



Vegetable Production and the COVID-19 Lockdown

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Abstract

Due to various policies measures to curtail the Corona Virus Disease-19 (COVID-19), one of which was lockdown, the occurrence of COVID-19 had a negative impact on the nation's economy, especially the rural smallholder farmers. Hence, the objectives of the study include to: examine the effect of COVID-19 lockdown on vegetables production, estimate the profitability of vegetable production before, during and after the COVID-19 lockdown and identify the constraint facing vegetable farmers in the study areas. Descriptive statistics, budgetary approaches, multiple regression analysis, and a Likert scale were all tools used for the analysis of the data collected. The findings showed that most of the vegetable growers in the research areas were married women (88.33%) and 70% of the respondents having primary education. The number of extensions contact, farm size, market access and transportation cost were positively significant on the level of vegetable production in contrast to household size with negative effect. The result also noted that after the COVID-19 lockdown, vegetable production was extremely profitable, with an average gross margin of ₦82,836.04 which was statistically higher than the gross margin (₦60,709.97) generated from vegetable production during COVID-19 and the ₦71,234.91 gross margin generated prior to COVID-19. The constraints faced by vegetable farmers during the COVID-19 restrictions include: high cost of transportation, price fluctuation, and high cost of input, perishability of the produce and lack of improved seeds. It was concluded that COVID-19 pandemic had negative effect on the profitability of vegetable production and the economy of the country.

Keywords:

Budgetary Approaches, Covid-19, Gross Margin, Profitable

1. Introduction

Global pandemic illness epidemics, which occasionally occur, have a significant impact on all facets of human life. For example, numerous past pandemics including the Spanish Flu, Asian Flu, Hong Kong Flu, HIV/AIDS, SARS, Ebola, and Swine Flu had a significant negative influence on the economy, the environment, as well as human activities like agriculture, tourism, transportation, education, health, mining, industry, and business (Ahmed, 2020).

The coronavirus disease (COVID-19) caused by a virus named 'SARS-CoV-2' has created an unprecedented situation globally. It was first identified in Wuhan City, Hubei Province of China in the late December 2019 (WHO, 2019; Adebisi et al., 2021). The 'COVID-19' pandemic has posed a grave menace to human health, economy and food security both in developed and developing countries (Carroll et al., 2020). However, the poor people in developing countries such as Nigeria was impacted disproportionately mainly due to their poor income and inadequate healthcare system (Singh et al., 2020). The 'COVID-19' pandemic might have longer effects on income of poor people like smallholder vegetables farmers and consequently on their food security and nutrition (Aday and Aday, 2020). The ongoing rapid human to human transmission of COVID-19 is a big threat for a populous country (Sarker et al., 2020). The worldwide spread of the COVID-19 virus has resulted in lockdowns across low- and middle-income countries (Ridley and Devadoss, 2021).

The economic impacts of COVID-19 disturbances on farms and agricultural workforce-dependent households, agribusiness firms, and rural and urban buyers were severe, according to Boughton et al., (2021), who conducted research across Myanmar's agri-food system. The COVID-19 pandemic has particularly affected the supply of perishable foods such as vegetables, which could adversely affect food and nutrition security (Kamrul et al., 2022). Adebisi et al., (2021), noted that there was increase in expenditure on food items during the lockdown as the price of food items also increased during the period.

Nigeria is a large country with very large population with the non-farming population concentrated in our big cities all over the country. Feeding the over 160 million people in Nigeria today and at the same time conserving our environment are a great challenge facing our farmers and the government (FAO, 2021). Thus, sustainable intensification as being practiced by integrated Vegetable farmers and dealers in Nigeria is a way forward and an alternative to industrialized farming. Although this sustainable intensification of vegetable and fruits production may not be a panacea itself, it offers a useful approach to improving vegetable food availability given our situation. (Stephens et al., 2020).

Vegetables make up a major portion of human diet in many parts of the world and play significant role in human nutrition, especially as sources of vitamins A, B, C, and E; minerals, dietary fiber and phytochemicals, vegetables in the daily diet have been strongly associated with overall good health and improvement of gastro intestinal health, vision, risk of some forms of cancer, diabetics, and other chronic diseases (Amujoyegbe et al., 2015). Africans have always used traditional vegetables to meet their nutritional needs (Ozili, 2020). These vegetables are crops grown and consumed by local farmers along with the arable crops to serve as means of protein, minerals and vitamins in the diet of most African countries, and particularly in the Southwestern region of Nigeria. Leafy vegetables are an important feature of Nigerians' diet that a traditional meal without it is assumed to be incomplete (Sarker et al., 2020).

Vegetables can be distinguished from field crops by the fact that, vegetables are harvested when the plant is fresh and high in moisture while the fields' crops are harvested at the mature stage for their grain's seeds, roots fiber etc. In human nutrition, vegetables are an essential protective food containing vitamins and minerals. Any balanced diet should include vegetables and fruits for this reason (Ojediran et al., 2021). The proportion of vegetables required in a balanced diet per capita per meal is of the order of 45% of the total volume of the food, fruits and vegetables also contribute to the income of both the rural and urban dwellers. (Omotesho et al., 2015).

Horticultural crop production creates jobs. On average it provides twice the amount of employment per hectare of production compared to cereal crop production. Major vegetables in Nigeria include onion, tomato, okra, pepper, Amaranthus, carrot, melon, Corchorus olitorus (ewedu), Hibiscus sabdariffa (sobo), Adansonia digitata (baobab leaves) and pumpkin (Ugwu leave) (Ali et al., 2002).

Despite the prospect that lies ahead of vegetable farmers in Nigeria, the challenges of pest, diseases and theft, coupled with the effect of COVID 19 cannot be over emphasized. It is evident that COVID-19 pandemic affected the large populace and as well the farmers. Rural farmers were obviously affected the most through disruptions of the supply chain as a result of restriction placed on people and goods. Many farmers had problem accessing supplies of produced vegetables, access to labour, fertilizers, transportation, market and technical assistant needed to profitably grow and sell vegetables (Yegbemey et al., 2021). The survey on the perceptions of the impacts of COVID-19 in Nigeria indicated that many farmers were concerned and expected negative impacts on their livelihood (Mahmud and Riley, 2021) due to disruptions in agricultural supply chains and markets.

The COVID-19 pandemic has caused the breakdown of vegetables supply chain. Due to movement restrictions, traders were not able to come in the area. Farmers were forced to sell some parts of their product (about 25%) in the local markets directly to the consumers (Haque et al., 2022). Many vegetables deteriorated by the action of pathogens and was unable to send vegetables to distance urban and overseas markets due to lockdown. There is a reduction in purchasing power of the urban consumers due to economic crisis from the pandemic which has contributed greatly to fall the demand of vegetables (Roy, 2021). On the other hand, vegetable growers have remarkably increased vegetables consumption and distribution among relatives and friends. All these contributed to decline the price of vegetables dramatically which resulted in loss of vegetable growers' interest. Therefore, the effect of COVID-19 on crops especially vegetables would result in food insecurity which is a major challenge to sustainable food production. There could have also been a sharp decline in vegetable production during the COVID19 pandemic and arguably the production might yet to attain its full strength. Thereby making vegetable production quite expensive, increase its spoilage and difficulty in selling, have a negative effect on the livelihood and income of the farmers (Lucas, 2020). Majority of the farmers would decide to stay away from vegetable production in large scale during the pandemic because of the risk and some other factors. It will be surprising and disappointing if appropriate measures are not put in place in case of future threats and problems. Since COVID-19 pandemic came with disruption. However, it was noted that the effective COVID-19 on vegetable production are not well elucidated in literature in Nigeria.

Therefore, the objectives of this study include the following: determine the socio-economic characteristic of vegetable farmers, examine the effect of COVID-19 lockdown on vegetables production, estimate the profitability of vegetable production before, during and after the COVID-19 lockdown and identify the constraint facing vegetable farmers in the study areas.

2. Materials and Methods

2.1 Study Area

The study was carried out in Oyo State, Nigeria. Oyo state lies between latitude 8° 7' N and longitude 3° 25' E and covers land area of about 28,454 km². The Climate of the state is equatorial, notably dry and wet seasons with relatively high humidity. The dry season lasts from November to March while the wet season starts from April and ends in October. Average daily temperature ranges between 25 °C (77.0 °F) and 35 °C (95.0 °F) and annual rainfall of about 1467mm. The state population is about 7,840,864 (NBC, 2020). Oyo state was formed in 1976 from Western State, and included Osun State, which was split off in 1991. The state has a total number of 33 local governments. Oyo State is homogenous, mainly inhabited by the Yoruba ethnic group who are primarily agrarian but have a predilection for living in high-density urban center. Oyo state is boarder in the north by Kwara state, Osun state in the east, Ogun State in the south and by the Republic of Benin in the west. Agriculture is the main occupation of the people of Oyo state. Its climate favors the cultivation of crops like maize, yam, cassava, vegetables, millet, rice, plantains, cocoa, palm produce, cashew among others. Vegetables such as lettuce, broccoli, pepper, cucumber, tomatoes, garden egg, okra, jute, watermelon and fluted pumpkin.

2.2 Sampling technique

A three-stage sample technique was used in the study areas. First stage involves the random selection of three local government areas in Oyo state Nigeria. Second stage involves random selection of four villages from each local government selected and last stage involves snowballing of ten vegetable farmers each from the four selected villages making a total of 120 respondents.

2.3 Data collection

Primary data were used for this study. The data were collected with the aid of structured questionnaire augmented with personal interview where necessary.

2.4 Analytical tools

The data analysis used for this study includes:

- Descriptive statistics
- Budgetary techniques
- Multiple regression analysis
- Likert scale

2.5 Descriptive statistics

Descriptive statistics such as frequencies, mean, ratios and percentages were used to analyze the socio-economic characteristics of vegetable farmers.

2.6 Budgetary techniques

Budgeting is the formulation of plans for a given future period in numerical terms. Organizations may establish budgets for units, departments, divisions, or the whole organization. The usual period for a budget is one year and is generally expressed in financial terms. Budgets are the foundation of most control systems. It provides yardsticks for measuring performance and facilitate comparisons across divisions, between levels in the organization, and from one period to another. This analytical method helps to co-ordinate resource, define the standards needed in all control system, it provides clear and unambiguous guidelines about the resources and expectation and as well facilitate performance evaluations. The budgetary technique involves gross marginal analysis and various ratios are computed to ascertain the extent of the profitability.

$$GM = TR - TVC$$

Where; GM= Gross margin

TR= Total revenue

TVC= Total variable cost

Subsequently, a net return can be obtained from gross margin.

$$\text{Net returns} = GM - TFC$$

Where, TFC= Total fixed cost

Profitability ratio can also be computed.

$$\text{Benefit cost ratio (BCR)} = \frac{TR}{TC}$$

TR= Total revenue

TC= Total cost

2.7 Multiple regression analysis

Multiple regression is a statistical technique that can be used to analyze the relationship between a single dependent variable and several independent variables. The objective of multiple regression analysis is to use the independent variables whose values are known to predict the value of the single dependent value. Each predictor value is weighed, the weights denoting their relative contribution to the overall prediction.

The equation that describes multiple regression is

$X_1, X_2 \dots X_p$ which are the independent variables

$Y = B_0 + B_1X_1 + B_2X_2 + \dots + B_pX_p + e$

where; $B_0, B_1, B_2 \dots B_p$ are parameters

e is the random variable called "the error term"

The equation that describes how the mean value of Y is related to the P {which is the independent variable} is called "Multiple regression equation"

$E_{(y)} = B_0 + B_1X_1 + B_2X_2 + \dots + B_pX_p$

2.8 Likert scale method

Likert type scale will be used to determine the constraints faced by the vegetable farmers in the study area e.g. high cost of inputs, perishability of the produce, flood Incidence, theft etc. A five-point scale consisting of ordinal measurement (i.e. 1-5) will be used to examine the level of seriousness of the fourth objective of this study. The five-point scale includes;

1=NOT SERIOUS

2=LESS SERIOUS

3=MODERATELY SERIOUS

4=SERIOUS

5=VERY SERIOUS

Therefore; $X_w = 5(F_5) + 4(F_4) + 3(F_3) + 2(F_2) + 1(F_1)$

Where,

X_w = Total weighted score

1-5 = Rating scale of not serious (1) to very serious (5)

F_5 - F_1 = Frequency of the respondents in each scale

X_w was used to rank constraints faced by vegetable farmers.

3. Results and Discussion

3.1 Descriptive statistics

Descriptive statistics were used to provide information on the socioeconomic characteristics of vegetable growers, and the results are shown in Tables 1 below. The majority of the vegetable growers in Oyo State are somewhat middle-aged; their average age is 45.31 years. As a result, it became apparent that they were still in their prime for productivity. The findings were consistent with the report of Nosiru et al., (2014) which concluded that farmers with age range between 30-50 years have high likelihood to earn higher incomes as they are at the peak of their active years. Young farmers tend to be stronger, more capable of making good production decisions and have more potential for greater productivity than old farmers.

The findings also revealed that married female farmers dominated vegetable production in the study area with (59.17%). Female domination in vegetable production confirmed that women are in charge of the fundamental vegetable production and marketing tasks in the study areas. A similar result of many females or relatively large number of females engaging in vegetable farming have been reported in previous studies (Mukaila et al., 2021). Most of the respondents in the study area has household size between 5-10. The amount of available family labour is usually proportional to size of cultivated farm because it was discovered from this study that most of respondents make use of their family members as labour on the farm. To lower the cost of production in traditional agricultural production, the average farmer exhausts all sources of labour within his family before employing labour. The findings were consistent with the report of Belewu et al., (2020) which arrived that the significance of household size in agriculture depends on the fact that the availability of labour for farm production, the total area cultivated for different crop enterprises, the amount of crop produced and retained for domestic consumption, and the marketable surplus are all determined by the size of the farm household. Most of the respondents have at least primary education, (70.83%). This indicates that majority of vegetable farmers are educated, and are more likely to implement agricultural innovations. The level of education affects the type of decision farmers take in agricultural production and determines the level of

opportunities available to improve livelihood strategies and managerial capacity in agricultural production (Igbalajobi et al., 2013). All the vegetable farmers in the study area (100%) have an average of less than 5 hectares of farmland. This revealed that vegetable farmers are still operating on small scale in the study areas and they are seriously in need of government intervention in order to lift them from their subsistence farming level. This result supports the conventional wisdom that, between 2- 5 ha fall into category of small-scale farmers. This was in line with the findings of Ayinde et al., (2018) who reported that the majority of rural households operate small farm. Most of the vegetable farmers were visited by extension agents in the two states.

Table 1. Socio-economic characteristics of the sampled vegetable farmers in the study area.

Variables	Frequency	Percentage
Age		
<30	5	4.17
31-40	37	30.83
41-50	46	38.33
51-60	24	20.00
>60	8	6.67
Mean	45.31	
Gender		
Male	49	40.83
Female	71	59.17
Marital Status		
Married	106	88.33
Divorced	4	3.34
Widowed	10	8.33
Household Size		
<5	37	30.83
6-10	83	69.17
Level of Education		
No formal	35	29.17
Primary	32	26.67
Secondary	37	30.83
Tertiary	16	13.33
Farm size		
<5	120	100.00
5-19	0	0.00
Farming Experience(years)		
<5	15	12.50
6-15	76	63.33
16-25	22	18.33
26-35	6	5.00
>35	1	0.83
Mode of Land acquisition		
Inheritance	60	50.42
Purchase	13	10.92
Hired	22	18.49
Community owned	24	20.17
Extension contacts		
Yes	27	22.50
No	93	77.50
Total	120	100.00

Source; survey data, 2022

3.2 Effect of COVID-19 on vegetable production

From the table 2, number of extensions contact, farm size, nearest to market and the cost of transportation significantly affect vegetable production in the study area. Extension contact was significant at 5% level, with a positive coefficient of 1.373. This implies that a unit increase in extension contact will increase vegetable production

by 1.373. This could be due to the dissemination of new techniques to the vegetable farmers to enhance their production with the contact. Farm size and nearest to market were significant at 1% and 5% levels, with a positive coefficient of 0.256 and 0.461 respectively. This implies that an increase in farm size will lead to an increase in vegetable production, likewise, the nearest to the market risen the vegetable production. Also, cost of transportation was significant at 1% level with a positive coefficient of 0.029. This implies that a unit increase in the cost of transportation will increase vegetable production in the study area. This is against a priori expectation, because as transportation cost increases, the production is expected to reduce. Household size was significant at 10% level with a negative coefficient of -0.051. This implies that a unit increase in household size will lead to a decrease in production of vegetable. This corroborates Siziba et al., (2011) who believed that large household size result in consumption of more portion of the output which reduces quantity for sale thereby reduces their level of output market participation. However, this is on a contrary to my expectation and Abdullah et al., (2017) who suggested that large household size increases output commercialization because of family labour advantage.

Table 2. the effect of COVID-19 on vegetable production by the farmers in the study area.

Variables	Coefficient	Std. Err	Z value	P> z
Age	.006	.006	0.98	0.329
Gender	.144	.087	1.66	0.100
Education	.008	.055	0.14	0.888
Household size	-.051*	.028	-1.81	0.073
Farm experience	-.007	.006	-1.09	0.278
Cooperative	.042	.098	0.43	0.668
Extension	1.373**	.661	2.08	0.040
Farm size	.256***	.064	3.98	0.000
Loan access	-.052	.147	-0.35	0.726
Labour	.028	.202	0.14	0.890
Nearest to Market	.461**	.187	2.46	0.015
Transportation cost	.029***	.009	3.28	0.001
Constant	2.586	.299	8.64	0.000

Source: survey data, 2022 Significant levels *** is 1%, ** 5% and * 10%

3.3 Profitability of vegetable production before, during and after COVID-19

From the table 3, there was significant difference across the total revenue realized from the sales of vegetables. Revenue generated before COVID-19 lockdown was. ₦105,812.00. and revenue generated during COVID-19 lockdown, ₦97,181.83, and that after COVID-19 lockdown was. ₦130,379.60. The total variable cost before COVID 19 which includes the cost of seed, fertilizer, herbicide, insecticide, manure and labour amount to ₦36,471.86 which was significantly different ($p < 0.05$) from total variable cost incurred during COVID-19 lockdown, ₦34,577.09, and before COVID-19 lockdown, ₦47,543.56. From table 3, vegetable production was profitable, with production before COVID-19 lockdown having the highest gross margin of ₦71,234.91 and was significantly different ($p < 0.05$) from the gross margin during and after lockdown, at ₦60,709.9 and ₦82,836.04, respectively. The profitability index showed that for every two naira spent on vegetable production before lockdown, there is a return of 67 kobo. Also, for every three naira spent on vegetable production during lockdown, there was 06 kobo return, and for every 2naira spent on vegetable production, there was 74 kobo returns after COVID-19.

Table 3. the budgetary analysis of the sampled vegetable farmers before, during and after COVID-19 lockdown

Variables	Before	During	After	P value
Total Revenue	105,812.00b	97,181.83c	130,379.60a	0.0386
Total variable cost	34,577.09b	36,471.87b	47,543.56a	0.0401
Seed	18,354.17	23,583.33	31,100	
Fertilizer	3,304.17	2,110.63	4,034.38	
Herbicide	2,183.33	2,114.58	2,291.67	
Insecticide	5,900.00	5,098.33	5,786.67	
Manure	2,085.42	1,290.00	1,989.17	
Labour	2,750.00	2,275.00	2,341.67	
Gross margin	71,234.91b	60,709.97c	82,836.04a	0.0310
Profitability index	3.06	2.67	2.74	

Source: Field Survey, 2022

3.4 Constraints to vegetable production

According to the table 4, there is high perception (weighted score of 453) among the respondents given high cost of inputs as a serious factor limiting vegetable production in the study area and it was ranked first using the Likert type analysis. This is in line with Rahman and Matin (2020) pest and diseases were ranked second with a weighted score of 437. As reported by the farmers, it hinders the productivity of the vegetables thereby reducing output and farmers' income. This corroborates Adeoye (2020) who stated that pest and disease, inadequate storage facilities and high cost of inputs are the major constraints that affect vegetable production in Nigeria. Lack of improved seeds and the incidence of flood were ranked third and fourth with a weighted score of 308 and 427 respectively. Ranked 5th is perishability of produce as one of the major constraints to vegetable production. Other constraints include; Price fluctuation, inadequate access to credit by the farmers, poor marketing information, theft, high cost of transport, low patronage and inadequate supply were all hindered the vegetable production in Nigeria.

Table 4. Constraints to vegetable production in the study areas

Constraints	Weighted score	Mean score	Rank
High cost of transport	265	2.21	10 th
Price fluctuation	416	3.47	6 th
Inadequate credit	374	3.12	7 th
Poor marketing information	331	2.76	8 th
Perishability of produce	426	3.55	5 th
Theft	288	2.40	9 th
Low patronage	220	1.83	11 th
Inadequate supply	196	1.63	12 th
Pest and diseases	437	3.64	2 nd
Lack of improved seeds	308	2.57	3 rd
High cost of inputs	453	3.78	1 st
Flood	427	3.56	4 th

Source: Field Survey, 2022

4. Conclusion and Recommendation

The study examined the effect of COVID-19 lockdowns on Vegetable production in Nigeria. Primary data were used for the analysis, using descriptive statistics, Budgetary techniques, multiple regression analysis and Likert scale were used for the analysis. A three-stage sample technique was used in this study areas. First stage involves the random selection of three local government areas in the study area. Second stage involves random selection of four villages from each local government selected and last stage involves snowballing of ten vegetable farmers each from the four selected villages making a total of 120 respondents.

The results reveal that majority of the vegetable farmers were females 59% of the total sampled and 41% were males in the study area with an average age of 45years. Majority of respondents were married with 88.33%. Majority of respondents have at least primary education with 70%. The multiple regression analysis result showed that the coefficient of extensions contact, farm size, market access and transportation cost were significantly affected the level of vegetable production with positive sign, and household size had a significant and negatively affects the vegetable production in study area. The result also revealed that vegetable production was highly profitable, before COVID-19 lockdown with an average gross margin of 71,234.91, during lockdown was 60,709.97 and after lockdown was 82,836.04. The constraints faced by vegetable farmers during the COVID-19 restrictions in the study areas include high cost of transportation, price fluctuation, and high cost of input, perishability of the produce and lack of improved seeds.

The study is concluded that vegetable production was resilient, and highly profitable across the three periods of pre, during, and post lockdown. Also, the COVID-19 lockdown factors were significant affect the production of vegetable, high cost of transportation, price fluctuation, high cost of input, perishability of the produce and lack of improved seeds constitute the high ranked problems facing vegetable production in the period of lockdown. It is also concluded that COVID-19 pandemic had negative effect on the profitability of vegetable production and severely affect economy of the country. As a result, the effect of COVID-19 lockdown on vegetable production was investigated in this study, more work can be done in the study areas to look at impact of COVID-19 lockdown on general wellbeing of rural farmers.

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