IJAAR PUBLISHING® DOI: 10.46654

International Journal of Advanced Academic Research | ISSN: **2488-9849**
Vol. 7, Issue 7 (July, 2021) | www.ijaar.org

COST-BENEFIT ANALYSIS OF CUCUMBER PRODUCTION UNDER IRRIGATION MANAGEMENT

***Godfrey C. Onuwa[1], Bassey A. Emmanuel[2], Ubana Eshimutu[3], Victor Fatoke[2] and Jesse Birma[1]**

[1]Department of Agricultural Extension and Management, Federal College of Forestry, Jos, Plateau state, Nigeria.

[2]Montanne Research Station, Forestry Research Institute of Nigeria, Jos, Plateau state, Nigeria.

[3]Northern Guinea Savannah Research Station, Nasarawa state, Nigeria.

*Corresponding author:onuwag@gmail.com (08035606473)

Abstract

Cucumber production under irrigation management can contribute to household economic empowerment if efficiently produced due to good remunerative incomes obtainable by the farmers from increased output levels relative to other vegetables. This study analyzed the profitability and constraints of cucumber production under irrigation management. Multi-stage sampling techniques were adopted in selecting 92 respondents for this study. Data collected was analyzed using descriptive statistics and farm budget analysis. The results revealed that most (50%) adopted hose & water pump as an irrigation practice; however, the level of adoption of these practices among the farmers was very low. In addition, the estimated gross and net farm incomes were ₦292,500/ha and ₦201,500/ha respectively. Also, the percentage profit margin and benefit-cost ratio were 72% and 2.21 respectively; these ratios are indicative of the profitability index of cucumber farming in the study area. The result also revealed that the identified constraints significantly affected cucumber production in the study area, these factors include; inadequate capital (95.6%), high cost of irrigation facilities/technology (85.9%), inadequate water supply (82.6%), inadequate agricultural inputs (76.1%), labour cost (72.8%), poor access to microcredit (70.6%), low farm output (63%), lack of extension contact (45.6%), fragmented farm holdings (41.3%)and pest and diseases (32.6%).Improved access to farm capital, agricultural credit, input, technology, water supply, extension services and policy modifications are strongly recommended.

Keywords: Benefit-cost ratio, constraints, farm output, irrigation practice, farm budget, vegetable production

1.0 Introduction

Cucumber (*cucumis sativus*) is an important vegetable. It is an annual vegetable vine crop grown for the fresh fruits. The crop originated from Europe and some parts of Africa, including Nigeria it is thought to be one of the oldest vegetable crop cultivated by man with historical record, dating back to 5,000 years ago (Wehner and Cramer, 2004). In most Nigerian households, vegetables are consumed as a source of minerals and vitamins and in some case as substitutes to the more expensive animal protein. In spite of these economic potentials, in the Nigerian economy, most Vegetable Farming Households (VFH) are small scale producers (Asogwa *et al*., 2012). Poverty contributes to poor agricultural productivity, as many farmers cannot afford to purchase necessary farm inputs such as fertilizer, pesticides and improved seeds, which would bring about increased productivity. Smallholder farming is the predominant form of agricultural production in sub-Saharan Africa (SSA) and also an important tool in poverty eradication in the region. Nigeria is one of the countries (in SSA) where self-sufficiency in food production remains a critical challenge even in the absence of wars and natural disasters (FAO, 2005; Khan and Ali, 2013). A sustainable production of vegetables to meet the demands of an ever increasing population in the country has been an issue of great concern (Khan and Ali, 2013). This is because the domestic demand for vegetables is met essentially from local production with importation of fresh vegetables into Nigeria been uncommon. It is acknowledged that increased agricultural productivity would help in attaining the needed food security. Enhanced productivity is a combination of measures designed to increase the level of farm resources as well as to make efficient use of resources (Adeyemo and Kuhlmann, 2009). The efficient use of farm resources is germane for agricultural sustainability (Goni et al., 2013) and a prerequisite for optimum farm production since inefficiency in resource use can distort food availability and security (Etim et al., 2005). Despite all the economic potential of the crop, the full production potential have not been realize in Nigeria, yields obtained by farmers is often low and especially in intensive cropping area due to low technical efficiency in production. Developing countries faced increasing demand of vegetable due to increase in population (Arsanti *et al*., 2007*)*. Yield differences was observed among farmers due to variations in their input utilization; indicating the existence of inefficiency in input usage *(*Khan and Ali, 2013). In Nigeria today there is a decline in agricultural production because there is an apparent shift of interest from agriculture which further worsens the poverty index, hunger and unemployment of Nigerians, especially the youth (Shrestha *et al*, 2015). The study was also designed to give policy implication of improving cucumber production to ensure increase in output levels (Shrestha *et al*, 2015). Given that cucumber is an important crop of high nutrition and economic value, concerted efforts must be made to stimulate the interest in its production at a commercial scale.

Cucumber can contribute to the economic empowerment if efficiently produced due to good remunerative incomes obtainable by the farmers from increased output levels, when compared to other local fruits vegetables. Research has been shown that, it is more profitable to produce cucumber during the dry season as it lead to higher quality produce due to low incidence of diseases (Khan *et al*., 2015*)*.Irrigation scheme in developing countries especially in sub-Sahara Africa (SSA) suffer from very poor access to irrigation technology and water resources; most ready available water resources have been mobilized already, thus expansion of irrigated farm lands should come from the development of small water deposits of smallholder farms such as small reservoir and shallow ground water. The optimal use of these limited resources is essential; the adoption of small-scale low cost technology by small holder farmers in Africa has great potential and could be one of the solutions for increasing food

production, farmers' incomes and improving food security (Van Leenwen, 2001). Most farmers who practice off season cucumber farming generally lack the necessary information on its economics due to dearth of literature and data. The introduction of irrigation is seen as a solution to the problem of low agricultural productivity, particularly in Nigeria. Irrigation has been defined as the method in which controlled amount of water is supplied plant at regular intervals for agricultural purpose. It is used to assist in growing of agricultural crops, maintenance of landscape, and vegetation of disturbed soil in dry area and during the period of inadequate rainfall. Small scale irrigation if implemented can mobilize indigenous knowledge and skills at a low investment cost, while increasing farm productivity (FAO, 2004). The irrigation area in Nigeria has increased by over 100% from an estimate of fewer than 20,000 hectares in the early 1970s to about 200,000 hectares in the 2000s (Owombo, *et.al*., 2005). Today with the increasing awareness of the people and government supportive role in developing irrigation throughout the country, irrigation activities have been boosted more than it was before. Dry season farming has become an important income generating occupation in Nigeria, which is characterized by intense mixed cropping. Irrigated agriculture will need to expand rapidly in the future in order to cope with this rising demands. However, water resources are limited and irrigation is very labour demanding because in many urban and semi-urban farming, irrigation water is carried by hand from the well, reservoir or river to the field (Van Leeuwen, 2001). Irrigation schemes in developing countries especially in sub-Sahara Africa (SSA) suffer from very low water use efficiency, resulting in water logging and salinity problems. Most readily available water resources have been mobilized already and a large part of the expansion of the irrigated area should come from the development of smallholder water deposits on farms such as small reservoirs and shallow groundwater. The optimal use of these limited resources is essential. The adoption of small-scale low-cost irrigation technologies by small-holder farmers in Africa has great potential and could be one of the solutions for increasing food production, farmers' incomes and improving food security (Van Leeuwen, 2001; Hillel, 2001).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. 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. Farmers encounter challenges in crop production as well as other market risks that affect returns on investment. A number of other constraints are also associated with cucumber production particularly during off-season farming, these factors may include; inadequate water supply, lack of agrochemical and fertilizer, pricing and grading, transportation and storage, etc. In Nigeria the output from cucumber production is low and therefore there is need to evaluate the profitability of cucumber production under irrigation management. In this light this research paper intends to identify the variants of irrigation practices, profitability and constraints of cucumber production, while the specific objectives of this study are to;

i. identify the typology of irrigation practices among the respondents;
ii. estimate the costs and return of cucumber production; and
iii. identify the constraints of cucumber production.

2.0 Methodology

2.1 Study Area

Jos-east Local Government Area (LGA) is in Plateau state, Nigeria. It is located between latitude 9°55N to 9°06E and longitude 917°N to 9.100°E. It has a total land mass of 1,020km^2 (390sq/m), scattered with bushes and grasses, rocky out crops and fragments; with

a projected population of 115,700 (NPC, 2006). It has an average rainfall of 1411mm and comprises of five (5) districts; Fobor, Fursum, Shere, Maigemu and Federe. It is landscaped with high plains of rocks that range from 1220m to 1450m above sea level (DESA, 2000).

2.2 Sampling Technique

A multi stage sampling technique was employed for this study, in the first stage, Jos east LGA was purposely selected due to the prevalence of cucumber farmers and dry season vegetable farming activities. The second stage entails random selection of some villages from each district. Sample size was estimated from the sample frame using a content sampling proportion to determine the number of respondents used for the study. The last stage involved the selection of one hundred and three (103) respondents representing three percent (3%) of the total population. Table 1 presents the sample frame distribution.

Table 1: Sample Size of the Respondents.

District	Selected village	Sample frame	Sample size
Fobor	5	683	21
Fursum	5	667	20
Shere	3	308	9
Maigemu	7	922	28
Federe	5	840	25
Total	**35**	**3420**	**103**

Source: field survey, 2017

However, for the purpose of this study only 92 questionnaires were retrieved.

2.3 Method of Data Collection

Primary data were collected from cucumber farmers in the study area, through the administration of well-structured questionnaires, oral interviews and physical observation.

2.4 Analytical Techniques

Descriptive statistics (such as frequency counts, percentages and means) were used to analyze objectives i and iii. The farm budget model was used to analyze objective ii.

2.4 Model Specification

2.4.1 Farm Budget Model

The farm budget model adopted for this study was the costs and returns analysis. Indicators such as net farm income, percentage profit margin and return per naira invested were analyzed to achieve objective ii. The budgetary techniques are presented in equation (1);

Net farm income (N.F.I) = GFI –TC ……. (1)

Where;
GFI = gross farm income
TC = Total cost
TC = TVC = TFC……. (2)
TVC = Total variable cost [Seed (₦), fertilizer (₦), labour (₦), and agrochemicals (₦)]
TFC = Total fixed cost [Land improvement (well, drainage, boundary mark, etc.) (₦) and depreciation of farm tools/equipment's (₦)].

The straight line method of evaluating depreciation will be used to estimate the depreciation of farm assets (farm tools, equipment's, irrigation facility, etc.) (₦). The straight line method of depreciation is specified in equation (3);

$$D = \frac{P - S}{N} \quad \ldots\ldots. (3)$$

Where;
D = Depreciation
P = Purchase price of the assets
S = Salvage value of the assets
N = Number of years of life of the assets
To further substantiate the profitability of this enterprise, profitability ratios such as: percentage (%) profit margin and benefit-cost ratio were analyzed and specified in equations (4) and (5);

Percentage (%) Profit margin = Net farm income/Total revenue x 100% ……. (4)
Benefit-cost ratio= Net farm income/Total cost ……. (5)

3.0 Results and Discussion

3.1 Irrigation Practices Adopted

Table 1: Distribution based on Irrigation Practice Adopted by the Respondents

Irrigation practice	Frequency	Percentage (%)
Drainage channels	33	35.8
Drip irrigation	6	6.5
Hose & water pump	40	43.5
Watering can /Bucket	3	3.3
Channel reservoir	10	10.9
Total	92	100

Source: field survey 2017

Table 1 revealed that most (43.5%) of the respondents adopted hose & water pump as an irrigation practice in the study area. Also drainage channels (35.8%) was indicated as a significant irrigation practice among the respondents, suggesting that irrigation practices were prevalent among the cucumber farmers however the level of adoption of this practices was significantly low due to factors such as, cost of adoption, poor access to facilities, lack of technical expertise in managing irrigation facilities, etc. Irrigation practice adopted determines and enhances efficiency among the farmers by ensuring adequate water supply which is a key requirement for optimum growth and output and hence sustainable farm profitability. However, the acquisition or lease and maintenance of these irrigation facilities are capital intensive and may therefore translate into high production cost which in turn affects the net farm income of the farmers. Moreover, none of the farmers adopted drip irrigation which is a very advanced and efficient irrigation system in crop production; attributable to its high cost of adoption and poor access to the technology.

3.2 Farm Budget Analysis

Table 2: Costs and Return Analysis of Cucumber Production per Hectare

Items	Quantity	Amount (₦)	Percentage (%)
A. Output			
i. Cucumber output	1,950kg/ha		
ii. Unit price per kg	₦150/kg		
B. Gross farm income	₦292,500		
C. Variable cost items:			
iii. Seed	350g/ha	14,000	15.4
iv. Inorganic Fertilizer	50kg	15,000	16.5
v. Organic fertilizer	150kg	3,000	3.3
vi. Labour cost	70 man-days	25,000	27.5
vii. Agro-chemicals	4lts	4,000	4.3
viii. Irrigation cost (lease/fuel/maintenance)		5,000	5.5
D. Total Variable Cost (TVC)		66,000	72.5
E. Fixed cost items:			
ix. Land improvement (Well, drainage, etc.)		20,000	22
x. Depreciation of farm equipment's		5,000	5.5
F. Total Fixed Cost (TFC)		25,000	27.5
G. Total Cost (T.C)		91,000	100
H. Net Farm Income (NFI) (B - G)		201,500	
I. % Profit margin(H/B)			68.9
J. Benefit-Cost ratio(H/G)		2.21	

Source: Field Survey 2017

Table 2 revealed that the net and gross farm income of cucumber production were ₦201,500/ha and ₦292,500/ha respectively, suggesting that cucumber production was a relatively profitable venture with prospects for improved economic potentials. The estimated total variable and total fixed cost were ₦66,000/ha and ₦25,000/ha respectively, suggesting that a significant proportion of the gross farm income was expended as production cost. The estimated total cost for cucumber production was ₦91,000/ha. Labour cost (27.5%) constituted the most significant production cost. Land improvement (22%) and inorganic fertilizer (16.5%) were also indicated as significant production cost components. The estimated percentage profit margin was 72%, which suggests the percentage net margin accruable to the farmer from the estimated gross margin. The benefit-cost ratio was 2.21, which is indicative that for every naira (₦1) invested in cucumber production ₦2.21 can be accruable in return. These ratios are indicative of the profitability index of cucumber farming in the study area. This corroborates with the findings of Goni *et al*., (2013) who also reported similar results in their study on dry season vegetable production.

3.3 Constraints of Cucumber Production

Table 3: Constraints Associated with Irrigated Cucumber Production.

Variables	Frequency	Percentage (%)
Inadequate capital	88	95.6
High cost of irrigation facilities/technology	79	85.9
Inadequate water supply	76	82.6
Inadequate agricultural inputs	70	76.1
High cost of labour	67	72.8
Poor access to microcredit	65	70.6
Low farm output	58	63
Lack of extension contact	42	45.6
Fragmented farm holdings	38	41.3
Pest and disease	30	32.6

Source: field survey 2017; * = Multiple responses

Table 3revealed that the identified constraints significantly affected cucumber production in the study area, these factors include; inadequate capital (95.6%); attributable to farmers poor access to adequate farm capital and agricultural credit, high cost of irrigation facilities/technology (85.9%); attributable to the absence of government and stakeholders interventions and input support, inadequate water supply (82.6%); attributable to poor access to water resources for irrigation activities, this poses a serious constraint to dry season cucumber farming, as the plant requires steady and consistent water supply; inadequate agricultural inputs (fertilizers, improved seeds, agrochemicals, etc.) (76.1%); attributable poor access and high cost of agricultural inputs among farmers constrain cucumber production in the study area. Labour cost (72.8%); attributable to the push factors of agricultural production that results in farm labour migration to other subsectors, poor access to microcredit (70.6%); attributable to the absence of formal financial institutions in the study area which results in financial exclusion especially among the farmers, low farm output (63%); attributable to the subsistent level of agricultural production and poor resource utilization among the farmers, lack of extension contact (45.6%); attributable to farmers poor access to extension services, fragmented farm holdings (41.3%); attributable to tenure policies which results in intense fragmentation of farmlands; and pest and diseases(32.6%); attributable to the prevalence of poor management practices among the farmers. This

corroborates with the findings of Goni *et al*., (2013) who also reported similar results in their study on dry season vegetable production.

4.0 Conclusion and Recommendations

This study revealed the variants of irrigation management practices among the respondents; however, the level of adoption of these practices among the farmers was very low. Also, cucumber production was relatively profitable, with prospects for improved economic potentials. Moreover, there is need to address all the constraints associated with cucumber production so as to improve the farm efficiency, output and subsequent income derivable therein. The identified factors were significant constraints to cucumber production among farmers in the study area. Based on the findings of this study, the following recommendations are made for policy actions to improve farm output and incomes derivable;

i. Policy formulation to improve access to farm capital and agricultural credit.
ii. Provision of facilities and infrastructure to improve adequate water supply for irrigation activities.
iii. Policy formulation to ensure adequate supply and access to production inputs and technology.
iv. Policy formulation to improve access to extension services among farmers.
v. Tenure policy modifications to mitigate fragmentation of farmlands.
vi. Formulation of policies to increase farmers' sensitization on modern management practices in vegetable production.

References

Adeyemo, R. & Kuhlmann, F. (2009). Resource Use Efficiency in Urban Agriculture in Southwestern *Nigeria Tropicultura*, 27 (1), 49-53.

Arsanti, I.W., Böhme, M.H. & Jahnke, H.E. (2007).*Resource use efficiency and competitiveness of vegetable farming systems in upland areas of Indonesia*. Conference on international agricultural research for development, University of Kassel-Witzenhausen and University of Göttingen, Tropentag.

Asogwa, B. C, Okwoche, V. A, Umeh, J. C. (2012). Analyzing the Determinants of Poverty Severity among Rural Farmers in Nigeria: A Censored Regression Model Approach, *American International Journal of Contemporary Research*, **2** (5), 166-176.

Department of Economic and Social Affairs (DESA) (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.

Etim, N.A., Udoh, E.J. & Awoyemi, T.T (2005).Measuring Technical efficiency of urban farms in Uyo Metropolis. *Global Journal of Agricultural Science*, 4, 19-95.

Food and Agricultural Organization (FAO) (2005). *Food Security and Agricultural Development in Sub-Saharan Africa: Building a case for more public support (Policy Brief)*. Retrieved from ftp://ftp.fao.org/docrep/fao/009/a0788e/a0788e.pdf

Goni, M., Umar, A.S.S. & Usman, S. (2013). Analysis of Resource-Use Efficiency in Dry Season Vegetable Production in Jere, Borno State, Nigeria. *Journal of Biology, Agriculture andHealthcare*, 3 (19), 18-23.

Hillel D (2001). *Small scale irrigation for arid zones, principles and options*.FAO development series No. 2, Rome, Italy.

Khan, H and Ali, F. (2013) Measurement of productive efficiency of tomato growers in Peshawar, Pakistan. *Czech Agricultural Economics*, 59: 381-388.

Khan, Z., Shah A.H, Gul, R.,Majid, A, Khan, U., Ahmad, H. (2015).Morpho-agronomic characterization of cucumber germplasm for yield and yield associated traits. *International Journal of Agronomy and Agricultural Research*, 6: 1-6.

National Population Census (2006); *National Population Census*. National Population Commission, Abuja, Nigeria.

Owombo, P.T, Adiyeloja, D.K, Koledoye, G.F., Ijigbade, J.O. &Adeagbo, M.A (2012). Gross Margin Analysis of Amaranth Vegetable Production inOndo State, Nigeria: A Gender Perspective. *Journal of Agriculture and Biodiversity Research*, 1 (6), 91-96.

Shrestha, R.B., W. Huang and U. Pradhan. 2015. Resource use efficiency in vegetable production in the high hills of Eastern Nepal. *Nepalese J. Agri. Econ*. 2 (3): 79-87.

Van Leeuwen NH (2001). *Irrigation reforms in Africa*. In proceding of Regional seminar on private sector participation and irrigation expansion in sub-Sahara Africa Oct. 2001, Accra, Ghana. Edited by Hilmy Sally and C.L.Abernetthy, pp. 50-58; 22-26

Wehner TC, Cramer CS. (2004). Fruit yield and yield components of cucumber populations grown at low plant density In: J.D. McVeigh (ed) p. 277-285. *ASHS Press*. Alexandri, XVII (2), 17-21.