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Assessment of the Cost-returns and Profitability Patterns of Tomato Production in Yamaltu-Deba Local Government Area of Gombe State, Nigeria

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ARTICLE INFO	ABSTRACT
	The study examined profitability of tomato production in Yamaltu-Deba Local Government Area of Gombe State. A three-stage sampling technique was used to select 96 tomato producers. Data were collected using a structured questionnaire and were analysed using descriptive statistics, farm budget model, and t-test analysis. The results revealed that, the mean age of tomato producers was 38.94 years, 92.48% were males, 71.56% were married with the majority (95.44%) had family size ranging from 1 – 6 persons, and had 6.55 mean years of farming experience, having an average of 0.6 ha farm size holding. Furthermore, the result revealed that only 8.74% that have attained tertiary education. The results also revealed average variable costs constituted 88.98% and 88.84% of the average total costs of production in the dry and rainy seasons respectively. The per hectare average net income realised were found to be ₦ 154,444.20 ($ 398.05) and ₦ 39,725.14 ($ 102.38) in the dry and rainy seasons respectively. Hence, the returns per naira invested was ₦ 0.67 ($0.00173) in dry season and ₦ 0.18 ($0.00046) in rainy season (P<0.05). Moreover, the results revealed positive and desirable gross and operating ratios of < 1; implying the tomato farms in the study area maintained profitability levels both in the short and long run. However, inadequate capital was critical; which was attributed to lack of affordable sources of credits. Lack of storage and processing facilities were among the impediments to large scale tomato production in the study area. However, improvement in the existing patterns and as well as the provision of adequate essential factors of production will help expand the present scale of operations. Therefore, governments and other financial institutions should do more to provide soft loans to the farmers to improve efficiency.

1. Introduction

Tomato (*Lycopersicon esculentum*) is one of the most important protective food crops in the country and it is the world's largest vegetable crop because of its special nutritive value and its wide spread production [1]. It is a commercial and dietary vegetable crop which is consumed

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in diverse ways; including raw, as an ingredient in many dishes, sauces, salads, and drinks. As it is short duration crop and gives high yield, it is important from economic point of view and hence area under its cultivation is increasing day by day [2]. It is grown as food and cash crop worldwide, and also processed into industrial products such as tomato sauce and/or paste. Its nutritional value in terms of vitamins made the crop one of the most popular items on menus [3].

According to [4], vegetable production requires high level of management, labour, capital and close attention; thus, tomato production is subject to the variations that occur in weather, which may result in severe crop damage and losses. Labour requirements for production, harvesting, grading, packaging and transporting are very intense. [5] added that tomato production is labour intensive and bulk of production is mostly supported by small family farm. According to [6], tomato production is done mostly during the dry season, between October and May. The period between July to September is severe tomato scarce period because of high incidence of pests and diseases associated with growing tomato; general crop management and shifting of tomato producers to production of grain crops. These critical supply elements drive high demand for fresh tomatoes, causes inflation of fresh tomato prices; thus, opened market for unhygienic sun-dried tomato as well as clearance for imported fresh tomatoes from neighbouring states and nations [2]. Subsequently, for production to be profitable and serve as an incentive, there should be a good price and ready market for the produce. However, unlike cereal crops, the production and marketing of tomato in particular, is more complex and risky because of the special characteristics such as high perishable nature, bulkiness and seasonality in production; thus, needs special attention. This as a result, the supply of fresh tomato is subjected to various problems including wide fluctuation in prices [7].

Despite the fact that tomato production is a viable venture; in order to increase farm income and hence alleviate widespread poverty in Nigeria, considerable attention has not been given to tomato sector; because of the imbalance in distribution system and lack of organized marketing system. There is always a market glut of tomato in the main production season and always scarce in other seasons [1]. However, there is wastage of tomato annually as tomatoes harvested in the country are lost due to poor food supply chain management, price instability resulting from seasonal fluctuation in production and the supply preference of farmers and middlemen for urban markets than direct users due to low farm gate prices etc. [8]. These and other factors can reduce profit accrual to both producers and marketers. Thus, a wide gap deficit between demand and supply in the country sets in [2].

It has been a generally established fact that tomato farmers fetched fairly farm gate prices. However, on the ground of higher visible prices at market levels and without considering farm investments on production processes and intermediaries' costs on commodity transfer at various levels, the farmers claim that they are not sharing fairly on the consumers' prices. The prices available to the farmers could be genuine, considering low storability, fresh consumption-pattern and sophisticated transportation needs of tomato that render its marketing a complex business incurring higher costs and risks at marketers' level [6].

Based on such reasoning and visualizing the constraints involved in tomato production thus; [9] viewed that tomato producers were extremely exploited. Unless the associated problems are identified and abated, alleviating poverty in the farming communities as envisaged by national development goal would not be possible. Real problems in the system can only be described, when the economics of production mechanism and marketing system for tomato is evaluated. However, in order to close the gap between demand and supply of fresh tomato requirement, it has become very necessary to extend researches on the costs, returns and as well as production inefficiencies.

Therefore, it is worthwhile to study tomatoes to identify its production and marketing problems to provide information that looks into the possible ways and means of increasing producers' income. To this effect, the study is made to provide answers to the following research questions:

i) What is the socio-economic characteristic of tomato producers in the study area?

ii) What is the costs and returns of tomato production in the study area?

iii) What is the seasonal difference in farmers' income in the study area?

iv) What is the constraint to tomato production in the study area?

2. Methodology

2.1 Study Area

Yamaltu-Deba is one of the eleven Local Government Areas of Gombe State, with its headquarters situated at Deba-habe, 27 kilometers south-east of the State capital Gombe. It lies within latitude 10°50" N and longitude 11°40" E. It shares common borders with Local Government Areas of Gombe, Kwami, Akko, Kaltungo and Balanga to the West, North-West, South-West and South respectively and also with Borno State to the East [10]. It

occupies a landmass of 1,981 km^2 with estimated human population of 255,248 with an annual growth of 3.2% [11]. The study area is presumed the home of Tera and Jara ethnic groups; with some pockets of Waja, Fulani, Hausa, Gasi, and Kanuri. The area is characterised with warmth climate having average temperature of 30°C in the dry season and 750 mm of mean annual rainfall received [12]. The soil is rich clay-loam which provides favourable conditions for agricultural activities. Both irrigated and rain fed farming are practiced in the production of wide range of vegetables, fruits and cereal crops. Also, animal husbandry and fishing are best practice in the study area [13].

2.2 Sampling Procedure

A three stage sampling technique was used to select 120 tomato producers. In stage I, Yamaltu-Deba Local Government Area will be purposively chosen being the principal area for tomato production in the State. In stage II, the study area was divided into four major tomato belts namely; *Kwadon, Dadinkowa, Baure and Dunbu* and were purposively selected for their popularity in tomato production. In stage III, a total of 120 tomato farmers were selected using simple random sampling technique disproportionate to the number of farmers in each tomato belt. This was to ensure that every member of the population had equal and independent chance of being selected [14]. The sampling frame for this study comprised of all the participants drawn from the selected tomato belts in the study area, having an estimated total of 1,203. A sample is a subset of the population on which observations were taken for obtaining information and to draw valid conclusions about the population. However, in determining the sample size appropriate for this study, the [15] model was used. According to this model, the appropriate sample size for estimated population of 1,203 vegetable farmers will be 120; representing 10%. A disproportional allocation technique was therefore employed to select 30 tomato farmers from each tomato belt.

2.3 Method of Data Collection

Data for the study were collected from primary sources using structured questionnaires in line with the objectives of the study. Also, personal interviews to observe the full production process were made simultaneously with the formal questionnaire administration. This was to enable the researchers generate qualitative information not captured in the questionnaire. The questionnaire was divided into three sections; A, B and C; containing coded questions on tomato producers' socio-economic characteristics, the production variables, and as well as constraints

to tomato production respectively. Also, the questionnaire contained few open-ended questions that allowed the respondents to discuss freely particular production issues of concern to them. However, the content of the questionnaire was made to provide answers to the research questions.
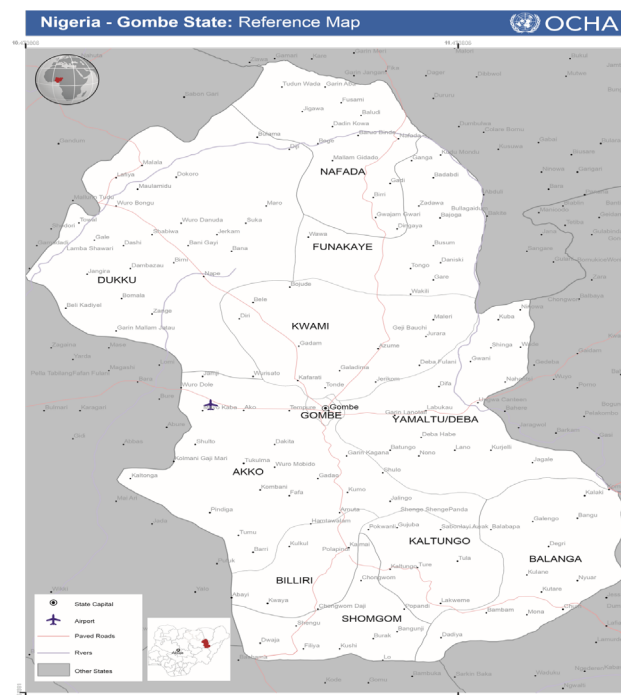

Figure 1. *Map of Gombe State Showing the Position of Yamaltu-Deba L.G.A.*

Sources: UNCS, International Organization for Migration, World Health Organization: https://www.humanitarianresponse.info/en/operations/nigeria Retrieved 28th May, 2021

2.4 Method of Data Analysis

There are many analytical tools available for use in research of this kind and the choice depends on the availability of appropriate data [14]. However, to achieve the specific objectives of the study; the descriptive and inferential statistics, and as well as the farm budget models were used for analysis.

2.4.1 Model Specification

Descriptive Statistics

The descriptive statistics such as the frequency distribution table, percentage, range, means and rankings were used to describe the observed events and as well to achieve objectives of the study. They were used to present and show the distribution of the socio-economic characteristics, cost-return and constraints variables of the respondents. The mean function used as adopted by [14] was

expressed as:

$$\bar{x} = \frac{\sum fxi}{\sum f} \tag{1}$$

where;

$\bar{x}$ = Mean of grouped data

$\sum fxi$ = Sum of products of all variables and frequencies

$\sum f$ = Sum of all frequencies of variables

Farm Budgeting Model

This was used to achieve objective two of the study. The model was meant to estimate cost-returns and profitability of tomato production. According to [16,17], the Net farm income analysis is a popular model used to measure the profitability of an enterprise especially when the fixed cost components were captured and assumed significant. The model is therefore specified in the equation as:

$$NFI = TR - TC \tag{2}$$

but, the total costs (TC) is expressed as:

$$TC = TFC + TVC \tag{3}$$

where:

NFI = Net Farm Income (₦)

TR = Total revenue (₦)

TC = Total costs (₦)

T-test Analysis

The Paired t-test analysis was used to achieve objective three of the study; to assess the income variation among tomato producers due to seasonality in production. The model is assumed appropriate to compare the means of two sample groups [18]. The model is specified in a more explicit form as:

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2}}} \tag{4}$$

where;

t = t-test value

$\bar{x}_2$ = Arithmetic mean of income realised from tomato production in the rainy season

$\bar{x}_1$ = Arithmetic mean of income realised from tomato production in the dry season

$\frac{S_1^2}{n_1}$ = Variance in income realised from tomato production in the dry season

$\frac{S_2^2}{n_2}$ = Variance in income realised from tomato production in the rainy season

3. Results and Discussion

3.1 Socio-economic Characteristics of Tomato Producers in Yamaltu-Deba L.G.A. Gombe State

The socio-economic variables used for this study include; age, gender, marital status, household size, educational attainment, farming experience etc., of tomato producers in Yamaltu-Deba Local Government Area of Gombe State. However, the result showed that most (58.5%) of tomato producers in the study area were within the age range of 31-40 years, closely followed by those in the age range of 41 − 50 years accounted for 39.30%, and only 2.2% that had 21 − 30 years old of age, with the mean of 38.94 years (Table 1). Also, [19] obtained similar findings that the mean age of tomato farmers in Nigeria was approximately 40 years.

Hence, concluded that they were still in their active years and were assumed innovative, adaptive, physically and mentally upright that would make them able to withstand tedious activity in traditional patterns of farming. In the same vein, the result revealed that 92.48% of the respondents were male while 7.52% were female (Table 1). This proves the assertion that tomato farming is a male dominance activity. Such that, low women participation could be due to socio-cultural and religious barriers affecting involvement of women in outdoor economic and agricultural activities in most parts of northern Nigeria [9].

The results also revealed that, majority (70.83%) of tomato farmers in the study area were married and then 29.17% were either single or widowed. Moreover, Table 1 shows 55.33% of tomato producers had household size of 4 − 6 persons; closely followed by those having 1 − 3 persons accounted for 40.41%, and only 2.13% that have family size of 10 and above; with the mean of 4 persons per family. This entails tomato producers in the study area have the advantage of supply of average family labour especially when we look at the size of their farm holdings. The result coincides with [20] and admitted that, the farmers had manageable family sizes which may add to them of extra helping hands in their farm businesses. But in contrast with [21], who admitted that, large family size may cause negative consequences, because the family heads bear heavy burden which greatly undermined their invest-

ment capacities resulting from higher family consumption expenditures.

Furthermore, Table 1 shows that majority (81.74%) of tomato farmers in the study had formal education, while only 18.26% that had attained non-formal education. This implies that tomato farmers may be responsive to challenges of new technologies in the study area; thus, consistent with the findings of [22]. Moreover, [23,24] both in their different studies emphasized that education assists the households to better utilize efficiently whatever available resources in their domain. Thus, the higher the level of education of individual, the stronger is the demand for his/her services in relation to production. [6] concluded that, literate farmers have been found to adopt new farming strategies faster than the illiterate ones and would find it relatively easy in their dealings with people more especially in the exchange process.

In the same vein, the results reveled years of farming experience of tomato producers as follows; 43.7% had 7 – 9 years; 37.3% had 1 – 3 years; 11.7% had 4 – 6 years; and then 7.3% had ≥ 10 years of farming experience with the mean of 6.6 years. This implies that tomato production in the study area was dominated by experienced farmers who are in their active years and thus; tomato farmers are assumed to achieve high level of productivity in the study area. However, this supports the findings of [25], who reported positive and significant relationship between farming experience and technical efficiency.

This could infer that, the more the years of experience the less the number of participants; hence the more the ability of the farmers to realize more profit. Also, [23] reported similar results and stressed that, experience in agricultural production has been identified as a key qualitative variable for farm output. Individuals with longer farming experience tend to utilize the scarce resources more efficiently than the new entrants. One may conclude that the longer a farmer stays in tomato production the more the stability and consistency of income which can in-turn determines efficiency.

Increase in hectarage outputs reflects level of income with its multiplier effect on the level of profit realized. It can be observed from Table 1; the average farm size holding of tomato producers in the study areas was 0.67 hectares. The land holding reflects the accumulated output, capital transfer and revaluation of assets. Size of farmland is considered as the biggest asset for rural households as it can be accumulated in terms of money and productive asset at the time of financial emergency [26]. The *a priori* expectation was that, farmers with large farm holdings produced additional level of the crop and vice versa.

According to [23], the finding is in agreement with the

permanent income hypothesis (PIH); that, households who owned large farmlands could increase the level of their disposable income and profit by producing additional outputs. This trend is consistent with the conclusions of [27] that, large farmland ownership helps farmers to benefit from economies of scale, higher production, and profit.

Table 1. Socio-economic characteristics of tomato producers in Yamaltu-Deba L.G.A

Variable	Category	Frequency	Percentage	Mean
Age (years)	21 – 30	4	2.20	
	31 – 40	55	58.50	38.94
	41 – 50	37	39.30	
	Total	96	100	
Household size (number)	1 – 3	39	40.41	
	4 – 6	53	55.33	4
	7 – 9	2	2.13	
	10 – 12	2	2.33	
	Total	96	100	
Years of experience	1 – 3	30	37.30	
	4 – 6	22	11.70	6.55
	7 – 9	32	43.70	
	10 – 12	12	7.30	
	Total	96	100	
Farm size (hectare)	0.5	63	68.32	
	1.0	33	31.68	0.67
	Total	96	100	
Gender	Male	88	92.48	
	Female	8	7.52	
	Total	96	100	
Marital status	Married	68	70.83	
	Widowed	24	25.0	
	Single	4	4.17	
	Total	96	100	
Educational attainment	Adult/ Non-formal	19	18.26	
	Primary	30	31.80	
	Secondary	40	41.20	
	Tertiary	7	8.74	
	Total	96	100	

Source: Field survey (2019)

3.2 Cost-returns and Profitability of Tomato Production in Yamaltu-Deba L.G.A

Table 2 shows the average total costs and returns of tomato production in the study area. The results revealed the average total costs of cultivating one hectare of tomato farmland were ₦ 229,014.20 ($ 590.24) and ₦ 226,015.66 ($ 582.51) in dry and rainy seasons respectively. The results further revealed the proportions of average variable

costs (88.98% and 88.84%) of the total costs of production in the dry and rainy seasons respectively. The results agreed with [28] who conceptualized that, small-scale entrepreneurs' capital allocated to fixed inputs is low and sometimes negligible. However, [6,29] further supported the idea; that most at times, the proportion of fixed cost components in small-scale agricultural value chain constituted < 1.0% of the total costs in Bauchi State Nigeria. In terms of returns; the average gross revenues of ₦ 383,458.40 ($ 988.30) and ₦ 265,740.80 ($ 684.90) were realized from the sales of 3.8 tons and 3.3 tons of tomato in the dry and rainy seasons respectively; thus, confirmed the business was profitable when compared with the total costs of production. However, the total income might be misleading because it may not be good enough to reflect the total amount of capital involved in the production process. Furthermore, the result revealed the average net income of ₦ 154,444.20 ($ 398.05) in dry season and ₦ 39,725.14 and ₦ 39,725.14 ($ 102.38) in the rainy season. The results concurred with the findings of [30], who concluded that dry season tomato production is profitable than in the rainy season.

Table 2 further shows the positive and desirable gross and operating ratios of < 1; thus, indicated the farms maintained their profitability status [31]. The implication here is that; the total revenue realized from the business would be able to pay for the total and variable costs of production in the short run. But note that, these ratios did not guaranty debt repayment or expansion capacity of the venture. Also, the returns per naira invested were found to be ₦ 0.67 ($0.00173) and ₦ 0.18 ($0.00046) in the dry and rainy seasons of tomato production respectively.

3.3 Paired T-test Analysis of Difference in Farmers' Income Due to Seasonality in Production

Table 3 shows the result of t-test analysis of differences in net incomes of dry and rainy seasons of tomato production. The result revealed a significant difference in net income ($P < 0.05$) from the sales of tomato in the dry and that of rainy season. The result coincides with [32], who stated that, tomato has ceased to be main crop during rainy season in most parts of northern Nigeria. Also, [33], confirmed higher profitability and economic efficiency for most of vegetable crops produced under irrigation system relative to rain-fed system of agriculture. These results corroborate with the finding of [34], who advocated adoption and utilization of irrigation schemes as tool of poverty alleviation among rural youths in the developing

Table 2. Cost-returns and profitability of tomato production in Yamaltu-Deba LGA

Items	Dry season			Rainy Season		
Variable costs	Quantity	Amount (₦)	% of TC	Quantity	Amount (₦)	% of TC
Fertilizer	200 kg	24,023.00	10.48	200 kg	24,023.00	10.62
Seeds	25 kg	10,513.29	4.59	25 kg	10,513.29	4.65
Agrochemicals	8 litres	20,019.62	8.74	8 litters	20,019.62	8.86
Land preparations	1 ha	48,418.56	21.14	1ha	48,418.56	21.42
Family consumption	260.86 kg	26,086.00	11.39	260.40 kg	23,436.00	10.37
Gift value	240.23 kg	21,969.24	9.59	240.23 kg	21,620.70	9.57
Loading & transport	75 basket	24,250.03	10.59	75 basket	24,250.03	10.72
Empty basket	142.5 pcs	28,500.92	12.44	142.5 pcs	28,500.92	12.61
Total variable cost		203,780.66	88.98		200,782.12	88.84
Fixed cost						
Depreciation		25,233.54	11.02		25,233.54	11.16
Total fixed cost		25,233.54	11.02		25,233.54	11.16
Total costs		229,014.20	100		226,015.66	100
Returns	3.8 tons			3.3 tons		
Total Revenue		383,458.40			265,740.80	
Net Income		154,444.2			39,725.14	
Gross ratio		0.59			0.85	
Operating ratio		0.53			0.76	
Returns/ naira		0.67			0.18	

countries.

Table 3. T-test analysis of difference in farmers' income due to seasonality in production

Season	Mean	SE	t-statistic	P-value	N
Dry season	8.5200E3	2444.88295	1.121**	0.9462	96
Rainy season	8.1050E3	1320.21697			

Source: Field Survey data (2019); **Significant (P<0.05)

3.4 Constraints to Tomato Production in Yamaltu-Deba LGA

Table 4 shows that majority (90.63%) of tomato producers in the study area were faced with inadequate capital, closely followed by 85.42% who claimed to have problem of pests and diseases all year-round. High costs of production ranked the third problem of tomato production in the study area; which accounted for 82.29% of the respondents. The result agreed with the findings of [7], who reported inadequate capital hinders tomato farmers from expanding their business. However, [2,28] in their different studies, both attributed high tomato losses were due to pests and diseases infestation resulting from poor farm management and cultural practices. This implies that there was high level of post-harvest losses of tomato which may discourage farmers from increasing their production capacity [7].

Table 4. Constraints faced by the tomato producers

Constraints	*Frequency	Percentage	Ranking
High transportation cost	69	71.88	5th
High costs of production	79	82.29	3rd
Inadequate Capital	87	90.63	1st
Pests and diseases	82	85.42	2nd
Rainfall	62	65.58	6th
Poor storage	74	77.03	4th
Fatigue	60	62.50	7th

*Multiple response
Source: Field survey (2019)

4. Conclusions and Recommendations

Tomato production was relatively profitable venture in the study area. This was because at least 42.5% of the total investment could be generated as revenues. This is an indication that the production efficiency based on profit is good and equally viable as revealed by the gross and operating ratios. However, the profitability of the prod-

uct depends largely on the least costs of production per hectare; and as well as fast and viable markets linkages to sell off the tomato due to its nature of perishability. Thus, the findings of this research attempt to contribute to the general knowledge in production economics in the study area; thereby providing basis for concerted stakeholders' action towards large scale production. However, the findings would be essential in guiding producers and traders in selecting factors that would improve their income levels, hence justifying the relevance of the study. It is also hoped that, the study contributes to the existing little stock of knowledge on tomato production which can serve as a stepping forward for further researches at local and/or national level at large. Based on the findings, it was recommended that tomato producers in the study area should form and or join Tomato Producers Unions to enable them to gain access to government interventions and loans from financial institutions. Moreover, governments and any intending investors to establish tomato processing plants in strategic locations in the study area so as to encourage large scale production; and hence will help reduce post-harvest and marketing risks of tomato in the study area.

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