Profitability of irrigated tomato production in Kano river irrigation project (KRIP) Kano State, Nigeria

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Abstract

The paper estimated the profitability of irrigated tomato production KRIP, Kano State, Nigeria. Primary data were collected from 212 irrigated tomato farmers, using multi-stage sampling procedures in three Local Government Areas covered by KRIP. Data were collected for 2017 irrigation season using structured questionnaire. Data collected were analyzed using descriptive statistics and net farm income analysis. The result of the study indicates that irrigated tomato production was profitable with an estimated net farm income of ₦ 96,459.52/ha, and a return per naira investment of ₦1.78. Also, the constraints to irrigated tomato production under KRIP include inadequate processing and storage facilities, high cost of inputs, pests and inadequate credit facilities among others. It was therefore recommended that irrigated tomato production under KRIP should be encouraged because it is very profitable to farmers. Also, tomato farmers should be encouraged to form strong cooperative and combine their resources together in the purchase of inputs, so as to have advantage of bulk purchase, expand their production and make more profit in irrigated tomato production in the area.

Keywords: Profitability, irrigated tomato, production, Kano river irrigation project

Introduction

Tomato (*Lycopersicon esculentum* Mill) is globally cultivated for its fleshy fruits and known as a protective food because of its special nutritive value and its wide spread production. It is the world's largest vegetable crop after potato and it tops the list of canned vegetables (Ojo, Ibrahim and Mohammad, 2009; Usman and Bakari, 2013). Tomatoes can be eaten directly as raw vegetable or consumed in a variety of processed delicacies. The crop has a short generation time of about three to four months, well adapted to different cropping systems of cereal grains, pulses and oilseeds. Hence, it is the most widely grown vegetable crops worldwide under outdoor and indoor conditions (Katanga, Danwawu and Musa, 2018). It is an important source of vitamins like vitamin A and C, and also contains minerals like iron, phosphorus and is the richest source of nutrients, dietary fibers, antioxidant like lycopene and betacarotene (Shankara *et al*., 2005). It is also an important cash crop for small - holder and medium scale commercial farmers and it is a quick- cash generating vegetable crop with multiple harvest.

In Nigeria, an annual total area of one million hectares is reportedly used for

tomato cultivation and it makes up about 18 percent of the average daily consumption of vegetables in Nigerian homes (Chidi 2012). Tomato is perhaps the most important popular vegetable crop grown all over the country. The consumption of tomato has high income elasticity of demand. Thus, there will be more demand for this vegetable with population growth, economic growth, and urbanization (Engindeniz, 2007). Both the wet and dry season cropping system contributes immensely to the national requirement; though bulk production is from the dry season cropping with the help of irrigation (Usman and Bakari, 2013). Example of such irrigation is the Kano River Irrigation Project (KRIP) established in Kano.

The Kano River Irrigation Project is one of the largest and most successful irrigation schemes in Nigeria. It is located in Bunkure, Kura and Garum Malam Local Government of Kano State with project office at Kura. Its source of water is the Tiga Dam, which provides a perfect setting for gravity irrigation. Its total irrigable area is 22,000 hectares (Anonymous, 2019). It is a modern integrated agricultural land use development in Northern Nigeria. It is meant to be a large-scale agricultural project with focus on irrigation. This major irrigation scheme is planned to cover 66,000 ha. KRIP is sub divided into categories, 22,000 ha or KRIP (Phase1) is being developed as of 2006. The project is dependent on Tiga Dam, Bagauda Dam, and Challawa Dam and the floodplains around them (Sangari, 2006). In Kano, tomato production is highly dependent on this KRIP for dry season tomato production.

The dietary importance of tomato to human beings and their contribution to rural economy is very important as most of the cases of malnutrition come from the rural region. Also, dry season tomato production using this project is expected to increase the income and improve the livelihood of the farmers. Yet, most farmers in the study area are not fully exploring this area of agricultural production given it economic viability. Many farmers complained of high cost of inputs in tomato production while others encountered glut and price fluctuation in tomato production.

If the establishment of KRIP is for economic gains, it is therefore necessary to estimate the profitability of tomato production in KRIP which this study seeks to provide. Therefore, this study estimated the profitability of irrigated tomato production under Kano River Irrigation Project and identify the constraints to irrigated tomato production under KRIP, Kano State, Nigeria.

Materials and methods

Study area

The Study was carried out in Kano State, Nigeria. Kano State lies between latitudes 8^0 30^1N to 9^0 40^1 N of the equator and longitudes 11^0 30^1E to 12^0 03^1 E of the Greenwich Meridian. According to National Population Commission (NPC) (2006) Kano has a total population of 9,401,288. The projected population of Kano in 2019 using annual growth rate of 3.2% is 14,251,276. It is the most populated State in Nigeria. It is made up of 44 Local Government Areas with a total land area of 20, 760.60 square kilometres. It shares boundary with Jigawa state to the North-East, Katsina State to the North-West and Kaduna State to the south. Kano state

consists of two agro-ecological zones namely, Northern Guinea Savannah (NGS) and the Sudan Savannah (SS). The NGS has an annual rainfall of 600-1,200mm. The central and northern parts are in the SS, with an annual rainfall of 300-600mm (Kano State Government, 2012). The predominant ethnic groups are Hausa and Fulani.

Agriculture is the major employer of labour in the state with many citizens involved in farming, animal husbandry and fishery despite the fact that the State is a commercial centre (Muhammad and Atte, 2006). The cropping system is mostly undertaken under dry season and rain-fed condition and majority of the farmers are small scale holders with less than 2.5 hectares per farm household and either resources are meager (Kano Agricultural and Rural Development Authority (KNARDA), 2002). The Research was specifically conducted under Kano River Irrigation Project (KRIP) because of large scale cultivation and highest number of tomato farmers along the irrigation area in the state.

The KRIP is one of the largest and successful projects, not only in Nigeria, but in West African sub-region. It was designed in in such a way that the entire water distribution network operates on gravity (Hadejia Jama'are river basin development authority - HJRBDA, 2013). Water is conveyed from Tiga Dam to the project site through 18km long main canal, which splits into East (Bunkure) and West (Garun Malam and Kura) Branches. These are then further broken into lateral canals, distributaries canals, field channels and finally to the farm for the crops to be irrigated (Kano State Government, 2012). Crops cultivated include tomato, wheat, onion, maize, rice, garlic, cucumber, potatoes, millet, guinea corn and melon. The KRIP Phase I is currently providing all year- round direct employment to about 41,250 farmers and their families (KRIP-water users cooperative society (WUCS), 2014).

Sampling procedure and sample size

A reconnaissance survey was first conducted. Kano state comprises of three agricultural zones, namely Danbatta, Rano and Gaya zones. The first stage involved the selection of Rano Zone. Rano zone was purposively selected because it is the main location of KRIP in Kano State. The major irrigated tomato producing Local Government Areas are in the zone, namely, Bunkure, Garun-Mallam and Kura which are covered by Kano river irrigation project (KRIP) Phase I. The second stage involve the selection of two villages with the highest number of large- scale irrigated tomato farmers from each of the three Local Government Areas. The third stage involve random selection of ten percent of the sample frame **(**2122**),** given sample size of 212 irrigated tomato farmers in the study area.

Data collection and analysis

Primary data were used for this study. The data collected was based on 2017 irrigation season with the aid of structured questionnaire. Data were collected with the assistance of field enumerators (Extension agents) on specific variables that were relevant for the research. Information was collected on the following variables among others: age, sex, marital status, educational status, household size, access to extension contacts, farming experience, farm size, sources of finance, cooperative

membership, type and cost of labour (both family and non-family), access to market, type and cost of inputs used per hectare, revenue, water rate, produce prices and constraints to irrigated tomato production under KRIP.

Data were analyzed using descriptive and inferential statistics. The descriptive statistics was used to identify the constraints to irrigated tomato production in the study area while inferential statistics was used to estimate the profitability of tomato production using net farm income analysis.

Net Farm Income (NFI)

Net farm income (NFI) was used to estimate the profitability of irrigated tomato production under KRIP.. The model for estimating the net farm income is represented by:

$NFI = GR - TC$ .....(1)

Where:

Gross Revenue (GR) = Unit price (P) × Quantity (Q)

Total cost (TC) $= TVC + TFC$ .....(2)

NFI = Net farm income (Per ha)

The gross return (GR) is a function of yield and unit price of the output.

Therefore:

$GR = P_i Y_i$.....(3)

Where:

Y_i = Yield (kg/ha)

P_i = Unit price of product (₦) (price per basket)

The total variable costs (TVC) include the following:

X_1 =Seed cost (kg)

X_2=Fertilizer cost (kg)

X_3= Pesticides cost (L)

X_4= Labour cost (mandays)

X_5 = Cost of water(?)

The total fixed costs (TFC) include cost of buying/renting land and depreciation on farm tools used

Depreciation

Depreciation on farm tools like hoes and cutlasses was also used in the calculation of fixed costs. The straight -line method of calculating depreciation was used to obtain the depreciation. The straight line depreciation method is specified as:

$D = P - S/N$ .....(4)

Where:

D = Depreciation on farm tools used

P = Original cost of the tools

S = Salvage value of tools used

N = Number of years of life of the tools.

Results and discussion

Costs and returns analysis (profitability)

The costs, returns (profitability) analysis of irrigated tomato production is presented in Table 2.

Gross returns

The gross return was computed by multiplying the total quantity from the sampled farmers by the unit price of tomato at the time of data collection on average basis. There was fluctuation in prices between early harvest period and the peak period of harvest. All the farmers agreed that the average price of 40 kg basket was N5000/basket (i.e. N 125/kg) which was computed and used to determine the profitability. The average gross return was N219,423.32

Cost of production

The variable cost components considered include the following:

Cost of seed

The seeds used by the farmers in the study areas were either bought from certified seed companies, out growers or obtained the seeds from previous harvest. The average cost of seed used by farmers was N720.20.

Cost of fertilizer
The average cost of fertilizer in the study area was N6,803.43 per 50 kg bag for the different fertilizers used including cost of transporting the fertilizer.

Labour costs
The labour cost includes the cost of land preparation, fertilizer application, planting/transplanting, pesticide application, irrigation and harvesting. The wage rate varied depending on the operation that was performed. The average wage rate was N500 per man-day. The average labour per hectare was N52,428.03

Pesticide costs
The cost of pesticides in the study area was N2000 per 2kg sachets. The average market price of ₦1000/kg was used for this study. The average cost of pesticides was N4,213.22 per hectare.

Cost of empty basket
The average cost of empty basket at ₦500 per basket was used. The average cost of empty basket per hectare was ₦5,114.40.

Total variable cost
The total variable costs of production consist of the costs of fertilizers, seeds, pesticide and labour, cost of empty basket and cost of pesticides. The high cost of production could be responsible for the under- utilization of the inputs by tomato farmers in the study area. The total variable cost was ₦105,384.32 per hectare.

Total fixed costs
Fixed cost components include cost of renting land and depreciations on farm tools used (hoes and cutlasses). The total cost of fixed inputs was ₦17,579.48 on the average per hectare.

Net farm income
The average net farm income of the farmers was ₦96,459.52 per hectare while the return per Naira invested was 1.78. This implies that for every Naira spent on irrigated tomato production under KRIP, a profit of 78 kobo was made. This means that irrigated tomato production under KRIP is profitable. This finding also agrees with the findings of Ahmed (2016) who had a return per Naira invested of 1.73, 1.72 and 1.85 for small, medium and large-scale irrigated tomato production respectively under KRIP. Also, this finding agrees with the findings of Katanga *et al.* (2018) who had a return per Naira investment of 1.50 in their research on Economics of tomato production in Fagge Local Government Area of Kano State. All these findings in the same Kano State shows that tomato production is profitable.

Constraints to irrigated tomato production in Kano river irrigation project (KRIP)
The following are some of the constraints observed by farmers:

I. Inadequate processing and storage facilities: This ranked first among the major constraints. According to the farmers, they lost a lot of revenue due to lack of processing and storage facilities
ii. High cost of inputs: Inputs like fertilizers and labour are very expensive which drastically reduced the returns at the end of the harvest period. Labour constitute the largest components of input costs as tomato requires multiple harvest.
iii. Destruction of crop by pests and diseases which brings about considerable yield loss.
iv. Inadequate credit facilities: Inadequate credit facilities to procure essential inputs like fertilizer, labour and seeds.
v. Irregular rainfall: Irregular rainfall

affects the time of planting and growth of tomato crop.

vi. Depletion of soil fertility: There was problem of depletion of soil fertility which also brings about yield reduction.

Conclusion and recommendation

This study revealed that for every 1Naira spent on irrigated tomato production under KRIP, a profit of 78 kobo was made. Thus, irrigated tomato farming under KRIP was profitable in the study area. Some key constraints to irrigated tomato production include inadequate processing and storage facilities, high cost of inputs, pests and inadequate credit facilities. Based on the findings, it was therefore recommended that irrigated tomato production under KRIP should be encouraged because it is very profitable to farmers. Also, tomato farmers should be encouraged to form strong cooperative and combine their resources together in the purchase of inputs, as high cost of inputs was among the top constraints to tomato production, so that they can have advantage of bulk purchase, expand their production and make more profit in tomato production.

References

Ahmed, S. B. (2016). Economics of size in irrigated tomato (*Lycopersicum esculentum* Mill) production under kano river irrigation project (KRIP) Phase I, Kano State, Nigeria, A Published M. Sc. Dissertation, Department of Agricultural Economics, Ahmadu Bello University, Zaria, Nigeria, 104 p.

Anonymous (2019). Kano River Irrigation Scheme, Link: https://www.triming.org/schemes/kano-river-irrigation-scheme-kris/ Retrieved , December, 2019.

Chidi, A. (2012). Tomato, nutritious vegetable. Seventeenth Nigerian Economic Summit. Manufacturing in Nigeria today, Alafrican post web team. Pp1-3.

Engindeniz S, (2007). Economic analysis of processing tomato growing:the case study of Torbali, west Turkey Instituto Nacional de Investigacióny Tecnología Agrariay Alimentaria (INIA) *Spanish Journal of Agricultural Research* 5:7-15

Hadejia Jama'are River Basin Development Authority (HJRBDA, 2013). Brief on Kano River Irrigation Project (KRIP), Phase I.

Kano agricultural and rural development authority (KNARDA) (2002). Kano State estimated crop production. monitoring and evaluation unit.

Kano State Government (2012). Brief on Kano State. kano.gov.ng/new/index.php/2012-02-28-03-51-05/brief. Accessed on 10th January, 2013.

Katanga, N. Y., Danwawu, S. S. & Musa, B. (2018). Economic Analysis of Tomato Production in Fagge Local Government, Kano State, Nigeria, *Dutse Journal of Economics and Development Studies* (DUJEDS), 6 (2): 98-104

KRIP-.WUCS (2014). Kano river irrigation project-water users cooperative society: Hadejia-Jama`are river basin development authority, Kura office

Muhammad, L.A. & Atte, O.A. (2006) Analysis of Agricultural production in Nigeria. *African Journal of General Agriculture*, 2(1):

NPC (2006). National Population Commission. Population Census of the Federal Republic of Nigeria. *2006 Census Report* National Population Commission, Abuja.

Ojo, M. A., Ibrahim, O. A. & Mohammad, U. S. (2009). Profitability and production function of small scale irrigated tomato production in Niger State, Nigeria. *Continental Journal of Agricultural Economics,* 3: 16-22.

Sangari, D.U. (2006). An Evaluation of Water and Land Uses in the Kano River Project, Phase I, Kano State. *Journal of Applied Environmental Science Management,* 11 (2): 105-111.

Sani, M. H. & Haruna, U. (2010). Planning Model for Sustainable Vegetable Crop Production in the Eastern Part of Kogi State, Nigeria. *Journal of Agronomy,* 9(1): 17-22.

Shankara, N, Joep Van Lidt, D. J, Marja, D. G, Martin, H. & Barbara, V. D. (2005). Cultivation of Tomato: Production, Processing and Marketing, Agrodok 17, Agromisa Foundation and CTA, Wageningen.

Usman, J. & Bakari, U.M. (2013). Profitability of Dry Season Tomato (*Lycopersicon esculentum* Mill.) Production in Fufore Local Government Area of Adamawa State Nigeria, *The International Journal of Engineering and Science* (IJES), 2(11): 113- 117.

Table 1: Summary of sampling procedure and sample size selected

Local Govt. Area	Village	Sampling frame	Sample size (10%)
Bunkure:	Gafan	442	44
	Dorayi	197	20
Garun	Bangaza	124	12
Mallam:	Agalawa	191	19
Kura:	Bugau	628	63
	Dakasoye	540	54
	Total:	**2, 122**	**212**

Source: Field survey, 2017

Table 2: Average costs and returns per hectare of irrigated tomato production under KRIP

Items	Total value (₦/ha)
1. Gross returns (GR)	**219,423.32**
2. Variable costs (VC)	
Seed	720.20
Fertilizer	6,803.43
Labour	52,428.03
Cost of pesticides	4,213.22
Cost of empty basket (₦)	5,114.4
Cost of water for irrigation	36,105.04
3. Total variable cost (TVC)	105,384.32
4.Fixed cost (FC)	
Cost of renting land	13,596.23
Depreciation on fixed asset	3,983.25
Total fixed c ost (TFC)	17,579.48
Total cost of production (TCP)	122,963.80
NFI	96,459.52
RNI (GR/TC)	1.78

Source: Field survey, 2017

Table 3: Distribution of irrigated tomato farmers according to their constraints

Constraints	*Frequency	Rank
Inadequate pr ocessing and storage facilities	185	1st
High cost of inputs	167	2nd
Destruction of tomato by pests and diseases	150	3rd
Inadequate credit facilities	132	4th
Irregular rainfall	111	5th
Depletion of soil fertility	97	6th

Note: * = Multiple response
Source: Field survey, 2017