

*Full Length Research Paper*

# Economic Analysis of Dry Season Vegetable Production in the Sokoto Fadama Area, Nigeria

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Many developing countries face major challenges to achieve food security in a sustainable manner, considering the increasing population, limited availability of land and water resources. Thus, the study centered on analysis of profitability of small-scale dry season vegetable production under fadama in Sudan savannah ecological zone of Sokoto State, Nigeria. A three-stage sampling technique was employed to collect data from one hundred and sixty respondents distributed in eighteen villages in the study area. Descriptive statistics and farm budgeting were employed to analyze the data for the study. The study revealed that vegetable farmers obtained an average gross margin and net farm income of ₦190, 024.36/ha and ₦173, 465.58/ha, respectively. While the return to owner's labor and management is ₦84, 951.88, the rate of returns to investment is 97.20%. This indicates that small-scale dry season vegetable production under fadama in the area is profitable. From the viewpoint of this study, certain crops and crop mixture are more rewarding. It is therefore recommended that quite a substantial proportion of land should be devoted to the cultivation of these crops.

**Key words:** Profitability, constraints, dry season vegetable farming, Sudan savannah, fadama.

## INTRODUCTION

The population of the world is increasing at an alarming rate. It has been projected to grow to 8.2 billion by the year 2025 and is likely to approach 9.3 billion in 2050 (DESA, 2000). Feeding such rapidly projected growing population is becoming a big problem. It is estimated that agricultural productivity will have to double over the next two decades to keep up with population growth. Nigeria has advantage in the production of a variety of fresh crops especially vegetables during dry season in the fadama lands (NFDO, 2005). Production of vegetable is a major occupation of people of Sokoto and neighboring

states in northwestern Nigeria, especially in the dry season when rainy season cultivation is over. This activity is both an income earner as well as a source of employment to a large proportion or otherwise underemployed labour force (Ibrahim, 2005). Sokoto state is among the northern area endowed with fadama lands where substantial quantities of vegetable are grown under irrigation during the dry season (Dogondaji, 2005). Bello et al. (1998) observed that the fadama land although quite small in area is one of the most valuable agricultural resources in the state. In vegetable production, farmers adopt different cropping practices. These practices determine the quality and quantum of gross agricultural production and the crop-mix grown in an agricultural year.

For the individual farmer there is a problem of what

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**Table 1.** Sampling distribution in the study area.

| Western zone | Number of respondent | Northern zone  | Number of respondent |
|--------------|----------------------|----------------|----------------------|
| Kamata       | 10                   | Tunga          | 10                   |
| Wajajuke     | 9                    | Taloka         | 10                   |
| Jirga        | 10                   | Kwargaba       | 10                   |
| Kaura Kwasau | 10                   | Sabo Dole      | 9                    |
| M/gari       | 8                    | Lugu           | 10                   |
| Shuni        | 10                   | Goronyo        | 10                   |
| Salla        | 10                   | Gidan Ajlkwara | 9                    |
| Saida        | 10                   | Gidan Kaima    |                      |
| Total        | 77                   | Total          | 78                   |

Grand total = 155 respondents. Source: Field survey (2009).

combination of crops to grow on limited land area with given quantities of labour, capital, management and other resources in order to maximize returns to vegetable production? Thus, this study describes the constraints and examines the profitability to dry season vegetable production under Fadama in Sudan Savannah Ecological Zone of Sokoto State, Nigeria.

## METHODOLOGY

### Area of the study

This study was conducted in Sokoto State. The state lies within two ecological zones; the northern portion which lies largely within the Sudan savannah ecological zone, the southern portion on the other hand lies in the northern guinea savanna of Nigeria. The state is located in the North West geographical zone of Nigeria within longitude 11° 3 to 13° 50 E and latitude 4° to 6° 40' N. It covers a land area of 2,648.48 km<sup>2</sup> (Singh and Yakouba, 2000). The area could be classified as one of the semi-arid regions of the world, where water is probably the most limiting factor to agricultural production. There are two distinct seasons in the state; the rainy season which starts around May and last till September and the dry season from October to April. The annual rainfall is frequently erratic, poorly distributed and varies from 500 to 1300 mm (SMANR, 1998). There are two temperature extremes; the hot period (March to May) which is as high as 39°C and the cold harmattan months of December to January; when cold, dust-laden winds blow from across Sahara bringing down the temperature to as low as 15°C, averaging about 27°C (SMANR, 1998). Since the rainy season is short, farmers usually plant early maturing upland crops during the period. In order to avoid idleness of resources during the long dry season, farmers undertake irrigated farming.

The topography of the state is characterized by gentle undulating plains that rise from an elevation of about 300 m above the sea level in the North-west to an average of 460 m above the sea level. There are few low-lying valleys or fadama which terminate to form streams at their lowest levels. The soil consists of ferruginous soil of alluvial origins, as well drained loamy sandy soil. In the fadama, the soil generally consists of finer sand, silt and clay. River Sokoto and Rima are the major rivers in the state with their numerous tributaries. The major occupation of the people of the state includes arable and livestock farming. The major occupation of the people of the state includes arable and livestock farming. The major upland

crops include Millet, Sorghum, Groundnut, Cowpea and Tobacco. Major dry season vegetable crops which are mainly grown under irrigation include Onion, Tomato, Sweet and Hot pepper (Tsoho, 2004); others include Carrot, Rice, Wheat and garden egg. The livestock raised in the area consists of cattle, sheep, goat, donkey, camel and horses (SMANR, 1998).

### Sampling procedure and sample size

The target population for this study was the fadama vegetable producers in Sokoto State. Sokoto state is divided into two main agro-ecological zones by the state Agricultural and Rural Development Authority (SARDA) in consonance with ecological characteristics, cultural practices and project's policy and administrative convenience. These zones are the northern and western zones with a central headquarters in the state capital. Since vegetable is produced in virtually all the areas of the state and in order to have a representative sample in achieving the stated objectives, the sampling procedure covered the two zones equally. Accordingly, a two-stage sampling procedure was employed in selecting the sample for this study. The first stage involved the random selection of eight villages in each of the agricultural zone of the state using the existing (SARDA) village listing. The second stage was the random selection of ten farming households in each of the selected village. Accordingly, a sample of one hundred and sixty farming households was collected and subsequently analyzed for the study. However, for lack of complete information, only one hundred and fifty five questionnaires were found useful for the study. The sampling distribution of the respondents is shown in Table 1.

### Analytical techniques

Descriptive and inferential statistics and a partial farm budget analyses were the analytical tools employed to achieve the research objectives. The model for estimating the farmers returns to labor and management is outlined thus: Gross value of output which was obtained by multiplying the total output with market prices of the output expressed in naira.

### Less

Total variable cost of production comprised of expenses (direct and imputed) on seeds, fertilizers, agro-chemicals, mechanical services,

hired labor, transportation and marketing including expenses on water applied.

### Equals

#### Gross margin:

##### (a) Less

Interest on capital made up of cost of formal and informal capital used by farmers. The average period for irrigation of vegetable covers six months, so only half the total annual interest charge was to be used in the computation of interest on capital (Omotesho, 1991).

- Imputed rent on land: this item represented the amount which the farmers would have paid for land if they did not own it.
- Depreciation charges: this was determined using the straight line method with no salvage value for items like water pumps, hoses, tube-wells, open wells, hoes, cutlasses, baskets, sprayers, jute bags, fertilizer bags, etc.
- Imputed cost of family labor: Unpaid family labor (in man days) employed by each farmer was calculated. Family labor is assumed to have opportunity cost equal to the prevailing wage rate in the study area at the time of the survey.

##### (b) Equals

**Returns to farmer's labor and management:** This is given as the net income less than the imputed cost of family labor. This is the focal point for the costs and returns analysis of this study. The rate of returns (ROR) which provides a measure of economic performance of each farm in terms of revenue accruing to the farmer and the capital employed was equally determined and expressed in percentage (%) as:

$$TR - TVC$$

$$ROR = \frac{\quad}{TVC} \times 100$$

## RESULTS AND DISCUSSION

Table 2 shows the age distribution of the respondents in the study area. The age of the farmer according to Adewumi and Omotesho (2002) is expected to affect his productivity and output. It also affects the adoption of innovation in traditional farming. The mean age of the respondents is 43.33 years and the modal age is 41 to 50 years which constituted about one-third of the total respondents. This agrees with findings of Tsoho (2004). This might have implication for available family labor force. Given the ageing nature of the sample, there might be a reduction in the effective labor force for agricultural production in the study area. It was observed during the field work that all the one hundred and fifty five sampled respondents in the study area were male. This may be due to cultural and religious (Islamic) belief of the people in the area, which prohibits women to go out freely and engage in certain activities such as farming. Where the

women own land, they usually delegate its administration to their senior male child or one of their male relations. The study revealed that more than 90% of the respondent were married, while the remaining were either single or widow(er), respectively. This, coupled with the polygamous nature of the area probably explained the large family size recorded in the area. The mean family size was 10 persons per respondent and it range from 1 to 40. About one-third of the respondents have family sizes greater than this average number. This study also revealed that although all the respondents (100%) have one form of education or the other, but 15.49% have attained between primary and tertiary education. More than two-third of the respondents had Qu'ranic education.

Almost all the respondents have inherited farming as an occupation, while the remaining were introduced to farming by either friends or relatives. About 90% of the respondents have farming as their main occupation and only 10% adopts farming as their secondary occupation. The farmers who engaged in farming on full time basis are expected to be more efficient and prepared to explore new methods that offer increases in farm income compared to those who engaged in farming on part time basis. As observed by Baba (1998), part time occupations may make possible a fuller use of farmers' labor especially in slack season. Farmers experience is expected to have a considerable effect on farmer's productive efficiency. The farmer's years of experience range from 5 to 45. The average farming experience of the farmers is 23.21 years. About 84% of the respondents have more than 10 years of experience in farming. Less than 20% of the respondents have less

than ten years farming experience. The analysis of the land further revealed that farm size ranged from 0.13 to 1.70 ha with a mean of 0.54 ha. The respondents practiced both mixed and sole cropping, although, the former dominated. Seven vegetable enterprises were identified in the area. The major vegetable crops grown by the sampled farmers are tomato, onion and pepper.

The respondents who grew a combination of tomato, onion and pepper on the same farmland constitute the highest number of about one-third of the total sampled farmers. Others grew tomato and onion, tomato and pepper, onion and pepper and soles of tomato, onion and pepper, respectively.

## CONSTRAINTS TO VEGETABLE PRODUCTION UNDER FADAMA

The constraints confronting dry season vegetable production under fadama as perceived by farmers are presented in Table 3. Although, returns to dry season fadama farming were quite high in the study area, it appears opportunities still exist for improving them if the

**Table 2.** Socio-economic characteristics of the households' heads in the study area.

| <b>Characteristics</b>                    | <b>Frequency</b> | <b>Percentage</b> |
|---|------------------|-------------------|
| <b>Age of the respondent</b>              |                  |                   |
| 1- 20 years                               | 1                | 0.65              |
| 21-30 years                               | 25               | 16.13             |
| 31-40 years                               | 36               | 23.22             |
| 41-50 years                               | 54               | 34.84             |
| 51-60 years                               | 20               | 12.90             |
| 61-70 years                               | 18               | 11.61             |
| 71-80 years                               | 1                | 0.65              |
| Total                                     | 155              | 100.00            |
| <b>Marital status of the respondent</b>   |                  |                   |
| Married                                   | 145              | 93.55             |
| Single                                    | 4                | 2.58              |
| Widower/Separated                         | 6                | 3.87              |
| Total                                     | 155              | 100.0             |
| <b>Family size respondent</b>             |                  |                   |
| 1-10                                      | 104              | 67.9              |
| 11-20                                     | 39               | 25.16             |
| 21-30                                     | 10               | 6.45              |
| 31-40                                     | 2                | 1.30              |
| Total                                     | 155              | 100.00            |
| <b>Education status of the respondent</b> |                  |                   |
| Qu`ranic education                        | 119              | 76.77             |
| Adult                                     | 12               | 7.74              |
| Primary                                   | 10               | 6.45              |
| Secondary                                 | 12               | 7.74              |
| Tertiary                                  | 2                | 1.30              |
| Total                                     | 155              | 100.00            |
| <b>Respondents farming experience</b>     |                  |                   |
| 1-10 years                                | 25               | 16.13             |
| 11-20 years                               | 38               | 24.52             |
| 21-30 years                               | 64               | 41.29             |
| 31-40 years                               | 17               | 10.97             |
| 41-50 years                               | 11               | 7.09              |
| Total                                     | 155              | 100.00            |
| <b>Farm size (ha)</b>                     |                  |                   |
| 0.01 – 0.25                               | 28               | 18.06             |
| 0.26 – 0.50                               | 62               | 40.00             |
| 0.51 – 0.75                               | 36               | 23.23             |
| 0.76 – 1.00                               | 15               | 9.68              |
| 1.01 – 1.25                               | 6                | 3.87              |
| 1.26 – 1.50                               | 4                | 2.58              |
| 1.51 – 1.75                               | 4                | 2.58              |
| Total                                     | 155              | 100.00            |

**Table 2.** Contd.

| <b>Respondents widely adopted crop mixtures</b> |     |        |
|---|-----|--------|
| Tomato/Onion/Pepper                             | 48  | 30.97  |
| Tomato/Onion                                    | 33  | 21.29  |
| Tomato/Pepper                                   | 23  | 14.84  |
| Onion/Pepper                                    | 9   | 5.80   |
| Sole Tomato                                     | 7   | 4.52   |
| Sole Onion                                      | 32  | 20.64  |
| Sole pepper                                     | 3   | 1.94   |
| Total   | 155 | 100.00 |

Source: Field survey (2009).

**Table 3.** Perceived constraints of the farmers.

| <b>Identified constraint</b>  | <b>Frequency</b> | <b>Percentage</b> |
|---|------------------|-------------------|
| Non-availability of land  | 16               | 10.32             |
| Non-availability of credit  | 155              | 100.00            |
| Low produce price   | 155              | 100.00            |
| Inadequate/high cost of improved input (fertilizers and pesticides) | 155              | 100.00            |
| Lack of extension advice  | 95               | 61.29             |
| Shortage of water irrigation  | 60               | 38.71             |
| Pests and diseases  | 135              | 87.10             |
| High costs of fuel/lubricants                                       | 155              | 100.00            |
| Others constraints (transportation, storage and marketing)          | 255              | 164.52*           |

Source: Field survey (2009). \*Note that the responses add up to more than 100% due to multiple responses.

constraints as highlighted by the respondents are adequately addressed. There appears to be no major labor bottlenecks in dry season farming among the studied farmers as none of the respondent identified non-availability of labor as a constraint. The result in Table 3 shows that only 16 of the respondents (10.32%) have identified non-availability of land as a constraint to their vegetable production. In fact, about 35% of the farmers reported that they owned suitable land lying fallow, while the remaining 55% did not foresee any difficulty in acquiring more land, through leasing/borrowing, if they were to increase their area under cultivation. Interestingly, all the 155 respondents in the area have identified non-availability of credit as constraints to their vegetable production. None of the sampled respondent indicated obtaining credit from any money-lending agency for dry season farming. In planning for effective small-scale irrigation development, provision of credit should be considered as an integral part of the strategy. It is generally believed that provision of credit would enable farmers to purchase such items as water pumps/accessories and other improved inputs that would enhance the efficiency of their vegetable production.

In the same vein, all the respondents identified low

prices of the products, which are highly perishable as a major constraint. An insight into the price movement during the irrigation season indicated that the prices of the major vegetable crops (Tomato, Onion, and Pepper) fluctuate widely. They were generally highest at the beginning of the season but decreased rapidly until they reached their lowest values at the peak of harvest period (around January to March), and farmers are forced to sell their product at low prices, after which the prices began to rise again. Similarly, all the respondents identified the inadequate supply and high price of fertilizer as constraints to their fadama farming. This most likely, explains the under-utilization of this input. The present fertilizer distribution system in the country that appears to favour only the rainy season farming needs to be reorganized. Fertilizer should also be sold at subsidized rate for the benefit of dry season irrigation farmers. Increase in the used of this input will undoubtedly improve farmer's returns. In addition, none of the respondent indicated using improved seeds of the crops grown due to their non-availability and high cost. Most of the farmers interviewed expressed lack of knowledge of where to find them. Although, all the farmers use agro-chemical, they however, complained of its high costs as

**Table 4.** Summary of average costs and returns by enterprise per hectare (₦).

| Enterprise | Freq. | AGR       | ATVC       | AFC       | ATC        | AGM       | ANFI     | ARLLM    | ARLM      | AROR (%) |
|------------|-------|-----------|------------|-----------|------------|-----------|----------|----------|-----------|----------|
| T/O/P      | 43    | 391,218.8 | 191,257.83 | 16,360.33 | 207,618.16 | 199,960.9 | 183,601  | 174,485  | 96,935.5  | 104.55   |
| T/O        | 33    | 365,666.6 | 177,622.16 | 15,389.59 | 223,982.43 | 204,791   | 172,655  | 166,667  | 87,117.62 | 105.87   |
| T/P        | 23    | 409,757.6 | 204,966.4  | 19,016.1  | 223,982.4  | 204,791   | 185,775  | 173,503  | 85,752.4  | 99.91    |
| O/P        | 9     | 432,435.5 | 197,810.4  | 23,417.4  | 221,227.6  | 234,625   | 211,208  | 200,504  | 117,340.3 | 118.61   |
| T          | 7     | 162,761.2 | 230,514.9  | 15,696.5  | 246,211.5  | -67,753.7 | -83,450. | -216,617 | -162,890  | -29.40   |
| O          | 32    | 443,820.6 | 175,892.7  | 14,217.4  | 190,110.1  | 267,928   | 253,711  | 242,232  | 154,683.1 | 152.65   |
| p          | 3     | 443,658.5 | 224,214.4  | 11,097.6  | 235,312.0  | 219,444.0 | 208,347  | 195,542  | 117,992.6 | 97.87    |

Source: Field survey (2007). Key: T = Tomato; O = Onion; P = Pepper; AGR = average gross returns (₦/ha); ATVC = average total variable costs (₦/ha); AFC = average total fixed costs (₦/ha); ATC = average total costs (₦/ha); AGM = average gross margin (₦/ha); ANFI = average net farm income (₦/ha); ARLLM = average returns to land, labor and management (₦/ha); ARLM = average returns to labor and management (₦/ha); AROR = average rate of returns on investment (%).

all the products were bought from open market. Another constraint identified by the respondents in the area is lack of extension services. A large proportion of the farmers have identified lack of extension advice as a major problem militating against their fadama farming. This finding is in line with that of Baba and Etuk (1998) whose study on economics of dry season vegetable farming in Bauchi state revealed that farmers indicated lack of extension advice as one of their major constraint.

Most of the farmers interviewed, demonstrated lack of knowledge of the existent of the extension agents and in the same vein, some farmers have perceived extension agents more as exploitative as positive advisers. Therefore, a very serious effort needs to be geared towards this direction by the concerned authorities. Water shortage is another constraint identified by at least one- third of the respondents. This is more for the shadouf users who depended on wells and other natural sources of irrigation water such as rivers, streams and pond. Some of the wells usually dried-up within the irrigation season leaving the farmer with the alternative of digging shallow wells, which in turn dry up within short periods. This led to reduced yields and returns. Concerted effort is needed to enable the farmers to benefit from the opportunity that exists for increasing profits through increased water availability through the groundwater development strategy. This can be achieved through the sinking of tube wells and boreholes that are more reliable than wash bores which also easily dry up. The erection of small-scale dams could also enhance water availability in the area. It should be noted that availability of reliable water sources would reduce labor consumption and production costs since manual digging of wells would become unnecessary (Baba et al., 1999). Attack on crops through the effect of pests and diseases were considered by 135 respondents representing 87.10% as a major problem limiting the farmers output. Vegetable crops are subjected to a variety of pests and diseases that can

reduce yield and quality of the crop (Ibrahim, 2005).

The findings of this study have further identified other major constraint militating against the dry season fadama farming to include; transportation problem (49.52%), lack of storage facilities (80%) and marketing system (35%). As could be noted, most of the problems put forward by the farmers could be analyzed within the context of the farmer's operational level. When the farmers were asked to proffer solutions to their problems, they simply give in to fatality. This points to the fact that the awareness level of the farmers with regard to a better perception of themselves and their problems is very low due to possibly their low formal educational level. This study, therefore, suggests that there is an apparent need for serious extension work to raise the awareness level of the farmers and to identify solutions to their problems as well as suggest ways on how such solutions can be achieved. Consequently, in planning small-scale irrigation development, these constraints must be clearly brought into focus and strategies designed to alleviate them.

## COSTS AND RETURNS ANALYSIS

In any production process, costs are incurred in producing output and returns are earned from the sales of such output. Table 4 presents summary of average costs and returns to dry season vegetable production under fadama for each enterprise in the study area expressed in ₦/ha. The exchange rate was ₦148 per dollar as at the time of this survey. Table 4 shows the respondents average costs structure per enterprise in ₦/ha. The table revealed that on per hectare basis, sole tomato has the highest ATVC (₦230,514.9) and ATC (₦258,104.05), while the sole onion and tomato/onion combination has the least ATVC (₦175,892.70) and ATC (₦198,999.64), respectively. On the other hand, the onion/pepper had the highest AFC (₦23,417.24), while

the sole pepper had the least (₦11,097.60). The estimated average costs of production incurred by all the respondents as revealed by Table 4 is ₦212,059.56/ha. Since most of the inputs were not purchased, the costs had to be imputed. The total costs of production is made up of both 'variable' percent and 'fixed' components. As shown in the table, the variable cost dominated the production cost, accounting for 92.19 and 87.89% (imputing and not imputing the rent value of land, respectively) of the total cost. This finding is in agreement with those of Baba (1989), Baba and Wando (1998) and Tsoho (2004) who in separate studies found variable costs accounting for 98.40, 99 and 92.55%, respectively, of the total cost of production under dry season irrigation.

The fixed costs in the area accounted for only 7.81 and 12.11% (imputing and not imputing the rent value of land, respectively). This suggests a low level of capital investment in the dry season farming in the study area. In fact, investment in capital items is limited to purchase of pumps and accessories, hoes, cutlasses, and in some cases construction of open and tube wells. The fixed costs was obtained by depreciating the costs of these items, using a straight-line method with assumed zero terminal value. A large proportion of the variable costs were attributable to the labor input, which accounted for more than 50%. This identifies labor as the single most costly input in operating an irrigated dry season farms in the study area. This situation is not unexpected, since all farm operations including land clearing, leveling, channel construction, planting, weeding, watering, digging of wells, and harvesting were accomplished through manual labor. The costs of seeds, fertilizer, agro-chemical, fuel and lubricants were relatively low. The cost of labor was however, dominated by the imputed cost of unpaid family labor which accounted for over 70% (₦78,123.50) of the total labor cost. The cost of family labor, although not directly incurred by the farmers was imputed on the assumption that if the farmer and his family had not worked on his farm, they could have hired out their labor to other farmers. In imputing the costs of family labor, therefore, the prevailing average wage rates in the study area based on age group and gender was used. Hence, one manday of family labor was weighted as one manday of non-family labor. However, as observed by Baba (1998), this needs not to be the case.

In fact, if most of the farmers choose not to engage in dry season farming, they may not find profitable employment on other peoples' farm or elsewhere. Hence, the opportunity costs of family labor may not necessarily be up to the cost of non-family labor. However, for consistency, it is assume to be the same in this study. The variable cost for traditional farmers involving the use of shadouf/calabash in most cases exceeded that of pump users because they employed more labor than pump users. However, the fixed cost for pump was generally higher than that of shadouf/calabash because

pump system requires high fixed capital investment than the other traditional systems. Table 4 shows that the average gross returns (AGR), average gross margin (AGM), average net farm income (ANFI), average returns to farmer's land, labor and management (ARLLM), average returns to farmer's labor and management (ARLM), and the average rate of returns to investment (AROR) were computed for each vegetable enterprise expressed in ₦/ha. The table revealed that all the farmers that are engaged in the dry season vegetable farming for six of the seven identified enterprises realized a positive AGM, ANFI, ARLLM, ARLM and AROR (₦/ha) except for sole tomato. This indicated that all the six enterprises are profitable. The study further shows that sole onion has the highest AGR, AGM, ANFI, ARLLM and ARLM/ha. Interestingly, it has the lowest AFC/ha. Another striking revelation is that of sole tomato which despite having the highest ATVC, it however had a negative AGM, ANFI, ARLLM, ARLM and AROR (₦/ha). This shows that on the average, farmers that grow sole tomato in the area incurred losses. This study agrees with the finding of Ibrahim (2000) who reported an average loss of ₦1,898.00 per hectare for farmers in Galmi District, Niger Republic. He attributed loss incurred to the high cost of inputs and labor coupled with low produce price at harvest.

The negative AROR of -29.40% for sole tomato suggest that on the average a lost of 29k will be incurred on every naira invested in the cultivation of dry season tomato in the area. This situation may not be unconnected with very low prices of the commodity experienced during the period. Similarly, the AGM, ANFI, ARLLM, ARLM and AROR (₦/ha) for all respondents in the study area were computed as revealed by Table 5. The table revealed that, the average gross revenue recorded for all respondents in the area was ₦385,525.36/ha, while the average gross margin, which is the gross revenue minus total variable cost of production including the opportunity cost of family labor input was ₦190,025/ha. The table further shows that the average net farm income of the farmers (obtained by deducting the total cost of production from the gross revenue) was ₦173,465.58/ha. The returns to farmers land, labor and management, which is the net income less the rent value of the farmers land (opportunity cost of farmers land, which represented the amount the farmer would pay if he does not own the land) was ₦163,075.38/ha. The returns to farmers labor and management, which is the net income less the opportunity cost of family labor in the area was ₦84,951.88/ha.

The average rate of returns to total investment including the imputed cost of family labor in the study area was 97.20%. This implies that an average profit of N0.97k was realized on every naira invested in dry season vegetable production in the area, which signifies

**Table 5.** Average costs and returns structure for all respondents (N/ha).

| Item                                    | Costs      | Returns    |
|---|------------|------------|
| Gross revenue (GR)                      |            | 385,525.36 |
| Less                                    |            |            |
| Variable costs (VC)                     | 195,501.00 |            |
| Seed/seedlings                          | 24,789.14  |            |
| Fertilizer                              | 15,230.00  |            |
| Chemicals                               | 8,663.56   |            |
| Fuel                                    | 25,248.54  |            |
| Pump repair/maintenance and lubricants  | 1,773.33   |            |
| Family labor (opportunity cost)         | 78,123.50  |            |
| Non-family labor                        | 36,764.00  |            |
| Total labor                             | 114,887.50 |            |
| Marketing/transportation/others         | 4,908.93   |            |
| Equals                                  |            |            |
| Gross margin                            |            | 190,024.36 |
| Less                                    |            |            |
| Fixed cost (FC)                         | 16,558.56  |            |
| Depreciation on pump/accessories        | 6,950.35   |            |
| Depreciation on tube wells              | 2,835.20   |            |
| Depreciation on shadouf/other structure | 3,880.71   |            |
| Depreciation on farm tools              | 2,892.30   |            |
| Total cost (TC)                         | 212,059.56 |            |
| Equals                                  |            |            |
| Net farm income                         |            | 173,465.58 |
| Less                                    |            |            |
| Imputed rent value of land              | 10,390.42  |            |
| Equals                                  |            |            |
| Returns to land, labor and management   |            | 163,075.38 |
| Less                                    |            |            |
| Imputed cost of family labor            | 78,123.5   |            |
| Equals                                  |            |            |
| Returns to labor and management         |            | 84,951.88  |
| Rate of return to investment            |            | 97.20%     |

Sources: Data analysis (2009).

that on the average the investment is highly profitable.

## CONCLUSION AND RECOMMENDATIONS

This study used descriptive statistics to analyze the socio-economic characteristics of smallholder vegetable farmers in Sokoto State of Nigeria. The result shows that respondents in the area were generally small holders of land acquired mainly through inheritance. Various constraints as perceived by the farmers were identified.

They include; non-availability of credit, low produces price, high costs/non-availability of improved inputs, and high costs of fuel and lubricants reported by all the one hundred and fifty five respondents. Others are non- availability of land, lack of extension advice, shortage of irrigation water, pests and diseases. This study also analyzed costs and returns using the partial farm budget analysis. The gross revenue recorded was ₦ 385,525.36, while the total cost is ₦212,059.56. Similarly, an average gross margin and net farm income of ₦190,024.36 and ₦173, 465.58, were respectively realized by the

vegetable farmers in the area. The rate of returns to owner's labor and management in the area is ₦84,951.88 and the rate of returns to total investment is 97.20%. This indicated that small-scale dry season vegetable production under fadama in the area is profitable.

From the viewpoint of this study, certain crop and crop mixture are more rewarding. The sole onion crop has the highest AGR, AGM, ANFI, ARLLM and ARLM/ha. It is therefore recommended that quite a substantial proportion of land should be devoted to the cultivation of this crop.

## REFERENCES

- Adewumi MO, Omotesho OA (2002). An analysis of production objective of small rural farming households in Kwara State, Nigeria. *J. Rural Develop.* 25 (winter): pp. 201-211.
- Baba KM, Wando MA (1998). Impact of membership of fadama user associations on resources use, crop yield and farm income; A case study from two local government areas of Niger State. Nigeria. *J. Basic Appl. Sci.*, 7: 31-41.
- Baba KM (1998). Irrigation development strategies in Sub-Sahara Africa. Comparative study traditional and modern irrigation systems in Bauchi State of Nigeria'' *Agric. Ecosyst. Environ.*, 45: 47-58.
- Baba KM, Etuk EG (1998). Resource Use Efficiency and Constraints in Irrigated Agriculture: Empirical evidence from Bauchi state, Nigerian *J. Agric. Technol.* 3 (1991). pp. 10-21.
- Bello HM, Singh BR, Garba UA (1998). "Improving strategies for Fadama Farming in Sokoto". Sp Edition ISSN 0189-7543, 2: 17-20. DESA, Department of Economic and Social Affairs (2000). World Population Prospects: The 2000 revision. United Nation population division, Department of Economic And Social Affairs in Badaurakis. *Int. J. Agribus.*, 18(4): 543-558.
- Dogon-Daji SD (2005). Economics of dry season onion production and marketing in Sokoto and Kebbi States. A Ph.D Thesis submitted to the Department of Agricultural Economics and Extention Usman Dan Fodio University, Sokoto, Nigeria.
- Ibrahim ES (2000). Onion Production and Marketing in Galmi district, Niger Republic. Unpublished B. University of Ilorin Sc project to Department of Agricultural Economics and Rural Sociology, ABU, Zaria, Nigeria. p. 64.
- Ibrahim ND (2005). Insect infestation and control of thrips in onion in Sokoto State, Nigeria. A Ph.D. thesis submitted to the Department of crop protection, faculty of Agriculture, University of Ilorin, Ilorin, Nigeria.
- NFDO (2005). Poverty reduction and increased productivity through empowerment. Fadama Development Project. National Fadama Development Office of Projects Coordinating Unit. Federal Ministry of Agriculture and Rural Development, Nigeria.
- Omotesho OA (1991). Determining appropriate charges for Irrigation awter at the Kano River Project, Kano state, Nigeria. Unpublished Ph.D Thesis submitted to the Department of Agricultural Economics, University of Ibadan, Nigeria.
- SMANR (1998). Sustainable Agricultural, Environmental and Rural Development. A survey of report prepared by Sokoto State Ministry of Agriculture and Natural Resources, March, 14th, p. 149.
- Singh BR, Yakouba M (2000). Physico-chemical and hydraulic properties of the fadamd soils in Sokoto-Rima River Basin. Department of soils science and agricultural Engineering, Usman Danfodio University, Sokoto (unpublished data).
- Tsoho BA (2004). Economics of Tomato Production under Small-scale Irrigation in Sokoto State. Unpublished M.Sc Thesis submitted to the Dept. of Agric. Economics and Farm Management. University of Ilorin, Ilorin, Nigeria.