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EFFECT OF TUTA ABSOLUTA (TOMATO EBOLA) ON THE STANDARD OF LIVING OF COMMERCIAL FARMERS IN IKARA LOCAL GOVERNMENT AREA OF KADUNA STATE

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Abstract
This research was carried out to assess the effect of Tuta absoluta (Tomato Ebola) on the standard of living of commercial farmers in Ikara Local Government Area of Kaduna state. The population of the study is 159,000 which comprises of comprise of 9,000 tomato farmers and about 150,000 households from Ikara Local Government Area. a well-structured questionnaire was used in getting firsthand information as regards the research. The instrument for data collection was validated and produced for data collection at the Department of Agricultural Extension, Faculty of Agriculture, Ahmadu Bello University, Zaria. A combination of purposive and random sampling technique was used to select 109 tomato farmers from four (4) wards which were mostly hit by Tuta absoluta. A four-point Likert Type Scale and structured Questionnaire were used to collect data from the respondents. Descriptive statistics such as frequency counts and percentage were used to analyze the data collected. Research findings shows that there was a decline in the standard of living of the farmers while less than 15% experience a positive increase in their standard of living. It was concluded that Tuta absoluta (Tomato Ebola) had negative effect on tomato farmers' standard of living in the study area. It was recommended that farmers should use effective herbicides which is a preventive and curative measure; Government should also set up policies that will enable research institutions discover solutions pertaining to the disease to reduce the loss on the farmer's side and support in form of incentives.

Keywords: Tomato Ebola, standard of living, commercial farmers

Introduction

Tomato (*Lycopersicon esculentum*) is one of the most widely grown vegetables in the world (FA0, 2013). World tomato production in 2001 was about 105 million tons of fresh fruit from an estimated 3.9 million hectares. Tomato is the world largest vegetable crop after sweet potato but it tops the list of canned vegetables. As it is a short duration crop and gives a high yield, it is economically attractive and the area under cultivation is increasing daily. Tomato belongs to the Solanaceae family. Nigeria is relatively ranked the second largest producer of tomato in the World (Food and Agriculture Organization, 2014). This family also includes other well-known species such as potato, tobacco, pepper). *Tuta absoluta* is also known as South American tomato moth, Tomato borer, and Tomato Ebola in Nigeria. *Tuta absoluta* (*Lepidoptera gelechiidae*) originates from South America, where it was first recorded as serious pest of tomato. *Tuta absoluta* is a leaf-mining moth of the family Gelechiidae (Lepidoptera) and is one of the most serious pests of tomato (*Solanum lycopersicum* L.) (Solanaceae) (Desneux *et al.,* 2010). (Larraín *et al.*, 2014). It also attacks other cultivated Solanaceae, such as potato, eggplant, peppers and tobacco (Tumuhaise *et al.*, 2016). Although Potting *et al.* (2013) disputed peppers as a host. Tomato *ebola* also feeds on various solanaceous weeds (Chidege *et al.,* 2016). It was experimented that a female *Tuta absoluta* lays up to 260 eggs individually on the tender leaves during its life time (Desneux *et al.,* 2010). *Tuta absoluta* was later accidentally introduced to space in 2006 where it spread North to the Netherlands and East to Iran (Desneux *et al.,* 2010). It travels and breeds in swarms and has a reputation for swiftly ravaging tomato cultivation in a little above 48 hours prompting famers to nickname it "Tomato Ebola". The moth and its larva feed on the leaves of the tomato plants depriving it of the

nutrient to flower and to develop fruit. *Tuta absoluta* has a high rate of reproduction, the female moth lays up to 260 – 300 eggs leading to 12 generations per year mostly singly, on leaves, stems and young fruit depending on environmental conditions (Gebremariamd, 2015). From figure 1 the female lays eggs under the leaf. The leaf miner goes through six stages, namely egg, three larval stages, pupa and adult. The larvae bore between the epidermal layers of the leaf creating mines and, when older (at the 3rd and 4th instar or later developmental stage of the larva) the adult leaf miners are small, yellow and black colored flies.

The larvae form mines in the leaves of plants but can be found in growing points and in the flower. Pupation takes place mostly in the soil. Overwintering can take place during egg, pupa or adult moth but not in larva stage. It can complete between 10 – 20 generations in a year depending on environmental conditions, its minimum action temperature being 9 °C. At 14°C, it takes 76 days while at temperatures above 20 °C; it takes 24 days. The pest has also had higher areas of the adaptation, it can survive temperature as high as 49 °C in summer and also survive at temperatures below 5 °C. Tomato Ebola can also tolerant dryness, making it flourish well in hot and dry areas. The larva feeds voraciously upon tomato plants, producing large galleries in leaves, burrowing in stalks, and consuming apical buds and green and ripe fruits. It is capable of causing a yield loss of 50% to 100%. The species can overwinter in the egg, pupa, or adult stage. The standard of living of many commercial farmers is attributed to certain crucial factors, and these factors may hold the keys that give rise to how they affect the farmers. The look at the determinants of rural income provides an in-depth knowledge into the factors that explain low income yields and poverty in rural regions where these rural farmers constitute about 90% of the total population (Olatona, 2007).

The inventory of farmers' income in Nigeria has always been problematic from different research (Gebremariam, 2015; Borisade *et al*., 2017) work carried out. This is because most of the rural farmers do not keep records and a host of them are not literate. Meanwhile, the Federal and State Governments have been trying to alleviate farmers' problems through various programs. Despite all these development efforts, the average rural farmer is still regarded as being poor. The basic questions still remain: what is the average income of the rural farmer? What is the production level of the rural farmers in the study area? Are there some notable factors that can be isolated as determining the rural farmers' income? Land and sustainable practices. Various factors such as housing (shelter); Feeding (balanced diet and how many times they are able to feed in a day); Education (informal or formal education level of education); Access to good medical health care; Income (low class, middle class, or high class earners,) and Farm size are a head start to determine the standard of living of these commercial farmers. Consequently, there is need to make agriculture economically viable by seeking a balance between efficient and productive agricultural enterprise and environmental protection and sustainability (Olawepo, 2003).

The study area is also characterized with some relative problems which are typical of a Nigerian rural setting. The rural farmers are saddled with problems associated with income generation and their access to fund, land policy issue, transportation problems and a host of others. The farmer's income in this study is used as a major tool to determine their standard of living and dive into the reality of what these farmers are going through. Tomato farmers in Ikara, Makarfi, and Soba Local Government Areas of Kaduna State usually produce in commercial quantity. This tomato is being transported to various parts of Nigeria. They obtained high tomato yield. As a result, they are the higher income earners. This in turn result in their better standard of living. This may however be determined by socio-economic and environmental conditions such as availability of storage facilities, pests and disease, financial constraint, production and processing material and so on. *Tuta absoluta* is a global challenge affecting different parts of the world at different times and seasons, it is not limited to Africa with plant and socio- economic human complication. In 2016, a sporadic attack by an invasive Tomato Ebola T. absoluta was reported to cause more than 80% yield loss in Nigeria (Borisade *et al*., 2017). It was initially detected in the Liberian peninsula in 2006, and ever since then it

has rapidly moved across the Mediterranean area (Potting,2009), and has been detected in Italy, France, and even United Kingdom (U.K). According to the Federal Ministry of Agriculture and Rural Development (FMARD) Nigeria currently produces 1.8 million tons annually signifying that the output lost from the pest invasion is equivalent to 720,000 metric tons (MT). However, the root cause of *T. absoluta* introduction into Nigeria is unknown and had become the most devastating pest with severe destructions in tomato producing areas. Huge economic losses and rapid spread of the devastating pest had been recorded in recent years. It spreads across tomato farmlands in the northern part of the country targeting areas around Makarfi, Hunkuyi, Soba, and Zuntu villages in Kaduna State, in Danja, Katsina State and in Kura, Kadawa, Dakasoye villages in Kano State according to Agro- Nigeria in 2016 which made the price of tomato to triple in price. This research was carried out to access how the damage of tomato caused by *Tuta absoluta*, as well as how increase in tomato price had affected the standard of living among tomato farmers in the year 2016. The study addressed the following research questions

Research Questions

i. What are the socio-demographic and economic characteristics of tomato maize farmers in Ikara Local government area of Kaduna State*?*
ii. What are the effects of Tomato Ebola emergence on tomato availability?
iii. What is the effect of *Tuta absoluta* on tomato farmers' income in Ikara local government area?
iv. What are the curative and preventive measures in tackling *Tuta absoluta*?

Methods

Descriptive survey research design was used for the study. This design allows the researcher to collect data based on the opinions, feelings, and thoughts of the farmers. The population of the study is 159,000 which comprises of comprise of 9,000 tomato farmers and about 150,000 households from Ikara Local Government Area. Tomato is one of the major crop produced the LGA. Ikara LGA was one of the areas that suffered *tuta absoluta* disease. A multi stage sampling procedure was used for this study. In the first stage, a purposive sampling procedure was used to select four (4) wards (Kurmin kogi, Paki, Rumi, Auchan) based on the predominance of tomato farming. In the second stage, a total list of 274 registered tomato farmers (Kurmin-kogi [60], Paki [65], Rumi [68], and Auchan [81]) was obtained from Department Agriculture at Ikara LGA. In the last stage, simple random sampling procedure was employed in selecting 40% (109) of tomato farmers for this study as sample size.

Sampling Table

Wards	**Sample frame**	**Sample size (40%)**
Kurmin Kogi	60	24
Paki	65	26
Rumi	68	27
Auchan	81	32
Total	**274**	**109**

Instrument for Data Collection

The questionnaire: a well-structured questionnaire was used in getting firsthand information as regards the research. It was distributed to the sampled farmers. The instrument was divided into sections; section A collected information on respondent's bio-data while section B collected information *tuta absoluta*.

Validation of the Instrument

The instrument for data collection was given to 2 professors at the Faculty of Agriculture, Ahmadu Bello University Zaria for vetting. The observation, corrections, and amendment of the items were incorporated into the final copies, hence, the questionnaire were validated and produced for data collection.

Method of Data Collection and Analysis

The data of the study were collected using structured questionnaire and semi structured questionnaire, key informant interview (to eliminate researcher's bias towards qualitative and quantitative information and for counterfactual. Respondents who could not read and write had their questionnaire interpreted by the researcher and a research assistant. The researcher distributed one hundred and nine questionnaires (109) to rural farmers in Ikara Local Government Area of Kaduna State. All (109) the questionnaire were duly completed.

Descriptive statistics such as mean, frequencies, percentages and standard deviation were used to achieve all the objectives of the study.

Results and Discussion

Socio-economic Characteristics of Tomato Farmers

The result in Table 1 shows the socio-demographic and economic characteristics of tomato farmers. It was found that majority (52%) of the respondents were males, while 48% were females. The domination of males in tomato production in the study area could be attributed to the fact that males have access to the land and other resources than their female counterpart. The result also revealed that majority (57%) of the tomato farmers are between the ages of 20-30 years, while some (32%) were between the ages of 30-40 years, only few (11%) were below 20 years of age. This result shows that majority of the farming population were young and in active age group implying that farmers could make positive contribution to tomato production as well as serve as agents of innovation transfer in tomato farming activities.

The table also showed that majority (65%) of the respondents had secondary education while 7%, 2% and 26% had Informal, Primary, Tertiary, respectively. This indicated that the respondents had one form of education or the other. Which indicated that farmers could use their education in tomato production. The result showed that 62% were married while 38% of the respondents were single. It can be deduced that the larger percentage of the population were married showing that the respondents had one responsibility or the other. Based on farming experience, the result showed that 23% of the respondents had been in tomato production for 1-5years, while 49%, 38%, have been in to tomato production for between 6-10years, 11-16 years and above, respectively. It was discovered that 48% of the farmers produce between 1-50 baskets, 27% produced on a high scale between 51-100 baskets, 11% produce on a higher scale of between 151 baskets and above while 14% produce between 101-150 baskets. These implies that farmers are predominantly large-scale farmers and venture in commercial tomato farming.

Table 1 Socio-demographic and economic characteristics of the Respondents

Variable	Frequency	Percentage %
Gender		
Male	57	52
Female	52	48
Age		
Below 20	12	11
20-30	62	57
30-40	35	32
Level of education of the respondents		
Informal	8	7
Primary	2	2
Secondary	71	65
Tertiary	28	26

Marital status		
Single	41	38
Married	68	62
Years of farming experience		
1-5	25	23
6-10	53	49
11-16years and above	41	38
Average yield per basket		
1-50	52	48
51-100	29	27
101-150	15	14
150 and above	13	11

Field survey 2021

The result on the emergence of the disease and how it has affected the availability of tomato is showed in Table 2 It was found that 59.6% recorded a massive decline in the supply of tomato as a result of the high rate of destruction caused by *Tuta absoluta,* on the other hand 34.9%, also experienced moderately low supply of tomato during the outbreak of the disease. Only few (3.7%) strongly disagree with this, meaning that only this percentage were not affected in terms of tomato supply, 1.8% also disagree with this opinion. The availability of tomato has been negatively affected by the market demand, 49.5% strongly agreed to this opinion, while 39.4% also agreed to this while 6.4% strongly disagree and 4.6% agreed, the conclusion drawn from this is that due to the high demand of tomato by consumers, and marketers, it negatively affected the availability due to poor harvest. The emergence of tomato has positively affected the market supply of tomato. This is because most farmers supplied tomatoes at hiked prices causing the farmers to acquire more income while the consumers suffer loss in terms of money, 46.8% strongly agreed to this, 33.9% agreed to this,11.9% strongly disagreed to this while 7.3% disagreed to this. Other substitute has been adopted in order to cover the breach caused by tomato Ebola, substitutes such as processed tomato, genetically improved tomato can be used, 33.0% strongly agreed to this, 49.5% agreed to this while 7.3% strongly disagreed to this and 13.8%. Also, 56.9% strongly agreed that the presence of the disease has affected the availability and quantity of tomato exported.

Table 2: the emergence of the disease has affected tomato availability

	SA		**A**		**SD**		**D**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**
The emergence of tomato Ebola has caused a declined in the market supply of tomato.	65	59.6	38	34.9	4	3.7	2	1.8
The availability of tomato has been negatively affected by the market demand	54	49.5	43	39.4	7	6.4	5	4.6
The emergence of tomato has positively affected the market supply of tomato	51	46.8	37	33.9	13	11.9	8	7.3
Other substitute have been adopted in order to cover the breach caused by tomato Ebola	36	33.0	50	45.9	8	7.3	15	13.8
The presence of the disease has affected the availability and quantity of tomato exported	62	56.9	31	28.4	7	6.4	9	8.3

Source: Field Survey, 2021

The result in Table 3 shows the effect of Tomato Ebola on tomato farmers' income. The result showed that 63.3% strongly agreed that the emergence of the disease has resulted to a decrease in farmers' income. Despite the presence of the disease only about 32.1% experience an increase in their income and 39.4% agree to experiencing an increase in their income, this conclusion can be drawn from the fact that the farmers that responded to this are mostly from Auchan and Paki wards because they were the wards that were averagely hit by the disease, 16.5% 11.9% strongly disagreed, and disagreed to this because most of these farmers come

from the ward that was mostly hit which is Kurmin kogi. Due to the emergence of Tomato Ebola the farmers find it difficult to purchase farm inputs, 42.2% percent strongly agreed to this supporting the fact that farmers' income were negatively affected, 38.5% agreed to this while 14.7% disagreed and 4.6% strongly disagreed. The emergence of the disease has affected the income paid to the laborers by the farmers 60.6% strongly agreed to this while 22.0% agreed to this because the disease negatively affected the income of the farmers there by the amount usually paid for labour decreased and the labour force was reduced. Only 10.1% strongly disagreed and 7.3% disagreed to this which is as a result of the wards which is Paki and Auchan. The effect of the disease has affected the income of the farmers in aspect of storage 55.0% strongly agreed to this, 24.8% agreed to this while 11.0% strongly disagreed to this while 9.2% disagreed to this fact.

Table 3: effect of Tomato Ebola on tomato farmers' income

	SA		A		SD	D	
	F	%	F	%	F	F	%
The emergence of the disease has resulted to a decrease in your income	69	63.3	31	28.4	6	5.5	3	2.8
The presence of the disease has a positive impact on your income	35	32.1	43	39.4	18	16.5	13	11.9
Due to the emergence tomato Ebola I find it difficult to purchase farm inputs	46	42.2	42	38.5	5	4.6	16	14.7
The emergence of the disease has affected the income paid to my laborers	66	60.6	24	22.0	8	7.3	11	10.1
The effect of the disease has affected my income in the aspect of storage	60	55.0	27	24.8	12	11.0	10	9.2

Source: Field Survey, 2021

From Table 4, use of herbicides as curative measure tend to have the highest support from the farmers with 52.3% strongly agreed and 35.8% agreed. Which shows that herbicides are very reliable in handling this disease. However, caution must be taken because these pests usually attack at night therefore herbicides should be sprayed at night, while the use of natural enemies such as birds is next 43.1 strongly agreed while 22.0% agreed because it is biological method which is cheaper and does not affect the environment or the ecosystem. Also, only 35.8% strongly support the use of common farming practices, however, they are mostly not as reliable as the two methods mentioned above.

Table 4: Select the appropriate curative measures of handling Tomato Ebola

	SA		A		SD		D	
	F	%	F	%	F	%	F	%
Use of natural enemies (predators) like birds	47	43.1	24	22.0	18	16.5	20	18.3
Use of herbicides	57	52.3	39	35.8	5	4.6	8	7.3
Use of common farming practices such as crop rotation, ploughing	39	35.8	47	43.1	10	9.2	13	11.9

Source: Field Survey, 2021

From table below it observed that the use of effective herbicides can serve as preventive measure with 58.7% strongly supporting this and 26.65% agreeing this while 7.3% strongly disagree. Complete removal of plant debris which can contain foreign materials can be

used introduce the pest to the farm therefore, the farmers strongly support (38.5%) that plant debris should be removed completely before cultivation proceed, 34.9% also agreed while14.7% strongly disagreed and 11.9% disagreed. 34.9% strongly agreed to the use of crop rotation with vegetables, 6.4% strongly disagreed.

Table 6: The most suitable preventive measure that can reduce the damage

	SA		**A**		**SD**		**D**	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**
Use of effective herbicides	64	58.7	29	26.6	8	7.3	8	7.3
Crop rotation with cruciferous crops (vegetables)	38	34.9	48	44.0	7	6.4	16	14.7
Complete removal of plant debris	42	38.5	38	34.9	16	14.7	13	11.9

Source: Field survey 2021

Conclusion

This research discovered that *Tuta absoluta* (Tomato Ebola) outbreak has significantly affected tomato supply in Ikara Local Government Area. The result also shows decrease in farmers 'income, this in turn had negative effect on the standard of living of farmers in study area. This implies that all the variables together, explained 100% of the variability of the standard of living of farmers were affected, in which more than 85% experience a negative turn on their income which negatively affected their standard of living. Conclusively, *Tuta absoluta* (Tomato Ebola) had negative effects on tomato farmers' living standard in the study area.

Recommendations

1. Preventive measures are the most effective ways to reduce the damage caused by Tomato Ebola due to the fact that the disease is difficult be managed they consume the whole tomato fruit in a rapid manner and live on the inner part of the leaves without notice, therefore awareness should be created by government and Non- Governmental Organization (NGOs) to enable farmers address this menace and improve the standard of living of the farmers, preventive measures are cheaper than employing curative measures.
2. Government should set up policies that will support research institutes to develop seeds that will be resistant to diseases like Tomato Ebola which will boost production and national economy at large in the aspect of exportation, industrialization as well as attract foreign investors and positively improve the standard of living of an average Nigerian farmer.
3. Government should also consider construction of road linkages to local markets where farmers can sell their products, to reduce the risk of perishability of the crop.
4. Adoption of improved tomato varieties that can resist the disease could enhance increased productivity and availability of tomato, this can be made possible through introduction of new varieties and encouraging farmers to adopt the varieties of tomato introduced to them.

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