields - oil palm, cassava, vegetables, etc.
v. Own livestock, 20+ sheep.
vi. Owns a well-planned house, concrete block building, self-contained (that is occupied by nuclear family or household members only), plastered and painted or terrazzoed, and in some cases the building has a modern touch, e.g. roofing tiles or anything that is fashionable.
vii. May own a car.
viii. May own colour television and other electronic gadgets powered by a generator.
ix. Household never buys food on credit and members eat well.
x. Household members use good clothing and dresses.
xi. Children attend good schools, in some cases outside the town.
xii. Children wear prescribed uniform and footwear to school.
xiii. Older children attended high schools and some are outside the country.
xiv. Such households never see hardships because they always remitted.

Below Average

i. May have no land.
ii. Households that own land, have 0.5 acre to 1.5 acres.
iii. Because of persistent poverty and indebtedness, the household head has to offer labour on other people's farms instead of his/her own.
iv. The female household heads often provide labour to head-carry water on irrigated vegetable farms.
v. Often stays in the extended family compound house; but his/her share of rooms may be collapsing with parts of the metal roofing ripped off.
vi. The household head is often a drunkard, for both men and women.
vii. May be an individual without children anywhere; but quite often, such a household head has many children (5 to 10 or more); the man may have more than 1 wife, and if a woman, she might have married more than once.
viii. Experience high mortality rate. The household has to rely on a loan any time a child becomes sick, but the loan often comes too late to save the sick child.
ix. Wife/wives, children are poorly looked after. Household depends on food purchase for survival, often buying on credit which places it in continuous indebtedness.
x. Head may have 1 cloth that is used for all occasions - for travelling, for public gathering, and for sleeping.
xi. The female household head is worst off; may have no clothing on her own, often in second-hand dresses and sympathizers have to step in. A gift cloth from a sympathiser is used on public occasions.
xii. Children's school uniform is poor, worn out, and sometimes no footwear; school fee payment is always a tussle and the child concerned has to stay in the house until the head can obtain a loan for school fee payment.
xiii. The man or woman often defaults in the payment of communal development levies. In the case of water levy, defaulting households are prohibited from fetching clean water from the public stand, and have to depend on stream water.
xiv. Never defaults communal works that involve manual labour; they are the first to attend and the most hardworking on such occasions. Already indebted to many people and sometimes to the village/town, they cannot afford to add to their burden by staying away from communal labour.
xv. Such people are never involved in any positions or posts in town. They feel too shy to come up for such posts.
xvi. Indebtedness can be carried to death but not to the grave. Always, the extended family is compelled to absolve their deceased relative from carrying indebtedness to the grave, and in the case of indebtedness to the community, payment has to be sought first before the community allows a place for the body to be buried.

Average

i. The average household is often a farming unit, holding 10 acres of land or more, of which 2-3 acres or more have been planted.
ii. The average household grows food crops. It is often the household that engages in irrigated vegetable cultivation. Because it is hardworking, it is never found wanting in food and other basic needs.
iii. May have livestock, 4-5 fowls and 4-5 sheep.
iv. The head owns a mud or landcrete house or is able to rent accommodation for household.
v. May own a black and white television, and a radio.
vi. May own a bicycle.
vii. Household is well catered for; spouse and children dress well, and the household head goes to public places in acceptable dresses.
viii. All children are in school and school fees are paid at all cost.
ix. Often, child reaches the junior secondary school (JSS) and is then enrolled in apprenticeship or vocational training, or occasionally furthered to the senior secondary school (SSS).
x. They are in the community Unit Committee of the local government.

Box 3
Wealth Ranking Indicators – Baworo

Well-off

i. The head of the well-off household maybe an active farmer or an absentee farmer, a businessman or a master artisan.
ii. They are or might have been migrant cocoa farmers and own cocoa farms in the cocoa frontier areas, example Ahafo and Sefwi regions, of 80 acres or more.
iii. Owns a store in this village or may have their own artisan workshop with up to 20 apprentices.
iv. Owns a landcrete building, plastered and painted or terrazzoed, with zinc/aluminum roofing.
v. Owns a car or a corn mill.
vi. Owns a colour television, fridge, good furniture and floor carpet.
vii. The head, spouse and children dress very well for public outings.
viii. Children have no problem in schooling; the fees are promptly paid and they may have sets of the prescribed school uniform.
ix. Children attend private/international schools outside the locality; their education can be catered for to high school level and beyond.
x. Grown-up children are well employed or are overseas.
xi. Attend communal work; does not participate in the manual work but contributes in cash or kind towards communal development projects.

Below Average

i. Many of the households of the below average category have no land on their own and have to enter into share-cropping arrangements.
ii. Those who have land are constrained by poverty to do any meaningful farming. Most of them are subsistence farmers who plant cassava, but because cassava has low cash value, generally, such households find it difficult to progress in life.
iii. Very few are engaged in the dry season vegetable farming. Often they are unsuccessful in this enterprise.
iv. They contribute the village's hired labour force for farming and other manual works.
v. Many of the below average households live in compound houses of the extended family. Characteristically, their sleeping places are poor, and they are incapable of repairing or maintaining their share of the extended family accommodation.
vi. May own no personal effect except a simple bed.
vii. The below average household is usually large; 6, 7, and up to 10 or more children.
viii. The female head might have gone into many marriages, and have children with different fathers.
ix. The household is poorly catered for; clothing and dresses of head, spouse(s) and children are always poor and worn out. The male head for example may have 1 cloth for all occasions, and the female head may have 2 cloths; some have no clothing. Children may be virtually naked or may have on very worn out clothes.
x. Not all children attend school. Those who go to school are in public schools - parents cannot afford to send children to international schools outside the locality.
xi. Parents cannot look after children in school. They have difficulty in paying school fees and children seldom use the prescribed school uniform. Whatever uniform is being used, may be worn out.
xii. Sick children are often helpless. When a member is sick, the household cannot make any self-effort to get him/her orthodox medical treatment unless a sympathizer comes their way.
xiii. Head and spouse are usually the defaulters of communal levies for development projects.
xiv. Never defaults on communal works, and are the most hardworking on such occasions.
xv. Few of the male heads of the below average households are in the Unit Committee. For those that are, their involvement in such social organizations is for boosting their self-esteem.

Average

i. Mostly farming households although some average household heads are artisans - tailors/seamstresses, drivers, masons, and saloon keepers.
ii. The average household has 1 to 4 acres of farm made up of cassava and vegetable fields. They are often the dry season vegetable growers and would not mind migrating to other places to rent-in land purposely for irrigating farming.
iii. May own livestock - 10 to 20 sheep.
iv. Owns brick-built house, floor cemented/screeded, wall-plastered but not necessarily painted. Metal roofing. Unlike the well off, the rooms have no ceilings and households have no mains electricity to the house yet.
v. Owns no television, no fridge, but has a tape recorder or a radio.
vi. All children are sent to school, often up to the JSS.
vii. After the JSS, children are enrolled into apprenticeship.
viii. Heads and spouses are often involved in communal committees and lead in communal works.

Box 4
Wealth Ranking Indicators – Abrakaso

Well-Off

i. Mainly farmers, but might be traders or transport owners as well.
ii. Has cocoa farm in the locality (harvesting 5-6 bags of cocoa beans yearly), or owns cocoa farm in the cocoa frontier area. May also have an oil palm farm in addition.
iii. Women in this category of households trade in foodstuffs, granting loans to farmers in return for their harvests.
iv. Spends all money in business and child investment.
v. Often are members of the chief's council of elders, but hardly found in the Unit Committee of the local government.
vi. Owns a concrete block or brick built house, cemented and painted with zinc or aluminum roofing.
vii. Has a well furnished room with latest furniture, colour television and fridge.
viii. Has a relatively smaller household; fewer children, maximum being 3-4.
ix. Caters for spouse and children well, always found in good attire for public or social gatherings.
x. All children attend good schools - international schools outside the town.
xi. Provides all children's needs for schooling and looks after them to the SSS level and beyond. Some of the grown-ups may be outside the country and sending home remittances.

Below Average

i. Mainly farmers, and may own between 4 and 15 acres of land.
ii. Some are lazy, some are weak and others are infirm (the old ones).
iii. The household has no money to buy farm inputs; members depend solely on their strength for farming.
iv. Owns only a cassava farm for which planting materials are easy to come by - cannot afford to have a plantain farm, for example, because of the high cost of plantain suckers.
v. Lives in extended family compound house; but share of accommodation will often be found in a very deplorable state - the roof and walls may be at the verge of collapse.
vi. Household may own house, mud-built, thatch roofing, not cemented, and unlikely to have a raised or standing-bed.
vii. Have many children, 6-16 children per household.
viii. Females amongst them have no husbands. They have had many marriages and have many children with different fathers.
ix. Provide labour for the community, often as hired day labour. Because of poverty, head and spouse spend most of their time and energies on other people's farms and activities.
x. Personal effects are non-existent, and household upkeep is always an uphill task. Head and spouse themselves would lack clothing for outings. They may have 1 cloth each for very special occasion. Often they have to borrow cloth before they can attend occasions like funerals.
xi. Cannot send all children to school. Some children are right from the outset deprived of education because their parents cannot pay the ¢200 (4 ½ cents US at the time of survey) being the daily canteen fees for the local kindergarten school.
xii. Children may go to school without prescribed school uniform; sometimes bare footed or in bathroom slippers. Some time ago, children in bathroom sandals were driven out of school and the District Education Office had to intervene because of low school enrolment.
xiii. Few are involved in irrigated vegetable farming.
xiv. Some are involved in the Unit Committee.
xv. Often defaulters of communal levies. The community strikes for payment when the defaulter dies or becomes bereaved. Funeral rites cannot be performed in the village/town until full payment has been made by the defaulter's extended family.
xvi. Very committed to communal works and always the most outstanding at communal works.

Average

i. Mainly farmers, and often irrigated vegetable farmers - tomato, okra and onion. They are also cassava and plantain cultivators but have no cocoa or oil palm farms.
ii. May own livestock - 3 to 10 sheep or 5 goats.
iii. Owns brick house, cemented and roofed with zinc or aluminum sheets.
iv. Owns furniture, black and white television, cassette radio and other personal effects.
v. Often a member of the Unit Committee.
vi. Children attend school and some go to international school outside the village and children use the prescribed school uniform.
vii. Children are looked after to the JSS, thereafter they enter apprenticeship outside the locality.
viii. Household is always catered for. Head and spouse have clothes for outings.

Box 5
Wealth Ranking Indicators – Aduama

Well-Off

i. Mainly farmers, either active farmers or absentee farmers. They are also professional artisans working in the informal automobile workshop (Magazine) in Kumasi. Others are traders.
ii. well-off households owns cocoa/oil palm farm and food crop farm in this village; household may also own cocoa farm elsewhere and harvest 30 bags and above annually.
iii. The traders amongst them sell eggs or trade in foodstuffs.
iv. May have a private or commercial vehicle.
v. The household head owns a house, block built with zinc/aluminum roofing, plastered but not necessarily painted.
vi. May have inherited house and maintained it in good condition. Improvement on inherited building includes repairs, painting or terrazzoeing.
vii. Often part of the chief's council of elders or the community's development committees.
viii. Appears publicly in good attire or clothing.
ix. Household is well catered for.
x. All children attend school, often at an international school outside the village. Children may have 2 sets of the prescribed school uniform. Parents look after children to the SSS and beyond.

Below Average

i. Farming households, planting only cassava - less than ½ acre.
ii. Accommodated in family compound house; share of accommodation is always the worst, sometimes almost collapsing yet no maintenance.
iii. Have many children, 3, 4, or 5 to 8.
iv. Females amongst them are often divorcees who look after many children alone.
v. Large family size creates hardships, and parents are forced to offer labour on other people's farms. That is, constitutes the source of hired labour force for the community - provides by-day labour and the females amongst them collect firewood for sale.
vi. Children are completely without clothing or poorly clothed.
vii. Survival of the household is itself difficult, let alone sending children to school.
viii. Children that are in school use worn out attire and often not the prescribed uniform.
ix. Seldom do children of such homes complete the basic primary school because they have to work towards their own education, e.g. weaving wooden baskets for sale.
x. Sick children are helpless until a sympathizer comes in to help.
xi. The pregnant woman never attends maternity care.
xii. Has only 1 cloth, used for all occasions. For funerals in the village, he/she will attend, but when a funeral occurs outside the village, which everyone is attending and requires paying to travel, he/she must be counted out.
xiii. They are not involved in the Unit/Development Committees of the village.
xiv. Often defaulters of communal levies. The community strikes for payment when the defaulter dies or becomes bereaved. The community holds up the funeral rites until full payment has been made by the defaulter's extended family.
xv. Committed to communal works and are known for the outstanding performance on such occasions.

1.1 Average

i. Farming is the main occupation, often found in informal irrigation farming and cultivation of plantain. Some are cocoa farmers, akpeteshie distillers, chain saw operators, and women traders.
ii. The cocoa farmers amongst them can harvest up to 10 bags of cocoa beans a year.
iii. May have sheep up to 20.
iv. Owns a concrete block or brick house with zinc/aluminum roofing.
v. Children attend international school outside the locality and able to look after children up to the SSS level.
vi. Children use the prescribed school uniform, but would not have many sets as children of the well-off households.
vii. Has a quick response to finding treatment for child or any member of the family when he/she falls sick.
viii. Able to cater for household. The head and spouse dress well for public gatherings.
ix. Dominate the village Unit/Development Committees.
x. Some are in the chief's council of elders.