A COMPARATIVE STUDY OF THE USE OF MANURE AND FERTILISER IN THE SHALLOT INDUSTRY AT ANLOGA IN THE VOLTA REGION

BY

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DECLARATION

I, JONATHAN GUSTAV ADOMAH, author of this dissertation do hereby declare that the work presented in this dissertation: A COMPARATIVE STUDY OF THE USE OF MANURE AND FERTILISER IN THE SHALLOT INDUSTRY AT ANLOGA IN THE VOLTA REGION was done entirely by me in the Department of Agricultural Economy and Farm Management, University of Ghana, Legon from August 2000 to August 2001. This work has never been presented either in whole or in part for any other degree of this University or elsewhere.

....

JONATHAN GUSTAV ADOMAH

(Student)

This dissertation has been submitted for examination with my approval as the supervisor.

....

MR. D.P.K. AMEGASHIE

(Supervisor)

DEDICATION

THIS WORK IS DEDICATED TO MY DEAR DAUGHTER,

JUDY SENAM YAA ADOMAH

AND MY WIFE,

MABEL BABY ADOMAH

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To Ms. Peace Enyonam Ntumy, I say thank you very much for the patience in typing this manuscript.

Finally, to God be the Glory.

JONATHAN GUSTAV ADOMAH

ABSTRACT

The purpose of this study was to compare the use of manure and fertiliser in the shallot industry at Anloga.

The responses to the questionnaire were analyzed, using percentages, chi-square (X^2) test and simple t-test. The study revealed that there was no significant difference between the mean profit of farmers who combined manure with fertiliser and those who used manure only (calculated t_{58} = 0.8, critical t_{60} = 1.7) at 10% significance level. However, a marginal analysis using the partial budgeting approach revealed a net gain of ¢0.5 million per hectare for substituting fertiliser for manure. The farmers complained of non-availability of both manure and fertiliser when they were most needed. In the case of input cost, whereas all the respondents agreed that fertiliser cost was high, less than 50% identified high cost as a problem with manures. The peculiar problem associated with the use of fertiliser, according to the farmers, was high level of storage losses due to spoilage.

Among others, the use of some combination of manure and fertiliser was recommended since this is associated with higher net returns. It was also recommended that a study be conducted into the cost effectiveness of the use of small scale sprinkler irrigation schemes to reduce water inadequacies, especially in the dry season when the wells become dried up and also the farmers should form vigilante groups to guard the shallot farms to reduce stealing of shallot.

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INTRODUCTION

1.1 Background

Farmers constitute a significant proportion of the poor. According to World Bank reports poverty still remains a rural phenomenon (World Bank, 1996). Such people live in areas that have little agricultural potential or activity and which are environmentally fragile. Being poor usually means being without key assets especially land and credit. Hansen (1998), identified lack of credit as one of the principal causes of small scale farming in the country. Food farmers have little to invest from their resources and need credit either in cash or kind to secure the hired and mechanised services to produce.

The productivity of land has been declining generally in Ghana as illustrated by the fact that land expansion has been the dominant source of the modest growth in aggregate agricultural output achieved in the country during the last three decades (Tshikala, 1990). A declining trend in land productivity constitutes a major constraint, not only to improved standards of living in the farm sector but also to the development of agriculture and the rest of the economy. Also, the worsening of living conditions in the farm sector contributes to human capital transfer out of agriculture, which constraints the productive capacity of the farm sector. Furthermore, a declining trend in the growth of agricultural income also affects negatively the process of capital formation and limits the ability of the farm sector to invest in productivity enhancing inputs and techniques.

During the past few years, the World Bank has devoted large funds to help developing countries to increase their agricultural output. However, this credit facility to developing countries has not been without conditions. For instance, prior to the exchange rate reforms in Ghana (which begun in 1983) subsidy on fertiliser was as high as 66%. This was, however, reduced gradually until it was completely removed in 1990 (Asenso-Okyere et al., 1993). This situation is likely to cause price increases in agricultural inputs especially fertiliser, thereby making farmers to reduce their use. As a result, they may not realise optimum yields from farming.

An important component of the Structural Adjustment Programme is the policy of the agricultural input and output marketing reforms, which aside the removal of input subsidy, involves a simultaneous increase in the producer price of cocoa (Adeoye, 1991). The policies, however, had no focus on other crops, particularly shallots, which need large quantities of fertiliser and a subsequent increase in cost of production.

Shallots are known to be grown in Ghana, Nigeria and Cote d'Ivoire coast in west Africa. Until recently, shallots were more popular than onions in Ghana. Often onions are confused with shallots; onions are much bigger compared to shallots. Being an ancient crop, shallots were thought to have originated from Mesopotamia in Western Asia (Nukunya, 1971). It was introduced into Ghana from Anecho in the Republic of Togo, where the crop has been cultivated since 1800.

In Ghana shallots are successfully cultivated in Anloga area between Keta and Anyanui, a ferry point on the lower banks of the Volta River, covering an area of about 600 hectares. Other areas in Ghana which are noted for the cultivation of the crop are Kwahu, Mankesim and Berekum.

Shallot cultivation in Anloga has metamorphosized from low levels into an industry with unique and specialised methods of cultivation using natural manure solely or in combination with fertiliser. The system enables the same piece of land to be cultivated continuously season after season.

1.2 Statement of the Problem

Shallots are intensively cultivated at Anloga due to scarcity of land. Large quantities of fertiliser are therefore needed to maintain the fertility of the soil. Fertiliser prices are however very high, ranging between seventy thousand cedis (¢70,000.00) and one hundred thousand cedis (¢100,000.00) per bag of fifty kilograms due to the removal of subsidy on agricultural inputs. Farmers are likely to withhold the use of these yield-enhancing inputs, thereby not realizing the optimum benefits of high yield. Observations reveal that many farmers use manure as a suitable alternative to fertiliser in maintaining soil fertility in the shallot industry in the area.

From the foregoing issues, the following research questions may be asked:

1. What is the socio-economic background of shallot farmers at Anloga.
2. To what extent do shallot farmers use fertiliser?
3. Is there any significant difference in net returns for farmers who combine fertiliser with manure, and those who use manure only?
4. What problems are faced by shallot farmers in the use of fertiliser and manure?

1.3 Objectives of the Study

The primary objective of the study is to compare the use of manure and fertiliser in shallot farming at Anloga.

The specific objectives are to:

1. assess the socio-economic profile of shallot farmers.
2. estimate the proportion of shallot farmers who use fertiliser compared to manure.

3. compare the profit level per hectare for farmers using manure and fertiliser combined, and manures only.
4. identify the general problems faced by the shallot farmers and compare the problems associated with the use of fertiliser and manure.

1.4 Significance of the Study

The implementation of the structural adjustment programme was intended to make life more meaningful to all Ghanaians. As a component of this programme, subsidy on all agricultural inputs were withdrawn which, as a result, has brought with it price hikes in the cost of agricultural inputs. The result is increased cost of agricultural production and a subsequent reduction in the profit margin of agricultural investments.

Though some research work has been carried out on the shallot industry, the focus has been on the general profitability of the shallot industry (Avemegah, 1990; Alorsey, 1992). However, no attempt has been made to compare the benefits of the use of substitute inputs in this industry. This research therefore hopes to help to determine whether it is more cost effective to use fertiliser or manure in the shallot industry at Anloga. The results obtained would be useful to the farmers, since they can now be better informed, through this study in making a better choice between alternative inputs that would enable them minimize cost.

The Keta District Assembly will have a direct benefit, since increased yield implies increased supply of shallots to the market and hence increased tax revenue.

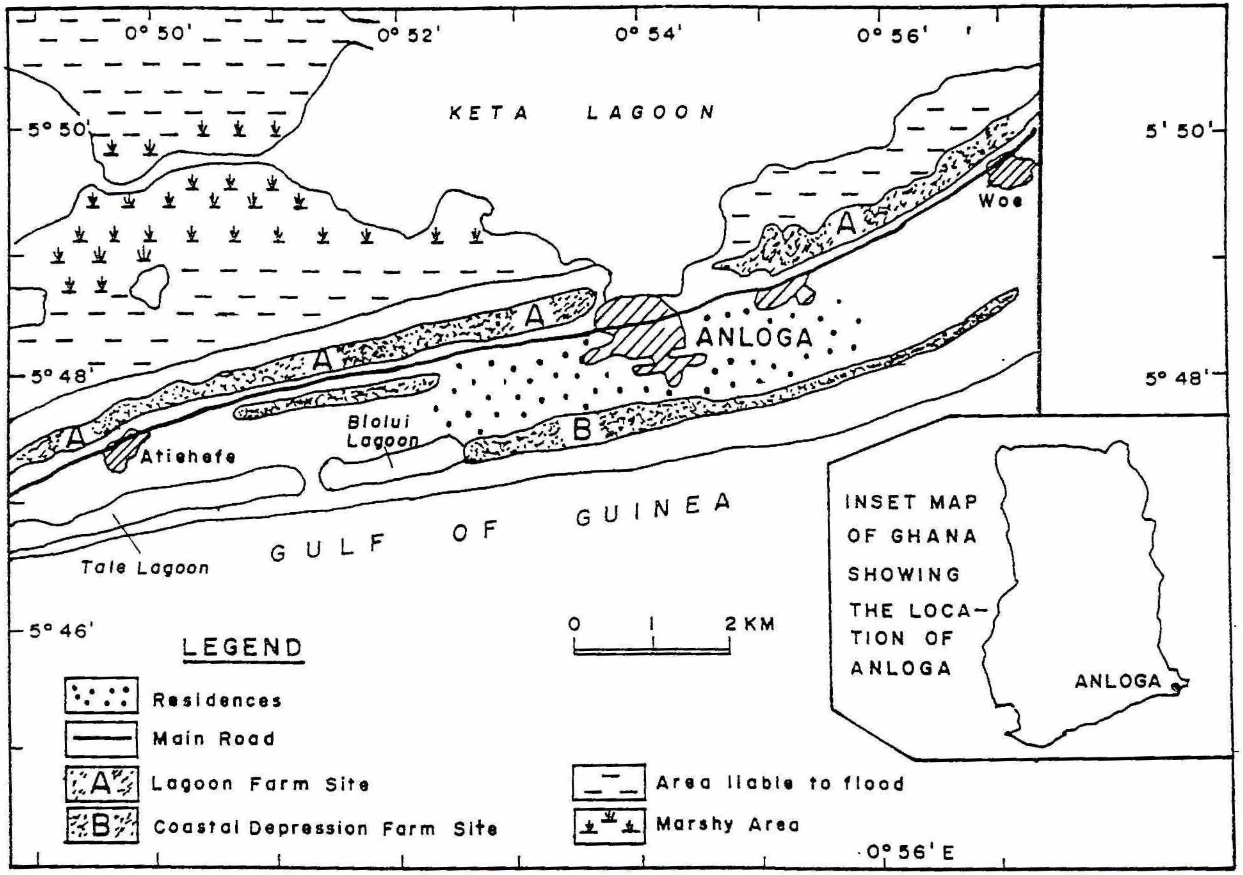
The research results would also serve as a base for research build up in the shallot industry.

1.5 The Study Area, Scope and Limitations of the Study

The study area is located at Anloga. Anloga is found in the South-Eastern corner of Ghana in the Keta District of the Volta Region. It lies between latitudes 5° 45'N to 5° 55'N and longitude 0° 40'E to 1° 00'E (Figure 1). The elevation of the land is not more than 76 metres above sea level. The area experiences dry equatorial climate with two rainfall maxima but the dry seasons are more marked. The mean annual rainfall is about 800 millimetres. This amount of rainfall if evenly distributed, favours the growth and development of shallots.

Anloga is the chief town of the people of Anlo and it is believed that the first shallot farm in the area was found here some 300 years ago. The town is bordered to the South by the Gulf of Guinea, to the North by the Keta Lagoon and to the East and West by Woe and Atiehefe respectively (Figure 1), all settlements of Anlo. The choice of Anloga as the study area is based on the fact that it is the single largest shallot producing town in the area.

FIG.1 SHALLOT FARMING SITES OF ANLOGA



Source: Town and Country Planning Dept., Anloga.

The study covered the September-December 1999 shallot farming season in the area and involved farmers who used manure-fertiliser combination and manure only.

A very important limitation of the study was the lack of record keeping among the farmers and hence the need for the researcher to rely on the memory of the farmers for data. It is also important to note that shallot prices fluctuate widely because it is very perishable. For instance, at the time of the research farmers quoted prices per bundle of shallot of about 46.0 kilograms between ¢40,000.00 and ¢120,000.00 therefore the research had to be based on the average price of ¢80,000.00 per bundle.

Another limitation to the study was the absence of farmers who use fertiliser only. Hence, marginal analysis was used to isolate the net effect of fertiliser use.

An important limitation is the fact that farmers apply manure in the undecomposed state and, by the time the manure gets well decomposed for use, the shallot is due for harvesting. Thus, the full benefit from manure is not realized.

Also, farmers use manure liberally without taking into account the fertiliser equivalence. This introduces a shortfall in the comparison.

1.6 Organisation of the Study

The study is organised into five chapters. In chapter one a background of the study is given. It contains a brief description of together with the objectives justification, the study area, scope and limitations, and organisation of the study.

Chapter two deals with literature review. It covers literature on the Anlos and the shallot industry, botany and uses of shallots, growth requirements, land preparation and planting, harvesting, handling and storage of shallots, and the use of manure in maintaining soil fertility.

In chapter three, the methodology used in the study is described. It covers the analytical framework and data collection.

Chapter four contains the analysis and discussion of the results, while the fifth chapter provides the summary, conclusion and recommendations made on the basis of the findings of the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Anlos and the Shallot Industry

The Anlos are believed to have migrated from Notsie in the company of other Ewe groups. They, however, found settlements in the Keta and the Ketu Districts of the Volta Region, with their chief town as Anloga, sand-witched between the sea and the Keta Lagoon. The people of Anloga are noted for shallots which are intensively cultivated due to scarcity of land.

It is, however, important to note that not all land available is suitable for the cultivation of shallots. The crop thrives only along the low lying shorelands of the Keta lagoon and the narrow depressions between the sea and the lagoon. The bulk of the shallot is produced at Anloga and Woe, covering an area 6.4 kilometres long and 0.4 kilometres wide. Hardly does an individual holding exceed an acre (Alorsey, 1992). In order to get as much output as possible from the available land, there is intensive cultivation of the land to shallot or in combination with other crops such as okro, tomato, garden eggs and pepper as well as maize.

The shallot industry in Anloga is believed to have started in the early 1920's (Nukunya, 1971). It was not of economic importance outside the Anlo area until around 1935 when the coconut wilt disease in the area forced some coconut farmers to go into shallot production as the main cash crop. Shallot farming subsequently became the main occupation of the people of the area. Until then, the most valuable sources of income were copra and coconut oil.

2.2 Land Tenure and the Shallot Industry

Land tenure is a system or a process by which land is held for different purposes. Agricultural production and land productivity, all things being equal, are enhanced by a streamlined and an unambiguous land tenure system. Where land is acquired without any ambiguity and uncertainty, tenants are known to enormously invest in soil conservation and management (Nukunya, 1972).

There are various forms of tenancy arrangements with respect to the shallot industry in the study area. The principal of these is the inherited tenancy from which other forms of tenancy evolved. Here, land is passed on patrilineally to the male children after the death of their father. Those who inherit the land through their ancestors may decide to crop the land themselves, lease it out on sharecropping basis or mortgage it for cash. This gives rise to sharecropping and mortgaged tenancies (Nukunya, 1971). Another form of tenancy arrangement is where the landlord has not got enough credit to cultivate his beds and he decides to rent it out to prospective farmers on seasonal basis.

Of all the tenancy arrangements it is the inherited and the mortgaged tenancies which are desirable and advantageous to most tenants (Nukunya, 1971). In terms of inherited tenancy, the probability of tenant securing a loan from the bank using his plot as a collateral is high. In addition, full benefit is derived from investing in soil fertility conservation in which proceeds from yield accrue solely to the tenant. This benefit is also enjoyed by the mortgaged farmer except the use of land as a collateral, which does not apply to the inherited tenancy.

In shallot farming at Anloga, sharecropping is preferred to rented tenancy since in the case of the latter, the tenant loses his rent and yield when there is crop failure (Alorsey, 1992).

2.3 Botany and Uses of Shallot

Shallots belong to the family "Alliaceae" and scientifically called Allium ascalonicum. It is a perennial crop but cultivated as an annual. It is a leafy vegetable with hollow rounded leaves up to 30 centimetres long. The bulbs are small, ovate and angular and varies between 1.9 centimetres to 3.75 centimetres in diameter. The bulb colour is either red, pink or white, which occur in clusters of 8 to 12 per plant and are covered with thin scale (Norman, 1992).

The nutritional value of shallots according to Norman (1992) includes moisture 81.8%. A 100 gram edible portion of the bulb has a food energy of 67 calories and contains:

protein	1.5 grams
fat	0.3 grams
total carbohydrate	15.4 grams
fibre	0.7 grams
ash	0.6 grams
calcium	36.0 milligrams
phosphorus	45.0 milligrams
iron	0.8 milligrams
sodium	12.0 milligrams
potassium	33.4 milligrams
vitamin A	5.0 International Unit
thiamin	0.04 milligrams
riboflavin	0.02 milligrams
niacin	0.3 milligrams
ascorbic acid	2.0 milligrams.

In Ghana shallots are used in preparing soup, stew, and salad. The leaves are used for flavouring purposes, they are eaten raw or cooked and eaten with bread and cheese.

2.4 Growth Requirements of Shallot

Shallot is a shallow-rooted vegetable. It thrives best in sandy loams which are well drained and well manured. Heavy clay soils are not favourable for shallot cultivation. In the Anloga area, the crop is grown on sandy soils which are not well suited for the crop, resulting in low yields (Norman, 1992).

High temperatures favour bulbing of the shallot which occurs at temperatures at about 21.1°C or more. Larger bulbs are produced under longer day lengths (Norman, 1992). The crop matures earlier under long day conditions (Norman, 1973; Sinnadurai et al., 1971).

Where rainfall is very high bulbs are hardly produced, and flowering hardly occurs in the lowland tropics but studies have shown that flowering can occur if bulbs are stored at a maximum temperature of 10°C for a period of 90 days or more before planting and where large size bulbs are used (Sinnadurai and Amuti, 1971). However, on the Amedzofe and Kwahu mountains of Ghana, shallots have been reported to flower (Norman, 1992).

2.5 Land Preparation and Planting

Shallot cultivation is usually on raised beds to ensure good drainage, but the crop can be grown on flats where the soils are very well drained. The soil must be prepared by digging deeply enough or ploughing, and then manured with compost. Alternatively, shallot can follow a crop for which large amounts of organic matter were applied. Well decomposed manure, if available, could be applied about 1.3 centimetres deep over the surface after which the bed is raked to a good tilth (Norman, 1992).

In the Anloga shallot farming area, much of the land is subject to annual flooding and sand is carted to neutralise the heavy silt deposit left by the floods and also to maintain the level of the beds before manure is applied (Norman, 1992).

Shallots are propagated using the daughter bulbs, because seeds are difficult to produce. Before planting, the outer scales of the bulb are removed and the doubles split up. During planting the bulbs may or may not be buried completely, depending, on the season and the moisture conditions of the soil (Norman, 1992). The medium-sized bulbs are best for planting. According to Blay and Bayorbor (1990) there is no significant difference between yields when bulbs spacings are either 10 centimetres x 10 centimetres or 12 centimetres x 12 centimetres but a spacing of 12.5 centimetres x 12.5 centimetres is used by farmers in Anloga area. Sinnadurai (1978) reported that the size of shallot bulbs planted influences the number of bullets produced and therefore yield. He further noted that large size bulbs produce more bullets, but medium to small-sized bulbs (1-2 grams) are used as planting materials as they are more economical. Adjei-Twum (1980) also showed that as mother bulb size increased bulb yield, rate of sprouting and the number of leaves developed were enhanced.

There are three growing seasons in Anloga area during the year: January-March, April-August and September-December of which April to August is the major season, January to March is the minor season and September to December is the intermediary season.

2.6 Harvesting, Handling and Storage

Shallots take 60 days from sprouting to maturity in Anloga area. The mature plant is characterised by brown to pale green leaves with the top fallen on the side. After harvesting, the plants are left in the field for a few days to enable the leaves to wilt before they are taken to the shed, to be cleaned, graded and tied into mini-bundles of about 142 grams for sale.

According to Norman (1973) one plant produces 8 to 15 daughter bulbs which weigh 42.5 - 80 grams. He also noted that nutrient levels of the soil and cultural practices performed after planting also influence the yield of the crop. Yields are higher in the dry season on sandy loams compared to the wet season. According to Norman (1973) yields as high as 23 tons per hectare can be recorded.

According to Sinnadurai and Amuti (1971), bulbs stored at lower temperatures of between 4.5°C to 15.6°C break their seed dormancy and sprout within 10 days, with an optimum temperature of about 10°C. Storage at higher temperatures of 24°C to 35°C may cause bulb loss of 40% due to drying out, pests and diseases. Ordinarily, shallots are dormant for about 70 days from the time of harvest to sprouting in bulbs stored at room temperature.

2.7 The Use of Manure in Maintaining Soil Fertility

Ghuman and Lal (1988) observed that there was a decline in the use of organic manure in favour of fertilisers in the early 1980s, and attributed this to the advent of high-yielding crop varieties. The authors further indicated, however, that there was a renewed interest in the use of organic manure in the late 1980s largely because increasing costs of fertiliser, greater incidence of multiple nutrient deficiencies, and deterioration in physical soil properties were resulting in reduced yields. The organic materials commonly used are: farmyard manure, compost and green manure (Chowdhury and Rosario, 1992; Ghuman and Lal, 1998).

On average, one kilogram of manure generally contains: potassium, nitrogen, phosphorus and other nutrients in the following proportion:

potassium	21.3 grams
nitrogen	18.3 grams
calcium	16.4 grams
magnesium	5.6 grams
phosphorus	4.5 grams
iron	10.8 grams
manganese	0.8 grams
zinc	0.1 grams
copper	0.02 grams

The authors (Ghuman and Lal, 1988) established that manure from experimental stations contained significantly more of these nutrients (particularly, nitrogen, potassium, phosphorus, magnesium copper and zinc) than the manure from smallholder farms. This may, probably be due to the difference in feed availability and quality. Comparing nutrient concentration in fresh and stored (or dry) manure, no significant difference was found although stored manure had slightly higher nutrient concentrations, probably due to concentration effect after loss of carbon (Lupwayi et al., 2000). Although adequate manure may be applied to some fields, it is not available in sufficient quantities to support crop production on a wider scale in most parts of Africa.

According to Morris et al., (1999) managing manure as a fertiliser resource for crop production can increase the return to the producer, minimize the pollution potential of animal waste, and enhance the overall production efficiency of a livestock and crop operation. William (1999), however, pointed out that farm-level decisions concerning the use of manure are governed by socio-economic and institutional factors as well as agronomic and ecological concerns. Factors that positively influence farmers manuring decisions are the farmer's own herd size, contractual arrangement between herders and farmers for manure, seasonal migration and its effect on livestock investment and the proportion of cultivated land owned by the farmer. On the other hand, factors found to negatively affect manure use include farm size, distance of fields to the homestead and the production of cultivated land under fallow.

CHAPTER THREE

METHODOLOGY

3.1 Analytical Framework

3.1.1 Socio-Economic Background of Shallot Farmers

These are the differences between a group of people caused mainly by their financial situation. The socio-economic characteristics of the farmers considered were gender, age, marital status, level of education and experience in shallot farming. With the exception of gender distribution the other characteristics were grouped into convenient categories.

Age was classified into groups: below 20, 21 - 30; 31 - 40; 41 -50; 51 - 60; 61. - 70 and above 70. The marital status considered were; married, single, divorced and widowed. The levels of education considered were Primary, Middle/Junior Secondary, Secondary/Senior Secondary, Post-Secondary and Tertiary. Number of years in shallot farming was used as a measure of experience and grouped as: 1 - 10; 11 - 20; 21 - 30; 31 - 40 and above 40 years. Responses were tallied to determine their frequencies and percentages of occurrence.

3.1.2 The Extent of Use of Manure and Fertiliser in the Shallot Industry

To determine the extent of use of fertiliser and manure each respondent was asked to give information on whether his/her adjacent farmers use manure or fertiliser.

The responses were tallied and their frequencies determined, and averages found. The results were analysed using the chi-square (X^2) test, to test for the significant difference in the extent of use of fertiliser and manure (refer to Appendix 6). The chi-square (x^2) test is expressed as:

$$X^2 = \frac{(\text{Observed count-expected count})^2}{\text{expected count}}$$

X^2 - Calculated was then compared with X^2 - critical with (r-1) (C-1) degrees of freedom, where r is number of rows and C is number of columns.

3.1.3 Net Returns on Shallot Farming

Profit per hectare was determined by deducting total cost of operation per hectare from total revenue per hectare,

ie: $\Pi = TR - TC$

where

Π = Profit

TR = total revenue

TC = total cost.

The components of total cost include cost of seeds, fertiliser, manure, insecticides and labour. These cost components, which vary with area of land cultivated were calculated per hectare basis. The total variable cost per hectare (TVC) was calculated as: number of beds per hectare multiplied by variable cost per bed.

$$\text{i.e.:} \quad TVC = \frac{10{,}000m^2}{A} \times VC$$

where, A = average area per bed (in m^2)

VC = variable cost per bed

$10{,}000m^2$ = 1 hectare.

Total revenue (TR) was similarly calculated as the number of bundles per hectare multiplied by revenue per bed (given as the product of quantity of output and price).

$$\text{i.e.:} \quad TR = \frac{10{,}000m^2}{A} \times Q \times P$$

Where:

Q = output per bed in bundles (bundle of shallots weighs about 46 kilograms)

P = unit price per bundle (¢80,000.00).

Mean profits for the two categories of farmers were calculated. Simple t-test statistic was used to test for the significance of difference between the mean profits of those who combined fertiliser with manure and those who used manure only. The t-distribution with $(n_1 + n_2)-2$ degrees of freedom was calculated using the formula:

$$t\,((n_1 + n_2)-2) = \frac{\bar{x}_1 - \bar{x}_2}{S\sqrt{(n_1+n_2)/(n_1 n_2)}}$$

where $S = \sqrt{[(n_1-1)S^2_1 + (n_2-1)S^2_2]/((n_1+n_2)-2)}$

where n_1 and n_2 are the sample sizes, S_1 and S_2 are sample standard deviations and $\bar{x}_1$ and $\bar{x}_2$ are sample means of the two categories of farmers.

Mean cost of production for each of the two categories of farmers were also compared, using the t-test. The t-distribution with $(n_1+n_2)-2$ degrees of freedom was calculated using the formula:

$$t\,((n_1 + n_2)-2) = \frac{\bar{u}_1 - \bar{u}_2}{S\sqrt{(n_1+n_2)/(n_1 n_2)}}$$

where $S = \sqrt{[(n_1-1)S^2_1 + (n_2-1)S^2_2]/((n_1+n_2)-2)}$

where n_1 and n_2 are the sample sizes, S_1 and S_2 are sample standard deviations and $\bar{u}_1$ and $\bar{u}_2$ are sample means of the two categories of farmers.

Mean revenue for each of the two categories of farmers were also compared, using the t-test. The t-distribution with $(n_1 + n_2)-2$ degrees of freedom was calculated using the formula:

$$t\,(n_1 + n_2 - 2) = \frac{\bar{a}_1 - \bar{a}_2}{S\sqrt{(n_1+n_2)/(n_1n_2)}}$$

where $S = \sqrt{[(n_1-1)S^2_1 + (n_2-1)S^2_2]/(n_1+n_2)-2}$

where n_1 and n_2 are the sample sizes, S_1 and S_2 are sample standard deviations and $\bar{a}_1$ and $\bar{a}_2$ are sample means of the two categories of farmers.

To determine the net effect of substituting fertiliser for manure, marginal analysis, using the partial budgeting approach was used. Under this, the following values were estimated:

Losses:

i. cost added due to fertiliser introduced; and

ii. revenue foregone due to manure replaced.

Gains:

i. cost saved due to manure replaced; and

ii. revenue added due to fertiliser introduced.

The difference between the total losses and total gains constitutes the net effect. A net gain (that is, if total gains is higher than total losses) implies that it is more beneficial to use fertiliser or in combination with manure than to use manure only in shallot cultivation.

3.1.4 Problems Associated with the Use of Manure and Fertiliser in Shallot Farming

In comparing the problems associated with the use of fertiliser and manure, the responses from the two groups of farmers were tallied separately. The frequency of occurrence of each problem was determined and their percentages calculated based on the total number of farmers who responded to the questionnaire in each group. The problems were then ranked, based on frequency of occurrence for each group.

3.1.5 General Problems in the Shallot Industry at Anloga

In determining the general problems faced by the shallot farmers in the area, the researcher pre-determined some likely problems and the respondents were asked to determine whether these were problems. These include financing, storage and availability of shallot beds. In addition the farmers were asked to state other problems faced. The responses were tallied for each problem stated to determine their frequencies, from which percentages were calculated. The problems were then ranked, based on their percentages.

3.2 Data Collection

The study population is made up of shallot farmers at Anloga who use fertiliser and manure. The farmers were put into two categories: those who use some combination of fertiliser and manure and those who use manure only.

A maximum of 30 farmers were selected from each of the two categories using the convenience sampling technique. The choice of the sampling technique is due to the relatively uniform mode of operation among the farmers in the area.

The study involved the use of primary cross-sectional data only. The main instrument of data collection was the use of the questionnaire. It consisted of both "multiple-ended" and "open-ended" questions. This was supplemented with interviews and personal observations.

CHAPTER FOUR

ANALYSIS AND DISCUSSION OF RESULTS

4.1 Socio-Economic Background of Shallot Farmers

4.1.1 Age and Gender Distribution

About 40% of the shallot farmers in the survey area were fifty years old and above. A relatively larger proportion (about 60%) were below fifty years (Table 1).

Table 1: Age Distribution of Shallot Farmers

Age Distribution	Frequency	Percentage
20 and below	2	3.3
21 - 30	13	21.7
31 - 40	10	16.7
41 - 50	11	18.3
51 - 60	14	23.3
61 - 70	5	8.3
71 - 80	4	6.7
81 and above	1	1.7
Total	60	100

The proportion of this age group (under 50) is an indication that shallot farming at Anloga has a future. On gender distribution, the study indicates that both men and women engage in shallot farming. However, out of the total number of sixty respondents, women formed only 16.7% (Table 2).

Table 2: Gender Distribution of Respondents

Sex	Frequency	Percentage
Female	10	16.7
Male	50	83.3
Total	60	100

This observation is a deviation from the general opinion that women form a greater proportion of peasant farmers in Ghana (Moser, 1993). It may be attributed to the fact that women in the study area get involved more in petty trading and fish mongering.

4.1.2 Marital Status

Table 3 shows that only 10% of the female respondents were married. The remaining 90% were either divorced, widowed or single.

Table 3: Marital Status of Respondents

Marital Status	Male		Female	
	Frequency	Percentage	Frequency	Percentage
Married	33	66.0	1	10.0
Single	8	16.0	2	20.0
Divorced	9	18.0	5	50.0
Widowed	0	0	2	20.0
Total	50	100	10	100

A relatively large proportion (66%) of the male shallot farmers were married, with the rest (34%) either divorced or single. The relatively small proportion of married women recorded compared to the married men may mean that they carry out the farming jointly with their husbands.

4.1.3 Educational Background

Most of the shallot farmers (88.3%) had some level of education, distributed as: 13.3% primary, 30% middle/JSS , 26.7% secondary/ SSS, 13.3% post-secondary and 5% as tertiary graduates (Table 4).

Table 4: Educational Background of Shallot Farmers

Level of Education	Frequency	Percentage
No formal Education	7	11.7
Primary	8	13.3
Middle/JSS	18	30.0
Secondary/SSS	16	26.7
Post-Secondary	8	13.3
Tertiary	3	5.0
Total	60	100

This is particularly very important to the shallot industry at Anloga since educated farmers adopt new technologies and have access to extension services better than non-educated farmers (IFPRI, 1995).

4.1.4 Years of Experience in Shallot Farming

Over 76.7% of the shallot farmers had over ten years experience in shallot farming, with the majority in the range of 11 - 30 year of experience (Table 5). This is an indication that the people of Anloga take to shallot farming as a lifetime vocation.

Table 5: Experience in Shallot Farming

Years of Shallot Farming	Frequency	Percentage
1 - 10	14	23.3
11 - 20	18	30.0
21 - 30	18	30.0
31 - 40	8	13.3
41 and above	2	3.4
Total	60	100

4.1.5 Sources of Labour

Shallot farming is labour intensive due to watering. In the research area 36.7% of the farmers use only family labour. The rest 63.7% supplement their family labour with hired labour (Table 6).

Table 6: Sources of Labour to Shallot Farmers

Sources	Frequency	Percentage
Family labour only	22	36.7
Family labour and hired labour	38	63.3
Total	60	100

4.1.6 Sources of Funding

Farmers in the study area reported of two main sources of funding: self finance and support from relatives (Table 7).

Table 7: Sources of Funding the Shallot Farms

Source of finance	Frequency	Percentage
Self-finance	48	80.0
Relatives	12	20.0
Total	60	100

It was observed that the majority (80%) of the shallot farmers self finance their farming activities. They claimed they do not seek assistance from the banks because the procedure was too cumbersome, though their sources of finance were inadequate. This situation might rather be a reflection of the high returns that were recorded (¢3.1 million and ¢4.1 million per hectare for the use of manure and fertiliser/manure combinations respectively), which the farmers were able to plough back into the farm projects.

Those farmers who could not adequately finance their farming activities (constituting only 20%) preferred to seek financial assistance from relatives.

4.1.7 Tenancy Arrangements

Land for shallot cultivation in Anloga could be acquired by leasehold or through inheritance as indicated by the respondents. Farmers who inherited their farm plots constituted only 46.7% while those who leased beds every season represented 53.5% of the total number of respondents (as shown in Table 8).

Table 8: Tenancy Arrangements

Tenancy arrangement	Frequency	Percentage
Lease tenure	32	53.3
Inherited tenure	28	46.7
Total	60	100

The study revealed that the rate of lease of an average sized shallot bed (about $45m^2$) ranged between ¢3,000.00 and ¢4,000.00 per shallot farming season. It further indicated that most of the farmers did not get as many beds as they would like to cultivate during the farming season. This was attributed to non-availability of adequate farm land.

4.2 The Extent of Use of Manure and Fertiliser in the Shallot Industry

The extent of use of manure and fertiliser in shallot farming at Anloga was determined from two perspectives; in one situation the respondents were not included in the sample while in the second instance they were included. Out of a total number of two hundred and forty farmers identified (without the respondents), only nineteen of them use manure only, representing 7.9% (Table 9). The remaining 92.1% combine fertiliser with manure.

Table 9: Extent of Use of Fertiliser

Material Used	Without Respondents		With Respondents	
	Frequency	Percentage	Frequency	Percentage
Manure only	19	7.9	49	16.3
Manure and fertiliser	221	92.1	251	83.7
Total	240	100	300	100

Source: Summarized from Appendix 1

X^2 (critical value) = 2.71 at 0.1%

X^2 (calculated value) = 7.74

(refer to Appendix 6).

Including the respondents, forty-nine of the farmers out of three hundred use manure only, representing 16.3%, while the remaining 83.7% combined fertiliser with manure.

On average, 12.1% of the shallot farmers use manure only while 87.9% used a combination of fertiliser and manure. The difference between the two groups is significant at 0.1%. The low level of usage of manure only may be attributed to the relatively low yield (3.5 tonnes per hectare) associated with manure when used solely as a means of maintaining soil fertility in the area, compared to a relatively high yield of (4.4 tonnes per hectare) when manure is combined with fertiliser (Appendix 4). The difference in yield of shallots between the two groups is however insignificant (calculated $t_{58} = 0.6$, critical $t_{60} = 1.7$) at 10%. It is worth noting that the yields recorded fall far below the optimum of 23 tonnes per hectare of shallot production (Norman, 1973). The yields recorded rather re-emphasised an earlier assertion that the sandy soils of Anloga are not well suited for shallot production (Norman, 1992).

4.3 Profitability of Shallot Farming

4.3.1 Net Returns Estimates

The farmers who used manure only had returns ranging between ¢3.3 million and ¢9.2 million with a mean of ¢5.8 million per hectare. Farmers who used manure-fertiliser combination had returns ranging between ¢4.4 million and ¢12.2 million with a mean of ¢7.5 million per hectare. The mean returns of ¢7.5 million from the manure-fertiliser combination was found to be significantly different at 1% from that of manure only (calculated t_{58}=2.9; critical t_{60}=2.7).

Net returns to the shallot farmers who used manure only ranged between ¢1.7 million and ¢7.3 million per hectare with a mean of about ¢3.6 million per hectare. The net returns to farmers who used some combination of fertiliser and manure ranged between ¢0.5 million and ¢9.1 million per hectare with a mean profit of ¢3.9 million per hectare (Table 10).

Table 10: Estimated Net Returns per Hectare of Shallot Production

	Minimum (¢'million)	Maximum (¢'million)	Mean (¢'million)
Manure Only:			
Returns	3.3	9.2	5.8
Cost	1.2	4.8	2.2
Mean Profit	1.7	7.3	3.6
Manure-Fertiliser Combination:			
Returns	4.4	12.2	7.5
Cost	1.7	7.5	3.4
Mean Profit	0.5	9.1	4.1

Source: Appendices 3 and 4.

However, the difference in net returns between the use of manure only and manure-fertiliser combination was insignificant (calculated t_{58} = 0.78; critical t_{60}=1.8).

The cost of production ranged between ¢1.2 million and ¢4.8 million per hectare (Table 10) for using manure only, with a mean of ¢2.2 million. The cost of production for using a combination of fertiliser and manure ranged between ¢1.7 million and ¢7.5 million per hectare, with a mean of about ¢3.4 million. The difference in the mean cost of production between the groups is also significantly different at 0.1% (calculated t_{58} = 4.2; critical t_{60} = 3.5). Thus, cost of manure constituted 38% of total cost. While the mean profit per hectare for manure-fertiliser combination was found to be ¢0.5 million higher than that of manure only, the manure-fertiliser combination on average requires an extra cost of ¢2.1 million (Table 11).

Table 11: **Mean Cost Estimates per Hectare for the Substitution of Fertiliser**

Technology	Quantity used (bags)	Cost of use (¢'million)
A. Manure Only:		
Mean Total	505.7	2.2
B. Manure-Fertiliser Combination:		
1. Mean Total	297.4	3.4
2. Manure Component	219.5	1.3*
3. Fertiliser Component ($B_1 - B_2$)	5.9	2.1
C. Replaceable Manure ($A - B_2$)	214.2	0.9

Sources: Summarized from Appendices 2 - 5.

Note: A bag of manure is about 50kg.

Note: *Computed as:

$$= \frac{\text{Manure component (bags)}}{\text{Manure only (bags)}} \times \text{cost of using manure only}$$

4.3.2 Marginal Analysis

The loses and gains for the marginal analysis (partial budgeting) were obtained as provided below:

1. Estimation of Costs due to the Substitution of Fertiliser for manure

In maintaining soil fertility, the shallot farmers who use manure only, on average, used 505.7 bags of manure per hectare. The cost of use of this quantity of manure was estimated at ¢2.2 million. On the other hand the farmers who used a manure-fertiliser combination consumed an average of 297.4 bags of the two inputs together with an associated cost of use of ¢3.4 million. The quantity of manure and fertiliser in this combination were 291.5 bags and 5.9 bags respectively. The cost of their use were estimated at ¢1.3 million and ¢2.1 million respectively. The quantity of manure replaceable by fertiliser was estimated at 214.2 bags with an associated cost of ¢0.9 million. The cost of use of the manure component of the combination was ¢1.3 million. Hence, cost saved due to the withdrawal of 214.2 bags of manure equals ¢0.9 million while cost added due to the introduction of 5.9 bags of fertiliser to replace the quantity, of manure withdrawn equals ¢2.1 million.

2. <u>Estimation of Revenue Foregone due to Manure Replaced</u>

Mean revenue per hectare for using manure only

= ¢5.8 million (see Appendix 3).

Quantity of manure applied = 505.7 bags (Table 11)

Therefore, revenue per bag of manure (Rm)

$$Rm = \frac{¢5.8 \text{ million}}{505.7 \text{ bags}}$$

$$= ¢11469.25$$

Revenue foregone = Rm x quantity of manure replaced by fertiliser

But quantity of manure replaced by fertiliser
= 214.2 bags (Table 11)

Therefore, revenue foregone = Rm x 214.2
= ¢11,469.25 x 214.2
= ¢2.5 million

3. <u>Estimation of revenue added due to fertiliser introduced</u>

Revenue added due to fertiliser introduced

= mean revenue from manure-fertiliser combination less revenue from manure component.

But mean revenue from manure-fertiliser combination

= ¢7.5 million (Appendix 4; column 3).

Quantity of manure in manure-fertiliser combination

= 291.5 bags (Table 11).

Expected revenue from manure component

= Rm x 291.5

= ¢11,469.25 x 291.5

= ¢3.3 million

Therefore, revenue added due to fertiliser introduced

= ¢7.5 million - ¢3.3 million

= ¢4.2 million.

The results were summarized in Table 12 for the estimation of net gain due to the substitution of fertiliser for manure.

Table 12: Estimation of Net Gain due to Substitution of Fertiliser for Manure

Losses	Value (¢'million)	Gains	Value (¢'million)
1. Cost added due to fertiliser introduced	2.1	1. Cost saved due to manure replaced	0.9
2. Revenue Foregone due to manure replaced	2.5	2. Revenue added due to fertiliser introduced	4.2
Net gain	0.5	-	-
Total	5.1	Total	5.1

Consequently, the substitution has generated a net gain of ¢0.5 million per hectare. This implies that it is more beneficial to the farmers who combined manure with fertiliser than those who use manure only, though insignificant as earlier observed in the case of net returns estimates. The net returns estimates revealed ¢0.5 million more, for manure-fertiliser combination over manure only (Appendices 3 and 4).

4.4 Problems Associated with the Use of Manure and Fertiliser in Shallot Farming

The types of manure used in shallot farming at Anloga during the survey period were cowdung and poultry droppings. The cowdung was bought from villages in South Tongu and Dangme East districts. The poultry dropping was bought usually from Anloga but in few cases from Tema.

In response to the problems associated with the use of manure and fertiliser, all the thirty respondents (100%) complained of high fertiliser prices, while in the case of manure, only twelve respondents (40%) complained (Table 13).

Table 13: Problems Associated with the Use of Manure and Fertiliser

Type of Problem	Manure		Fertiliser	
	Frequency	Percentage	Frequency	Percentage
High cost	12	40	30	100
Non-availability on time	21	70	25	83.3
Low yield	25	83.3	-	-
High spoilage in storage	-	-	23	76.7
Little or no knowledge of method of application	-	-	15	50

Most of the users of manure (70%) and fertiliser (83.3%) reported that the inputs were not available when most needed. Peculiar to the manure is low yield according to 83.3% of the respondents. On the other hand, little or no knowledge of method of application and high spoilage in storage according to 50% and 76.7% respectively were associated with the use of fertiliser.

4.5 General Constraints in the Shallot Industry

In response to the constraints faced in the shallot industry, 68.3% of the farmers mentioned inadequate rainfall while 63.3% stated fluctuation of shallot prices in the area (Table 14).

Table 14: Constraints Reported by Farmers in the Shallot Industry

Type of problem	Frequency	Percentage
Inadequate rainfall	41	68.3
Fluctuation of shallot prices	38	63.3
Inability to store produce	34	56.7
Theft of farm produce	31	51.7
Lack of extension services	25	41.7

In addition, 51.7% of the farmers also mentioned high rate of shallot stealing on shallot beds and 41.7% responses indicated lack of extension services to the shallot industry at Anloga. About 56.7% of the farmers did not store their produce because they needed money immediately to meet other obligations.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary and Conclusions

The study compared the use of manure and fertiliser in shallot production at Anloga in the Volta Region of Ghana. It assessed the socio-economic background of the farmers, estimated the proportion of farmers who use fertiliser compared to manure as well as the problems associated with their use and also determined the general problems facing the shallot industry in the area.

The socio-economic background of the farmers and the problems associated with the shallot industry were assessed using frequency distributions and descriptive analyses. The profit levels were compared using simple t-test while the proportion of farmers using fertiliser or manure were compared using chi-square (x^2) test.

The study reveals that about 60% of the shallot farmers were below fifty years while 83.3% were males. Majority of the farmers (88.3%) had some level of education with over 76.7% having more than ten years experience of shallot farming.

In maintaining soil fertility, 87.9% of the farmers use a combination of manure and fertiliser, but no significant difference was recorded between the mean profit when a combination of fertiliser and manure were used as compared to the use of manure only. However on carrying out marginal analysis using a partial budgeting approach on the substitution of fertiliser for manure, a net gain of ¢0.50 million per hectare was revealed.

The main problems encountered by farmers who use manure were low yield and untimely availability, while the users of fertiliser complained of high cost of fertiliser and non-availability as well as high levels of spoilage of shallots in storage which were produced from fertiliser.

The cost of operation per hectare when a combination of manure and fertiliser were used was significantly higher than when manure only were used (calculated $t_{58} = 4.2$, critical $t_{60} = 1.7$). There was however no significant difference (calculated $t_{58} = 0.78$, critical $t_{60} = 1.7$) between the mean profits from the two methods at 10%. The main types of manure used in the shallot industry were cowdung and poultry dropping.

The farmers either self-finance their farm projects or get financial assistance from relatives.

The main constraints to shallots farming at Anloga include:

- insufficiency of shallot beds
- inadequate rainfall in the area
- lack of extension services

- fluctuation of shallot prices
- theft of farm produce.

In conclusion, most of the shallot farmers in the study area were males who had some level of education. The study revealed that it was more beneficial to use a combination of manure and fertiliser in the shallot industry. The industry is also encounted with problems ranging from social, economic to climatic which if resolved will enhance its performance.

5.2 Recommendations

Based on the results of the research and for maximum benefit to the shallot farmers the following recommendations were made:

1. Farmers should use a combination of manure and fertiliser since this is associated with higher net returns.
2. Farmers apply manure in the undecomposed state and, by the time the manure gets well decomposed for use, the shallot is due for harvesting. This observation calls for field trials to determine to output over a number of cropping seasons. These trials should include a fertiliser plot as a "control" to eliminate the influence of climatic factors.

3. The need to conduct a study into the cost effectiveness of the use of sprinkler irrigation in the industry to reduce water problems faced especially in the dry season when the wells become dried up.
4. In order to reduce the fluctuation in shallot prices the Ministry of Food and Agriculture (MOFA) in collaboration with the Ministry of Trade and Industry and Export Promotion council should find export markets for the shallot to reduce glut on the local market.
5. The farmers should form vigilante groups to reduce shallot theft on the farms.
6. The farmers should pool their resources together to enable them acquire the manure from South Tongu and Dangme East districts in large quantities for storage and re-sale to individuals at minimum cost.

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APPENDIX 1: Farmers Closest to Respondents and their Choice of Technology

Respondent	Manure-fertiliser Combination	Manure Only	Total
1	4	0	4
2	3	1	4
3	4	0	4
4	4	0	4
5	3	1	4
6	4	0	4
7	4	0	4
8	4	0	4
9	4	0	4
10	4	0	4
11	2	2	4
12	4	0	4
13	4	0	4
14	3	1	4
15	4	0	4
16	4	0	4
17	4	0	4
18	4	0	4
19	4	0	4
20	3	1	4
21	4	0	4
22	4	0	4
23	4	0	4
24	4	0	4
25	4	0	4
26	4	0	4
27	4	0	4
28	3	1	4
29	4	0	4
30	4	0	4
31	4	0	4
32	4	0	4

APPENDIX 1 Con'td

Respondent	Manure-fertiliser Combination	Manure Only	Total
33	3	1	4
34	3	1	4
35	4	0	4
36	4	0	4
37	3	1	4
38	4	0	4
39	4	0	4
40	4	0	4
41	4	0	4
42	4	0	4
43	4	0	4
44	4	0	4
45	0	4	4
46	4	0	4
47	4	0	4
48	4	0	4
49	2	2	4
50	4	0	4
51	2	2	4
52	4	0	4
53	4	0	4
54	4	0	4
55	4	0	4
56	1	3	4
57	4	0	4
58	4	0	4
59	4	0	4
60	4	0	4
Total (Without Respondents)	221	19	240
Percentage	92.1	7.9	100
Total (With Respondents)	251	49	300
Percentage	83.7	16.3	100

APPENDIX 2: Quantities of Manure and Fertiliser Used per Hectare (in Bags)

Respondents	Manure Only*	Manure-Fertiliser Combination		
		Manure	Fertiliser	Total
1	459	556	11	567
2	667	333	7	340
3	468	408	8	416
4	583	204	4	208
5	451	437	9	446
6	486	255	5	260
7	390	200	4	204
8	468	229	5	234
9	625	204	4	208
10	408	453	9	462
11	573	306	6	312
12	458	235	5	240
13	408	200	4	204
14	450	243	5	248
15	408	170	3	173
16	408	160	3	163
17	459	555	11	566
18	465	417	8	425
19	367	278	7	285
20	525	200	4	204
21	584	191	4	195
22	588	333	7	340
23	408	230	5	235
24	578	287	6	293
25	589	291	6	297
26	585	311	5	316
27	578	288	6	294
28	578	287	6	293
29	583	217	5	222
30	574	267	6	273
Total	15171	8745	178	8924
Mean	505.7	291.5	5.9	297.4

*Respondents who use manure only are not the same as those who adopt the manure-fertiliser combination.

APPENDIX 3: Output per Hectare of Shallot (Using Manure Only)

Respondents	Output (MT/HA)	Revenue(¢million)	Cost(¢ million)	Profit(¢ million)
1	2.7	4.3	1.6	2.7
2	5.2	8.9	3.5	5.4
3	3.0	5.2	1.6	3.6
4	2.7	4.7	2.0	2.7
5	2.6	4.5	1.7	2.8
6	3.5	5.6	1.5	4.1
7	2.3	3.9	1.5	2.4
8	2.9	5.0	1.5	3.5
9	4.9	8.2	1.8	6.5
10	3.1	5.4	3.0	2.4
11	4.4	7.6	3.0	4.5
12	5.3	9.2	3.2	6.0
13	4.7	8.2	4.8	3.4
14	2.6	4.5	2.3	2.3
15	4.7	8.2	2.4	5.8
16	4.7	8.2	2.0	6.2
17	5.3	9.2	1.9	7.3
18	3.2	5.6	3.1	2.5
19	2.5	4.4	2.3	2.1
20	3.2	6.5	1.6	4.9
21	2.6	4.2	1.8	2.5
22	2.4	4.1	2.0	2.2
23	3.7	6.5	3.0	3.5
24	2.4	4.8	1.6	3.2
25	2.4	4.1	2.4	1.7
26	2.1	3.8	1.5	2.3
27	2.4	4.6	1.5	3.1
28	2.2	4.1	1.8	3.4
29	3.6	6.3	3.5	2.8
30	2.0	3.3	1.2	2.2
TOTAL	99.3	173.1	66.6	108.0
MEAN	3.3	5.8	2.2	3.6
STD. DEV.	1.1	1.8	0.8	1.5
VARIANCE	1.3	3.3	0.7	2.4

APPENDIX 4: Output per Hectare of Shallot (Using Manure-Fertiliser Combination)

Respondents	Output (MT/HA)	Revenue (¢ million)	Cost (¢ million)	Profit (¢ million)
1	4.3	7.3	5.7	1.7
2	3.9	6.7	6.1	0.5
3	3.9	6.5	3.9	2.7
4	4.7	8.2	7.5	0.6
5	5.3	9.2	1.8	7.4
6	5.1	8.7	6.6	2.1
7	6.0	10.2	3.1	7.1
8	3.6	6.3	3.5	1.5
9	2.9	5.0	4.2	5.0
10	5.2	9.2	2.3	3.0
11	4.2	5.3	3.2	3.1
12	7.1	12.2	6.3	6.0
13	3.6	6.6	2.5	4.1
14	2.8	4.8	1.8	3.0
15	3.7	6.4	3.4	3.0
16	5.6	9.6	2.6	7.0
17	6.6	11.5	2.4	9.1
18	3.8	6.7	4.4	2.2
19	6.4	11.0	3.8	7.2
20	6.4	11.1	3.1	8.1
21	4.6	7.5	1.8	5.7
22	4.7	8.1	1.7	6.4
23	3.1	5.4	3.1	2.3
24	4.6	8.0	2.0	6.0
25	3.5	6.0	3.8	2.1
26	3.8	6.2	3.2	3.1
27	3.1	5.4	2.2	3.3
28	3.5	6.2	2.5	3.8
29	2.5	4.4	2.0	2.4
30	3.3	5.9	2.3	3.6
TOTAL	131.8	225.6	102.3	123.1
MEAN	4.4	7.5	3.4	4.1
STD. DEV.	1.1	2.2	1.7	2.3
VARIANCE	1.5	5.0	3.0	5.3

APPENDIX 5: Cost of Substituting Fertiliser for Manure (¢ million)

Respondents	Manure only*	Manure-Fertiliser combination			Replaceable Manure
		Manure**	Fertiliser	Total	
	A	B	C(B-D)	D	E(A-B)
1	1.6	2.7	3.0	5.7	-1.1
2	3.5	1.1	5.0	6.1	2.4
3	1.6	1.9	2.0	3.9	-0.3
4	2.0	0.8	6.3	7.5	1.2
5	1.7	2.1	1.7	1.8	-0.4
6	1.5	1.2	5.4	6.6	0.3
7	1.5	1.1	2.0	3.1	0.4
8	1.5	1.1	2.4	3.5	0.4
9	1.8	0.7	3.5	4.2	1.1
10	3.0	2.4	-0.1	2.3	0.6
11	3.0	1.2	2.0	3.2	1.8
12	3.2	1.1	5.2	6.3	2.1
13	4.8	1.1	1.4	2.5	3.7
14	2.3	1.2	0.6	1.8	1.1
15	2.4	0.9	2.5	3.4	1.5
16	2.0	0.9	1.7	2.6	1.1
17	1.9	2.7	-0.3	2.4	-0.8
18	3.1	2.0	1.6	4.4	1.1
19	2.3	1.7	2.1	3.8	0.6
20	1.6	0.8	2.3	3.1	0.8
21	1.8	0.7	1.1	1.8	1.1
22	2.0	1.3	0.4	1.7	0.7
23	3.0	1.2	1.9	3.1	1.8
24	1.6	1.1	0.9	2.0	0.7
25	2.4	1.0	2.8	3.8	1.4
26	1.5	1.9	1.3	3.2	-0.4
27	1.5	1.1	1.1	2.2	0.4
28	1.8	1.1	1.4	2.5	0.7
29	3.5	0.8	1.2	2.0	2.7
30	1.2	1.0	1.3	2.3	0.2
TOTAL	66.7	39.9	63.7	102.8	26.9
MEAN	2.2	1.3	2.1	3.4	0.9

*Respondents who used manure only are different from those who combine manure with fertiliser.
**Obtained as a proportion of cost of using manure only.

APPENDIX 6

CALCULATION OF CHI SQUARE (X^2)

Material Used	Without Respondents	With Respondents	Total
Manure only	19	49	68
Manure/Fertiliser Combination	221	251	472
Total	240	300	540

The proportion of farmers who used manure only

$$= \frac{\text{with respondents + without respondents}}{\text{total observation}}$$

$$= \frac{19 + 49}{540} = \frac{68}{540} = 0.13$$

The symbol (f) is introduced to represent the expected frequency associated with the cell located at the intersection of the ith row and the jth column:

f (11) = 0.13 x 240 = 30
f (12) = 0.13 x 300 = 39

The proportion of farmers who used manure/fertiliser combination = 1 - 0.13 = 0.87
f (2,1) = 0.87 x 240 = 209
f (2,2) = 0.87 x 300 = 262

The expected frequency for each cell is entered in parentheses below the observed frequency each cell.

Material Used	Without Respondents	With Respondents	Total
Manure only	19 (30)	49 (39)	68
Manure/Fertiliser Combination	221 (209)	251 (262)	472
Total	240	300	540

THE X^2 - STATISTICS

Cell (Row, Column)	fo	fe	fo-fe	$(fo-fe)^2$	$\frac{(fo-fe)^2}{fe}$
1,1	19	30	-11	121	4.03
1,2	49	39	10	100	2.56
2,1	221	209	12	144	0.69
2,2	251	262	-11	121	0.46
Total	240	240	-	-	7.74

The degree of freedom = (r-1)(C - 1)
(r is number of rows and C number of columns).

X^2 (Critical value) = 2.71 at 0.1%

X^2 (Calculated value) = 7.74.

APPENDIX 7

SAMPLE QUESTIONNAIRE

BACKGROUND INFORMATION

1. (a) Sex: male .... Female ....
   (b) Age: ....
   (c) Marital status:
   i. Married: ....
   ii. Single: ....
   iii. Divorced: ....
   iv. Widowed: ....

2. Have you ever attended school? Yes ..... No ...

3. If yes in (2) what was your last level of educations?
   a. Primary: ....
   b. Middle/JSS: ....
   c. Secondary/SSS: ....
   d. Post secondary: ....
   e. Tertiary: ....

4. For how long have you been engaged in shallot farming?
   ....

SHALLOT PRODUCTION

5. How many beds did you cultivate during the previous season September December 1999?

6. What was the average size of the beds in metre (m)?
   ....
   (a) Length ....
   (b) Breadth ....

7. What was your average production per bed? ....

8. How much of your crop produced (in bundles) last season was
   (a) Sold? ....
   (b) Given as gift? ....
   (c) Consumed by family? ....

9. How much was the price of a bundle of shallot during the previous season? ....

10. What was the source of labour on your farm?
    (a) Family labour only ....
    (b) Hired labour only ....
    (c) Both family and hired labour ....

11. Provide information on labour allocated to the different farm operations for last season in the table below

	No. of Workers	Hours worked per day	No. of days worked	Wage rate
Bed Preparation				
Sowing				
Fertiliser Application				
Harvesting				
Transportation of produce				
Drying				
Storage & Marketing				
Others (State)				

12. What type of fertiliser did you apply?
    a) chemical fertilisers only ....
    b) organic manures only ....
    c) Both types of fertilisers ....

13. Describe briefly the sequence and time of application

14. Provide information on quantity and cost of inputs in the table below.

	Quantity applied per bed	Cost per bag	Total cost per bed
Manure			
Fertiliser			
Insecticide			
Seeds			

15. List the types of manure used and their sources

Manure		Source	
i.	....	i.	....
ii.	....	ii.	....
iii.	....	iii.	....
iv.	....	iv.	....

16. Do you get enough of the manures for your use?
Yes .... No ....

17. If no in (16), what will you suggest: ....

18. What problems are associated with the use of the manures?
....

19. What will you suggest as solution to problems in (18)?
....

20. What problems are associated with the use of chemical fertilisers? ....

21. What will you suggest as solution to problems in (20)?
....

FINANCING THE SHALLOT FARM PROJECT

22. How do you finance your farming activities? By
(a) Loans from money lenders ....
(b) Loans from banks ....
(c) Self finance ....
(d) State other sources if any ....

23. Did you have a say in the amount required?Yes[ ] No:[ ]

24. Was it difficult for you to get loan from the banks?
Yes [ ] No:[ ]

25. Give reason for your answer in (24) above ....

26. Do you get enough funds for your farming activities?
Yes [ ] No: [ ]

27. If No, what would you suggest? ....

28. How did you acquire land for your farm projects?
(a) Outright purchase ....
(b) Inherited ....
(c) Leased ....

29. If the land is on a lease, how much do you pay per bed per season? ....

30. Do you normally get the required number of beds you want to cultivate?
Yes [ ] No: [ ].

31. If No, what reasons will you give? ....

32. State some of the key problems you faced in managing the farms.
i. ....
ii. ....
iii. ....

33. What will you suggest as solution to the problems in (32) above? ....

STORAGE AND MARKETING OF SHALLOTS

34. After harvesting do you store your shallot for sometime before sales?
Yes [ ] No: [ ].

35. If yes, for how long? State ....

36. If No in (34) above give reason ....

37. Do you have some spoilage during storage? Yes[ ] No:[ ]

38. If yes, what will you suggest as the cause?
(a) Pest infestation ....
(b) Disease ....
(c) Drying out ....
(d) Any other reason, state ....

39. What is the percentage of spoilage in your opinion?
....

40. Do you have shallot farmers association at Anloga?
Yes [ ] No [ ].

41. If yes, how do you benefit from the association? State
....

42. If No, give reasons why it does not exist ....