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COST AND RETURN ANALYSIS OF IRRIGATED UPLAND TOMATO (*Lycopersicon Esculentum*) PRODUCTION IN GOMBE STATE, NIGERIA

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ABSTRACT
The study examined the cost and return analysis of irrigated upland tomato (*Lycopersicon Esculentum*) production, in Gombe State, Nigeria. Multi-stage random sampling procedure was used to select 459 respondents. Data were collected using structured questionnaire and were analysed using descriptive and inferential statistics. The result revealed that Most of the types of farms implements use for dry season tomato production in the study areas were tractors (32.4%), hand tools (37.6%) and animal traction (30.0%). Capital for dry season tomato production, the respondents in Dukku, Nafada, funakaye and Yamaltu Deba LGA respondents had a mean capital of ₦212,747.36, ₦183,662.55, ₦261,540.30, and ₦204,785.956 respectively. The findings also revealed the result of maximum likelihood estimate of parameters of the stochastic frontier production function of dry season tomato farming in the study area reveal that farm size (P< 0.001), labour (P< 0.001), farming experience (P< 0.001), and capital (P< 0.001) were the major factors statistically affecting the respondents rice production at 1%. The analysis of dry season maximum likelihood estimate of the parameter of stochastic frontier cost of tomato production showed that ploughing (P< 0.001), transplanting (P< 0.001), harvesting (P< 0.001) and capital (P< 0.001) were the determinant of cost of output of the respondents. The result further reveals the costs and return of dry season tomato farming in the study area depicts that the total variable cost of production was ₦2,384,894 with a total cost of production which is the total variable plus the fixed cost of ₦3,266,031. The revenue realized was ₦4,070,558. The net farm income for the dry season tomato farmers for one hectare in the study area was ₦804,529.23. The profit index of the respondents was ₦1.7. The major constraints to the irrigated upland tomato production were inadequate water for irrigation (23.0%), lack of irrigation facilities (20.7%), heat stress and drought (27.2%) preventing maximum productions in the study area. In addition, constraints to irrigated upland tomato farming in the study area includes high cost of irrigation services (26.0%), high-cost fertilizer (19.3%), high cost of pesticide (20.9%) and high cost of insecticide (18.2%). It was concluded that the respondents are operating at a lost and again the labour cost looking at the high cost incurred from production which clearly shows that there was over utilization of resources especially in the area of labour cost. The study made the following recommendations; efforts should be made to improve access to adequate water for irrigation purposes, there is a need to provide modern irrigation facilities to farmers to improve water management and efficiency, there is a need to promote value addition in tomato farming through processing and packaging to increase the shelf life of tomatoes and reduce post-harvest losses and farmers should be encouraged to formed cooperatives to be united in one voice to have a bargaining power over labour cost and can also make request to government on their needs and access inputs and training from policy support programme to achieve optimal yield.

Keywords: Tomato, Farmers, Cost, Return, Gombe State.

INTRODUCTION
Nigeria is one of the most developed economies in Africa with the petroleum industry providing 95% of foreign exchange earnings and about 80% of budget revenues. Yet, agriculture is still the main source of revenue for two-thirds of the population (Tsue, 2015). Tomato (*Lycopersicon esculentum*) is perhaps the most important popular vegetable crop grown all over the country. Tomato production in Nigeria is seasonal and consequently, its supply for home and industrial use is seasonal with a peak

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during harmattan season. The seasonality of supply affects price. About 90% of the country's food is produced by small-scale farmers cultivating tiny plots of land who depend on rainfall rather than irrigation systems (Maurice, 2007 cited in Abur, 2014). Tomato production is one of most important farming activities in Nigeria, believed to reduce food and cash insecurity. The crop is cultivated continuously throughout the year because apart from the rain-fed system that normally spans between June and November (Donkoh *et al.*, 2013). In Nigeria, there are two distinct seasons, the rainy and dry seasons. The rainy season is the normal cropping season and starts from April and stops in October, while the dry season starts from November and ends in March. During the rainy season, the production of vegetable is high resulting in saturation of the market, but during the dry season, there is usually the scarcity of this important farm product, thereby leading to a high price due to short supply (Onoh *et al.*, 2016). This seasonality has resulted in food insecurity which is a challenge to sustainable food production. It has been found that most farmers do not want to go into large scale vegetable production because they are apprehensive of risk of cropping in dry season. The risk involve are poor storage facilities, inadequate processing facilities, inadequate knowledge in packaging, inadequate access to finance etc. This has made farmers to grow vegetables as an intercrop of low significance as a way of avoiding risks.

Tomato (*Lycopersicon esculentum*) is one of the most popular and widely grown fruit in the world including Africa. It is native to South America, but was introduced into West Africa by Portuguese traders and freed slaves from West Indies. It is the second most important vegetable worldwide; in terms of the number of vitamins and minerals it contributes to the diet. Tomato (*Lycopersicon esculentum*) is one of the world's most important vegetable crop and is consumed fresh and or cooked (Guan *et al.*, 2017). Tomatoes belong to the Solanaceae family and originated in the America. According to a press release by the Central Bank of Nigeria in 2019, the annual production in the country was estimated at 1.701 million tons while annual consumption stood at 2.93 million tons. This leaves an annual supply shortfall of over 1.2 million tons valued at $2.5 billion annually, which is met through importation and smuggling (Central Bank of Nigeria [CBN], 2019). Nigeria is ranked second largest producer of tomato in Africa and fourteenth largest in the world, producing 1.51 million metric tons of tomato annually valued at ₦87 billion at an average of 25-30 tons per hectare under rainfed production (CBN, 2019). Tomato is grown and eaten all over the world. It is used in diverse ways, including raw in salads, and processed into tomato soup. Unripe green tomatoes can also be breaded and fried. Tomato juice is sold as a drink. The fruit is preserved by drying, often in the sun, and sold either in bags, baskets or in jars with oil. Tomato is rich in vitamins, minerals and lycopene, an excellent antioxidant that helps to reduce the risk of prostate and breast cancer (Adedeji *et al.* 2015). The crop is a short generation time of about three to four months, well adapted to different cropping systems of cereal grains, pulses and oilseeds. Hence, it is the most widely grown vegetable crops grown worldwide under outdoor and indoor conditions. Nigeria's agricultural sector contributes to a significant part of the country's GDP. Between January and March 2021, the agriculture contributed to 22.35% of the total GDP, an increase by almost one percentage point compared to the same period of 2020 (www.data.worldbank.org).

The significance of this study lies in its potential to provide valuable insights into the economic viability and sustainability of irrigated upland tomato production in Gombe State. By analyzing the costs involved in production, including inputs such as seeds, fertilizers, pesticides, labor, and irrigation, as well as estimating the returns from tomato sales, the study will help farmers determine the profitability of tomato farming and identify areas where cost-efficiency can be improved. Additionally, the findings of this study can inform policymakers and agricultural extension services on strategies to support and promote sustainable tomato production practices, thereby contributing to the overall development of the agricultural sector in Gombe State.

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MATERIALS AND METHODS

The Study Area

Gombe State is located between Longitude $10^{\circ}15^{1} - 10^{\circ}50^{1}$N and Latitude $11^{\circ}00 - 11^{\circ}45^{1}$E of the Greenwich meridian. It lies within the North East region of Nigeria and occupies a total land area of about 20,265 km^2. The number of inhabitants of the area has a projection population of 3,822,081 based on 3.2% annual population growth (NBS, 2021). The major ethnic groups are Tera, Bolewa, Hausa, Fulani, Tangale, Lunguda, Waja, Kamo, Kanuri, Jukun, Peroshonge, Cham, Dadiya, and Tula. The State shares boundary with Yobe State to the North, Adamawa and Taraba State to the South, Borno and Bauchi State to the West. As presented in Figure 1, the State is administratively divided into 11 Local Government Areas, which include: Akko, Balanga, Billiri, Dukku, Funakaye, Gombe, Kaltungo, Kwami, Nafada, Shongom and Yamaltu Deba.

The study area experience dry season from November to April while wet season begins from late April to October. This is characterized by the north easterly wind blowing across the country from Sahara Desert known as Harmattan wind (Dabo, 2017). The annual rainfall starts in late April and ends in October with mean annual rainfall ranges from 800 mm to over 900 mm with rainfall duration of 4-5 months. The mean minimum daily temperature recorded ranges from 13.6℃-31.9℃ in January and 9.0℃ to 28.5℃ in August. (Gombe State Agricultural Development Programme [GSADP], 2018). Rainfall intensity and duration is sufficient to permit production of typical rainfall farming in the areas. The vegetation type in the area is predominantly natural growing trees, such as *afzelia Africana acasia SSP* which are found on heavier soil. The area is characterized by shrubs savannah on fertile soil, short grass and thorny vegetation on cetaceous sediments. All the rivers are seasonal (GSADP, 2018).

Sampling Procedure and Sample Size

Gombe State Agricultural Development Programme reveals that there are 32,887 farm families in the State, out of which 19,732 engaged in rain-fed while 13,155 engaged in both irrigated and rain-fed tomato production (GSADP, 2017). Multi-stage random sampling procedure was used to select sample farmers for this study. In the first stage, five LGAs namely Yamaltu Deba, Funakaye, Dukku, Nafada and Kaltungo were randomly selected on the basis of potential *fadama* areas. In the second stage, three farming communities were randomly selected from three Local Government Area (Dukku, Kaltungo and Nafada) and four communities were also selected from two LGA (Funakaye and Yamaltu Deba) were selected on the basis of area and production of dry season tomato making a total of 17 farming communities. Thus, an area with high number of tomato producers gets large number of beneficiaries. Lastly, in each LGA, proportionately 10% was used to select the sample size out of 4,591 sampling frame. This is in line with Eboh (2009) who stated that 10% for 2000 -5000 sampling frame is appropriate for decision making in case of social science research.

Method of Data Collection

Data were collected using structured questionnaire by the researcher with the assistance of GSDAP trained enumerators. The questionnaire was divided into sections and each is aimed at achieving an objective of the study. The sections in the questionnaire cover socio-economic characteristics of the farmers, cost and returns, technical, allocative and economic efficiency, socio-demographic, economic and institutional factors, Income, and constraints associated with the dry season tomato production system in the study area. This approach was adopted to facilitate intensive data collection.

Method of Data Analysis

Data were analyzed using simple descriptive statistics (Type of Farm Implement Use for Dry Season Tomato Production and Capital for Tomato Dry Season Production), farm budgeting techniques (net farm income) (cost and return of Faro-44 rice production) and regression (Stochastic Frontier Production Function of Dry Season Tomato Production) analysis.

RESULTS AND DISCUSSION

Type of Farm Implements used for Dry Season Tomato Production

Table 1 revealed the types of farms implements use for dry season tomato production in the study areas. In Dukku LGA larger proportion of the farmers use hand tools (hoe, rake, shoves)

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representing 47.1% some of the farmers use tractor representing 28.6% while others use animal traction representing 24.3%. The result in Nafada LGA revealed that many of the farmers use hand tools representing 38.6%, those who use tractor were 34.1% and others use animal traction 27.3%. Furthermore, in Funakaye LGA more respondents use tractor representing 34.7% followed by those who use hand tools 33.7% and those for animal tractor represent 31.6%. The result in Yamaltu Deba LGA also revealed that tractor, hand tools and animal traction were represented as 32%, 30.9%, and 37.0%, respectively. The result agreed with the report of Nwalieji *et al.* (2015) that farmers mostly used crude implement such as hoes and cutlass to carry out farm activities.

Table 1: Type of Farm Implement Used for Dry Season Tomato Production

Locations	Type of farm implement	Frequency	Percentage
Dukku	Tractor	20	28.6
	Hand tools (Hoe, Rake, Shovel)	33	47.1
	Animal traction	17	24.3
	Total	**70**	**100.0**
Nafada	Tractor	15	34.1
	Hand tools (Hoe, Rake, Shovel)	17	38.6
	Animal traction	12	27.3
	Total	**44**	**100.0**
Funakaye	Tractor	34	34.7
	Hand tools (Hoe, Rake, Shovel)	33	33.7
	Animal traction	31	31.6
	Total	**98**	**100.0**
Yamaltu Deba	Tractor	58	32.0
	Hand tools (Hoe, Rake, Shovel)	56	30.9
	Animal traction	67	37.0
	Total	**181**	**100.0**
Kaltungo	Tractor	17	25.0
	Hand tools (Hoe, Rake, Shovel)	20	29.4
	Animal traction	31	45.6
	Total	**68**	**100.0**
Mean % Tractor		32.4	
Mean % Hand tools		37.6	
Mean % animal traction		30.0	

Source: Feld Survey, 2023

The result further revealed that in Kaltungo LGA, many of the respondents used animal traction representing 45.6%, while those using tractor were 25.0% and those for hand tools were 29.4%. This implies that many of the farmers in Dukku and Nafada use hand tools for the production of dry season tomato. Also, respondents in Yamaltu Deba and Kaltungo use animal traction for ease of tomato production, while in Funakaye use more of tractor for the production. With the use of farm implements the respondents in the study area do their farm operation with ease and that facilitate production and output of tomato. These findings are in consonance with facts that farmers hire services of tractors and other farm implements from others if required and also, that the interaction of the various farm implements or inputs contributes to increased agricultural productivity of *fadama* crops (Kushwaha and Ochi, 1996; Sani, 2000).

Estimated Capital for Dry Season Tomato Production

Table 2 showed the amount of funds use for dry season production of tomato in Gombe State. The mean result from Dukku LGA is ₦212,747.36 with minimum ₦120,822 and maximum ₦432,982, respectively. The finding indicated that in Nafada LGA the mean was ₦183,662.55, minimum ₦153,862 and maximum ₦325,692 naira respectively. From the respondents in Funakaye LGA it was obtained that, the mean was ₦261,540.30, minimum ₦132,881 and

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maximum ₦529,079, respectively. The mean obtained from Yamaltu Deba from the findings on capital for tomato dry season production was ₦204,785.956, minimum ₦142,262 and maximum ₦434,958, respectively. The mean capital obtained from Kaltungo for dry season tomato production was ₦191,815.90, minimum ₦165,572 and maximum ₦333,272, respectively. This study revealed that the respondents in Gombe State have different sources of capital for the production of dry season tomato in a sustainable manner for farm efficiency. Girei *et al.* (2013) reported a similar finding that farmers had relatively small capital which hindered them to carry out large scale production.

Table 2: Distribution of the Respondents According to Capital for Tomato Dry Season Production

	N	Minimum	Maximum	Mean (₦)	Std. Deviation
Dukku	70	120,822.00	432,982.00	212,747.36	11.51344
Nafada	44	153,832.00	325.692.00	183,662.55	23.87728
Funakaye	98	132,881.00	529,079.00	261,540.30	31.02483
Yamaltu Deba	181	142,262.00	434,958.00	204,785.96	12.77956
Kaltungo	68	165,572.00	333,272.00	191,815.90	10.12106

Sourced: Feld Survey, 2023

Stochastic Frontier Production Functions of Dry Season Tomato Production

This section deals with the results of the maximum likelihood estimates of the parameters of dry season tomato farmers as well as the results of maximum likelihood estimate of the parameters of the stochastic frontier cost of dry season tomato farmers in the study area.

Maximum Likelihood Parameters Estimate of Dry Season Tomato Production

The findings in Table 3 revealed the result of maximum likelihood estimate of parameters of the stochastic frontier production function of dry season tomato farming in Gombe State, Nigeria. The diagnostic statistic of the model such as: - the log likelihood ratio (73.02) is high and significant at $P<0.10$, the variance ratio define by gamma (γ) is 0.6239 and is significant at $P<0.01$ meaning that the variable influence that are unexpected from production function are dominants sources of random errors. This indicate that 73% of the variation in the output of tomato production was due to the existence of technical inefficiency among dry season tomato farmers. The sigma squared (σ^2) is 0.5628 and is significant at $P<0.01$ meaning that the explanatory variable included in the stochastic frontier production model jointly effluence the level of production of tomato in Gombe State.

The effect of the variables in this model as presented in Table 3 is that any variable with negative sign or coefficient is an indication that the variables have power of reducing technical efficiency and the positive coefficient implies that the variable has the effect of increasing technical efficiency that is the ratio of farmer physical output to the total physical inputs. The farm size determines the farm production as presented in table 3, the farm size has positive coefficient of 0.12372 and is significant at 1% level of probability. That means that the farm size has the tendency of increasing technical efficiency of dry season farmers in Gombe State, Nigeria. This implies that with 1% increase in the dry season tomato land size cultivation, output of the tomato will increase by 12.4% this is due to the fact that land is an important factor of tomato production and the more the ownership in the study area by inheritance without restriction of usage by family members. This is in agreement with Adenuga *et al*. (2013) who reported that increment of farm size by 1% will increase output by 0.667% in Kwara State, Nigeria. To improve tomato growth and yield, fertilizer has positive coefficient of 0.76081 and statistically significant at 1% meaning that a percentage change in increase in fertilizer usage will lead to 0.761% change in output of tomato, meaning that fertilizer is an important farm inputs to which output of tomato response in the study area. Even thou majority of fertilizer is source from open markets or farmers result to alternative fertilizer source, e.g., inorganic fertilizer.

In the study, seed and seedlings, have the coefficient of 0.16281 and was also positive and significant at 5% meaning that seed is an important variable in tomato production. The high level of seeds inputs shown that tomato cannot be technically and efficiently practices without the right quality of seeds or seedlings. It can lead to multiplication and better seedlings supply in the next planting season

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at the low cost, this result implies that 1% increase in tomato seeds used will result to 16.3% increase in yield for output of the farmer. This finding agrees with Anim *et al*. (2015, and Shettima *et al*. (2015) in which, numbers and amount of seed used positively, and significantly, affected production efficiency of tomato; and cost of labour, fertilizer and seed significantly affected the economic efficiency of tomato. These results indicated the relative importance of labour and amount of seed for technical efficiency and the importance of cost of land, seed, fertilizer and labour for economic efficiency of tomato farmers. it is implied that these inputs are critical in production process of tomato and they need special attention to improve efficiency of tomato farmers.

Table 3: Maximum Likelihood Estimates of the Parameters of the Stochastic Frontier Production Function of Dry Season Tomato Production

Variables	Parameters	Coefficient	Standard error	t-ratio
Production factors				
Constant	β_0	0.26768	0.03168	8.449495***
Farm size (ha)	β_1	0.12372	0.03117	3.969201***
Quantity of fertilizer (Kg)	β_2	0.76081	0.34141	2.228435**
Quantity of seed/Seedling	β_3	0.16281	0.07575	2.149307**
Quantity of herbicide (Ltr)	β_4	0.12394	0.62058	0.199716NS
Quantity Pesticide (Ltr)	β_5	0.53394	0.54704	0.976053NS
Labour (Man-day)	β_6	0.14179	0.03808	3.723503***
Inefficiency effects				
Age (Z_1)	δ_1	0.16363	0.10219	1.60123*
Years of education (Z_2)	δ_2	0.17053	0.06047	2.82007*
Farming experience (Z_3)	δ_3	0.12183	0.02448	4.97672***
Distance to farm (Z_4)	δ_4	0.16363	0.13219	1.23784NS
Sex (Z_5)	δ_5	-0.10053	0.08997	-1.11737NS
Household size (Z_6)	δ_6	-0.24477	0.12399	-1.97411*
Capital (Z_7)	δ_7	0.44999	0.1071	4.20158***
Diagnostic statistics				
Log likelihood ratio	LR	73.02*		
Sigma squared	(σ^2)	0.5628	0.1663	3.38425***
Gamma	(γ)	0.6239	0.1215	5.13498***

Note: *, ** and ***significant at 10%, 5%, 1%, respectively; and NS = Not significant.
Sourced: Feld Survey, 2023

Also, in Table 3, the quantity of herbicides has a positive coefficient of 0.12394 and is not significant. The quantity of pesticides has positive coefficient of 0.53394 and is not significant. Labour (man-day) has the positive coefficient of 0.14179 and is significant at 1%. This signifies that as the cost of labour increases the farmer productivity also increases by 14.17%. Table 3 further disclose the variables included in the inefficiency model based on their specific socioeconomic variable which included age, level of education, Extension contacts, sex, household size, and access to credits. These sources of inefficiency are estimated by parameter sigma squared (σ^2). However, the interpretation here was that, the opposite direction of the area discussed the variables that constitute the sources of production or technical efficiency. More so, if the coefficient of the parameter is positive for instance, it means the variable has negative or decreasing effect on technical inefficiency of tomato farmers. In Table 39, age has positive coefficient and is significant at 1% implies that age increases technical efficiency. This could be based to the fact that more of the activities that were conducted in tomato production are more vigorous that are the farmer grow older they become less active in undertaking such operations. This is also in agreement with the *a prior* expectation that the farmers age is expected to have positive effect on technical efficiency effect as the farmer get older that farmer become less energetic to production routine and practices, This is in conformity with results from the study by Ofor *et al.* (2015); Nwaliji and Ajaji, (2008); Ehirim *et al.* (2014); Onoh *et al*. (2016); Mgbada (2010); and

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Tsoho and Salau (2012) which revealed that the average age of farmers in Nigeria is between 41 and 50 years. This depicts that the respondents were still within the productive age to carried out farming and marketing activities.

The level of education has positive coefficient of 0.17053 and significant at 10% meaning that the level of education of the farmer have decreasing effect on their technical efficiency. This is in consonance with Dipeolu and Akinbode (2008) reported that education affected level of economic efficiency of tomato farmers positively, and significantly. Also, Shettima *et al*. (2015) reported that education was a significant variable to affect technical efficiency of tomato production. All these might imply that as the level of education increases farmers are concerned about scarce resources, and place more emphasis on increasing levels of output at a given level of input(s). This is because educated farmers are likely to more easily access information and make informed decisions with better management of farming activities.

The coefficient of the farming experience is 0.12183 and is significant at 1% level of probability and is positive. This implies that the more years of experience decreases farmer's inefficiency in production because they would know the right management practice for higher output. This agrees with Mehmet and Vedat (2007), Cyprian (2014), and Shettima *et al.* (2015) who reported that years of experience in tomato production positively affect level of technical efficiency of tomato farmers. The study by Donkoh *et al.* (2013) reported that years of experience positively, and significantly, affected levels of technical and economic efficiency of tomato producers. These findings agree with Mkhabela (2005) who reported that production experience significantly, and positively, affected technical efficiency of vegetable production. As years of experience increase knowledge and skill on utilizing farm resources increases, which increases the level of production from a given set of inputs.

The distance from farm has positive coefficient of 0.16363 and is not significant, sex has a negative significant and not significant. The household size has a negative coefficient and is also negative and significant at 10% with a negative sign, meaning that the household size increases technical efficiency.

The capital has coefficient of 0.44999 and is significant at 1 %, the coefficient of the dry season tomato farmers access to capital was positive and is significant socio-economic variable in determining technical efficiency of the farmer. However, the farmers use their personal savings for dry season tomato production in Gombe State that also help to decrease technical efficiency. Capital is one of the essential ingredients in agricultural production. It helps to improve capacity utilization and also provide opportunity for purchase of adequate inputs for more efficient production. It can also be used to expand farm business, to take advantage of economies of scale, as well as acquisition of new technologies and payment for hired labour and related services. It is also needed to acquire capital assets like farm machinery and equipment and for working capital to purchase improved seedlings, fertilizer and agrochemicals (Sanusi and Ayinde, 2013). This result is in line with the results from the study by Usman and Bakari (2013) and Sanusi and Ayinde (2013) who reported that, inadequate capital hinders tomato farmers from expanding their business.

Costs and Return of Dry Season Tomato Farming in the Study Area

This section presents the average costs and return per hectare for dry season tomato production in the study area. These findings revealed the results of Table 5 on dry season tomato farmers on how much they incurred on the total variable cost of production in Gombe State as follows; -₦506,777 for Dukku LGA, Nafada ₦432,560, Funakaye 460,648, Yamaltu Deba ₦481,325 and Kaltungo ₦503,584. Aminu and Sani (2020) supports these results stating that irrigated tomato production is profitable in Kaduna State with gross margin of ₦67,792.00 per year and ₦87,610.58 per hectare and that farm size, quantity of seed, labour and agrochemicals significantly influence quantity of irrigated tomatoes.

The total cost of production which is the total variable plus the fixed cost are ₦679,913, ₦621,418, ₦621,256, ₦642,071 and ₦701,373 for Dukku, Nafada, Funakaye, Yamaltu Deba and Kaltungo, respectively. However, the following are the revenue for Dukku, Nafada, Funakaye, Yamaltu Deba and Kaltungo LGAs ₦905,347, ₦814,256, ₦791,122, ₦751,565, and ₦808,268, respectively. The net farm income for the dry season tomato farmers for one hectare in Gombe State was ₦225,434.23,

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₦192,840, ₦169,866, ₦109,494 and ₦106,895, for Dukku, Nafada, Funakaye, Yamaltu Deba and Kaltungo LGAs, respectively.

The profit index of the dry season tomato in Dukku, Nafada, Funakaye, Yamaltu Deba and Kaltungo LGAs are ₦0.44, ₦0.45, ₦ 0.37, ₦0.23, and ₦0.21. This implies that; the rate of returns on investment realized by dry season tomato farmers in Gombe State was that for every one naira investment for the production of tomato by dry season tomato farmers in Dukku LGA, the farmer realized ₦0.33, for each one naira invested for the production of tomato in Nafada LGA, the farmer realized ₦0.31, for each one naira invested by tomato farmers in Funakaye LGA, the farmer realizes ₦0.27 same in Nafada LGA where the farmer realizes ₦0.17 same in Kaltungo LGA where the farmer realizes ₦0.15. These results implies that the, the farmers are operating at a lost and again the labour cost looking at the high cost incurred from production which clearly shows that there was over utilization of resources especially in the area of labour cost. These results are in agreement with Cecilia *et al.* (2020) who reports that average variable cost of dry season tomato farming incurred in tomato farmers was lower than the farmer's total revenue and therefore, an indication that dry season tomato production was a profitable enterprise.

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Table 5: Summary of Average Costs and Return of Dry Season Tomato Production

Inputs (₦)	**Dukku**	**%**	**Nafada**	**%**	**Funakaye**	**%**	**Yamaltu Deba**	**%**	**Kaltungo**	**%**
Seed/Seedling	5,589	0.82	4,426	0.71	5,813	0.94	6,277	0.98	5,503	0.78
Fertilizer (Kg)	44,230	6.51	47,364	7.62	54,462	8.77	57,234	8.91	62,713	8.94
Herbicide (Ltr)	16,874	2.48	11,266	1.81	19,585	3.15	14,050	2.19	13,097	1.87
Pesticide (Ltr)	13,964	2.05	7,384	1.19	14,644	2.36	7,960	1.24	14,146	2.02
Labour	426,120	62.67	362,120	58.27	366,144	58.94	395,804	61.64	408,125	58.19
TVC = A	**506,777**	-	**432,560**	-	**460,648**	-	**481,325**	-	**503,584**	-
Machinery and equipment	173,136	25.46	188,858	30.39	160,608	25.85	160,746	25.04	197,789	28.20
TC =B	679,913.00	100.00	621,418.00	100.00	621,256.00	100.00	642,071.00	100.00	701,373.00	100.00
Revenue = C	905,347		814,258		791,122		751,565		808,268	
Net farm income D = (C-B)	225,434.23		192,840.00		169,866.00		109,494.00		106,895.00	
Profit index = D/A	0.44		0.45		0.37		0.23		0.21	
RRI = D/B	0.33		0.31		0.27		0.17		0.15	

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CONCLUSION AND RECOMMENDATIONS

The study concluded that the respondents are operating at a lost and again the labour cost looking at the high cost incurred from production which clearly shows that there was over utilization of resources especially in the area of labour cost. Based on the constraints faced by dry season tomato farmers in Gombe State, the following recommendations are suggested to enhance their production and profitability;

i. Efforts should be made to improve access to adequate water for irrigation purposes. This can be achieved through the construction of water storage facilities, boreholes, and the rehabilitation of existing irrigation systems.
ii. There is a need to provide modern irrigation facilities to farmers to improve water management and efficiency. This includes the provision of drip irrigation systems, sprinkler systems, and access to water pumps.
iii. Farmers should be encouraged to adopt climate-resilient farming practices such as the use of drought-tolerant tomato varieties and mulching to conserve soil moisture.
iv. Efforts should be made to reduce the cost of inputs such as fertilizers, pesticides, and seedlings through subsidies or bulk procurement.
v. Measures should be put in place to improve market access for farmers, including the provision of storage facilities and the development of market linkages.
vi. There is a need to promote value addition in tomato farming through processing and packaging to increase the shelf life of tomatoes and reduce post-harvest losses.
vii. Improving the condition of rural roads will facilitate the transportation of produce to markets, reducing transportation costs and improving farmers' access to markets.
viii. Farmers should be encouraged to form cooperative associations, to be united in one voice to have a bargaining power over labour cost and can also make request to government on their needs and access inputs and training from policy support programme to achieve optimal yield.
ix. Insecurity issues can be overcome by collective efforts of the community, government, NGO and capable individuals.

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