



SOCIO-ECONOMIC CHARACTERISTICS OF IRRIGATED UPLAND TOMATO (*Lycopersicon esculentum*) FARMERS IN GOMBE STATE, NIGERIA

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ABSTRACT

The study was carried out to examine the socio-economic characteristics of irrigated upland tomato (*Lycopersicon esculentum*) farmers in Gombe State, Nigeria. Multi-stage random sampling procedure was used to select 461 farmers as sample size for this study. The result revealed that majority (68.8%) of the farmer in Gombe State representing are male and 73.1% are married; majority (82.9%) of the respondents in Dukku LGA were married. Furthermore, in Nafada LGA, 75.0% are married while in Funakaye 64.3%, and in Yamaltu Deba 80.1%, however more than the half of the farmers in Kaltungo LGAs 55.9% married. Many (22%) of tomato farmers acquire their production through gift mean age of the respondents to be 43.7 with minimum age of 35 and maximum being 42 years with standard deviation of 8.55096. The mean household size in Gombe State at Dukku, Nafada, Funakaye, Yamaltu Deba and Kaltungo were 8.5, 6.9, 7.5, 8.8, and 7.7 persons, respectively. Mean years of the farming experience of dry season tomato farmers in Gombe State was 12.3 years. The mean farm size of the respondents for dry season tomato production in Gombe State was 3.3ha. The results showed that majority (64.3%) of respondents in Dukku LGA have attended formal education. Majority (25.59%) of the farmers procured their seeds from the open market. Half (59.19%) of the farmers prefer using seedlings while the rest 48.81% used seeds. In Gombe State most (47.1%) of the farmers use hand tools (hoe, rake, shoves) and many (38.6%) of the farmers used hand tools. Furthermore, many (34.7%) respondents use tractor representing. The field report of Yamaltu Deba LGA the revealed reveals that the respondent using tractor, hand tools and animal traction were represented as 32%, 30.9%, and 37.0%, respectively. The source of labour in Gombe State at Dukku LGA included family labour, hire labour, exchange labour, contracted labour and all of the above, which represent 24.3%, 21.4%, 17.1%, 15.7% and 21.4%, respectively. The distance of farm to resident project were Funakaye 6.1 km; Dukku 5.7 km, Kaltungo 5.0 km, Yamaltu Deba 4.0 km, and Nafada 3.4 km. The study concluded that all the respondents fell within the economically productive active age group, which means that the respondents in the study area has the capacity and ability to enhance the production of dry season tomato and can easily adopt new technology. It was recommended that government should support the farmers with more farm implements to reduce drudgery of labour in irrigated upland tomato production in Gombe State.

Keywords: Socio-economic characteristics, Tomato, Gombe State, Farmers, Sampling.

INTRODUCTION

The failure of tomato farms to meet demand in Nigeria has raised concern over the ability of these farms to increase tomato output. In view of the growing demand for tomato in Nigeria, improving the efficiency of resource use would be the key to increased tomato



production in the Nigeria. Thus, for the Country to thrive in tomato production, it needs to achieve a high level of efficiency which is essential for competitiveness and profitability. It is against this background that this study intends to carry out the efficiency of resource use among tomato farmers as well as the factors influencing the output of tomato in Nigeria (Ibitoye *et al.*, 2015).

In Nigeria, tomato plays a critical role in meeting domestic and nutritional food requirement, generation of Income to producers and creation of employment. Tomato production has a long tradition among farmers in Nigeria. Farmers like growing tomato because the crop grows fast, covers large area with little investment, has a high demand in the market, has a reasonably good yield and a good return. However, the average yield of tomato in Nigeria has remained low (Samuel *et al.*, 2019). As reported by Food and Agriculture Organization (FAO, 2012), production of tomatoes in Nigeria in 2012 was about 1.8 million metric tons, which accounts for about 68.4% of West Africa, 10.8% of Africa's total output and 1.28% of world output. Unfortunately, the country experiences deficiency in critical inputs, lack of improved technology, low yield and productivity, high post-harvest losses and lack of processing and marketing infrastructure for tomato production.

Donkoh *et al.* (2013) expressed farmers' level of formal education and years of farming experience each positively affected their technical efficiency (or negatively affected their inefficiency), farm size negatively influenced their efficiency (or positively affected their inefficiency). Education is an important determinant of the efficiency of farmers as it equips one with knowledge in the discretionary use of modern technology, farm organization, and optimal utilization of farm inputs which raises efficiency. This finding confirms that of Seidu (2008) who stresses that education enables farmers to understand the social and economic conditions governing their farming activities and thereby increasing their output. Kavoi *et al.* (2016) found the educational level of the household, experience in tomato farming and family size to have a positive impact on technical efficiency. Expectedly, gender and farm size exhibited a negative relationship. Similarly, in a study in Swaziland, Malinga *et al.* (2015) established that age, educational level, experience and access to credit had a significant positive relationship on the technical efficiency of tomato growers.

Usman and Bakar (2013) revealed that majority of respondent fell within the age range of 41-60 years accounting for 9.6% of the respondents were above 60 years of age while 7.9% were within the age range of 21-40 years. The mean age of respondent was 51 years. This implies increased productivity and technical efficiency among tomato farmers in the area since majority of the farmers are still in their active and productive age. This agrees with the findings of Usman *et al.* (2013) who found that tomato production was dominated by adults who were between the age range of 40-60 years of age and attributed it to labour requirement in tomato production. Access to credit may enable farmers to purchase productive inputs on time. It may lead to higher productive efficiencies. The coefficients of access to credit were negative for production inefficiencies and were significant at 0.05. This shows that the higher the access to credit, the more efficient the farmer became (Martin *et al.*, 2017). Similarly, Shaibu (2015) disclosed that quantity of pesticide, seed and fertilizer were over utilized while labour and farm size were under-utilized. The study further showed that all the inputs were not utilized to optimum economic advantage. The profit level of farmers can be increased if these resources are efficiently allocated and utilized. Saleh *et al.* (2016) carried out a study on resource use efficiency in tomato production in a semi-arid zone of Nigeria. The finding reveals that measures of technical efficiency of resource use such as marginal value product (MVP) and marginal factor cost (MFC) were revealed that the ration of the MVP and MFC were greater than unity (1) for all the inputs. This implies that seeds and fertilizer were under-utilized. This



means that tomato output was likely to increase and hence revenue if more of such input (labour, fertilizer, farm size, chemical, and seeds) had been utilized.

Shrestha *et al.* (2016) explained that production efficiency of vegetable farming could be increased with a greater access to improved seed, agricultural credit, training and extension services in eastern high hills of Nepal. Ofor *et al.* (2015) pointed that, traditional land tenure system was a constraint to irrigated tomato production. Other constraints included scarcity of water for irrigation and poor marketing channels. Olademeji *et al.* (2014). Shows that lack of access to irrigable land (water) took the lead indicated by 21.3%. This was followed by the high cost of equipment (14.4%) and inadequate finance (13.3%). It suffices to note that these three constraints identified as most important constraints sum up to over half (49%) of the problems of vegetable farmers in the study area. Tsoho *et al.* (2012). Attack on crops through the effect of pests and diseases were considered as a major problem limiting the farmer's output. Vegetable crops are subjected to a variety of pests and diseases that can reduce yield and quality of the crop (Tsoho, 2012). The findings of the study have further identified other major constraint militating against the dry season *fadama* farming to include; transportation problem, lack of storage facilities, and marketing system.

MATERIALS AND METHODS

The Study Area

Gombe State is located between Longitude $10^{\circ}15' - 10^{\circ}50'N$ and Latitude $11^{\circ}00' - 11^{\circ}45'E$ of the Greenwich meridian. It lies within the North East region of Nigeria and occupies a total land area of about 20,265 km². 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°C-31.9°C in January and 9.0°C to 28.5°C 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).

The Area is gentle undulating plains both east and west of an escarpment, which is defined by localized sandstone hills. Soil type has an impact on determination of land suitability for suitable crop production. Because all types of soils are not suitable for vegetable production. The soils in Gombe State were classified according to soil classification methods from the FAO-UNESCO classification system. According to National *Fadama* Development Project (*Fadama* III AF II) study on soil fertility Bauchi, Gombe revealed that, Soil has been categorised into six broad groups (Luvisols, Fluvisols, Nitosols, Regosols, Vertisols, and

Leptosols) and were spatially distributed across the state based on the prevailing physiographic factors.

Gombe State is mainly an agrarian state, and some of the major crops grown include food crop like sorghum, rice, millet, maize, cowpea, sweet potatoes, cassava and a wide variety of vegetables such as tomato, pepper, onion, melon etc. Also, other crops; groundnut, soya beans, benny seed and cotton are also being produced. Other trades of the peasants include hunting, fishing and carving. Livestock rearing including cattle, sheep, goats and poultry contribute immensely to the economy of the study area.

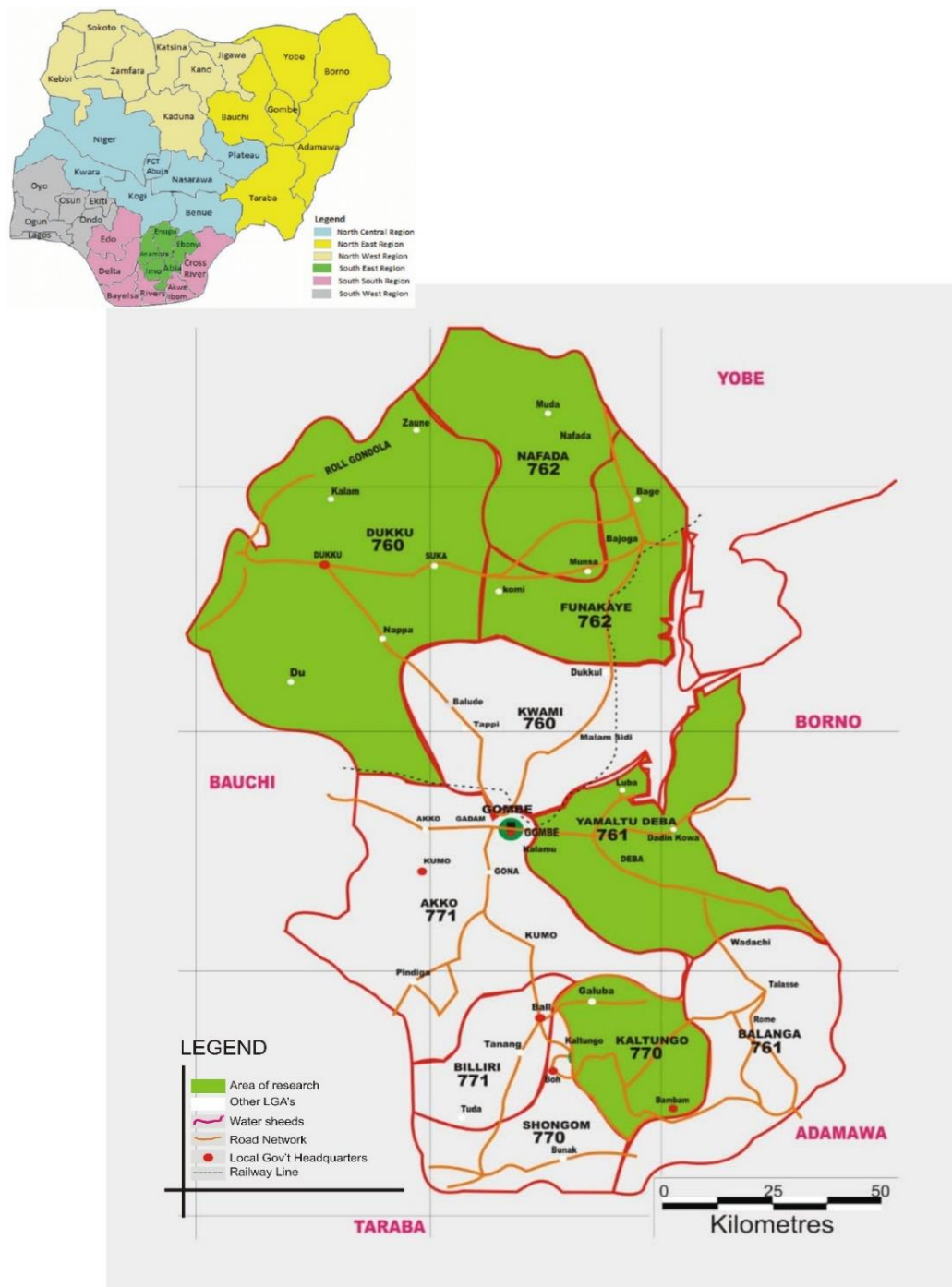


Figure 1: Map of Gombe showing LGAs of intervention



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. At first, five LGAs namely Yamaltu Deba, Funakaye, Dukku, Nafada and Kaltungo will be randomly selected on the basis of potential *fadama* areas. In the second stage, three farming communities will be 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, 10% sample size out of 4,606 sample frames were selected using purposive sampling, thus making a total of 461 farmers used in the study area. Finally, the samples will be randomly selected from the complete list of tomato farmers for interview. 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.

Table 1: Sample size determination and selection plan for the study

LGA	District	Ward	Sample frame (N)	Sample Size (10% of N)
Northern Gombe:				
Dukku	1. Ashidu	Ashidu	187	19.0
	2. Malala	Malala	250	25.0
	3. Zaunne	Zaunne	258	25.8
Sub-total			695	70
Nafada	1. Nafada	Nafada Esat	160	16.0
	2. Barwo Nasawo	Barwo Nasawo	111	11.1
	3. Barwo Winde	Barwo Winde	165	16.5
Sub-total			436	44
Funakaye	1. Ashaka Gari	Ashaka Magaba	308	30.8
	2. Jagabari	Jillahi	216	21.6
	3. Dubbel	Tilde Bodor	191	19.1
	4. Kupto	Kupto	269	26.9
Sub-total			984	98
Central Gombe:				
Yamaltu Deba	1. Kwadon	Kwadon	896	89.6
	2. Dasa	Jagali South	362	36.2
	3. Dadinkowa	Hinna	300	30.0
	4. Difa	Lobo/Difa/Kinafa	253	25.3
Sub-total			1,811	181
Southern Gombe:				
Kaltungo	1. Dogo Ruwa	Awak	284	28.4
	2. Kamo	Kamo	198	19.8
	3. Kaltungo Lakoli	Kaltungo East	198	19.8
Sub-total			680	68
Total			4,606	461

Source: Reconnaissance survey, 2022; GSADP Gombe 2017/2018 CAY



Method of Data Collection

Data were collected from the selected farmers, through the use of pretested 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, farm budgeting techniques (net farm income) and regression analysis of the socio-economic characteristics as well constraints associated with dry season tomato production system in the study area. The objectives of the study were analyzed using descriptive statistics.

RESULTS AND DISCUSSION

Socio-economic Characteristics of Dry Season Tomato Farmers

This section discussed the results of sex, marital status, and level of education, primary occupation and source of land of the respondents in Gombe State. Sex is sum of the characteristics that distinguish organism on basis of their reproductive function either of the two-category male or female and this links with the categorization of farmers into male or female. The result on the Table 2 revealed that majority of the farmer in Gombe State representing 68.8% are male while 31.2% are female. This implied that the dry season farmers in Gombe State was dominated by male may be due to labourious nature of dry season tomato production activities while women are into processing, and marketing of agricultural produce and are also engaged on off farm activities. This is in agreement with Bello *et al.* (2022) who reported that greater proportion (75%) of farmers are male.

Marital status is one's situation with regard to whether one is single, married, separated, divorce or widowed. Based on this study the revealed that majority of the farmers who are into dry season tomato production in Gombe State were married (73.1%) while those who were single are just 26.9%. This implied that dry season tomato farming was dominated by married households who were struggle to ensure that they provide food security for their households and other households need. Educational status is the act teaching knowledge to others and the act of receiving knowledge from someone. The findings revealed that many of the respondents had formal education representing 48.6% this meaning that the dry season tomato farmers had attended formal form of education stand a better chance to be guided and had sound mental attitude towards awareness and acceptance of new tomato value chain practice. This findings in consonance with Sani 2000 who reported that education play important role in human development. Those who attended informal form of education representing 51.1%.

Source of land in agriculture means access to farm, many of the respondents in Gombe State who are into tomato acquire their production through gift representing 22% follow by inheritance representing 20.8% those who acquire through hired and purchase were 19.1% each while those who had land through lease were 18.2%. Source of labour means of manpower which include skill, semi skill and general labour. Based on the result of the findings they use more of exchange and family labour with 21% each followed by hired labour with 20.10% while contract and all of the above were 18.9% and 16.7%, respectively.



Table 2: The distribution of respondents according to Sex, Marital status, level of education and land acquisition of Gombe State dry season tomato farming.

Variables	Frequency (n = 461)	Percentage
Sex		
Male	317	68.8
Female	144	31.2
Marital Status		
Married	337	73.1
Single	124	26.9
Educational Status		
Primary Education	69	14.9
Secondary Education	80	17.4
Post Secondary education	75	16.3
Vocational	83	18.0
Arabic Education	65	14.1
Adult Education	89	19.3
Source of Land		
Inherited	96	20.8
Hired	88	19.1
Purchased	92	19.1
Lease	84	18.2
Gift	101	22.0
Source of Labour		
Family Labour	101	22.1
Hired Labour	94	20.10
Exchange Labour	102	22.1
Contracted	87	18.9
All of the above	77	16.7

Farmers' Age, Household Size, Farm Size and Farming Experience

Table 3 present the result of the findings showing the mean age of the respondents to be 43.7 with minimum age of 35 and maximum being 42 years with standard deviation of 8.55096. This means that the dry season tomato farmers in Gombe State fall within the productive age group. Going by this result farmers have the ability and capability of adopting new production practice that will maximize their farm profit. The findings in the Table 3 also revealed that the households had minimum size of 1 and the maximum of 18 with the mean of 7 persons and the standard deviation of 0.38774. This implied that the dry season farmers in Gombe State had household size that supplies family labour and this helps to reduce household expenses on production. Farming experience the minimum years of experience was 4 and maximum of 34 years with mean of 10 years 6 months and the standard deviation was 0.538. Table 3 also showed that the minimum farm size for the production of dry season tomato in Gombe State was 0.522 while the maximum was 7 ha with mean of 3.69496 ha.

Table 3: Distribution based on farmers' age, household size, farm size and farming experience

Variables	Minimum	Maximum	Mean	STD
Age (Years)	35	42	43.70204	8.55096
Household Size	1	18	7.38636	0.38774
Farming Experience	4	34	10.65928	0.538
Farm Size	0.522	7	3.69496	0.5813



Source of Inputs for Dry Season Tomato Farming in Gombe State

The findings in Table 4 revealed that dry season tomato farmers in Gombe State sourced their inputs from four sources. Majority of the farmers procured their seeds from the open market representing 25.59% follow by recycle seeds from farmers which was 22.90% while others sourced their seeds from ADP and agro-dealers representing 22.78% and 22.73%, respectively. The type of chemical fertilizer used for the production of dry season tomato were NPK and Urea representing 39.26% and 38.83%, respectively, while those who used manure 21.91%. The dry season tomato farmers in Gombe State had their source of fertilizer. Many of the respondents acquired their fertilizer from ADP and open market representing 36.23% each and those who acquired from agro dealers were 27.54%. The type of planting used for the production of dry season tomato were seeds and seedlings. Half of the farmers prefer using seedlings 59.19% while the rest 48.81% used seeds.

Table 4: Source of Inputs for dry season tomato farming in Gombe State

Variables	Frequency (n = 461)	Percentage
Source of Tomato Seeds		
Open Market	118	25.59
ADP	105	22.78
Recycle seed from farmers	124	22.90
Agro Dealer	114	22.73
Type of Chemical Fertilizer		
NPK	181	39.26
Urea	179	38.83
Manure	101	21.91
Source of Fertilizer		
Govt. Sales (ADP)	167	36.23
Open Market	167	36.23
Agro Dealers	127	27.54
Type of Planting Material		
Seeds	225	48.81
Seedling	236	51.19

Varieties of Tomato, Source of Water, Point of Sale, Grading and Source of Capital for Dry Season Tomato Production in Gombe State

The findings in Table 5 revealed the verities of tomato that the dry season farmers in Gombe State prefer to produce following the consumers taste and the quality that is prefer in the market. Based on the above it is observed that many of the farmers prefer producing comapari (Gbeske) follow by Beefsteak (Tyre) 17.79% and Grape (Alahusa) 17.57%. Those who produced Plum (Kerewa) and Betterboy (UTC) were 15.8% each. Their findings showed that source of water for the irrigation of tomato were surface, borehole, tube well and well. However, majority of the farmers used wash bore/tube well representing 40.13% while those who used surface and well were 30.58% and 31.88%, respectively. The point of sale where farmers took their tomato to sale were farmgate, market, cooperative association and farmgate and market. Many of the farmers took their tomato to the market to sale representing 27.33% follow by those who sale at the farmgate and market with 26.25% while those who sale at farmgate only were 21.04% those who sale through cooperative association 25.38%. Grading the act of sorting based on quality



and size. Only about 51.41% of the dry season tomato farmers in Gombe State were involved sorting and grading of tomato. This implies that the sorting and grading adds value to the tomato fruit which attracts more income and maximizes profit. While those who do not grade were 48.59% and will make very little income and this will reduce the farm efficiency.

Source of capital, the findings in the Table 5 revealed that many of the farmers representing 22.13% used their personal saving which was source of capital for the production of dry season tomato. Those who acquired capital for production from commercial bank were 21.04% other sourced their capital from family and friends representing 19.52%. Those who got theirs from cooperative association and bank of agriculture were 18.44% and 18.87% respectively. This implies that the dry season tomato production in Gombe State use more of informal source of capital for the production.

Table 5: Varieties of Tomato, Source of Water, Point of Sale, Grading and source of capital for dry season Tomato production in Gombe State

Variables	Frequency (n = 461)	Percentage
Varieties of Tomato		
Cherry (Omo-Okoko)	75	15.37
Comapari (Gbeske)	83	18.00
Grape (Alahusa)	81	17.57
Plum (Kerewa)	70	15.18
Better Boy (UTC)	70	15.18
Beefsteak (Tyre)	82	17.79
Source of Water		
Surface	141	30.58
Wash bore/Tube	185	40.13
Well	147	31.88
Point of Sale		
At farm gate	97	21.04
To the Market	126	27.33
Through Association	117	25.38
Farm gate and Market	121	26.25
Grading		
Yes	237	51.41
No	224	48.59
Source of Capital		
Personal Saving	102	22.13
Family and Friends	90	19.52
Cooperative Society	85	18.44
Commercial Bank	97	21.04
Bank of Agriculture	87	18.87

Marital Status of the Respondents

The marital status is whether the farmers were married, single, divorced or widowed. Table 6 revealed the results of the socio-economic characteristics of the dry season tomato farmers in the study area. The result shows that majority (82.9%) of the respondents in Dukku LGA were married. Furthermore, in Nafada LGA, 75.0% are married while in Funakaye 64.3%, and in Yamaltu Deba 80.1%, however more than the half of the farmers in Kaltungo LGAs 55.9% married. This implied that dry season tomato farming is male dominated in the



study area as a result of the laborious nature of tomato production activities. This results on marital status of the respondents across the study area agrees Sani *et al.* (2014b) that farmers that participated in the *fadama* III and had significant output have similar socio-economic characteristics like age, sex, marital status, farming experience, income, and educational level arising from the facts of labour opportunities and surpluses from the married family members which could provide cheap sources of labour for tomato production for optimum welfare of the famers' family members. Farmers should be encouraged to practice moderate substitution between family and hired labour in the sense that family labour was more economical to use by *fadama* III beneficiaries in wet or rain fed farming (Sani and Haruna, 2014a). Also, Bello *et al.* (2022) reported greater proportion (75.0%) of the farmers who were males, married (89.2%) with average farming experience of 13.3 years.

Table 6: Marital status of respondents of the Study Area of Gombe State

Locations	Marital status	Frequency	Percentage
Dukku	Single	12	17.1
	Married	58	82.9
	Total	70	100.0
Nafada	Single	11	25.0
	Married	33	75.0
	Total	44	100.0
Funakaye	Single	35	35.7
	Married	63	64.3
	Total	98	100.0
Yamaltu Deba	Single	36	19.9
	Married	145	80.1
	Total	181	100.0
Kaltungo	Single	30	44.1
	Married	38	55.9
	Total	68	100.0

Sex of the Respondents

Sex is that, either of the two main categories male and female into which humans and most other living things are divide based on their reproductive functions. Table 7 revealed the sex of the respondents of irrigated tomato in the study area. The study in Dukku, Nafada, Funakaye, Yamaltu Deba and Kaltungo shows that most of the respondents were male representing 67.1%, 65.9%, 68.4%, 65.7%, and 80.9, respectively. This implied that, irrigated tomato farming is dominated by male in Gombe State. This finding agrees with Bello *et al.* (2022) and Sani *et al.* (2014b) who reported 75.0% and 90.5% male farmers, respectively implying that men are more attracted in agricultural production activities because most often women like to be more engaged in non-farm activities.



Table 7: Sex of the respondents

Locations	Sex	Frequency	Percentage
Dukku	Male	47	67.1
	Female	23	32.9
	Total	70	100.0
Nafada	Male	29	65.9
	Female	15	34.1
	Total	44	100.0
Funakaye	Male	67	68.4
	Female	31	31.6
	Total	98	100.0
Yamaltu Deba	Male	119	65.7
	Female	62	34.3
	Total	181	100.0
Kaltungo	Male	55	80.9
	Female	13	19.1
	Total	68	100.0

High level of Education

Table 8 revealed the level of education of farmers, education is the process of giving a systematic instruction in a formal manner. The result shows that 64.3% of respondents in Dukku LGA have attended formal education, while 65.9% of the respondents in Nafada LGA have attended formal education, in Funakaye LGA 66.3% of the respondents have formal education while in Yamaltu Deba LGA 66.9% have attended formal education and in Kaltungo LGA have 57.3% have formal education. This implied that the majority of the respondent in the study area have formal education, and this can guide the mental attitude of the farmers towards awareness and acceptance of new tomato value chain practices. These finding are in consonance with Sani (2000) who report that even though education plays an important role in all round development of people including vegetable *fadama* farmers, it is very expensive to acquire in 21st century. Donkoh *et al.* (2013) also expressed that expressed farmers' level of formal education affects their productivity.



Table 8: Highest level of education attained

Locations	Level of education	Frequency	Percentage
Dukku	Primary	17	24.3
	Secondary	14	20.0
	Post-Secondary	7	10.0
	Vocational	14	20.0
	Arabic Education	8	11.4
	Adult Education	10	14.3
	Total	70	100.0
Nafada	Primary	5	11.4
	Secondary	7	15.9
	Post-Secondary	7	15.9
	Vocational	10	22.7
	Arabic Education	2	4.5
	Adult Education	13	29.5
	Total	44	100.0
Funakaye	Secondary	17	17.3
	Post-Secondary	20	20.4
	Vocational	18	18.4
	Arabic Education	13	13.3
	Adult Education	20	20.4
	Total	98	100.0
Yamaltu Deba	Primary	26	14.4
	Secondary	33	18.2
	Post-Secondary	28	15.5
	Vocational	34	18.8
	Arabic Education	30	16.6
	Adult Education	30	16.6
	Total	181	100.0
Kaltungo	Primary	10	14.7
	Secondary	9	13.2
	Post-Secondary	13	19.1
	Vocational	7	10.3
	Arabic Education	12	17.6
	Adult Education	17	25.0
	Total	68	100.0

Primary Occupation Engaged by Respondents

Table 9 shows that, in Dukku LGA *fadama* farming and civil servants represent 34.3% each while upland farming represents 31.4%, this implied that majority of the respondents in Dukku LGA are farmers and only about 34.4% are engaged in irrigated tomato production. In Nafada LGA the primary occupation is *fadama* farming, civil servants, upland farming, which represent 25%, 38.6% and 36.4%, respectively. But those who are fully involved in tomato production are 25%. The finding in Funakaye LGA reveals that *fadama* farming, civil servants' upland and upland farming represents 31.6%, 35.7%, and 32.7%, respectively. Which also indicate that 31.6% are involved in irrigated tomato production. The result of Yamaltu Deba also shows that *fadama* farming, civil servant and upland farming representing 31.5%, 30.4%, and 38.1%, respectively. This shows that 31.5% are involved in irrigated tomato production. That of Kaltungo LGA also revealed that *fadama* farming, civil servant, and upland farming representing 25.0%, 44.1% and 30.9%, respectively. There is seasonal glut and inconsistent supply (Pastuszek,



2017) and inadequate processing facilities as well as cheap imports that consumes the country foreign exchange that could have been saved in the sector. Importation has deprived the economy's foreign reserve and employment opportunities.

Table 9: Primary Occupation engaged by respondents

Locations	Primary Occupation	Frequency	Percentage
Dukku	<i>Fadama</i> farming	24	34.3
	Civil servant	24	34.3
	Upland farming	22	31.4
	Total	70	100.0
Nafada	<i>Fadama</i> farming	11	25.0
	Civil servant	17	38.6
	Upland farming	16	36.4
	Total	44	100.0
Funakaye	<i>Fadama</i> farming	31	31.6
	Civil servant	35	35.7
	Upland farming	32	32.7
	Total	98	100.0
Yamaltu Deba	<i>Fadama</i> farming	57	31.5
	Civil servant	55	30.4
	Upland farming	69	38.1
	Total	181	100.0
Kaltungo	<i>Fadama</i> farming	17	25.0
	Civil servant	30	44.1
	Upland farming	21	30.9
	Total	68	100.0

Method of Land Acquisition for Dry Season Tomato Farming

The findings of Table 10 revealed that most of the farmers are acquired their land through lease representing 24.3%, purchase 22.9%, gift 20%, hire 18.6% and inheritance 14.3% in Dukku LGA. In Nafada LGA land for dry tomato production is acquired through inheritance, hire, purchase, lease and gift, representing 13.6%, 20.5%, 29.5%, 18.2% and 18.2%, respectively. However, in Funakaye LGA majority of the respondents for dry season tomato farming acquired their land for tomato production by inheritance, this represent 30.6%, those who acquired through gift are 23.5% while those who acquire their land through hire, purchase and lease represent 19.4%, 12.2% and 14.3%, respectively.



Table 6: Method of Land acquisition for dry season tomato farming

Locations	Method of Land acquisition	Frequency	Percent
Dukku	Inherited	10	14.3
	Hired	13	18.6
	Purchased	16	22.9
	Lease	17	24.3
	Gift	14	20.0
	Total	70	100.0
NAFADA	Inherited	6	13.6
	Hired	9	20.5
	Purchased	13	29.5
	Lease	8	18.2
	Gift	8	18.2
	Total	44	100.0
Funakaye	Inherited	30	30.6
	Hired	19	19.4
	Purchased	12	12.2
	Lease	14	14.3
	Gift	23	23.5
	Total	98	100.0
Yamaltu Deba	Inherited	31	17.1
	Hired	35	19.3
	Purchased	41	22.7
	Lease	34	18.8
	Gift	40	22.1
	Total	181	100.0
Kaltungo	Inherited	19	27.9
	Hired	12	17.6
	Purchased	10	14.7
	Lease	11	16.2
	Gift	16	23.5
	Total	68	100.0

The result (Table 10) of Yamaltu Deba revealed that most of the farmers acquired their land through purchase and gift representing 22.7% and 21.1%, respectively. While the others acquired theirs through inheritance, hire and lease representing 17.1%, 19.3% and 18.8%. respectively. More so in Kaltungo LGA many of the respondents acquired through land through inheritance representing 27.9%, gift 23.5%, hire 17.6%, lease 16.2% and purchase 14.7%. This implies that land by inheritance is the dominant source of land for tomato cultivation in Funakaye and Kaltungo LGAs, land acquired by purchase is the dominant source of land for the production of tomato in Nafada and Yamaltu Deba LGAs, while land acquired by lease is the dominant source of land for dry season tomato production in Dukku LGA. By implication this study signifies that *fadama* land for tomato production in Gombe State is not a barrier to production. The implication of this is that most of the lands may be underutilized as the land tenure system in operation hinders the acquisition of large hectares of land for large scale tomato production. Also, land fragmentation will be the order of the day since ownership through inheritance has been a major cause of farm fragmentation in Africa (Sani, 2000) that *fadama* farming



occupational sustainability is influenced by existing farm resource use pattern, farmers' income and cost structure on different farmers categories.

Type of Farm Implements Use for Dry Season Tomato Production

Table 11 revealed the types of farms implements use for dry season tomato production in the study areas. In Dukku LGA most of the farmers use hand tools (hoe, rake, shoves) 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 field report of Yamaltu Deba LGA the revealed reveals that the respondent using tractor, hand tools and animal traction were represented as 32%, 30.9%, and 37.0%, respectively.

Table 11: Type of farm implement use 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

Further to Table 11 findings 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).



Source of Labour Use for Dry Season Tomato Production

Labour is one of the areas in which most farmers tend to incur cost during production. For this reason, the sources and cost to the farmer is a vital instrument of measuring farm performance. Table 12 revealed the sources of labour use for dry season tomato production in Gombe State. The source of labour in Dukku LGA includes family labour, hire labour, exchange labour, contracted labour and all of the above, which represent 24.3%, 21.4%, 17.1%, 15.7% and 21.4%, respectively, while in some cases all the four are used by some respondents for the production of irrigated tomato representing 21.4%. In the same vein, the finding in Nafada LGA also showed that family labour, hire labour, exchange labour, contracted labour represents 22.7%, 18.2%, 20.5%, 25.0%, respectively, while some of the respondents use all the sources of labour mentioned for the production irrigated tomato production in the study area which represented 13.6%. Table 12 also, shows that in Funakaye LGA, family labour, hire labour, exchange labour, contracted labour represents 26.5%, 25.5%, 16.3%, and 16.3% respectively, while some respondent uses the four sources the other sources of labour for the production representing 15.3%. The study in Yamaltu Deba LGA revealed that the family labour, hire labour, exchange labour and contract labour are use in the of dry season tomato production represents 21.0%, 19.3%, 24.9%, and 20.4%, respectively. Also, 14.4% of other respondents use the four sources of labour for the production of dry season tomato. These results are in agreement with Sani and Haruna (2014a) that both family labour and hired labour are available for utilization for water melon production but varies from season to season due to certain factors such as schooling, migration, household composition (age, sex, etc.), engagement in non-farm activities, cultural preferences and existing farming techniques.

The study in Kaltungo LGA as presented in Table 12 also revealed that the sources of labour for the dry season tomato production includes family labour, hire labour, exchange labour, and contracted labour presented as 14.7%, 16.2%, 29.4%, and 17.6%, respectively. While 22.1% of the total respondent in Kaltungo LGA uses the other four sources of labour. This signifies that Funakaye and Dukku LGAs used more of family labour. Yamaltu Deba and Kaltungo LGAs use more of contracted labour, while Nafada use more of exchange labour for the production of dry season production. Where family labour is used, it reduces cost of production and maximizes output and profit. However, all the sources of labour use by respondents are aimed to enhance production efficiency. These results agree with the findings of Usman *et al.* (2013) who found that tomato production was dominated by adults as attributed to labour requirement in tomato production.



Table 12: Sources of labour use for dry season tomato production

Locations	Sources of labour	Frequency	Percentage
Dukku	Family labour	17	24.3
	Hired labour	15	21.4
	Exchange labour	12	17.1
	Contracted	11	15.7
	All of the above	15	21.4
	Total	70	100.0
Nafada	Family labour	10	22.7
	Hired labour	8	18.2
	Exchange labour	9	20.5
	Contracted	11	25.0
	All of the above	6	13.6
	Total	44	100.0
Funakaye	Family labour	26	26.5
	Hired labour	25	25.5
	Exchange labour	16	16.3
	Contracted	16	16.3
	All of the above	15	15.3
	Total	98	100.0
Yamaltu Deba	Family labour	38	21.0
	Hired labour	35	19.3
	Exchange labour	45	24.9
	Contracted	37	20.4
	All of the above	26	14.4
	Total	181	100.0
Kaltungo	Family labour	10	14.7
	Hired labour	11	16.2
	Exchange labour	20	29.4
	Contracted	12	17.6
	All of the above	15	22.1
	Total	68	100.0

Age of the respondents

Table 13 revealed the Age of the respondents in the study area, in Dukku LGA the total number of respondents were 70, 18 with minimum and 57 maxima resulting with the mean of 34.7 with the standard deviation of 0.626. the respondents in Nafada were represented as 22 minimum 16 maximum with the mean as 41.1591 given that the standard deviation was 1.5898. the respondents in Funakaye LGA were minimum 20 maximum 58 with the mean and standard deviation as 39.2655 and 0.3204, respectively. Yamaltu Deba LGA minimum of the respondents were 23, while maximum 52 with the mean and standard deviation as 40.2099 and 1.2743, respectively. Kaltungo LGA had the minimum respondents 19.00 maximum 68.00 which resulted to mean and standard deviation were obtained as 44.4412 and 0.2816, respectively. This study reveals that all the respondents within the study area fall within the economically productive active age group, which means that the respondents in the study area has the capacity and ability to enhance the production of dry season tomato and can easily adopt new technology. This result is in agreement with Sani (2000) findings that age and gender are considered as an effective measure for estimation of effective work force availability on different categories of vegetable *fadama* farms.



Table 13: Age of Respondents

Locations	N	Minimum	Maximum	Mean	Std. Deviation
Dukku	70	18.00	57.00	34.7000	0.6264
Nafada	44	22.00	61.00	41.1591	1.5898
Funakaye	98	20.00	58.00	39.2653	0.3204
Yamaltu Deba	181	23.00	52.00	40.2099	1.2743
Kaltungo	68	19.00	68.00	44.4412	0.2816

Household Size of Respondents

The findings in Table 13 revealed the household size of the respondents of dry season tomato production in the study area. The mean household size of Dukku, Nafada, Funakaye, Yamaltu Deba and Kaltungo were 8.5, 6.9, 7.5, 8.8, and 7.7 persons, respectively. This signifies that every LGA of the study area had family labour available for the production. Though the household size varies from location to location in the study area, Dukku and Yamaltu Deba have the mean of 8 persons, while Funakaye and Kaltungo had 7 persons and Nafada had 6 persons. The household size which reflexes the family labour could not meet up with the labour requirements in some areas as described on the Table 8. This in agreement with Tafida and Ayuba (2020) who reported a mean household size of 8 people in a study on smallholder farmers' acceptance of improved tomato varieties in Kano River Irrigation Project (KRIP) Kano State.

Table 13: Household size of respondents

Locations	N	Minimum	Maximum	Mean	Std. Deviation
Dukku	70	1.00	21.00	8.5571	0.5047
Nafada	44	1.00	14.00	6.9318	0.3495
Funakaye	98	1.00	19.00	7.4796	0.3890
Yamaltu Deba	181	1.00	16.00	8.7624	0.1889
Kaltungo	68	1.00	22.00	7.7941	0.5066

Farming Experience of Respondents

The result on Table 14 showed the mean years of the farming experience of dry season tomato farmers in Gombe State as follows; Dukku 12.3, Nafada 10.6, Funakaye 18.5, Yamaltu Deba 11.2, and Kaltungo 9.6. The implication of this results in the study area involved in the production of irrigated tomato signifies that the respondents have sufficient years of farming experience to enable them cope and manage the production of dry season tomato to attend farm efficiency. This implies that a greater number of the respondents have been involved in tomato production for a long time and could have learnt from their past mistake and predict changes in climatic and economic factors. This may increase their level of efficiency because the more experienced a farmer is, the more efficient he/she is and vice versa. These findings are in consonance with Kavoi *et al.* (2016) found experience in tomato farming to have a positive impact on technical efficiency.

Table 14: Farming Experience

Locations	N	Minimum	Maximum	Mean	Std. Deviation
Dukku	70	3.00	32.00	12.3000	0.0255
Nafada	44	2.00	40.00	10.6364	0.5792
Funakaye	98	4.00	37.00	18.5306	0.9602
Yamaltu Deba	181	5.00	29.00	11.1823	0.2225
Kaltungo	68	4.00	32.00	9.6471	0.9026



Distance of Farm from Resident

The findings on Table 15 are the distance of farm to resident project the mean of Funakaye 6.1 km follow by Dukku 5.7 km, Kaltungo 5.0 km, Yamaltu Deba 4.0 km, and Nafada 3.4 km. The implication of the study is that the resident of the respondents is not too far from their farms and this also shows that they don't incur more cost for transportation or trek a longer distance. However, the preserved energy is used for production. A study by Sani (2000) on Sustainable strategy for vegetable farming under small-scale *fadama condition* in Dass of Bauchi State reveals maximum distance (km) of the farmers families to primary schools (11 km), Arabic schools (6 km) and to secondary schools in 7 km. This study is also in consonance with Leake *et al.* (2018) reported that the average distance to the nearest farm would require no transportation.

Table 15: Distance of farm to Residence

Locations	N	Minimum	Maximum	Mean	Std. Deviation
Dukku	70	0.58	18.00	5.7000	0.4646
Nafada	44	1.00	10.00	3.4091	0.7319
Funakaye	98	1.41	8.00	6.1224	0.9447
Yamaltu	181	2.20	14.00	4.0994	0.8783
Deba					
Kaltungo	68	0.83	9.00	5.0735	0.3653

Farm Size under Dry Season Tomato Farming

Table 16 revealed the mean of the farm size use by the respondents for dry season tomato production. The results are as follows in the following LGAs of study. Dukku 2.9, Nafada 2.7, Funakaye 3.1, Yamaltu Deba 2.0, and Kaltungo 3.3. The dry season tomato in Gombe State by this finding implied that they have the tendency of operating a medium farm size which lead to commercialization and generating incentive for marketable surplus for the farmers. This finding is agreeing with Ndanitsa *et al.* (2020) who reported that the mean farm size of 2.0 hectare and 1.85 hectare for tomato investment project participants and non-participant respectively. Sani (2000) also classified the total cropped area of *fadama* vegetable farming into different categories namely below 1ha, 1-2.99ha and 3-.99ha and found that many of the farmers cultivated below 1ha due to limited *fadama* land for vegetable farming.

Table 16: Farm size under dry season tomato farming

Locations	N	Minimum	Maximum	Mean	Std. Deviation
Dukku	70	0.50	5.00	2.9429	0.4027
Nafada	44	0.25	6.00	2.7045	0.6078
Funakaye	98	0.80	9.00	3.1735	0.4216
Yamaltu Deba	181	0.60	4.00	2.0055	0.4083
Kaltungo	68	1.00	6.00	3.3529	1.3244

Types of Cropping System

The result on Table 17 revealed the types of cropping system that the respondents practice in the study area. The findings in Dukku LGA showed that more than half of the respondents are engaged in mix cropping representing 68.6%, while 41.4% practice sole cropping. In Nafada LGA, more than half of the respondents practice sole cropping representing 52.3%, while mix cropping was 47.7%. The result of respondents in Funakaye



LGA shows that 56.1% are engaged into mix cropping while sole cropping 43.9%. In Yamaltu Deba LGA, more than half of the respondents are into sole cropping representing 50.8% while mix cropping is 49.2%. The study in Kaltungo LGA reveals that 58.8% of the respondents practice sole cropping while 42.2% are into mix cropping. The implication of this findings signifies that the respondents in Dukku and Funakaye LGAs are more engaged in mix cropping, the intercropping system practiced by tomato farmers could help them diversify farming activities, a situation which could increase accruable total farm revenue. The results also shown that tomato farmers from Nafada, Yamaltu Deba and Kaltungo LGAs engaged more of sole cropping. However, the respondents practice the type of cropping system that best suit their environment for best technical and economic efficiency. Sani and Haruna (201a) reports land tenure system mainly practiced on land by inheritance for *fadama* III beneficiaries 92.6% and non-beneficiaries was 95.3%; and implying that the size and quality of landholdings is a pre-condition for vegetable crop production and technology choices and also an indicating that it can constrain the potential of producing marketable surplus.

Table 17: Type of cropping system

Locations	Type of cropping system	Frequency	Percentage
Dukku	Sole	29	41.4
	Mixed	41	58.6
	Total	70	100.0
Nafada	Sole	23	52.3
	Mixed	21	47.7
	Total	44	100.0
Funakaye	Sole	43	43.9
	Mixed	55	56.1
	Total	98	100.0
Yamaltu Deba	Sole	92	50.8
	Mixed	89	49.2
	Total	181	100.0
Kaltungo	Sole	40	58.8
	Mixed	28	41.2
	Total	68	100.0

CONCLUSION AND RECOMMENDATIONS

The study concluded that all the respondents in the study area fall within the economically productive active age group, which means that the respondents in the study area has the capacity and ability to enhance the production of dry season tomato and can easily adopt new technology. The sources of labour in irrigated upland tomato production in Gombe State includes family labour, hire labour, exchange labour, contracted labour. The farmers types of farms implement for dry season tomato production in the study areas include hand tools (hoe, rake, shoves), and tractors. It was recommended that government should support the farmers with more farm implements to reduce drudgery of labour in irrigated upland tomato production in Gombe State. Farmers should also form virile cooperative societies to support effective group communication to government and non-governmental agencies for farm support activities.



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