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# ANALYSIS OF THE EFFECTS OF COVID-19 PANDEMIC ON THE PROFITABILITY OF THE DRY SEASON WATERMELON FARMERS IN JIGAWA STATE, NIGERIA

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## ABSTRACT
The study was carried out to find the effects of the Covid-19 Pandemic on the Profit values of watermelon (Citrullus lanatus) Farmers across wet seasons in Jigawa State, Nigeria. Multistage sampling procedures were used for the selection of the respondents. A total of 91 Farmers, and 5 key informants were interviewed. Primary data were collected using structured questionnaires and checklist. The data collected was analyzed using descriptive statistics and Net return Income model. The results revealed that average Watermelon yield of 25,625.87kg/ha and 19,892.66kg/ha was obtained during the dry season enterprise before and during the Covid-19 Pandemic in the study area, respectively. The result further revealed that Watermelon production enterprise was a profitable venture with Net farm income of ₦535,991.41/ha & ₦279,871.11/ in dry seasons before and during the Pandemic, respectively. However, findings also revealed that farmers obtained higher yield (25,625.87kg/ha) and profit (₦535,991.41/ha) respectively, in the study area before the Covid-19 Pandemic. Most important constrains to Watermelon production during the Pandemic was the restrictions of human and vehicular movements which lead to rising cost of labour and material inputs as well as Glut. The study finally recommends immediate credit and loan intervention by governments and donor agencies as well as the establishment of processing firms, to address the flight of the farmers.

**Keywords:** Covid-19 Pandemic, Watermelon, Costs, Profit, Jigawa State.

## INTRODUCTION
The COVID-19 pandemic was caused when SARS-CoV2 virus spread among people all over the world. The pandemic created a massive socio-economic panic in all sectors across the world. Agricultural sector is among the most important and crucial part of developing economics in the world. Therefore, the disruption in agriculture and food systems have significant impacts on the livelihood of a large section of people in the world, Surendran *et al.* (2021). Agriculture is an input-intensive sector with each component of production varying considerably in the agricultural production system. The inputs and their connectivity including seeds, fertilizers, chemicals, and marketing of the agricultural commodities were distrusted with respect to interruptions in transportation, delays in customs clearance, limitation of credit access, increased interest rates, and capital costs, which can lead to an increase the cost of the inputs. The increases in inputs cost and the perishability of agricultural products may lead to a huge loss to the farmers. The exiting situations retarded the distribution of food and agricultural inputs which created barriers in continuous food production and supply to markets (FAO 2020d; FAO 2020e).

Therefore, a massive socio-economic panic Covid-19 pandemic created in all sectors across the world and Agricultural sector being among the most important part of developing

economics in the world was negatively affected, hence have had significant impacts on the livelihood of a large section of people in the world.

Watermelon (*Citrullus lanatu*s) is an important horticultural crop, mostly known for its sweet and juicy fruit, grown in warm climates all over the world (Robinson and Decker-Walters, 1997; Jeffrey, 2011; Harry *et al.*, 2015). Watermelon originates from Africa, but the exact geographical origin and domestication process of the crop is not clear. One probable gene center is in the Kalahari Desert region where the species can still be found in the wild in various forms (vander Vossen *et al.*, 2004), but it has also been suggested that the origin is in the Sahel Region in Northern Africa (Wasylikowa and vander Voseen, 2004). Watermelon spread from Africa to Asia about 800 AD and to Europe in 961 AD and was subsequently brought to America by Europeans in the 17th Century (Wehner, 2008). It is one of the most widely cultivated Fruit vegetable crops in the world at large and the global production reached 89.9 million mega grams (FAO, 2012). According to Saleh (2012) Watermelon production in Northern Nigeria Particularly North west and North Eastern parts of the country has over the years gradually became a viable enterprise providing small scale farmers in the region with alternative commercial crop successfully competing with already over plugged fruits and vegetables like Tomatoes, Onions, and Peppers e.t.c that are being produced in the area. This provides the teeming population with not only a means of livelihood but also the required micro nutrients deficient in the diet of the people of the region as reported by FOA (2012).

Studies (Muhammad, 2014; Saleh, 2012; Saleh, 2021) revealed that watermelon production has gain acceptance among smallholder producers in Jigawa and Kano States due to its huge economic potentials as a profit giving enterprise which is facilitated by the availability of irrigation facilities across the states. The high demand of the commodity from across the country and beyond makes farmers in the area to extend the production of the fruit to cover both dry and wet seasons, thereby ensuring all year-round production and supply of the commodity.

However, preliminary survey suggests that watermelon production in the study area under both irrigation (dry season) and rain-fed (wet season) systems poses similar and also varied problems. Producers have serious concerns over fluctuations in volume and value of output from both dry and wet season production. Variations in the amount and prices of inputs used for both wet and dry season production of watermelon leads to differences in efficiency, costs, returns and quality of the watermelon produced. These differences could also vary across locations. Glut and low prices of the commodity is apparently another serious source of concern to producers. The incidence of COVID-19 pandemic has further posed a serious challenge to producers likely leading to more glut, low prices and therefore poor or low profits to the producers (Saleh, 2021).

Managing production of a vegetable crop such as watermelon requires detailed and accurate information on the most profitable production system (irrigation or rain-fed) combination(s) of inputs and glut handling. This information is not common among watermelon producers in the study area. Other researchers have looked at production of watermelon in a general manner as in the case of value chain analysis (Saleh, 2012 & Saleh, 2021), resource use and profitability analysis under separate production systems (irrigation or wet season). An integrated study to look at both irrigated and rain-fed production across locations with demand and supply relationship is an important gap that needs to be filled. Interestingly, production and marketing constitute a continuum hence lack of development in one retards progress in the other (Abba, 2009).

The broad objective of the research is to carry out a Profitability analysis of both dry and wet season watermelon production in the study area. The specific objectives were to: (i)

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estimate the costs and returns of the wet and dry seasons watermelon production; and (ii) describe the implications of COVID-19 pandemic on production and profit values of the watermelon production enterprises.

## MATERIALS AND METHODS

### The Study Area

The study was conducted in Jigawa State, North-Western Nigeria, the state falls exclusively under the Sudan Savannah agro-ecological zone of the country. The State was created from the old Kano State in 1991 comprising of 27 LGAs covers a land area of 22,410km$^2$ with 2.2 million hectares and lies between latitude 10$^0$57' and13$^0$03' North and longitude 8$^0$ 08' and 10$^0$ 37' East. It shares a common boundary to the North by Niger Republic, to the west by Kano State, south-east by Bauchi and to the north-east Yobe State (JGSG, 2005). Jigawa State has two seasonal periods categorized on the basis of moisture with dry and rainy seasons. Most of the state lies within the Sudan Savannah agro-ecological zone of Nigeria. The mean annual rainfall varies from 600 mm to 1000 mm. Rainfall is higher in the southern part of the state with wide and rapid change in temperature and humidity. The mean daily average minimum and maximum temperatures are 19$^0$c and 35$^o$c, respectively, but temperatures of about 40$^o$c is common especially in the months of March to September and could be as low as 18$^0$c during the Hamatan period i.e., the month of November and January. The mean relative humidity can be as high as 80% in the month of August and as low as 15% in the month of December (JARDA, 1995). The State has an altitude of 380m above sea level. It has a population of 4,348,649 people (NPC, 2006). This figure rose to 6,273,326 in 2017 with projected national growth rate at 3.0%.

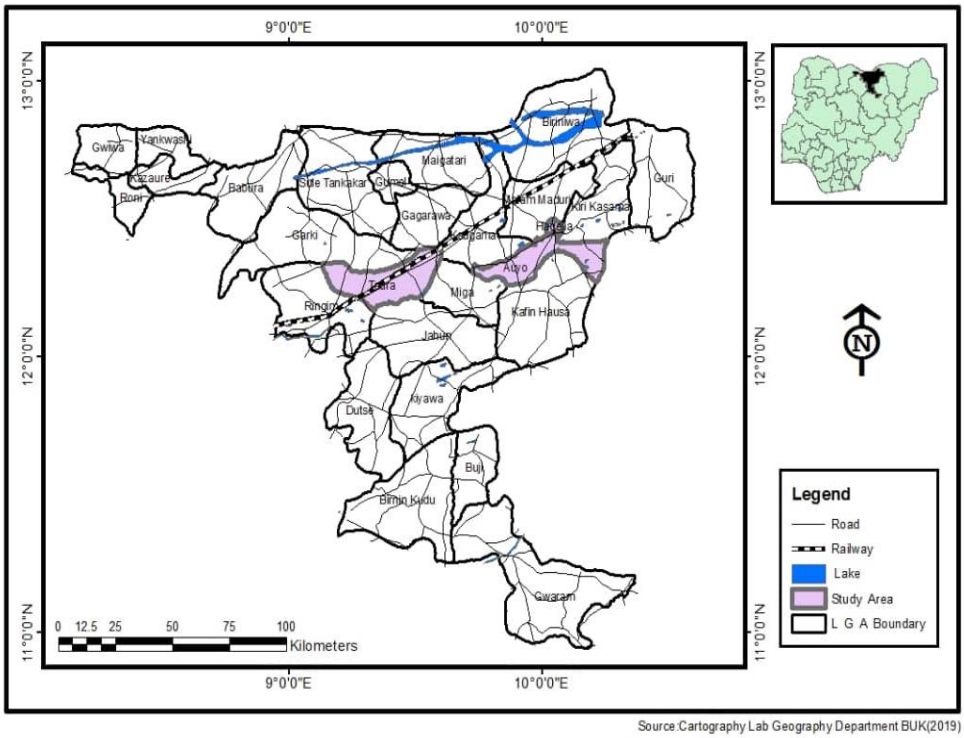


Figure 1: *Map of Nigeria showing Jigawa State.*

### Sampling Procedure

Multistage sampling technique was employed in the selection of the producers for the study. In the first stage, Jigawa state was selected purposively as a result of the high

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concentration of watermelon producers in the State. The second stage involved the selection of production clusters according to the concentration of the watermelon farmers in the state; specifically, Hadejia, Taura and Auyo Local Government areas were considered. These Local Government areas were selected because of the prevalence of the wet and dry season watermelon production in the areas which was facilitated by the presence of Irrigation facilities. In the third stage, a total of 91 Farmers were selected from the list of 230 farmers obtained from the Water Users Association (WUA) in Jigawa State at a 95% level of confidence. This was determined using the formula:

$$X = Z(^{c}/_{100})^{2} r(100\text{-}r)$$

$$N = {}^{Nx}/_{((N\text{-}1)E^{2} + x)}$$

$$E = \text{Sqrt}[{}^{(N - n)x}/_{n(N\text{-}1)}]$$

The sample size $n$ and margin of error $E$ are given by
where; $N$ is the population size,
n = the sample size
$r$ = the fraction of responses that you are interested in,
And $Z(c/100)$ = the critical value for the confidence level c.

The 91-sample size was allocated across the study locations based on proportions of the dry season watermelon farmers in the selected production clusters. Microsoft Excel programme was used to randomize lists of Farmers to enable random sampling (Table 1).

**Table 1:** Sample size of the watermelon Producers

| **Production Cluster** | **Sampling Frame** | | **Sample size** | |
|---|---|---|---|---|
| | **Dry Season** | **Wet Season** | **Dry Season** | **Wet Season** |
| **Jigawa:** | | | | |
| Hadejia | 51 | 46 | 21 | 16 |
| Taura | 36 | 27 | 16 | 11 |
| Auyo | 37 | 33 | 14 | 13 |
| Total | 124 | 106 | 51 | 40 |

Source (water users association) 2020

In addition, a total of 5 key informant producers of the commodity will be identified across the states for qualitative interview on the effect of COVID-19 and subsequent lockdown of the economy on the profitability of watermelon production in the area.

**Method of Data Collection**

Structured questionnaire was administered by trained enumerators to obtain primary data from the dry season watermelon producers across the state. Data collected covered information on. the production inputs including quantities of seeds, fertilizer, chemicals, irrigation water as well as quantity of labour used by the farmers for the enterprises was captured for analysis.

**Analytical Techniques**

In order to achieve the objective for this study, Net farm income models (NFI) was used. The Net Farm Income (NFI) was utilized to evaluate the profitability of both Dry and Wet seasons Watermelon Farmers (Objective ii). Net Farm Income measure returns to naira invested in the enterprise, according to Sanni and Ogundipe (2003) and Balogun *et al*. (2006). NFI is the income generated from the enterprise, which can be drawn without affecting the future rate of production operation. It measures returns to unpaid factor inputs such as family labour.

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NFI is for Dry season expressed as follows:

$NFI_D = GFI - TVC+TFC$ …(1)

where;

$NFI_D$ = Net income from dry season watermelon production (₦).

GFI = Value of total Watermelon output (₦)

TVC = Total variable cost of watermelon production (₦) expressed as:

$$\sum_{i=1}^{n} P_{i.} X_{.j} = \left(P_{x1} X_1 + P_{x2} X_2 + P_n X_n\right) \quad \ldots(2)$$

where;

$P_{X1}$ = Rental value of farmland dedicated to watermelon (₦/Ha)

$X_1$ = Size of farmland dedicated to watermelon production (Ha)

$P_{X2}$ = Unit cost of seed used in Watermelon production (₦/kg)

$X_2$ = Quantity of seed used in watermelon production (kg/ha)

$P_{X3}$ = Unit cost of fertilizer used in watermelon production (₦/kg)

$X_3$ = Quantity of fertilizer used in watermelon production (kg/ha)

$P_{X4}$ = Unit cost of herbicide used in watermelon production (₦/litre)

$X_4$ = Quantity of herbicide used in watermelon production (litre/ha)

$P_{X5}$ = Unit cost of pesticide used in watermelon production (₦/litre)

$X_5$ = Quantity of herbicide used in watermelon production (litre/ha)

$P_{X6}$ = Unit cost of labour used in watermelon production (₦/man- day)

$X_6$ = Amount of labour utilized in watermelon production (man-day)

$P_{X7}$ = Unit cost of Irrigation water used in watermelon production (₦/day)

$X_7$ = Amount of Irrigation water utilized in watermelon production (litres/day)

TFC = Depreciated value of equipment used in watermelon production.

The depreciation method used is the straight-line method where equal periodic charges are estimated over the calculated life span of the asset. This method was used because of uniform annual charges. It is expressed as:

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

where;

D = Depreciation on production asset

P = Original cost of production assets

N = Number of years of production asset's life.

S = Salvage value of the asset.

For Wet Season Watermelon Producers:

$NFI_W = GFI - TVC-TFC$ …(4)

where;

$NFI_W$ = Net income from wet season watermelon production (₦).

GFI = Value of total watermelon output (₦)

TVC = Total variable cost of watermelon production (N) expressed as:

$$\sum_{i=1}^{n} P_{i.} X_{.j} = \left(P_{x1} X_1 + P_{x2} X_2 + P_n X_n\right) \quad \ldots(5)$$

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where;
$P_{X1}$ = Rental value of farmland dedicated to watermelon (₦/Ha)
$X_1$ = Size of farmland dedicated to watermelon production (Ha)
$P_{X2}$ = Unit cost of seed used in watermelon production (₦/kg)
$X_2$ = Quantity of seed used in watermelon production (kg/ha)
$P_{X3}$ = Unit cost of fertilizer used in watermelon production (₦/kg)
$X_3$ = Quantity of fertilizer used in watermelon production (kg/ha)
$P_{X4}$ = Unit cost of herbicide used in watermelon production (₦/litre)
$X_4$ = Quantity of herbicide used in watermelon production (litre/ha)
$P_{X5}$ = Unit cost of pesticide used in watermelon production (₦/litre)
$X_5$ = Quantity of herbicide used in watermelon production (litre/ha)
$P_{X6}$ = Unit cost of labour used in watermelon production (₦/man- day)
$X_6$ = Amount of labour utilized in watermelon production (man-day)
TFC = Depreciated value of equipment used in watermelon production

The depreciation method to be used is the straight-line method where equal periodic charges are estimated over the calculated life span of the asset. This method was used because of uniform annual charges. It is expressed as:

$$D = \frac{P - S}{N} \qquad \ldots(6)$$

where;
D = Depreciation on production asset
P = Original cost of production assets
N = Number of years of production asset's life.
S = Salvage value of the asset

## RESULTS AND DISCUSSION

The results of the profitability analysis (Table 1) present the costs and returns associated with dry season's watermelon production before and during the Covid-19 pandemic in the study area. Generally, the variable cost components alone constitute 73% and 79% of the total cost of production before and during the Covid-19 pandemic, respectively. Among the variable components, cost of labour alone took up to 55% & 61% before and during the Pandemic, respectively. This implied that variable cost components constitute the major production cost in the dry the season watermelon production enterprise. The result is in agreement with the findings of Adeoye *et al.* (2011) in Oyo State; Saleh (2012) and Muhammad (2014) in Kano State.

The result further revealed that the enterprise is a labour-intensive venture as the costs of labour across the study area constituted over 55% and 61% of the total variable costs before and during the Pandemic. In general, the result also shows that the total variable costs (TVC) were higher than the total fix costs (TFC) during the season. Since labour was the major cost component among the TVC, its higher value may be as a result of the high demand for labour and hence higher prices in the season because of competing needs from other crops as a result of the lockdown and associated restrictions and protocols of the Pandemic. The total yield obtained in the season before and during the Pandemic was estimated at 25,625.87kg and 19,892.66kg respectively. This revealed that there was a decrease in yield of the Watermelon by 21% as a result of the Pandemic and subsequent lock down in the study area. This also implied that the restrictions during the lockdown lead to the decrease in yield of Watermelon as a result some difficulties experienced by the farmers in terms of timely acquisition and rising costs of material inputs like seeds which increase by 36%, Agro-chemicals (33%) and labour

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(45%) as indicated in the cost components. This result conforms with the *a priori* expectations and opinion of the key informants during the period of the survey, that lower watermelon yield will be obtained during the Pandemic and its associated human and vehicular restrictions which lead to difficulties in access to and rising costs of inputs resulting in delay and untimely farm operations. The results also revealed that the average net farm income for the dry season enterprise was ₦535,991.41/ha and ₦279,871.11/ha before and during the Pandemic, respectively. This means that watermelon farmers in the state realized profit, and that higher profit to the tune of ₦256,120.3/ha was realized before the advent of the Covid-19 over that obtained during the Pandemic. In addition, this further implied that the profit level of the watermelon farmers has been reduced by about 47% in the study area as a result of the Covid-19 Pandemic. The finding closely agrees with the findings of Adeoye *et al.* (2011) who reported a net margin of ₦288,448.96 k/ha in Oyo State and Saleh (2012 and 2021) also reported a net income ₦321,654.43 k/ha but strongly disagrees with that of Baba *et el.* (2014) who reported a comparatively meager amount of ₦30,946 k/ha in Kebbi State.

Furthermore, this monetary loss by the farmers as a result of the Pandemic is more pronounced when an aggregate loss for several hectares is considered. For example, since farmers loose an average of ₦256,120.3/ha representing 47% of their profit as a result of the Pandemic in dry season, it implies that when 100ha are to be considered, farmers in the area must have lost a whooping sum of ₦25,612,030 of their capital investment in only100 ha of Watermelon. The effect of this loss is likely to be more severe when other vegetable crops that are more perishable like Tomatoes, Pepper, and Onions are considered. Besides, this quantum of money that was lost by the farmers in form of profit is greatly required for re- investment in the production of other crops including the staple crops like rice, maize and guinea corn thereby posing serious danger to their production in the next coming year.

**Table 1:** Estimated Effects of the Covid-19 pandemic on the profitability of the Dry Season Watermelon Farmers in Jigawa State

| **Variable** | **Before Covid-19** | | **During Covid-19** | **% Change** |
|---|---|---|---|---|
| | **Quantity** | **Price/₦** | **Price/₦** | |
| Seeds | 0.36 | 5,511.74 | 8,640.52 | +56.77 |
| Fertilizer | 121.94 | 15,979.02 | 21,345.33 | +33.58 |
| Pesticides | 0.82 | 1,589.42 | 2,354.22 | +48.14 |
| Herbicides | 0.00 | 0.00 | - | - |
| Labour(Mds) | 59 | 71,584.42 | 103,452.4 | +44.51 |
| TVC | | 94,644.60 | 135,792.47 | +43.47 |
| Fixed Inputs | | | | |
| Farm size | 1.01 | 15,822.23 | 15,822.23 | - |
| Water pump | 01 | 15,470.51 | 15,470.51 | - |
| Siphon | 01 | 1,978.02 | 1,978.02 | - |
| Sprayers | 01 | 1,833.33 | 1,833.33 | - |
| TFC | | 35,104.09 | 35,104.09 | - |
| Total Cost (TC) | | 129,768.69 | 170,896.56 | +31.69 |
| Returns | | | | |
| Average yield (Kg/ha) | | 25,625.87 | 19,892.66 | -22.37 |
| Average Price (₦/Kg) | | 25.98 | 22.66 | -12.77 |
| Total Revenue (₦/ha) | | 665,760.10 | 450,767.67 | -32.29 |
| Net Farm Income (₦/ha) | | 535,991.41 | 279,871.11 | -47.78 |

Source: Field survey; 2020

## CONCLUSIONS AND RECOMMENDATIONS

Watermelon production enterprise has grown to be an important venture in terms of income generation and provision of employment for the teaming population in the study area. The enterprise is a profitable venture with varying degrees of profits. However, the Covid-19 Pandemic and its associated protocols of lockdown along with restrictions of human and vehicular movements has negatively affected the yield, and profit values of the farmers in addition to an alarming Glut situation. The study recommends for immediate credit and loan interventions by Governments and donor agencies in order to alleviate the farmer's plight.

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