



PROFITABILITY AND CONSTRAINTS OF PERI-URBAN VEGETABLE PRODUCTION IN KADUNA STATE, NIGERIA

¹Saras, J. Z., ¹Oladimeji, Y. U., ¹Sani, A. A. and ²Suleiman, R.

¹Department of Agricultural Economics, Ahmadu Bello University, Zaria-Nigeria

²Department of Agricultural Extension and Rural Development,
Ahmadu Bello University, Zaria-Nigeria

Corresponding Author's E-mail: yusuf.dimeji@yahoo.com **Tel.:** +2348032220000

ABSTRACT

In human nutrition, vegetables are an essential protective food containing vitamins and minerals, any balanced diet should include vegetables and fruits for this reason. The study assesses profitability and constraints of peri-urban vegetable production in Kaduna state, Nigeria. Primary data collected with the aid of structured questionnaire were used for this study through farm survey in 2018. A multistage sampling procedure was used in selecting 217 vegetable farmers for this study. Descriptive statistics, net farm income (NFI) and stochastic profit frontier regression model were used to analyze the data. It was revealed that tomatoes production has the highest profit of N145,580.7 compared with that of cucumber ₦112,992.7 and cabbage ₦78,450.3, respectively. The result showed that the estimated coefficients of (-0.342), agrochemical (-0.216), fuel (0.906) and fixed cost (0.233) were statistically significant. The coefficient of fertilizer implies that a 1% increase in fertilizer cost will decrease the profit made from vegetable enterprise by -0.342 units. Furthermore, the estimated coefficient of fuel cost will increase the profit made from vegetable enter by (0.906) units. The results of inefficiency model showed that the coefficient for age (0.024) was positive and statistically significant at 1% level of probability which implies that younger vegetable farmers are more profit efficient than the older ones. Conversely, the coefficient of household size (-0.027) was negative and statistically significant at 1% level of probability implying that farmers who have large household sizes are more profit efficient than those with few. Unstable market price, high cost of labour and incidence of pest and disease were the most critical constraints faced by vegetable farmers in the study area. It is recommended that; agribusiness industries and non-governmental organization should encourage and support the vegetable famers through provision of farm inputs at a subsidies rate.

Keywords: Profit, Subsidies, Unstable price, Vegetable, Constraints.

INTRODUCTION

The term 'vegetable' can be used to designate the tender edible shoots, leaves, fruits and roots of plants that are eaten whole or part raw or cooked as a supplement to starchy foods and meats (Oladimeji and Abdulsalam, 2014). In human nutrition, vegetables are an essential protective food containing vitamins and minerals, any balanced diet should include vegetables and fruits for this reason. Although horticulture and agriculture have many practices in common such as weeding, fertilizing and watering, horticulture is distinguished from agriculture by its specialized practices, for example, grafting, and by the smaller scale of its operations (Faraja, 2013). The proportion of vegetables required in a balanced diet per capita meal is of the order of 45 % of the total volume of the food (Afodu, 2015). Vegetables are very important component of the diet of most Nigerians as well as an important cash crop for many small-scale farmers. It is found in virtually every part of the country and in most areas vegetable production and consumption are expanding rapidly. This is especially so in regions with



rapidly expanding populations, resulting in large amounts of land in peri-urban being devoted to vegetable production (Yusuf *et al.*, 2015).

Peri-urban was defined by the Office of Rural and Institutional Development (ORID, 1980) as an area where urban and rural development processes meet, mix and inter-react, usually on the periphery of cities. One must recognize that the peri-urban is often not a discrete area, but rather a diffused territory identified by combinations of features and phenomena, generated largely by activities within the urban zone proper.

Due to unpredictable climate change resulting in unreliable and low rainfall, productivity of major food crops such as maize and rice have been unpredictable (Faraja, 2013). This has resulted in a great loss by the farmers and as a result increased rural poverty in some areas. Horticultural crops production such as vegetables could be used as an alternative means or on-farm ground diversification to cope with failure of major food crops and hence contribute to poverty reduction. Furthermore, in spite of the importance of horticultural crop, the sector still remains relatively under-developed. While farming has traditionally been restricted to the rural area, farming especially vegetable production within Nigerian cities is increasingly becoming an important economic activity among a section of the urban dwellers given the increasing number of small garden and vegetable plots springing up in peri-urban parts of the country (Oladimeji and Abdulsalam, 2014; Oladimeji *et al.*, 2016). This is because it serves both as a quick source of food thereby improving nutritional status as well as an employment opportunity for many urban dwellers particularly peri-urban settlers.

Therefore, the data from this study will generate recommendations for enhancing the role of vegetables for diversified income generation in home garden production and possibly commercial farming systems in Nigeria as a developing country. Moreover, information obtained from this study will help policy makers and other development practitioners to make more informed decisions with regard to vegetable production in the study area and Nigeria in general.

Furthermore, this study is important as it will help determine whether or not vegetable production is profitable and identify ways of responding to some of the challenges faced by vegetable farmers and proffer solution-based data to smallholder vegetable farmers in Kaduna State. Subsequently, the outcomes of this study will generate information for policy makers, governmental and non-governmental organizations and all those who are yet to embark on vegetable enterprise in Kaduna state to design and develop effective framework for sustainable livelihood strategies and policies. Following from above; the objective of this study was to assess the profitability and constraints of peri-urban vegetable production in Kaduna State, Nigeria.

MATERIALS AND METHODS

The Study Area

The study area is Kaduna State, Nigeria. The state lies between Latitude 09° 02'' and 11° 32'' North and Longitude 9° 15'' and 8° 60'' East of the Greenwich meridian. The state occupies about 46,016 square kilometers which represent about 5% of the Nigerian land mass of 923,768 square kilometers. The state is made up of 23 Local Government Areas (LGAs), with a projected population of 8,744,908 people as at 2019 projections at 3.2 percent growth rate. The State population structure shows that, majority of the citizens currently live in semi-urban settlements (Maina 2015). The State has northern guinea savanna in the north and southern guinea savanna in the south with a soil mixture of fine sand and clay which has been described as sandy-loam in texture which is arable. The average annual rainfall and humidity are 1,272.5 mm and 56.64 % respectively while the average daily minimum and maximum



temperatures are 15.1 and 35.18 °C (Kaduna State Development Plan, 2017). The physical properties of the soil are moderately good and allow continuous cropping of a wide variety of crops such as maize, rice, sorghum, cassava, cowpea, soya beans, ginger, cotton and vegetable such as: spinach, cabbage, onion, green beans, tomatoes, cucumber, eggplants, lettuce, pumpkin, pepper, and carrots.

Methods of Data Collection and Sampling Technique

Primary data was used for this study through farm survey in 2018. It was collected with the aid of structured questionnaire. The information that was collected includes farmers' socio-economic characteristics, production information; level of inputs used and output, constraints faced by the farmers in vegetable production, and information on household expenditure. A multistage sampling procedure was used in selecting respondents for this study. The first stage involves random selection of three (3) Local Government Areas (LGSs): Kudan, Zaria and Soba out of nine LGAs that have peri-urban set up and known to have intensive vegetable production. Other LGAs are: Giwa, Igabi, Ikara, Kubau, Makarfi and Sabon Gari (KADP 2017). The second stage involved random selection of four villages each from the three LGAs selected making a total of twelve villages through balloting system. Finally, using Yamane (1967) in equation 1 formula for calculating the sample size based on the assumption of 5% expected margins of error, 95 % confidence interval. Two hundred and seventeen (217) vegetable farmers and 45.7 % of sample frame were randomly selected from the twelve villages.

$$n = \frac{N}{1+N(e)^2} \quad \dots(1)$$

N = the population under study, n = the desire sample and e = the limit of tolerable error (0.05).

$$n = \frac{475}{1+475(0.05)^2} = \frac{475}{1+475 (0.005)} = \frac{475}{1+1.875} = \frac{475}{2.1875} = 217$$

Analytical Techniques

Descriptive statistics, net farm income (NFI) and Logit regression model were used to analyze the data. NFI in equation 2 was used to determine the profitability of vegetable production. The total cost of production includes both total variable cost and total fixed cost. Total variable cost includes; cost of seed, cost of fertilizer, cost of labour, cost of agrochemicals, cost of fuel and transportation while total fixed cost include cost of rent of land and depreciation of tools used in farming. Thus, the model is stated as follows:

$$NFI = TR - TC \quad \dots(2)$$

where; NFI = net farm income (Naira/ha), TR = total revenue (Naira/ha), TC= total cost of production (Naira/ha). The fixed inputs were depreciated using the straight-line method.

Also, this study incorporated Return per naira invested to determine the profitability of vegetable production. Return per naira invested (RNI), is obtained by dividing the gross income (GI), over the total cost (TC).

Therefore, the model in equations 2 and 3 adopted from Mohammed *et al.*, 2016, Oladimeji *et al.*, 2018 is stated thus:

$$RNI = \frac{GI}{TC} \quad \dots(3)$$

where; RNI = return per naira invested, GI = gross income (₦), TC = total cost (₦).

The stochastic frontier model was used to achieve factors affecting profitability of vegetable production as adopted by Maina (2015). The empirical Model is specified as:

$$\ln Y = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \beta_5 \ln X_5 + \beta_6 \ln X_6 + (V_i + U_i) \quad \dots(4)$$

where; ln = the natural logarithm, Y = Normalized total profit of vegetable (₦/ha with vegetable equivalent values), X₁ = cost of seed (₦/ha),

X_2 = cost of fertilizer (₦/ha), X_3 = cost of labour (₦/ha), X_4 = cost of agrochemical (₦/ha), X_5 = cost of fuel (₦/ha), X_6 = cost of transportation (₦/ha), β_0 = constant term, $\beta_i - \beta_6$ = regression coefficients, v_i = random variability in the profitability that cannot be influenced by the farmer and u_i = deviation from maximum potential profit attributable to profit inefficiency of the farmer.

The inefficiency model (Maina, 2015) is stated thus:

$$U_i = \delta_0 + \delta_1 \ln Z_1 + \delta_2 \ln Z_2 + \delta_3 \ln Z_3 + \delta_4 \ln Z_4 + \delta_5 \ln Z_5 + \delta_6 \ln Z_6 \quad \dots(5)$$

where; U_i = inefficiency effects, Z_1 = age of farmer (years), Z_2 = household size (number), Z_3 = formal education (years), Z_4 = farming experience (years), Z_5 = access to extension services (number of extension contact/season), Z_6 = membership of cooperative society (years), δ_0 = constant and $\delta_i - \delta_6$ = parameters to be estimated.

RESULTS AND DISCUSSION

Types of Vegetable Grown

Figure 1 revealed the different types of vegetable products grown by the vegetable farmers in the study area. The result shows that tomato was grown by 52.46% of the smallholder vegetable farmers, followed by those who plant cabbage (13.11%) cucumber (5.46%). However, the proportion of farmers who reported producing a combination of the vegetable products was apparent. For example, those who farm tomato with cucumber 12.02 %, tomato and cabbage 10.38%, tomato, cabbage and cucumber (3.28 %) while a relatively small number of farmers reported growing cucumber and cabbage (3.28 %). The reason given for this combination is that it is partly due to differences in profitability of the products, and availability of customers. This agreed with the findings of Iyabo *et al.* (2016). That farmer preferred to cultivate vegetables with higher profit, good number of customers and suitable to climate compared to the vegetables with either low profit and low number customers.

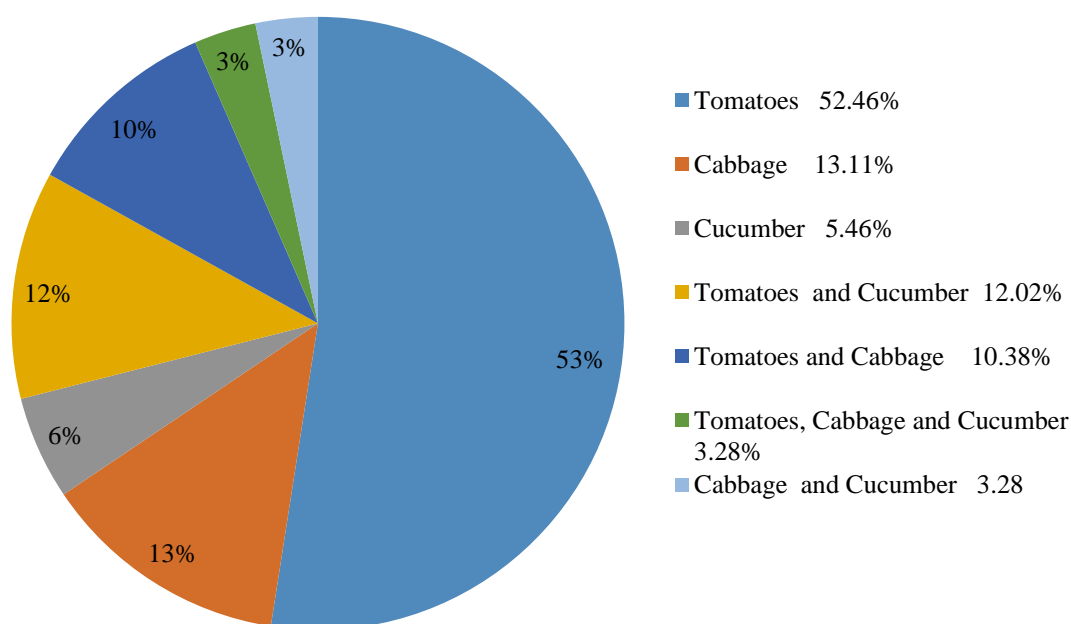


Figure 1: Distribution of farmers according to vegetable grown in the study area



Profitability Analysis of Vegetable Farming

Net farm income analysis was used to determine the profitability of the vegetable farmers. Table 1 gives the summary of costs and returns statistics of profitability of selected vegetables in the study area. The average quantity of seed used was 0.91 kg per ha with an average market price of ₦ 2,300 per kg was used and this constitutes about 2 - 3.1 % of the total cost of production. Labour costs consisted of cost of land preparation, nursery beds, transplanting, fertilizer application, spraying, weeding, and harvesting. The family labour was computed on the basis of opportunity cost in man-days. The wage rate varied according to farm operation performed. An average wage rate of ₦750 per man-day was used. Labour constitutes about 22-24% of the cost of production in the three vegetable enterprises. The average cost of fertilizer used was ₦8,085 of 50 kg. Fertilizer constitutes about 20 - 24% cost of vegetable production. The vegetable farmers make use of agrochemical which constitute about 4 -5.2 % of the cost of production. The cost of fuel used for season vegetable farming which constitute about 20 - 24 % of the cost of production. Transportation of vegetable product from the farm to the market constitutes about 8 - 17 % of the cost incurred. While the total cost of fixed inputs comprises depreciation of tools such as sprayer, generator, big and small hoe, hose, spraying can be incurred on vegetable production constitutes about 11.1 - 11.3 % of the cost of production.

Table 1: Profitability analysis of selected vegetable farming in the study area

| Variable / ha | Tomato | % | Cucumber | % | Cabbage | % |
|---------------------------|---------|------|----------|------|---------|------|
| Total revenue (TR) | 252,124 | | 197,947 | | 186,855 | |
| Variable cost (VC) | | | | | | |
| Seed | 2,383.7 | 2.2 | 2,640.30 | 3.1 | 3,319.9 | 3.1 |
| fertilizer | 24,467 | 23.0 | 17,820 | 21.0 | 22,490 | 20.8 |
| Labour | 25,504 | 24.0 | 20,765 | 24.4 | 23,580 | 22.0 |
| agro- chemicals | 5,477.4 | 5.2 | 4,776 | 6.0 | 5043.4 | 4.7 |
| Fuel | 21,575 | 20.0 | 20,196 | 24.0 | 23,145 | 21.4 |
| transportations | 14,858 | 14.0 | 6,750 | 8.0 | 18,818 | 17.4 |
| total variable cost | 94,267 | 88.7 | 72,947 | 86.0 | 96,397 | 88.2 |
| cost of renting land | 8,234.9 | 7.75 | 8,234.9 | 9.7 | 8,234.9 | 7.0 |
| depreciation | 3,771.9 | 3.6 | 3,771.90 | 4.4 | 3,771.9 | 3.5 |
| total fixed cost | 12,006 | 11.3 | 12,006 | 14.1 | 12,006 | 11.1 |
| total cost | 106,273 | | 84,954 | | 108,404 | |
| net farm income (TR-TC) | 145,850 | | 112,992 | | 78,450 | |
| return per naira invested | 2.37 | | 2.33 | | 1.72 | |

Note: The % denote the percentage contribution of each cost

In summary, the result showed that the TVC of tomato was ₦94, 267.00 and the total cost of tomato production was ₦106,273.9. The total revenue of tomato production was ₦252,124.6 and the net farm income was ₦145,850.7. The return on naira invested showed that for every ₦1 invested in tomato vegetable production, a return of ₦2.37 kobo was made. This implies that vegetable production is profitable in the study area.

Similarly, TVC of cucumber production was ₦72, 947.40 and the total cost was ₦84,954.3. The total revenue of cucumber production was ₦197, 947. The net farm income was therefore ₦112,992.7. The return on naira invested showed that for every ₦1 invested in cucumber vegetable production, a return of ₦2.33 kobo was made. This implies that cucumber



production is profitable in the study area. TVC of cabbage was ₦96,397.80 and the total cost of cabbage ₦108,404.7. The total revenue of cabbage production was ₦78,450.3. The return on naira invested showed that for every ₦1 invested in cabbage production, a return of ₦1.72 kobo was made. This implies that cabbage production is profitable in the study area.

From the findings, it was revealed that tomatoes production has the highest profit of ₦145,580.7 compared with that of cucumber ₦112,992.7 and cabbage ₦78,450.3, respectively. This implies that the revenue generated from tomato production in a hectare is higher. Thus, it can be concluded that vegetable production in the study area though on a small scale, was economically viable.

Factors Affecting Profitability of Vegetable Production

Stochastic frontier model was used to determine the factors affecting the profitability of vegetable production. MLE of the stochastic frontier model for profit efficiency of vegetable are presented in Table 2. The study revealed that the generalized log likelihood function was -93.151. The log likelihood ratio value represents the value that maximizes the joint densities in the estimated model. Thus, the functional form that is, Cobb-Douglas used in this estimation is an adequate representation of the data.

Table 2: MLE Results of Frontier profit Efficiency of vegetable Production and inefficiency model

| Variable | Parameters | Coefficient | Std. error | t – Value |
|------------------------------|--------------|-------------|------------|-----------|
| Production variable | | | | |
| Constant | β_0 | 5.694*** | 0.977 | 5.828 |
| Seed | β_1 | -0.181 | 0.249 | -0.726 |
| Fertilizer | β_2 | -0.342*** | 0.115 | -2.968 |
| Labour | β_3 | -0.093 | -0.061 | -1.546 |
| Agrochemical | β_4 | 0.216* | 0.114 | 1.882 |
| Transportation | β_5 | -0.135 | 0.169 | -0.799 |
| Fuel | B_6 | 0.906*** | -0.81 | 11.216 |
| Fixed cost | B_7 | 0.233* | 0.118 | 1.98 |
| Inefficiency variable | | | | |
| Constant | Z_0 | 0.501** | 0.214 | 2.336 |
| Age | Z_1 | 0.024*** | 0.009 | 2.623 |
| Household size | Z_2 | -0.027*** | 0.010 | -2.699 |
| Education | Z_3 | -0.009 | 0.013 | -0.776 |
| Farming experience | Z_4 | 0.004 | 0.008 | 0.053 |
| Extension visits | Z_5 | -0.004 | 0.027 | -0.159 |
| Membership cooperative | Z_6 | -0.057 | 0.074 | -0.755 |
| Diagnostic Statistic | | | | |
| Sigma-squared | (σ^2) | 0.573*** | 0.183 | 3.127 |
| Gamma | (γ) | 0.49*** | 0.033 | 15.019 |
| Log likelihood function | L/f | -93.151 | | |
| LR test | | 19.564 | | |
| Number of observations | | 183 | | |

Note: ***, **, *, denote significant at 1%, 5% and 10% respectively



In Table 2, the gamma (γ) estimates of 49 % which is statistically significant at 1 % level of probability implies that 49 % of random variation in the profitability of the farmers was due to the farmer's inefficiency and not as a result of random variability. Since these factors are under the control of the farmer, reducing the influence of the effect of γ will greatly enhance the technical efficiency of the farmers and improve their profit. The value of sigma squared (σ^2) was 0.57 which was also statistically significant at 1 % level of probability. This indicates a good fit and correctness of the specified distributional assumptions of the composite error terms.

The result showed that the estimated coefficients of (fertilizer $P < 0.01$ fuel $P < 0.01$ and depreciation on tools $P < 0.10$) were statistically significant, except for seed, agrochemical, labour and transportation which were not significant. The coefficient of fertilizer with respect to profit was -0.342 statistically significant at 1% level. This implies that a 1% increase in fertilizer cost will decrease the profit made from vegetable industry by -0.342 units. The reason may be that, the recommended practices were not properly utilized as evident from the comparison of the actual variable inputs applied, or it could be attributed to over application or misapplication of these resources. Fertilizer is a major land augmenting input because it improves the quality of land by raising yields per hectare. The coefficients of fertilizer (-0.717) were negatively related to the output of farmers. This could be attributed to over utilization or misapplication of these resources.

The estimated coefficient of fuel cost (0.906) was positive and statistically significant at 1% level of probability. This implies that a 1% increase in fuel cost will increase the profit made from vegetable industry by (0.906) units. Fuel cost accounted for about 9% of the total cost of vegetable production and therefore, more of this variable will increase the profit made from vegetable production. Also, the coefficient of depreciation on tools (0.233) was positive and statistically significant at 1% level of probability. This implies that a 1% increase in the cost of tools, will increase the profit made from vegetable industry by (0.233) units. This revealed that the tools are important cost component which greatly influenced the profit made from vegetable production. The result of this research agrees with the findings of Babangida (2016) where they reported direct effect on cost of production in their study on economies of scale and cost efficiency in cotton production in Nigeria.

The MLE of the Stochastic Frontier Model for Profit Inefficiency Variables

Socio-economic variables were considered and estimated in the model and the results were presented in Table 3. The result showed that the coefficient for age was positive and statistically significant at 1% level of probability. This implies that younger vegetable farmers are more profit efficient than the older ones. This finding is similar to that of Babangida (2016). The possible reason given may be due to the fact that as the farmers advanced in age, inefficiency in resource use increases while profit inefficiency increases.

The coefficient of household size (-0.23) was negative and statistically significant at 1% level of probability. This implies that farmers who have large household sizes are more profit efficient than those with few. As the number of people in a household increase, a pool of family labour becomes available and this leads to specialization. This agrees with Muhammad *et al.* (2016) that large household size depicts common characteristics of rural households particularly in Northern Nigeria where polygamy is mostly practiced and family labour is utilized for farming activities.

Frequency Distribution of Profit Efficiency Estimates of Vegetable Farmers

The profit efficiency estimates presented in Table 4, indicate that it ranged from 0.25 to 0.99 with a mean profit efficiency of 0.61. This implies that on average 61% of profit was obtained by the farmers. This is an indication that the profit from vegetable was 39% below the potential profit due to inefficiency of the farmers. Therefore, in the short run, there is room for increasing the profit by 39% through proper use of inputs optimally. It can be seen that about 28.42% of the respondents had efficiency score between 55 to 69% while about 13.11% of the vegetable farmers had profit efficiency of between 0.85 and above. The result indicates that average vegetable farmer in the study area would enjoy cost saving of about 39. (1-0.61/0.99x100) per cent if he is to attain the level of the most profit efficient farmer among the respondents. The most profit inefficient farmer will have an efficiency gain of 61% (1-0.25/0.99x100) in vegetable production if he is to attain the efficiency level of most profit efficient farmer in the state.

Table 3: Frequency distribution of profit efficiency

| Profit efficiency | Frequency | % |
|-------------------|-----------|-------|
| 0.25-0.39 | 19 | 10.38 |
| 0.40-0.54 | 54 | 29.51 |
| 0.55-0.69 | 52 | 28.42 |
| 0.70-0.84 | 34 | 18.58 |
| 0.85-0.99 | 24 | 13.11 |
| Total | 183 | 100 |
| Mean | 0.61 | |
| Minimum | 0.25 | |
| Maximum | 0.99 | |

Constraints faced by Vegetable Farmers

The constraints faced by vegetable farmers in the study area were ranked according to their severity as stated by the farmers (Table 4). The result reveals that 77.6% of the respondents identified unstable market price to be their major constraint, which was very severe. Daily fluctuation in market price especially during harvest periods has posed a great challenge to farmers generally. Farmers always desire to sell their farm produced at a higher price, but reverse was the case.

High cost of labour was severe in the study area. About 73.2% of the respondent identified high cost of labour to be one of their major challenges. Although family labour was used, but hired labour was mostly employed. Scarcity is usually characterized by high cost of input variables of production; therefore, the high cost of labour could imply unavailability of labour. Hence the amount charged per man-day was high. This explains the reason behind the high cost of labour and agrees with Maina (2015) who opined that high cost of labour and shortage of capital are considered to be the greatest constraints.

Pest and disease were also considered to be another factor that negatively influences the yield of vegetable produce. About 57.4% of the respondents identify it as such. This was link with inadequate fund and the coping strategy employed by the farmers was through personal savings and borrowing from friends to purchase agro-chemicals.

Fund was also cited as one of the constraints to vegetable production (44.8%) in the study area. This may account for the reason most respondents are small-scale farmers. Also, the stringent conditions and bureaucratic bottleneck of credit institutions shy farmers away



from obtaining loans to finance their farm operations. Credit is a very strong factor that is needed to acquire or develop any enterprise; its availability could determine the extent of production capacity. It agrees with findings of Nasiru, (2014) who noted that access to micro-credit could have prospect in improving the productivity of farmers and contributing to uplifting the livelihoods of disadvantaged rural farming communities. Another problem considered as being moderate by the respondents is lack of access to market of vegetable. This is perceived by about 31.7% of the respondents. This may be due to poor road network in some areas of vegetable farming especially during rainy season.

Table 4: Production constraints faced by vegetable farmers

| Constraints | *Frequency | % | Rank |
|------------------------------------|------------|------|------|
| Unstable market price | 142 | 77.6 | 1st |
| High cost of labour | 134 | 73.2 | 2nd |
| High incidence of pest and disease | 105 | 57.4 | 3rd |
| Inadequate credit facilities | 82 | 44.8 | 4th |
| Inadequate access to market | 58 | 31.7 | 5th |

*Multiple responses were allowed.

CONCLUSION AND RECOMMENDATIONS

Based on the findings from the study, it can be concluded that investment in vegetable production is a viable enterprise for income generation, poverty alleviation, job creation and improvement in the standard of living to every household since it is a profitable venture. Increase in the cost of fertilizer was found to decrease the profit of vegetable. It is recommended that; agribusiness industries and non-governmental organization should encourage and support the vegetable farmers through provision of farm inputs at a subsidies rate. In the light of these findings, necessary policies are needed in empowering peri-urban vegetable farming to enhance their income through vegetable potentials thereby reducing poverty in the study area.

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