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Socio-economic Determinants of Productivity in Tomato Farming: A Case Study of Gender Dynamics, Age, Education, Household Characteristics, and Land Ownership in Berekum West and Tano North Districts, Ghana

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ABSTRACT

Tomato farming is a vital component of the global agricultural sector, serving as a staple food and economic driver. This study examines the socio-economic characteristics of tomato farmers in Ghana, focusing on aspects such as gender, age, education, household size, and land ownership, to understand their impact on farming practices and productivity. The research was conducted in the Ahafo and Bono regions of Ghana using structured questionnaires and interviews with tomato farmers. The study reveals that the tomato farming sector is male-dominated, with a significant proportion of farmers being over 35 years old. Most farmers have basic education, small household sizes, and rent their farming lands. The majority do not have bank accounts or registered farm businesses. Agro-input dealers are the primary source of seeds and agrochemicals for farmers. Local tomato varieties are more commonly cultivated than improved varieties. Farmers' choice of tomato variety is influenced by yield capacity, ease of cultivation, and market demand. Small farm sizes and low yields characterise tomato farming in the study area, which has limited income and production capacity. Farmers are generally aware of the dangers of pesticide use but lack access to protective clothing. Verbal communication from buyers is the primary source of market information. The study's findings suggest that there must be targeted interventions to support tomato farmers, boost productivity, and encourage sustainable agricultural practices.

Keywords: Tomato farming, productivity, technology adoption, land ownership, educational levels, pesticide usage.

INTRODUCTION

Tomato production is a critical component of the agricultural industry internationally, known for its roles as a staple food and a substantial economic engine [1]. The tomato's reputation as one of the most frequently grown and consumed vegetables worldwide highlights its significance [2]. Tomato cultivation plays a crucial role in Ghana's agricultural economy, generating employment and enhancing food security. Understanding the socio-economic characteristics of tomato farmers is vital for assessing their productivity, identifying challenges, and exploring opportunities for development. Tomato farming supports numerous livelihoods and plays a key role in local economies. As one of the primary vegetables consumed in Ghana, tomatoes are central to daily diets and contribute substantially to the agricultural GDP [3]. The sector offers income for farmers and stimulates related industries such as processing, marketing, and export, thereby adding value along the supply chain [4]. Moreover, tomatoes are a high-value crop with a short production cycle, making them an attractive option for smallholder farmers seeking to improve their income and food security [5].

Socio-economic factors such as gender, age, education, and household size directly impact farming productivity. For instance, studies have shown that the age of farmers influences their openness to adopting new technologies, which can affect crop yields [6] [7]. Additionally,

gender disparities in access to resources like land, credit, and extension services can result in differential productivity levels [8]. By examining these characteristics, we can identify the specific challenges faced by different demographic groups within the farming community. For example, women often face constraints related to access to land and inputs, which can limit their productivity compared to their male counterparts [9] [10]. Recognising these challenges is the first step towards developing targeted interventions that can help overcome them. Understanding the socio-economic profile of farmers, again, helps in formulating targeted interventions to boost productivity and growth. For instance, enhancing educational opportunities for farmers has been linked to improved farm management practices and productivity [11]. Moreover, providing tailored support to young farmers can encourage the adoption of innovative practices and technologies, fostering a more dynamic agricultural sector [12].

This research aimed to provide an in-depth overview of the socio-economic attributes of tomato farmers, focusing on investigating their gender composition to understand its implications for farm management and productivity. Gender disparities in agriculture can affect access to resources, technology adoption, and farm output [13]. Understanding the role of gender in farming can help design policies that promote gender equity and empower women farmers [14]. It also focused on examining the age distribution of farmers to assess its impact on technology adoption and productivity. Younger farmers may be more inclined to embrace modern agricultural practices, which can enhance productivity [6]. Conversely, older farmers might rely on traditional methods and may require specific support to adopt new technologies [15]. The study again sought to analyse household size and headship to understand their influence on farm operations. Larger households can provide more labour for farming, which can positively impact productivity [16]. Furthermore, comprehending the dynamics of household decision-making can enhance understanding of resource allocation and management within farming households [17] (Bezu & Holden, 2014).

The study did not leave out the evaluation of the education levels of farmers and their effect on farm management, decision-making, and productivity. Education enhances farmers' ability to perform critical farm tasks, understand market dynamics, and make informed decisions [11]. Higher educational attainment is often associated with better adoption of agricultural technologies and improved farm efficiency [18]. Last but not least, the research considered land ownership patterns to assess their impact on farming practices and productivity. Land tenure security and ownership can influence farmers' investment in land and agricultural inputs [19] [20]. Secure land tenure encourages farmers to invest in long-term improvements and sustainable practices, thereby enhancing productivity [21].

The socio-economic characteristics of tomato farmers are not only significant for understanding their current farming practices but also for identifying strategies to support their development. For instance, studies have shown that gender disparities in agriculture significantly impact farm productivity and resource access [9]. Addressing these disparities is crucial for promoting equitable growth within the agricultural sector. By implementing targeted interventions that empower all farmers, particularly women, we can foster a more inclusive environment that maximises productivity and sustainability across the industry.

Similarly, the educational level of farmers is crucial for the adoption of improved farming techniques and technologies [11]. By addressing these disparities and enhancing farmers' capacities, it is possible to improve overall agricultural productivity and sustainability [22].

By providing a comprehensive overview of these characteristics, this study aimed to contribute to a deeper understanding of the tomato farming sector in Ghana. This understanding is essential for developing targeted policies and interventions that can address the specific needs of tomato farmers, enhance their productivity, and promote sustainable agricultural practices. Effective interventions can help mitigate the challenges faced by tomato farmers, thereby ensuring their livelihoods and enhancing food security at both local and national levels [23].

MATERIALS AND METHODS

Study Area

The study was conducted in two regions of Ghana; the Ahafo and Bono regions (Figure 1). The Ahafo Region is situated within Ghana's forest belt and characterised by its fertile soils. Similarly, the Bono Region is known for its moist semi-deciduous forests and fertile soils. The temperature in both regions ranges from 14°C to 40°C, according to the Ghana Statistical Service (GSS). These regions were chosen for the study due to their importance in tomato farming and their representative nature of the forest-savanna transitional belt in Ghana.

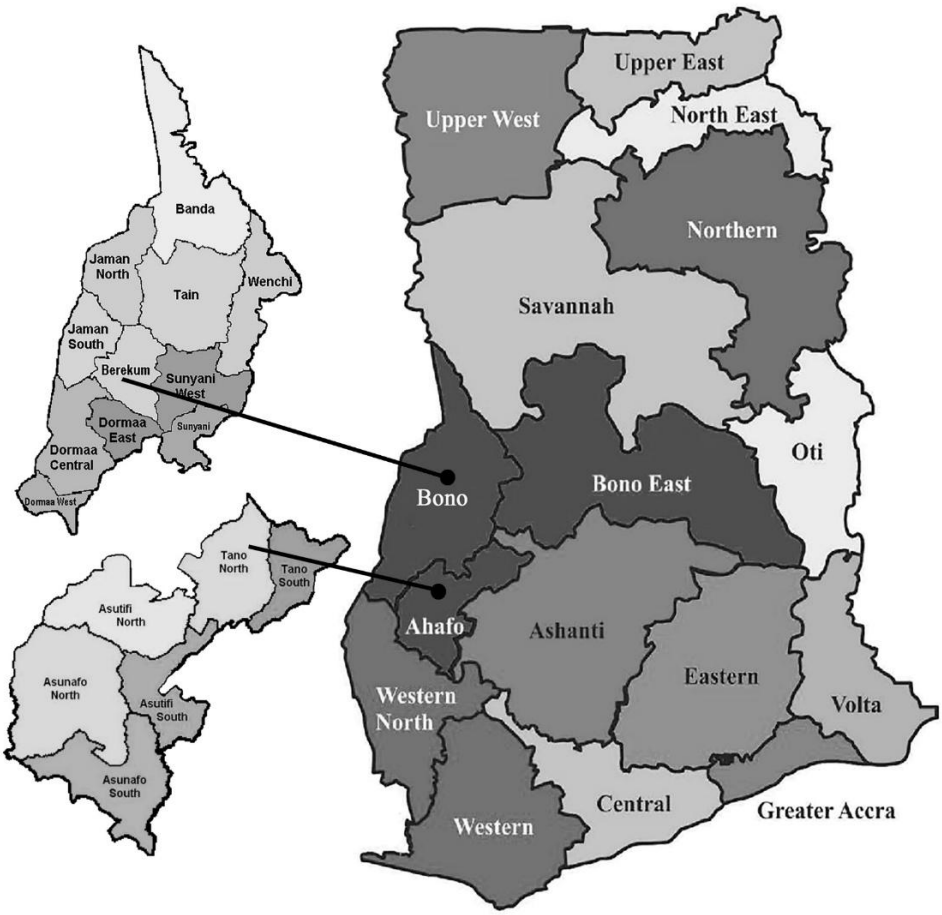

Figure 1: Map of study area

Data Collection

A structured questionnaire was developed to gather data on socio-economic characteristics, pesticide usage, sources of market information, and pest control strategies. A stratified random sampling method was used to select respondents from tomato farming communities. The sample included both male and female farmers across various age groups and educational backgrounds. Primary data were collected through face-to-face interviews with tomato farmers. Secondary data were gathered from existing literature and reports on tomato farming practices. Respondents were informed about the purpose of the study and provided consent before participating. Personal information was kept confidential, and data were anonymised to protect respondents' privacy.

Data Analysis

The data were analysed using descriptive statistics, including frequencies, percentages, means, standard deviations, and ranges. Tables and figures were used to present the results clearly. The results were compared with those from previous studies to contextualise the data and identify trends or deviations.

RESULTS AND DISCUSSION

Socio-economic Characteristics of Respondents

Analysis of the results in Table 1 indicates that the majority (79.68%) of the respondents were males, while the minority (20.32%) were females, implying that the tomato production sector is male-dominated. This is in line with the findings of [16], who also found that males dominated the tomato farming sector, while women are more involved in the retail and wholesale of tomatoes. Concerning age, a greater number (60.16%) of the respondents were 35 years old and above, whereas a minority (5.25%) were between the ages of 15 and 24 years. The farmers' age signifies youthful engagement in the tomato-producing sector. It also provides a chance to boost productivity because the young are more open to new production technologies [6]. The results correspond with the findings of [24], who in a similar study found the majority of the respondents were between the ages of 35 years and above. The results indicate that the majority (77.40%) were household heads, while the minority (22.60%) of the respondents were not household heads. The size of a farmer's household can be very beneficial in terms of farmhands and support on the farm. The results revealed that 613 respondents, representing 60.73 per cent of the farmers, had a household size of less than 5 people, whereas the minority (0.50%) of households had a household size of 14 and above. Farmers with larger household sizes usually receive help from their family members, which helps them grow and improve their production. This finding is similar to the observation made by [16], who also found a mean household size of 5 among tomato farmers in the Ashanti region of Ghana. The results show that a higher number of respondents (78.00%) were married, whereas a few (0.59%) of the respondents were widowed. The results revealed that a greater percentage (59.76%) of the respondents had at least a Basic/Junior High School (JHS)/Middle School Leaving Certificate (MSLC) education, while only 0.30% of the respondents had tertiary-level education. This implies that the majority of the farmers can perform basic tasks such as reading and writing; hence, this can aid them in conducting simple farm tasks such as record keeping and making informed production decisions. The finding is in tandem with the study of [11], who reported that 70% of tomato farmers in the Panna district of Madhya Pradesh are literate and can

therefore serve as a leverage point to improve tomato production and profitability. In furtherance, 543 tomato farmers, representing 53.82%, were found to have off-farm jobs, while 466 respondents, representing 46.18%, did not have off-farm jobs. Land ownership is one of the most important aspects of farming, and with regard to land ownership status, the majority (63.43%) of the respondents indicate that they rent the land they cultivate, whereas 3.67% of the respondents indicated they cultivate on communal lands. The findings are consistent with [20] study, which discovered that the majority of Ghana's farmers produce on rented land, which is influenced by a range of variables.

Table 1: Socio-economic characteristics of respondents

Variable	Frequency (F)	Percentage (%)
Gender		
Male	804	79.68
Female	205	20.32
Age		
15-24	53	5.25
25-34	349	34.59
35 years and above	607	60.16
Household head		
Yes	781	77.40
No	228	22.60
Household size		
Less than 5	613	60.73
5-9	334	33.10
10-14	57	5.65
More than 14	5	0.50
Marital status		
Single	144	14.27
Married	787	78.00
Separated	48	4.76
Divorced	24	2.38
Widowed	6	0.59
Educational level		
No formal education	151	14.97
Basic/JHS/MLSC	603	59.76
SHS/TVET	206	20.42
Diploma	26	2.58
Degree and above	20	1.98
Tertiary	3	0.30
Off-farm job		
Yes	543	53.82
No	466	46.18
Land ownership status		
Communal land	37	3.67
Inherited	150	14.87
Leasehold	60	5.95
Other gifts and purchase	122	12.09
Rent	640	63.43

TVET= Technical and Vocational Education and Training; SHS= Senior High School

Source: Field data (2024).

Bank Accounts Information of Farmers

Information from Figure 2 reveals that most (64.82%) of the tomato farmers interviewed indicated that they do not have bank accounts, whereas a minority (35.18%) indicated that they have bank accounts. The results agree with the findings of [25], who found that most farmers in Ghana do not have bank accounts due to the inability to access credit from financial institutions and also other factors such as market size, infrastructure, and security influencing their trust in banks.

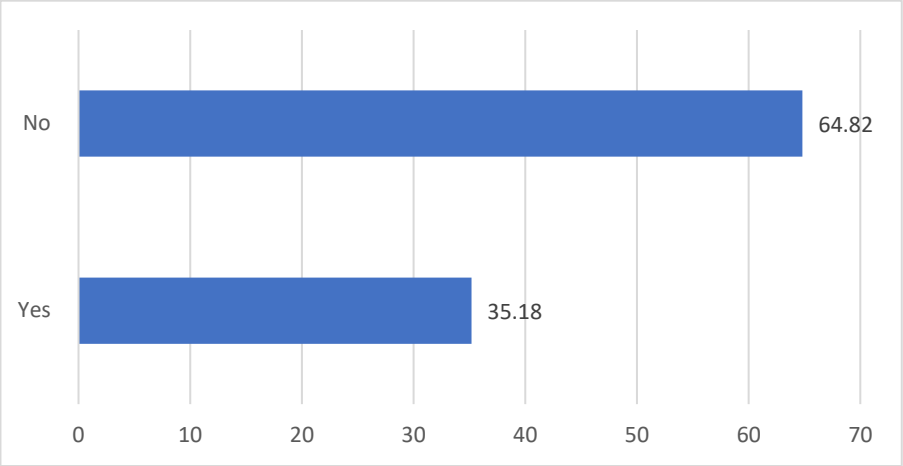

Figure 2: Bank account information of farmers

Farmers Business Registration and Certification Status

Information from figure 3 shows that a higher percentage (83.45%) of farmers reveal that they have not registered their business, while the minority (16.55%) of farmers reveal that they have registered their farm business.

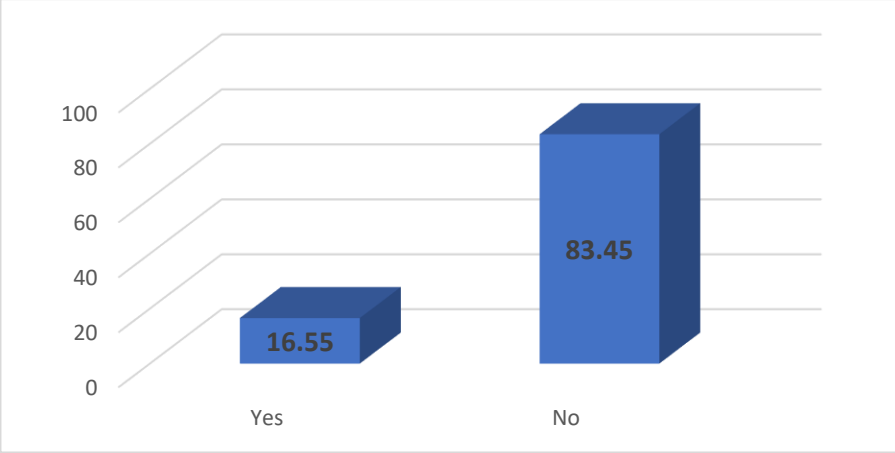

Figure 3: Farmers business registration and certification status

Source: Field data (2024).

In Ghana most farmers are subsistence farmers producing mostly to meet family needs and also see farming as a way of life rather than as a business; thus, they do not register their business. This can also be attributed to the fact that most farmers do not have formal education, and they

may not see the economic and financial value in their farms, as they may not be as high as anticipated; hence, spending money to register their business might not be worth it for farmers who are mostly not educated. Likewise, most Ghanaian farmers, especially smallholder farmers, do not register their businesses due to reasons such as farming not being their major occupation, low literacy rate, awareness of business registration and, most importantly, lack of financial resources, which may contribute to the low registration [26].

Source of Inputs for Tomato Farmers

Results on the source of inputs are presented in table 2. The analysis of the results reveals that the majority (58.67%) of the farmers sourced their seeds from the local market (agro-input dealers), whereas the minority (0.50%) got their seeds from financial institutions. In Ghana, there are several agrochemical shops which can be found in big cities, towns, districts and even villages. Therefore, agro-input shops have over the years been the sole reliable outlets where farmers source their seeds. The result is in tandem with the observation made by [27], who revealed that agro-input dealers play a crucial role in providing farm inputs and extension services to farmers. In addition, the study indicates that agro-input dealers also facilitate the distribution of new seed varieties [27]. Similarly, the results revealed that most (61.45%) farmers purchase their fertilizer, while the least (10.21%) get it as subsidies from processing companies and other government interventions. The study of [28] affirmed that most farmers in the Northern region of Ghana purchase their fertilizers from input shops. [29] indicated that vegetable farmers in Ghana benefit from fertilizer subsidy programs, such as planting for food and jobs; thus, farmers only have to purchase a portion of the fertilizer they might need from agro-input dealers. Further, the study shows that a colossal (74.72%) number of farmers indicated that they purchase agrochemicals from the local market (agro-input dealers), whereas a small percentage (8.03%) indicated that they acquire their agrochemicals from others (family and friends). The results demonstrate how agrochemical dealers are important to farmers since most of them purchase their agro inputs from them due to their wide availability in all parts of the country and reliability. The result agrees with the findings from [30], who indicated that farmers in Ghana, particularly in the Upper East region, mostly purchase a range of agrochemicals from input dealers due to their high reliability and availability.

Table 2: Source of inputs for tomato farmers

Variable	Frequency (F)	Percentage
Appropriate source of input for tomato cultivation for previous season (Seed)		
Local market (Agro input dealers)	592	58.67
MoFA extension agents	282	27.95
Processing company	100	9.91
Financial institutions	5	0.50
Others (friends, family etc.)	30	2.97
Appropriate source of input for tomato cultivation for previous season (Fertilizer)		
Local market (Agro input dealers)	563	61.45
MoFA extension agents	217	25.77
Processing company	103	10.21

Financial institutions		
Others (friends, family etc.)	18	2.58
Appropriate source of input for tomato cultivation for the previous season (Agrochemicals)		
Local market (Agro input dealers)	754	74.72
MOFA extension agents	153	15.16
Processing Company	81	8.03
Financial institutions		
Others (friends, family etc.)	21	2.08

MoFA = Ministry of Food and Agriculture
Source: Field data (2024).

Tomato Variety Cultivated by Farmers

The results from Figure 4 show that the majority (77%) of farmers cultivate local varieties of tomato seeds, whereas the minority (23%) cultivate improved varieties. In the study area, most farmers were cultivating local tomato varieties that were not high-yielding. However, improved varieties of tomatoes have been widely demonstrated to have higher yielding capacity and more resistance to pests and diseases; this helps to ease the burden of several production constraints that confront the farmers. However, farmers do not cultivate improved varieties; hence, this explains why their yields are usually very low. Even though better tomato varieties have their benefits, most farmers in developing countries still prefer local types because they are more adaptable, taste better, and are in higher demand on the market [31]. But local varieties usually don't produce as much and are more likely to get pests. Adoption of improved varieties is constrained by inadequate access to quality seed, ineffective extension services, low awareness, and risk aversion [18]. But better varieties have been shown to increase yields, income, and resilience [32]. Smallholder farmers still have a hard time adopting new practices because they can't get improved seeds. [33] says that, high prices and bad seed distribution systems often keep farmers from getting better varieties. [34] also point out that farmers are less likely to try new varieties when they are afraid of risk, especially in areas with unreliable rainfall and weak infrastructure. Cultural preferences and reliance on traditional farming practices further influence varietal choices, as many farmers prefer to reuse seeds from previous harvests, valuing their cost-effectiveness and proven performance under local conditions [35].

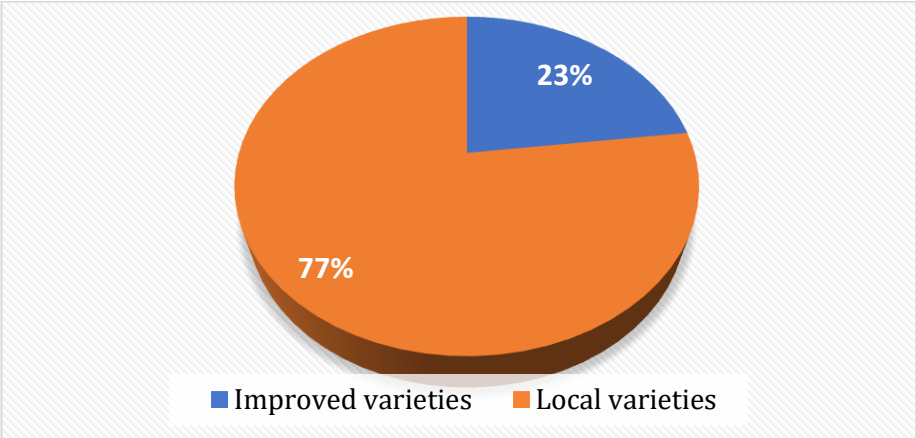

Figure 4: Tomato variety cultivated by farmers
Source: Field data (2024).

Factors Influencing the Choice of a Particular Tomato Variety

The study's findings indicate that various factors affect tomato farmers' selection of variety, with yield being the most significant. About 77.4% of farmers said that high yield is what makes them choose a better tomato variety. This is in line with what [36] found: that yield potential is a major factor in Ghanaian tomato farmers' choice of variety because it has a big effect on household income and welfare. [37] also said that many farmers still use traditional varieties because they don't have easy access to or know about better ones that produce more. In contrast, shelf life was not a significant factor for most farmers, with only 24.98% considering it in their choice of tomato variety. This aligns with the findings of [38], who indicated that, although short shelf life is acknowledged as a limitation in tomato production, it seldom influences varietal choices. This is mostly because farmers sell their tomatoes right after they pick them because they don't have good storage facilities or structured trade agreements. Market demand had a small effect on farmers' choice of variety; only 40.14% said it did. Even though tomatoes are always in high demand in Ghanaian homes, many farmers think that their crops will sell regardless of what kind they are. [37] also agree with this idea. [36] stress that limited access to markets, losses after harvest, and bad price information all make it harder to pay attention to market signals when picking varieties. Another important factor was how easy it was to grow, which 62.74% of respondents said. This reflects farmers' preferences for varieties that are less labour-intensive, mature quickly, or more resistant to pests and diseases. [39] research backs this conclusion up by showing that smallholder farmers in Ghana often put labour-saving traits first because they don't have a lot of resources and face a lot of risks in production. These results also highlight systemic issues that other studies have identified. [40] observed that inadequate access to high-quality seeds, elevated input costs, and informal seed systems constrain farmers' capacity to make optimal varietal selections. Because of this, traits like high yield and ease of cultivation are more important than shelf life and market demand, which are still important but are often pushed aside by more immediate production needs.

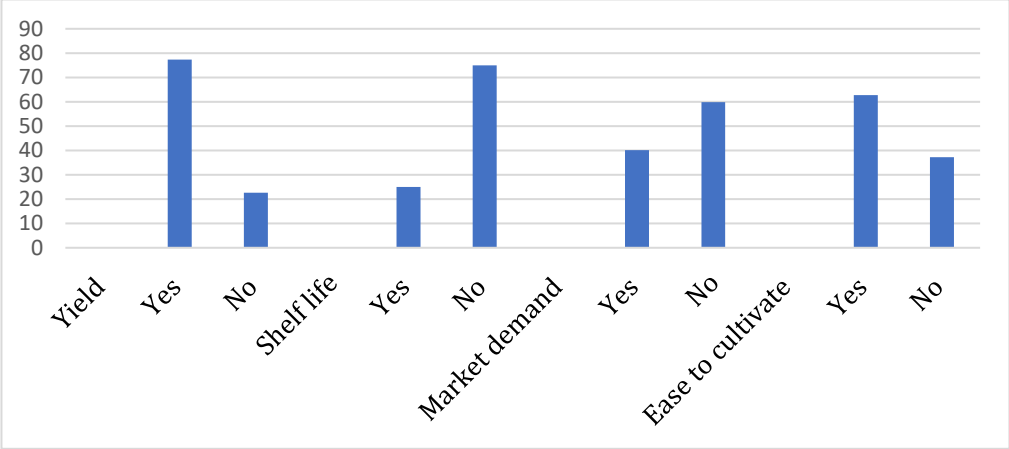

Figure 5: Factors influencing the choice of a particular tomato variety

Source: Field data (2024).

Summary Statistics on Farm Indicators

The results in table 3 reveal that the majority of farmers (46.28%) operate on small- to medium-sized farms of 1.0–2.0 acres, while a smaller proportion (11.60%) manage farms larger than 5

acres. A significant percentage of farmers (60.27%) produce more than 2.0 tonnes per acre, while 15.16% achieve average yields of 0.5 - 1.0 tonnes per acre. Most farmers (58.87%) spend more than GHS2,000 annually on production, with only 4.66% spending less than GHS500. A substantial majority (64.22%) earn more than GHS950 per acre annually, indicating high returns for some farmers. Over half (52.13%) work 8 hours or more daily on their farms, with 77.50% working 5 - 7 days per week. Additionally, 70.66% of farmers employ labour on their farms. The predominance of small-to-medium farms (1.0–2.0 acres) suggests limited land access or land fragmentation, typical in developing agricultural economies like Ghana [26]. Despite this, many farmers achieve high yields (>2.0 tonnes per acre), indicating good farming practices or favourable environmental conditions. Results reveal a high cost of production, with nearly 60% of farmers spending over GHS2,000 annually. This trend could reflect rising input costs or investment in improved technologies [41]. While the majority earn more than GHS950 per acre, a minority (5.95%) earn less than GHS330, reflecting possible disparities in resource use or productivity levels. The data shows farming is labour-intensive, with over 96% of farmers working 5–7 days per week and 52.13% working 8 hours or more daily, indicative of the high demand for labour in agricultural operations. The dominance of smaller farms highlights land access challenges, which could constrain production scalability. However, the prevalence of high yields (>2.0 tonnes per acre) suggests that productivity on smaller plots can be optimised through efficient management practices, improved seeds, or fertilisers. The high production cost implies significant investment in inputs, labour, and other operational expenses. Farmers who spend more on production may be utilising improved practices, which contributes to their higher yields and incomes. Labour dynamics reflect the critical role of human resources in agriculture, as most farms require intensive labour due to limited mechanisation. This might increase production costs but also underlines employment opportunities in the sector.

Other studies also suggest that in a given growing season, smallholder farmers are marginal and sub-marginal farmers who work on less than 2.0 acres of land [42] [43]. The results are also inconsistent with findings from similar studies in Ghana. For instance, [24] reported that smallholder farmers dominate the agricultural sector, often managing farms below 2.0 acres due to land tenure constraints. Research by [44] highlighted that productivity on smallholder farms could be enhanced through effective fertiliser use, timely planting, and improved crop varieties. Your finding that 60.27% of farmers achieve yields over 2.0 tonnes per acre reflects similar outcomes, where efficient management practices offset small farm sizes. Additionally, [41] noted that high production costs, primarily due to the rising price of inputs like fertiliser, significantly impact farmers' profitability. Studies by [45] have revealed income disparities among smallholders, influenced by resource access and farm management strategies. This resonates with your finding that 64.22% earn over GHS950, but a minority earn less than GHS330, underscoring productivity gaps. According to a study on labour use in smallholder agriculture by [46], smallholder farms in Ghana rely heavily on manual labour due to limited mechanisation, which explains your data showing over 52.13% of farmers working 8+ hours daily and 77.5% working 5-7 days weekly. Furthermore, [47] highlighted that labour remains a critical input in Ghanaian agriculture, with limited mechanisation leading to high dependence on human labour. Similarly, [48] indicated tomato farmers earn less income due to small farm

size and production capacity; hence, there is the need to increase production and commercialisation efforts to increase their income.

Table 3: Summary statistics on farm indicators

Variable	Frequency (F)	Percentage
Farm size		
0.5 acre or less	35	3.47
1.0 – 2.0 acres	467	46.28
2.5 – 3.5 acres	282	27.95
4.0 – 5.0	108	10.70
More than 5.0 acres	117	11.60
Average Yield per (kg) acre for the past three years		
0.5 – 1.0 tonnes	153	15.16
1.5 –2.0 tonnes	208	20.61
Less than 0.5 tonne	40	3.96
More than 2.0 tonnes	608	60.27
Average cost of production per for the past three years		
Less than 500 GHS	47	4.66
500 to 1,000 GHS	132	13.08
1,500 to 2,000 GHS	236	23.39
More than 2,000 GHS	594	58.87
What is the average income? per acres for the past three years?		
Less than 330 GHS	60	5.95
331 – 500 GHS	59	5.85
501 – 750 GHS	74	7.33
751 – 950 GHS	168	16.65
more than 950 GHS	648	64.22
How many hours do you work on the farm per day?		
Less than 2 hours	2	0.20
2 – 4 hours	34	3.37
5 – 7 hours	447	44.30
8 hours or more	526	52.13
How many days do you work on the farm per week?		
Less than 2 days	5	0.50
2 – 4 days	222	22.00
5 – 7 days	782	77.50
Do you employ workers on your farm?		
Yes	713	70.66
No	296	29.34
If yes, how many workers do you employ?	Mean	9.210109
	Standard deviation	31.51784
	Minimum	2
	Maximum	500
How many male workers do you have?	Mean	3.855865
	Standard deviation	3.855865
	Minimum	1
	Maximum	200
How many female workers do you have?	Mean	8.276056
	Standard deviation	24.35984
	Minimum	1

	Maximum	300

Source: Field data (2024).

Knowledge of Disease Effects of Pesticide Usage

The knowledge of farmers on pesticide usage is presented in Table 4. The results reveal that most (70.36) farmers used protective clothing while applying agrochemicals, whereas a minority (26.76) indicated that they did not use protective clothing while applying agrochemicals. The results indicate that farmers are aware of the dangers of applying agrochemicals and hence adhere to protecting themselves by wearing protective clothing while applying agrochemicals. However, the farmers indicated three main reasons why they do not wear protective gear. 82.01% of farmers indicated that protective clothing is too expensive to purchase, while 8.27% of farmers indicated that they prefer normal clothes. The plausible reason could be that farmers do not produce enough tomatoes and cultivate less yield; hence, they might not be financially stable enough to afford protective clothing. Generally using unprotected clothing poses several threats to farmers. The results show that the majority (64.22%) of farmers indicated that they do not know the dangers associated with the use of agrochemicals in tomato farming, while a minority (35.78%) indicated that they are aware of the dangers associated with the use of agrochemicals in tomato farming. Nonetheless, several studies reveal that although several Ghanaian farmers know about the dangers associated with not wearing protective clothing, they do not wear protective clothing [49] [50] [51] [52].

Farmers who indicated yes also gave answers about dangers associated with the use of agrochemicals. The majority (30.47%) indicated that they are aware that fertility and sexually related diseases in both men and women are some dangers that are associated with the unprotected application of agrochemicals, whereas a minority (0.56%) also added that they are aware that cancer is part of the dangers associated with the unprotected application of agrochemicals. The finding is consistent with the investigation by [53], which found associations between specific pesticides and bladder cancer risk. A colossal number (97.78%) indicated that they have never been diagnosed with a particular disease resulting from agrochemical use, whereas a small number (2.22%) indicated that they have been diagnosed with a particular disease resulting from agrochemical use. Furthermore, the majority (62.5%) of farmers responded that they were diagnosed with skin diseases as a result of unprotected use of agrochemicals, while the minority (12.5%) indicated that they were diagnosed with problems with key human organs such as kidneys and hearts as a result of unprotected use of agrochemicals. The findings are consistent with the study of [54], who found that unprotected use of agrochemicals has been associated with diseases of the human organs, such as kidney and heart diseases. Also unprotected use of agrochemicals is associated with other diseases such as asthma attacks and shortness of breath.

Table 4: Knowledge of disease effects of pesticide usage

Variable	Frequency (F)	Percentage
Do you wear protective clothes when spraying your chemicals?		
Yes	731	70.36
No	278	26.76
If no why		
Expensive to purchase	228	82.01

I prefer normal clothes	23	8.27
Uncomfortable to wear	27	9.71
Do you know the dangers associated with the use of Agrochemicals in your tomato		
Yes	361	35.78
No	648	64.22
If yes, can you state a few of those dangers.		
Skin diseases	160	44.32
Eye problems	67	18.60
Cancer	2	0.56
Fertility and sexual related diseases in both men and women	110	30.47
Leads to dysfunction of key human organs such as kidney, heart.	22	6.09
Have you ever been diagnosed of a particular disease as a result of the agrochemical		
Yes	8	2.22
No	353	97.78
If yes, what are the disease diagnosed		
Skin rushes	5	62.5
Cold	2	25
Problems of key human organs such as the kidney, and heart.	1	12.5

GHS = Ghana cedi. *Source:* Field data (2024).

Source/Medium of Market Information for Tomato Farmers

The source of information on pesticide availability and usage by farmers is very important because it gives farmers information on prices of pesticides and their availability, which helps farmers to make purchasing decisions. The results in Table 5 show that the majority (55.70%) of farmers acquire market information from verbal communication, whereas a minority (1.19%) acquire theirs from contract agreements. From the results, verbal communication from buyers and middlemen remains the most relevant source of market information for farmers. Comparatively, farmers do not rely on contract farming outlets for market information because most of them are not under contracts. Most of them perceive contracts might not yield enough benefits. The majority (57.88%) of the farmers indicated that they do not receive information through radio, while 42.12% responded otherwise. The majority (86.82%) of farmers indicated that they do not receive market information through mobile phone text. Only 13.18% indicated they receive market information through mobile phone text. The results also revealed that most (75.72%) of farmers receive market information through verbal communication with buyers (middlemen, wholesalers, etc.). In Ghana most farmers produce, especially tomatoes, is purchased by middlemen, wholesalers and retailers; hence, in most cases, they dictate market prices for farmers. This is usually based on the demand and supply of tomatoes. A colossal number (96.83%) indicated that they do not receive market information from contract agreements with processors/companies; only 3.17% indicated otherwise. Contract farming in tomato production has been seen to offer several advantages. 89.40% of farmers indicated they do not have marketing or produce-buying contracts with any processor(s), whereas 10.60% indicated otherwise. The results suggest that most of the tomato farmers do not engage in contract farming, although it has some benefits. [55] reinforced the favourable impact of contract farming by saying that it led to decreased transaction costs, improved production, and higher household income. [56] indicated that while contract farming is viewed as a solution for

smallholder farmers, they may have several concerns that may prevent them from participating. Furthermore, contract farming may not successfully alleviate poverty or enhance rural livelihoods [57]. In China, characteristics such as risk mentality, gender, farm size, and labour availability impact contract farming decision-making [58]. These data imply that the advantages of contract farming for smallholder farmers are not as obvious as generally imagined, hence underscoring the reason why the majority of tomato farmers are not participating in contract farming.

Table 5: Source/medium of market information for tomato farmers

Variable	Frequency	Percentage
Source of market information		
Radio	400	39.64
Mobile phone communication	35	3.47
Verbal communication	562	55.70
Contract agreements	12	1.19
Through which medium do you receive market information of tomato?/Radio		
Yes	425	42.12
No	584	57.88
Through which medium do you receive market information of tomato?/Mobile Phone Text		
Yes	133	13.18
No	876	86.82
Through which medium do you receive market information of tomato?/Verbal Communication with Buyers (Middlemen, Wholesalers etc.)		
Yes	764	75.72
No	245	24.28
Through which medium do you receive market information of tomato?/Contract agreements with Processors/Companies		
Yes	32	3.17
No	977	96.83
Do you have marketing or produce buying contract with any processor(s)?		
Yes	107	10.60
No	902	89.40
If Yes, mention the name of the processing company		
Boakye tomato farmers association	2	1.87
Weddi Africa tomato association	104	97.2
Cobbs company	1	0.93

Source: Field data (2024).

CONCLUSION

The study examined the socio-economic aspects of tomato farmers in Ghana, focusing on gender, age, education, household composition, and land. The majority of farmers are men, with women mainly involved in marketing and retailing. The study suggests incorporating gender parabolic interventions in agricultural value chains. Younger farmers are more likely to adopt new technologies and practices that enhance productivity. Most farmers have primary education, which could improve their farm management. However, most land is rented,

indicating insecurity about land tenure. Few businesses are registered, as farming is considered a way of living. Formalizing those engaged in farming can facilitate better credit access and market and economic development. Effective supply chains with quality inputs are needed, and the use of high-yielding and disease-resistant varieties of tomatoes is beneficial for enhancing productivity. There are gaps in knowledge and protective measures, such as pesticide use, necessitating education and cheap curative measures. The informal nature of the market is due to the interaction between buyers and farmers through word of mouth. Improved information dissemination through radio and mobile phones can enhance decision-making. Knowledge of these socio-economic characteristics can inform policies that aim to make resources available to all, improve resource use efficiency, and adopt better farming practices. Better market information systems and business registration can alleviate farmers' constraints on profit maximization potential. Focusing on these constraints and opportunities will improve the effectiveness and viability of tomato farming in Ghana, benefiting farmers and enhancing food security.

Author Contributions:
Danson-Anokye Alexander and Eric Adjei were in charge of coming up with the idea for the study, collecting and organising the data, doing the formal analysis, and making the results clear. Along with Isaac Adu Poku, Kontor Kennedy, Shadrack Debrah, Ayensu Patrick, Adom Prince and Sylvia Kyeremaa Hinneh, they helped come up with the methodology and took part in the project's administration and validation processes. Danson-Anokye Alexander and Eric Adjei worked together to manage resources and supervision. Danson-Anokye Alexander and Eric Adjei wrote the first draft of the manuscript. All of the authors; Isaac Adu Poku, Kontor Kennedy, Shadrack Debrah, Frimpong Enock Mensah, Ayensu Patrick, Adom Prince and Sylvia Kyeremaa Hinneh worked together to review and edit the final manuscript.

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