# TREND ANALYSIS OF TOMATO PRODUCTION IN NIGERIA (2010 TO 2014)

**[*a]Olanrewaju, T.O., [a]Jacobs, I.A., [b]Suleiman, R. and [a]Abubakar, M.I.**

*[a]National Agricultural Extension and Research Liaison Services, Ahmadu Bello University, Zaria, Kaduna State*

*[b]Institute for Agricultural Research, Ahmadu Bello University, Zaria, Kaduna State*

**Corresponding Author taofiqolanrewaju13@yahoo.com,*

**Abstract**

*Tomato (Lycopersicon esculentum Mill.) is one of the most important vegetables worldwide. It plays a major role in the provision of vitamins and minerals for humans. Tomato is cultivated almost all over Nigeria and still short in supply. This study assessed the trend of tomato production in Nigeria between the year 2010 to 2014 considering likely causes of supply shortage and postharvest losses. The study was conducted through verbal interviews with tomato farmers across Nigeria and secondary data. Study revealed that about 45% of the tomatoes produced in Nigeria do not reach their destination due to poor handling and transportation resulting in shortage in supply. Results revealed that there was a negative correlation between the six (6) geo-political zones and the rate of tomato produced between the years 2010 to 2014 indicated a decline in the production of tomato across the six zones. There was a significant difference at 5%. A weak correlation between all the zones studied and the estimated land area were observed, an indication that the estimated land area cultivated for tomato production has less effect on the decline of tomatoes produced across the zones between the period under review. Rather, other factors like insect infestations, handling, packaging techniques and transportation from farm to markets were the likely causes for the drop in production. Suggestions proffers were that an appropriate packaging container be developed to improve handling and transportation, introduction of effective insecticides, availability of farm inputs and intensive land reclamation be done.*

***Key words:*** *Tomato, production, shortage, packaging, handling*

## Introduction

Tomato (*Lycopersicon esculentum* Mill.) is a staple fruit vegetable, one of the most important vegetables worldwide (Saeed-Awan, Hussain, Tanveer-Abbas and Karim, 2012) considered as an important cash and industrial crop in many parts of the world (Ajagbe, Oyediran, Omoare and Sofowora, 2014) that has become popular over the last century. Tomato is a tender and compression-sensitive fruit (Babarinsa and Ige, 2014) it is a member of the *Solanaceae* family botanically known as berry (Abdullah, Salik, Ambreen and Justina, 2014). Tomato is a perennial crop butsome cultivars are grown as annual crop in some part of the world. It is the second most important vegetable crop next to potato (Abdullah *et al.*, 2010).Tomato is an important vegetable that play a major role in the provision of vitamins and minerals for humans, hence, necessary in the preparation of many local dishes and very important in the diet of both rural and urban dwellersin Nigeria (Olayemi, Adegbola, Bamishaiye and Daura, 2010). It is high in water soluble vitamins and minerals, essential amino acids, sugars, dietary fiber, low in fat and calories; main source of vitamins A, B, C, iron, phosphorous, protein, edible oil and lycopene (Ayandiji and Adeniyi, 2011; Achoja and Okoh, 2014). They can as well be consumed fresh in salads, cooked in sauces, soup and meat/fish dishes or as raw materials for food industries by processing into value added products likejuices, paste, puree, ketchup and canned products (Ajagbe *et al.*, 2014). Onifade, Aregbesola, Ige and Ajayi (2013) reported that daily intake of tomatoes provide the body with nutrients like carotene, vitamin, lycopene which lower the risk of cancer and cardiovascular diseases; it also have antioxidant components that are medically useful in the area of cataracts, bone metabolism, asthma and helps to reduce the risk of prostate and breast cancer (Shankara *et al.*, 2005). Tomato is used as condiments for stew which is a regular feature of African meals and accounts for about 18% of the average daily consumption of vegetables in Nigeria (Ebimieowei and Ebideseghabofa, 2013). It has presently been considered as an important cash and industrial crop in numerous parts of the world (Saeed-Awan *et al.*, 2012).

Production and consumption of tomato around the world has found to increase tremendously over the past 25 years, a production of about 105 million tons in 2001 from an estimated hectares of 3.9 million was reported for fresh fruits by Ayandiji and Adeniyi (2011). According to Ebimieowei and Ebideseghabofa, (2013), Nigeria was reported to bethe second largest producer of tomato in Africa after Egypt and 13$^{th}$in the world, with a production of 6 million tons annually prior to 1990. Tomato is grown in Nigeria in its diverse agro-ecological zones that range from humid in the south to sub-humid in the middle belt and semiarid/arid in the north. It is mostly cultivated in the northern regions of the country, between latitudes 7.5 °N and 13 °N, and within a temperature range of 25 – 34 °C. Idah, Ajisegiri and Jiya, (2007a) reported that enormous quantities of fruits and vegetables are produced in Nigeria and inconsistence figures are sometimes given as estimated annual production. Despite the huge and inconsistence figures reported yearly, fresh tomato fruits are mostly unavailable in several homes, rather, the dried unhygenically processed tomato are found as substitute. It is on this basis that this study was conducted to have a critical assessment of the tomato production in Nigeria and the likely causes of shortages.

**Methodology**

The study was carried out using secondary data. These were the data generated by National Agricultural Extension and Research Liaison Services (NAERLS) from their yearly Agricultural Performance Survey (APS) between the years 2010 to 2014. The APS is a yearly survey done by NAERLS by deploying their staffs and staffs other collaborating institutes to every states across the country. Two communities from two Local Government Areas (LGAs) are usually purposively selected from two geo-political zones in the states. The data collected from the field are analyzed and bind as an annual report. The data used for these studies was extracted from the NAERLS/FDAE for the years under review. Information obtained from the reports was production costs, cultivated land area estimates, and production estimates among others. The data extracted was statistically analyzed using SPSS 15.

**Results and Discussion**

The data collected for this study was a time series data. Most time series data has peculiar characteristics in that data taken for a particular year affects the currents and subsequent years. In order to linearize this particular data, the values of the variables were log. After linearization, the data were run using multiple regressions on Trend Test Analysis.

**Table 1:** Tomato Production in North East Zone

| Year | Coef. | Std. Error | T | P>\|t\| |
|---|---|---|---|---|
| Log Prod. Cost | -0.1365627 | 0.8029423 | -0.17 | 0.866 |
| Log %change prod. Cost | 0.4008041 | 0.5108082 | 0.78 | 0.437 |
| Log land area | 0.5852637 | 0.1240524 | 4.72 | 0.000 |
| Log %change land area | 0.5328991 | 0.1135836 | 4.69 | 0.000 |
| Log production estimates | 0.1071465 | 0.820155 | 1.31 | 0.199 |
| Log %change production | -0.333748 | 0.1089837 | -3.06 | 0.004 |
| Cons | 2010.423 | 8.190927 | 245.45 | 0.000 |

Number of obs = 48, F(6,41) = 10.12, Prob.> F = 0.0000, R-squared = 0.5970,
Adj. R-squared = 0.5380, Root MSE = 0.84126

Table 1 shows that the adjusted R-squared value(0.5380) for North East zone shows that 53.8% of the variation in production, land area and production over the years under review were associated. The land area and production was found to increase by 58% and 10.7% respectively while a decrease of 13.6% and 33.3% was recorded over the years in the production cost and the percentage change in production. The land area, percentage change in land area, and percentage change in production estimates were found to be significant at 1%, an indication that they have a significant effect on the trend of production in the zone under study within the reported years.

**Table 2:** Tomato Production in North West Zone

| **Year** | **Coef.** | **Std. Error** | **T** | **P>\|t\|** |
|---|---|---|---|---|
| Log Prod. Cost | -0.6193251 | 0.5140523 | -1.20 | 0.234 |
| Log % change prod. Cost | 0.2052691 | 0.2539469 | 0.81 | 0.423 |
| Log land area | 0.4320362 | 0.0952194 | 4.54 | 0.000 |
| Log %change land area | 0.2771171 | 0.1046893 | 2.65 | 0.011 |
| Log production estimates | -0.265347 | 0.1407671 | -1.89 | 0.065 |
| Log %change production | -0.3947002 | 0.983019 | -4.02 | 0.000 |
| Cons | 2018.849 | 5.571117 | 362.38 | 0.000 |

Number of obs = 56, F(6,49) = 7.10, Prob.> F = 0.0000, R-squared = 0.4651,
Adj. R-squared = 0.3996, Root MSE = 0.95757

The adjusted R-square (0.3996) for North West Zone shows a variation of 46.5% in production. A difference found to be responsible for the production trend. It was observed that production cost, production estimates and percentage change in production estimates decreased by 61.9%, 26.5% and 39.4% respectively. Conversely, the percentage change in production cost, land area and percentage in land area were found to increase with values of 20.5%, 43.2% and 27.7% respectively. Furthermore, the land area, percentage change in land area, production estimates and percentage change in production estimates all has impacts on the trend of tomato production over the years as they are significant at 1%.

**Table 3:** Tomato Production in North Central Zone

| Year | Coef. | Std. Error | T | P>\|t\| |
|---|---|---|---|---|
| Log Prod. Cost | -0.9259701 | 0.400525 | -2.31 | 0.025 |
| Log % change prod. Cost | 0.6658608 | 0.2812189 | 2.37 | 0.022 |
| Log land area | 0.7659479 | 0.1527909 | 5.01 | 0.000 |
| Log %change land area | 0.3433245 | 0.1307879 | 2.63 | 0.012 |
| Log production estimates | -0.1881862 | 0.2520682 | -0.75 | 0.459 |
| Log %change production | -0.3071818 | 0.1474802 | -2.08 | 0.043 |
| Cons | 2020.775 | 4.654571 | 434.15 | 0.000 |

Number of obs = 56, F(6,49) = 7.33, Prob.> F = 0.0000, R-squared = 0.4731,
Adj. R-squared = 0.4086, Root MSE = 0.95042

Within the years under review, results revealed that the percentage change in production cost, land area, and percentage change in land area increased by values of 66.2%, 76.5% and 34.3% respectively, while production cost, production estimates and percentage change in production estimates decreased by 92.5%, 18.8% and 30.7% respectively. The production cost, percentage change in production cost, land area and percentage change in land area were all found to be significant at 1% confidence level.

**Table 4:** Tomato Production in South West Zone

| Year | Coef. | Std. Error | T | P>\|t\| |
|---|---|---|---|---|
| Log Prod. Cost | 1.800205 | 0.5046985 | 3.57 | 0.001 |
| Log % change prod. Cost | 0.2750323 | 0.130619 | 2.11 | 0.041 |
| Log land area | -0.2102221 | 0.195025 | -1.08 | 0.287 |
| Log %change land area | 0.4930522 | 0.1568192 | 3.14 | 0.003 |
| Log production estimates | -0.491936 | 0.1884769 | -0.26 | 0.795 |
| Log %change production | -0.2694616 | 0.1274136 | -2.11 | 0.041 |
| Cons | 1992.185 | 5.906788 | 337.27 | 0.000 |

Number of obs = 48, F(6,41) = 5.75, Prob.> F = 0.0002, R-squared = 0.4569,
Adj. R-squared = 0.3774, Root MSE = 0.97663

The percentage change in production cost and percentage change in land area were found to increase, though by small values of 27.5% and 49.1% while, the land area, production estimates and percentage change in production estimates were revealed to have decreased by 21%, 49.1% and 26.9% respectively. More so, a 1% significant level was recorded for production cost and percentage change in land area indicating that they have an effects on the production trend within the years studied.

**Table 5:** Tomato Production in South East Zone

| Year | Coef. | Std. Error | T | P>\|t\| |
|---|---|---|---|---|
| Log Prod. Cost | -4.58171 | 0.9511985 | -4.82 | 0.000 |
| Log % change prod. Cost | 2.973566 | 0.5864217 | 5.07 | 0.000 |
| Log land area | 0.2621411 | 0.1670404 | 1.57 | 0.126 |
| Log %change land area | 0.1142543 | 0.130267 | 0.88 | 0.387 |
| Log production estimates | 0.1608172 | 0.211237 | 0.76 | 0.452 |
| Log %change production | -0.0752241 | 0.1148497 | -0.65 | 0.517 |
| Cons | 2056.744 | 9.957388 | 206.55 | 0.000 |

Number of obs = 40, F (6, 33) = 7.51, Prob.> F = 0.0000, R-squared = 0.5772,
Adj. R-squared = 0.5003, Root MSE = 0.87678

The area of land cultivated, percentage change in land area cultivated and production estimates increased with values of 26.2%, 11.4%, and 16%. Also, a reduction of 7.5% was recorded in the percentage change in production estimates. The production cost, and percentage change in production cost were both significant at 1% confidence level through the years under survey.

**Table 6:** Tomato Production in South-South Zone

| Year | Coef. | Std. Error | T | P>\|t\| |
|---|---|---|---|---|
| Log Prod. Cost | 1.961783 | 0.1844145 | 10.64 | 0.000 |
| Log % change prod. Cost | 0.5319119 | 0.1639503 | 3.24 | 0.002 |
| Log land area | 1.063731 | 0.1922109 | 5.53 | 0.000 |
| Log %change land area | -0.2088683 | 0.110159 | -1.90 | 0.065 |
| Log production estimates | 0.0868935 | 0.2044999 | 0.42 | 0.673 |
| Log %change production | 0.0185858 | 0.749165 | 0.25 | 0.805 |
| Cons | 1987.679 | 2.296835 | 865.40 | 0.000 |

Number of obs = 48, F (6, 41) = 35.11, Prob.> F = 0.0000, R-squared = 0.8371,
Adj. R-squared = 0.8132, Root MSE = 0.53491

Moreover, results revealed that the percentage change in production cost, production estimates and percentage change in production estimates increased over the years reviewed by 53.1%, 8.6% and 1.8% respectively. The production cost, percentage change in production cost, and land area were all significant at 1%.

**Table 7:** Correlation model for Tomato Production in Nigeria

*Correlations*

| | | Production | Zones | Years |
|---|---|---|---|---|
| Pearson Correlation | Production | 1.000 | -.886 | .123 |
| | Zones | -.886 | 1.000 | .077 |
| | Years | .123 | .077 | 1.000 |
| Sig. | Production | . | .000 | .262 |
| | Zones | .000 | . | .346 |
| | Years | .262 | .346 | . |
| N | Production | 29 | 29 | 29 |
| | Zones | 29 | 29 | 29 |
| | Years | 29 | 29 | 29 |

Table 7 above deduced that there was a high negative correlation between the six (6) geo-political zones and the rate of tomato produced from 2010 to 2014, indicated a decline in the production of tomato across the six geopolitical zones.

*ANOVA*[a]

| Model | | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 1453767.907 | 2 | 726883.953 | 60.086 | .000[b] |
| | Residual | 314529.802 | 26 | 12097.300 | | |
| | Total | 1768297.709 | 28 | | | |

The Analysis of Variance (ANOVA) table above shows that the productions across the six (6) geo-political zones are significantly different from zones to zones. The p-value was seen to be less than the alpha (0.05) value; hence, the null hypothesis which states that the production across the six (6) geo-political zones were the same was therefore rejected.

**Table 8:** Correlation Model for Estimated Land area

*Correlations*

| | | Land area Estimate | Zones | Years |
|---|---|---|---|---|
| Pearson Correlation | Land area Estimate | 1.000 | -.258 | .172 |
| | Zones | -.258 | 1.000 | .077 |
| | Years | .172 | .077 | 1.000 |
| Sig. (1-tailed) | Land Area Estimate | . | .088 | .186 |
| | Zones | .088 | . | .346 |
| | Years | .186 | .346 | . |
| N | Land Area Estimate | 29 | 29 | 29 |
| | Zones | 29 | 29 | 29 |
| | Years | 29 | 29 | 29 |

Table 8 reflects a weak negative correlation between the six (6) geo-political zones and the estimated land area.

*Coefficients*[a]

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | 230.505 | 60.191 | | 3.830 | .001 |
| | Land Area Estimate | .904 | .495 | .332 | 1.827 | .079 |

A unit increase in the cultivated land area across all the six (6) geopolitical zones in Nigeria used in the production of Tomato increases the production of tomato by a value of 0.904.

More so, if the same land area is cultivated by keeping the land area estimate constant, it means that tomato production will be 230.505. As a result, estimated land area cultivated is not actually responsible for the declinein production of tomatoes across Nigeria, though it is a contributing factorin the slight increase of tomato production in some zones.

Finally, other factors like handling during harvesting, insect infestations, packaging techniques adopted and transportation from farm to markets were found to be the likely causes of the significant drop in production across the geo-political zones in Nigeria between the years under study.

**Conclusion and Recommendations**

This study revealed that there are detailed data on the production, yield and land area cultivated for tomato in Nigeria, influencing the planning process of tomato farmers resulting in production gain or loss as the case may be. It was revealed that the cost of production has minimal effects on the trend of tomato production over the years studied. The land area has significant effects on the outcome of tomato estimates produced in all the geo-political zones in Nigeria. Despite the significant effects the land area cultivated has on tomato production in Nigeria, tomatoes produced still did not get to many of the end users.

It was deduced from the study that other factors that actually affects tomato production in Nigeria are inappropriate harvesting container resulting in tomato damage as they are being harvested. Lack of appropriate and universally acceptable packaging container has been identified as a major constraint in tomato production. This retards long distance transportation forcing farmers to sell at give-away price due to fear of damage with the use of conventional wicker baskets.

**Recommendations**

The following recommendations are made

A universally acceptable harvesting and packaging container be developed by

Agricultural Engineers to cub the menace of shortage in tomato production

A standardized container be used for selling tomatoes in order to increase the income of tomato producers

Government should endeavor to make available inputs for tomato producer as done for

cereal crops

Policies should be adopted to encourage industries that uses tomatoes as raw materials rather than allow farmers products rot away or sold at give-away price.

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