

Full Length Research Paper

An assessment of tomato production practices among rural farmers in major tomato growing districts in Malawi

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Tomato is one of the most commonly grown vegetables in Malawi. However, considerable attention has not been given for its production and marketing aspects among smallholder farmers. Therefore, this study was conducted in six major tomato growing districts in Malawi with the objective of identifying production and marketing practices and constraints affecting tomato productivity. Semi structured questionnaires were administered to 404 respondents comprising 368 farmers and 36 input suppliers and data was analyzed using descriptive statistics. The findings revealed that male dominated tomato farming in the study area. It further revealed that 27.2% had post primary school education, 65.5% attended primary school education and 7.3% had no formal education. The survey indicated that 95.9% of respondents grow tomatoes in an open field and very few use tunnel/greenhouses (4.1% of the respondents). The survey results identified four major production constraints: pests, diseases, marketing and input cost. Red spider mite and bacterial wilt were identified as major pest and disease, respectively. Regarding marketing of tomatoes, the major constraint is price fluctuations. Major problems faced by input suppliers included lack of capital (27.8% of respondents). These findings indicate urgent need to invest heavily in promotion of tomato production and marketing.

Key words: Diseases, farmers, tomato, pest, production, questionnaire.

INTRODUCTION

Tomato is an important vegetable in Malawi. It is grown throughout the year both for cash and food. It is widely consumed due to its high nutritive value. Tomato production in Malawi is dominated by poorly resourced smallholder farmers and relatively advanced semi-commercial farmers who practice protected cultivation using greenhouses (Nyondo et al., 2018).

The current production levels of tomato in Malawi fail to

satisfy local demand in terms of volume and quality. The total area under cultivation is estimated at 30,361 hectares (ha) and yield at 20.7 metric tonnes per hectare (mt/ha) (MoA, 2020). Field trials by the Department of Agriculture Research Services (DARS) in Malawi indicate that yields could potentially be increased to 50 mt/ha with adherence to recommended practices.

Malawi remains a net fresh produce importer for many

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horticulture products for which it has a comparative and competitive advantages based on climate, soil conditions and labor. Currently, Malawi is importing various fruits, spices, vegetables including tomatoes.

There have been some studies regarding tomato production, their challenges and efficiency in Malawi. Mango et al. (2015) studied competitive advantage in the production of tomato in Malawi and Mozambique while Mapemba et al. (2013) investigated productivity gains and cost saving of tomato production in Balaka district. However, most of these studies were limited in scope or focus either covering few districts or communities thereby ignoring the role played by majority of smallholder farmers that dominate tomato production in Malawi.

The objective of this study therefore was to understand production practices, constraints and opportunities in the major growing areas as a basis for designing integrated and sustainable tomato productivity strategies in Malawi.

MATERIALS AND METHODS

Sample survey

A field survey was conducted in major tomato growing districts in Malawi which are Mzimba in the northern region, Dowa, Lilongwe, Dedza and Ntcheu in central region and Thyolo in southern region in May, 2020. In each of the selected districts, a list of farmers involved in tomato cultivation was prepared with the assistance of the Agriculture Extension Development Coordinators (AEDCs) and Agricultural Extension Development Officers (AEDOs). Three Extension Planning Areas (EPAs) per district were randomly selected and about 20 to 23 tomato farmers were selected through a simple random sampling technique for the interview. Thus, a total of 368 farmers from 6 districts were served with semi structured questionnaires in order to collect the desired data from the farmers. Three inputs suppliers in each district (one from each EPA) were also interviewed making a total of 36 inputs suppliers. A separate semi structured questionnaire was used for the input suppliers.

Questionnaires were prepared in English language while the interview with respondents was done in local languages depending on locality (Chitumbuka in the north and Chichewa for central and southern regions). The survey collected data on the current status of tomato production in Malawi, including: socio-economic characteristics of tomato producers, tomato production and productivity, tomato production constraints and institutional factors affecting production and marketing of tomato.

Data analysis

Collected data had both quantitative and qualitative information. Data was analyzed using Microsoft Office Excel 2016 (Microsoft Corporation, CA, USA) where descriptive statistics (means and percentages) were computed.

RESULTS AND DISCUSSION

Analysis of socio-economic characteristics of the respondents

The socio-economic characteristics of tomato farmers in

the study area are presented in Table 1.

More than three quarters of the respondents (79.3%) were male producers while women comprised less than quarter of tomato producers (20.7%). The findings suggest that men tend to venture into production of agriculture commodities that generate sizable income (cash crops) and that are risky takers as compared to women who like to grow crops for home consumption (Venance et al., 2016).

The study revealed that the majority of the tomato farmers (90.2%) are within the age bracket of 31-52 years. This implies that most of the interviewed farmers are still within the active productive age. This result is in agreement with Simtowe (2010) who reported that middle aged farmers appear more productive.

Based on the results of their marital status, majority (95.1% of the respondents) of them were married. As a result, this could be attributed to the fact that the majority of the respondents, as stated earlier, are of reproductive age, making it obvious that they should be married.

With respect to the educational level of tomato farmers, 27.2% had post primary school education and 65.5% attended primary school education and these can safely be considered literate (Venance et al., 2016). Literate farmers are perceived to have better understanding of management practices of tomato production (Emana et al., 2017; Mwangi et al., 2015; Simtowe, 2010) and can easily understand concepts taught in different trainings consequently adopt new technologies with ease. On the other hand, 7.3% of the respondents had no formal education and this can affect adoption levels among farmers.

Majority of the farmers (54.4%) had household sizes of more than 6 persons and 45.6% of the respondents had family sizes of less than five. Results of the present survey indicate that the family size of the majority of the respondents is slightly higher than national average size in Malawi of 4.5 (NSO, 2016). However, this is a positive contribution to providing family labour for farm functions as there might be need to hire labour.

The farming experience of the farmers is expressed in the number of years the farmer has been into tomato production. Results of the present study show that 74.7% of the farmers had been into tomato production for less than 10 years and this implies that they have less experience in tomato production. This could be attributed to the fact that 90.2% of the respondents as reported above are still young hence may not be into tomato production for a longer time. Survey results reported that very few farmers (25.3%) had farming experience of 10 years and more.

Regarding major occupation of the respondents, the majority of respondents reported income from agriculture related activities (80.4% of the respondents) while only 19.6% of the respondents reported income from both agriculture and non-agriculture related activities such as casual work, building, business, tailoring and brick laying.

Table 1. Socio-economic characteristics of tomato growers interviewed.

Variable	Association	Frequency	Percentage
Gender	Male	292	79.3
	Female	76	20.7
	Totals	368	100.0
Age in years	Below 30	54	14.7
	31-41	147	39.9
	42-52	131	35.6
	53-63	26	7.1
	Above 63	10	2.7
	Totals	368	100.0
Marital status	Single	2	0.5
	Married	350	95.1
	Divorced	6	1.6
	Widowed	6	1.6
	Separated	4	1.1
	Totals	368	100.0
Educational level	No formal education	27	7.3
	Primary	241	65.5
	Secondary	99	26.9
	Tertiary	1	0.3
	Totals	368	100.0
Family size	1-3	27	7.3
	4-5	141	38.3
	6-10	196	53.3
	More than 10	4	1.1
	Totals	368	100.0
Experience (years)	Less than 1	4	1.1
	1-5	131	35.6
	6-10	140	38.0
	Above 10	93	25.3
	Totals	368	100.0
Occupation	Agriculture related	296	80.4
	Agriculture and non-agriculture related	72	19.6
	Totals	368	100.0
Reasons for growing tomato	Food	4	1.1
	Income	152	41.3
	Both food and income	212	57.6
	Totals	368	100.0

This finding is consistent with the known fact that over 80% of the population in Malawi depend on agriculture for food, nutrition and income security. Majority of the respondents (57.6%) indicate that they grow tomato for both food production and income while 41.3% of the respondents mainly grow the crop for income.

Income levels during 2018 to 2019 agriculture season

Results on respondents' income levels during 2018-2019 agriculture season are presented in Table 2. The study revealed that 57.1% of the respondents had total income levels between 100,000 Malawi Kwacha [122.7 United

Table 2. Income of tomato growers during 2018-2019 agriculture seasons.

Income level (MK)	Total farm income		Income from tomato	
	Frequency	Percentage	Frequency	Percentage
Up to 50,000	23	6.3	45	12.2
51,000- 100,000	20	5.4	64	17.4
100, 000- 500,000	210	57.1	203	55.2
500,000- 1,000,000	71	19.3	35	9.5
1,000,000- 5,000,000	36	9.8	5	1.4
More than 5, 000,000	2	0.5	1	0.3
No response	6	1.6	15	4.1
Totals	368	100.0	368	100.0

States Dollar (USD)]- MK 500,000 (613.5 USD) and 55.2% had this income from tomato signifying the importance of tomato as a source of income as compared to other sources. Furthermore, the income range reported from the present study is lower than those reported by FAO (2018). FAO (2018) reported that gross annual income from small farms in Malawi was 1840 USD.

Factors influencing farmers' productivity

Cultivation methods

Results on cultivation methods are presented in Table 3. Results indicate that 95.9% of respondents grow tomatoes in an open field only, 4.1% use both open field and greenhouse/tunnels and no single farmer uses solely greenhouse/tunnels. This finding indicates low adoption and use of tunnels/green house in tomato production in Malawi. Similarly, in Botswana and Kenya, adoption of greenhouse/tunnels technology is low with 4 and 5% of the farmers, respectively (Badimo, 2020; Geoffrey et al., 2014). According to Badimo (2020) and Mugambi (2020), low adoption of tunnel/greenhouse for tomato production is due to high initial cost of the technology, lack of knowledge on tunnel/greenhouse production and inconsistent markets for tomato produced. This finding further points to the need of promoting use of tunnel/greenhouse tomato production in Malawi. Galinato and Miles (2013) reported that tunnel/greenhouse tomato production can be three to ten times more profitable than open field tomato production.

The study revealed that 59.5% of the respondents grow tomato twice a year; during summer months (May to October) using residual moisture/irrigation and during rainy season (November-April). However, 47.6% of the respondents preferred summer tomato production to rainy season production. It can be deduced that the majority (47.6%) of the respondents grow tomatoes during summer months probably due to reduced disease and pest pressure (Osawere, 2010; Simtowe, 2010) and

being off-season for other annual crop production; most farmers may devote their time and resources towards tomato production.

Farmers practicing irrigated crop production such as tomatoes firstly rely on residual moisture and when residual moisture is depleted, supplementary irrigation using watering cans (Wiyo et al., 2000) or other advanced manual irrigation methods such treadle and motorized pump is done. Out of the 175 respondents who use irrigation, 64.4% use manual methods (such as watering cans) to bring water from the source which are mainly boreholes (33.4%) and rivers (32.9%). Although use of manual irrigation such as watering cans is a very time-consuming method and involves heavy work compared to more sophisticated methods such as sprinkler and drip irrigation, this method could be easier as the majority of respondents use family labour.

Most of the respondents (57.9%) indicated that they irrigate everyday followed by those that irrigate once to four times a week. This finding is in line with preceding results which state that irrigation is done to supplement residual moisture during the hot summer months. Nangare et al. (2016) concurs with this reasoning and further states that it is one way of maintaining moisture especially during critical stages of transplanting, flowering and fruit development.

Tomato seed

Table 4 indicates that about 66.3% of the respondents got their seed from the markets, 17.4% used recycled seed and 14.9% got the seed from the market and also use recycled seed, thus being consistent with findings reported by Asare-Bediako et al. (2007) and Sekumade and Toluwase (2014).

Out of the 368 interviewed farmers, 95.7% reported that they have never grown grafted tomato plants. This implies that the technology is not popular in major tomato growing areas of Malawi. This finding is in agreement with Freeman et al. (2011) who reported that in Kenya

Table 3. Factors influencing farmers' productivity: Cultivation methods.

Variable	Association	Frequency	Percentage
Method of cultivation	Open field only	353	95.9
	Tunnel/Greenhouse only	0	0.0
	Both open field and tunnel	15	4.1
	Totals	368	100.0
Frequency of growing tomato in a year	Once	48	13.0
	Twice	219	59.5
	More than twice	101	27.4
	Totals	368	100.0
Preferred season for growing tomatoes	Rainfed (November-April)	147	39.9
	Irrigated (May-October)	175	47.6
	Anytime	45	12.2
	No response	1	0.3
	Totals	368	100.0
Types of irrigation	Furrow	24	13.6
	Sprinkler/Microjet	0	0.3
	Manual	113	64.4
	Drip	2	1.1
	Others	36	20.7
	Totals	175	100.0
Main sources of Irrigation	Lake	5	2.7
	Rain	15	8.4
	Wetland residual moisture	22	12.8
	Springs	14	8.2
	Rivers	58	32.9
	Boreholes/Wells	58	33.4
	Rainwater harvest	3	1.6
	Totals	175	100.0
Frequency of irrigation	Everyday	101	57.7
	Once to four times a week	49	28.0
	Once to four times a month	9	5.1
	Others	4	2.3
	No response	12	6.9
	Totals	175	100.0

only 2% of the respondents planted grafted tomato plants. In Vietnam, this technique demonstrated that average yields (81.4 t/ha) and farm gate prices (USD0.41 kg⁻¹) of grafted tomatoes were significantly greater, by 31 and 39%, respectively, compared with nongrafted tomatoes (Schreinemachers et al., 2021). Therefore, it is paramount that the Government of Malawi should aim at promoting this technology through demonstrations since 95.7% of the respondents indicated that they have never

heard about the technology.

Tomato varieties

Results on tomato varieties grown by farmers in Malawi are presented in Table 5. The farmers grow a wide variety of tomatoes. Out of the interviewed farmers, 53.2% prefer to grow Tengeru 97 and 25% prefer

Table 4. Factors influencing farmers productivity: Tomato seed

Variables	Association	Frequency	Percentage (%)
Source of seed	Buying seed	244	66.3
	Recycling seed	64	17.4
	Given for free	2	0.5
	Buying and recycling seed	55	14.9
	Buying seed and getting free	3	0.8
	Totals	368	100.0
Use of grafted tomatoes	Have never grown grafted tomato	352	95.7
	Have grown grafted tomato	16	4.3
	Totals	368	100.0

Table 5. Factors influencing farmers' productivity: Tomato varieties.

Tomato variety	Farmer preference		Input seller preference	
	Frequency	Percentage	Frequency	Percentage
Tengeru 97	196	53.3	19	52.5
Rodade	92	25.0	12	32.8
Money maker	10	2.7	0	0.0
Tanya	24	6.5	5	14.8
Other varieties	46	12.5	0	0.0
Totals	368	100.0	36	100.0

Table 6. Factors influencing farmers' productivity: Labour.

Variable	Association	Frequency	Percentage
Source of labour	Hired	8	2.2
	Family	215	58.4
	Both family and hired	136	37.0
	Individual tomato farmer	5	1.4
	No response	4	1.1
	Totals	368	100.0

Rodade. Farmers preferred these two varieties because of their thick skin which increases shelf life (two weeks) and hence easy to transport. This aspect (long shelf life) is important for farmers as they do not own cold rooms (there is no organized markets) and this makes it easier for them to transport with less damage and less quality deterioration. Similarly, 52.5% of the input suppliers reported that most farmers like Tengeru 97 followed by Rodade.

Labour

In consistent with findings by Mutayoba and Ngaruka (2018), the current study indicates that more farmers (58.4% of the respondents) use family labour only, followed by combined use of family and hired labour

(37%) (Table 6). Baliyan (2018) narrates that those marginal farmers with small land base and lack resources attempt to reduce their paid cost by putting more family labour on their farm whereas farmers with larger holding sizes use hired labour more.

Farm size and ownership

Table 7 indicates that both total farm size (62.8% of the respondents) and land allocated to tomato production (99.2% of the respondents) is less than 1 ha with the average area of 1.27 ha (total) and 0.27 ha (under tomato production). These findings are partly agreeing with survey results reported by Al Wang and Siegel (1999) and Simtowe (2010) that 70% of Malawian smallholder farmers cultivate less than 1.0 ha, with the median area

Table 7. Factors influencing farmers' productivity: Farm size and ownership.

Variable	Total land area		Land area allocated to tomato	
	Frequency	%	Frequency	%
Land area				
Less than 1 ha	365	99.2	231	62.8
1-5 ha	3	0.8	130	35.3
>5 ha	0	0.0	7	1.9
Totals	368	100.0	368	100.0
Type of ownership				
Own land	252	68.5	269	73.1
Rented	26	7.1	60	16.3
Uses without paying rent	3	0.8	4	1.1
Both owned and rented	79	21.5	30	8.2
Both owned and uses without paying rent	4	1.1	2	0.5
Both rented and uses without paying rent	1	0.3	2	0.5
Owned, rented and uses without paying rent	3	0.8	1	0.3
Totals	368	100.0	368	100.0

Table 8. Factors influencing farmers' productivity: Institutional factors.

Variable	Association	Frequency	Percentage
Access to lending institutions	Yes	97	26.4
	No	271	73.6
	Totals	368	100.0
Member of association/cooperative	Yes	69	18.8
	No	299	81.3
	Totals	368	100.0
Source of information regarding tomato production and marketing	Radio	78	21.3
	Fellow farmers	148	40.2
	Extension agents	137	37.2
	Other sources	5	1.3
	Totals	368	100.0

cultivated being 0.6 ha, and devote 70% of the land to maize production, the main staple food. The present study suggests that out of total average area of 1.27 ha, about 1 ha may be devoted to maize production and other cash crops and the rest (0.27 ha) to tomato as a minor crop. If this can be the right assumption, the area allocated to tomato production is slightly lower than the area that farmers in Ethiopia allocate to tomato production (0.74 ha) (Emana et al., 2017). Table 7 indicates that majority use their own land (total = 68.5% of the respondents and land allocated to tomato production=73.1% of the respondents). Since the survey results indicate that majority of respondent are men, it may be concluded that they may have an easy access to land. Unfortunately, the majority of the respondents

(88.3%) have no title deed of their land. This may be due to the fact that land belonging to smallholder farmers is usually customary hence the land is free for use without restrictions as compared to estate farming where land is usually leased either because it is private (owned by government) or it was bought or leased from someone.

Institutional factors

Table 8 indicates institutional factors affecting tomato production and productivity. The survey results revealed that the majority of the respondents have no access to lending institutions that can help tomato farmers with funds (73.6% of the respondents) to support procurement

of various inputs. However, few farmers (26.4% of the respondents) indicated that they are able to access funds from lending institutions mainly from Village Saving Loans, Vision Fund and Concern Universal Microfinance Operations. Lack of access to funds from the lending institutions may be a contributing factor to low productivity as tomato farmers may not manage to buy the necessary inputs to support tomato production. It may be deduced that tomato farmers fail to access funds since the majority (81.3% of the respondents) do not belong to any cooperative or association. Use of village cooperatives as a marketing channel could solve the problem to some extent by empowering the farmers. However, most of the cooperatives formed are not active and in most areas are non-existent (Asgedom et al., 2011).

Although there are several sources of getting information on marketing of tomatoes and its production, 40.2% of the respondents get this information from fellow farmers seconded by extension agents (37.2% of the respondents). Only 21.3% of the respondents indicated that they get the information from the radio.

Tomato production constraints

Table 9 reveals the problems that serve as major constraints to production by farmers in the study area. The major four constraints identified by farmers in our study (in order of decreasing importance) were pests, diseases, marketing and input cost. Comparative analysis of tomato value chain competitiveness in selected areas of Malawi and Mozambique by Mango et al. (2015) also identified these four parameters as major constraining factors of tomato production in Malawi.

Pests and diseases of tomato

Among the tomato pests, most farmers (19.0% of the respondents) indicated tomato red spider mite as a major pest followed by aphids (15.2% of the respondents), nematodes (13.6% of the respondents) and tomato leaf miner (*Tuta absoluta*) (13.5% of respondents). In importance, bacterial wilt was ranked first (23.4% of the respondents) followed by late blight (22.6% of the respondents) and early blight (22.3% of the respondents). The study findings show that majority of respondents (59.5%) use chemicals to control pests and diseases and about 39.4% of the respondents indicated that they use a combination of different control methods (integrated pest and disease management) with the use of cultural and chemical being dominant as compared to combined use of cultural and biological or biological and chemical control. It is known that most farmers perceive the use of chemicals as the most effective method to control pests as compared to other methods (Ddamulira et al., 2021).

Use of chemicals is a worrisome development as dependence on chemicals is a great hazard to the consumer. This was evident in the report by Ntow et al. (2006) in which young farmers (less than 45 years of age) manifested poisoning symptoms due to inappropriate practices in handling and use of pesticides as they did more spraying than old farmers (more than 45 years of age). Additionally, use of chemicals is not only hazardous to humans but also pollutes the environment and sub-soil and increase problem of pathogen resistance towards the pesticides. Therefore, more education is needed to reduce misuse of pesticides but an alternate is to look to pest and disease management strategies such as use of resistant varieties that reduce reliance on chemical pesticides.

Marketing constraints

Table 10 indicates marketing constraints faced by farmers in the study area. Farmers in the study area face numerous problems with marketing of tomato such as price fluctuations, distance to markets, transportation and cost, unavailability of market structures, limited market information, group conflicts over prices and limited farmer organizations. The most cited marketing constraint is price fluctuations (71.5% of respondents). Price fluctuation in tomatoes and other crops is due to seasonality of production across seasons. Farm gate prices are usually very low during the dry season (irrigated) than in rainy season. This can be attributed to increased production of the crop (supply) with irrigated farming as there is a reduction of pests and disease incidences. In addition, there is increased attention to the crop in terms of resources and time with irrigated farming as compared to off season production (Osawere, 2010). The problem of price fluctuation can be reduced by the governments providing credit or subsidizes towards inputs and greenhouse/tunnel construction materials in order to have year-round tomato production, storage facilities, and adequate transport facilities with good roads for easy movement of tomatoes.

The survey results indicate that 80.4% of the respondents sell their tomatoes through unorganized market channels and 19.6% of the respondents were able to sell through organized markets. Organized marketing of tomato is completely ignored in Malawi as the majority of the markets are predominantly informal and the market infrastructure is also very rudimentary (Nyondo et al., 2018). Considering the lack of storage facilities and that tomatoes are highly perishable; farmers are exploited by middlemen and are forced to sell their products at a low price.

The survey results further indicate that 44.8% of the respondents sell their tomatoes outside the farm but few (19.8% of the respondents) sell their tomatoes on their farms. It can be deduced that those selling outside the

Table 9. Major constraints in tomato production and marketing.

Variable	Association	Frequency	Percentage	Rank
Constraints of tomato production	Pests	96	26.1	1
	Diseases	93	25.3	2
	Marketing	77	20.9	3
	Input cost	51	13.9	4
	Input purity	15	4.1	5
	Shortage of water	11	3.0	6
	Weeds	9	2.4	7
	Shortage of land	8	2.2	8
	Poor soil fertility	7	1.9	9
	Floods/Frost	1	0.3	10
	Totals	368	100.0	
Major pests of tomato	Tomato red spider mite	70	19.0	1
	Aphids	56	15.2	2
	Nematodes	50	13.6	3
	Leaf miner	50	13.5	4
	White fly	49	13.3	5
	Tomato fruit worm	48	13.2	6
	Cutworms	35	9.6	7
	Leaf grasshopper	10	2.7	8
		Totals	368	100.0
Major diseases of tomato	Bacteria wilt	86	23.4	1
	Late Blight	83	22.6	2
	Early blight	82	22.3	3
	Fusarium Wilt	63	17.1	4
	Tobacco Mosaic Virus	26	7.1	5
	Verticillium Wilt	17	4.6	6
	Cucumber Mosaic Virus	8	2.2	7
	Others	3	0.8	8
	Totals	368	100.0	
Control of pest and diseases of tomato	Cultural control	3	0.8	
	Chemical control	219	59.5	
	Biological control	1	0.3	
	All above	145	39.4	
	Totals	368	100.0	

farm have no organized marketing arrangement (have no formal customers) and are forced to bring their products directly to buyers for them to sell the tomatoes before they lose quality due to its perishability and they may not have bargaining power to negotiate for a better price. On the other hand, those selling tomatoes on their farm may be the ones that have a steady marketing arrangement hence do not bother to hunt for customers since they are least assured that their tomatoes can be bought without hassles due to prior agreement/arrangement.

Regarding distance from the farm to the markets, about half of the respondents were able to sell their tomatoes

within a distance of less than 10 km. On the other hand, about 40.0% of the respondents had to travel for more than 10 km to sell their tomatoes.

Tomato inputs

Table 11 indicates availability of inputs that support tomato production, status of acquisition, problems faced in acquiring them and quality of inputs (seed and chemicals).

Farmers use various inputs in tomato production

Table 10. Major constraints of tomato marketing.

Variable	Association	Frequency	Percentage
Constraints of tomato production	Price fluctuations	263	71.5
	Distance to markets	54	14.7
	Transport availability and cost	29	7.9
	Unavailability of market structures	7	1.9
	Limited Market information	6	1.6
	Group conflicts over prices	4	1.1
	Limited farmer organization	5	1.4
	Totals	368	100.0
Means of marketing of tomato	Through organized market	72	19.6
	No formal organized market	296	80.4
	Totals	368	100.0
Tomato selling points/places	On the farm	73	19.8
	Outside the farm	165	44.8
	On the farm and urban market	119	32.3
	Other places	11	3.0
	Totals	368	100.0
Distance to markets	Up to 5 km	122	33.2
	5-10 km	99	26.9
	10-20 km	75	20.4
	More than 20 km	72	19.6
	Totals	368	100.0

Table 11. Acquisition of inputs.

Variable	Association	Frequency	Percentage
Availability of inputs	Highly available	115	31.3
	Available	140	38.0
	Moderately available	93	25.3
	Not available	12	3.3
	No response	8	2.2
	Totals	368	100.0
Acquisition of inputs	Major problem	312	84.8
	Not a problem	53	14.4
	No response	3	0.8
	Totals	368	100.0
Problems faced in acquisition of inputs	High cost of inputs	232	63.0
	Are not available at proper time	38	10.3
	Distance	65	17.7
	Other problems	33	9.0
	Totals	368	100.0

ranging from tomato seed, fertilizers, chemicals, sprayers and irrigation equipment such as treadle pumps and watering cans. More than half of the respondents indicate

that various inputs are readily available on the market. However, although the inputs are available, majority (84.8% of the respondents) have problems to acquire

Table 12. Demographic characteristics of input suppliers.

Variable	Association	Frequency	Percentage
Gender	Male	27	75.0
	Female	9	25.0
	Totals	36	100.0
Years in selling inputs	< 1	2	5.6
	>1<2	2	5.6
	>2<5	8	22.2
	>5<10	15	41.7
	>10	9	25.0
	Totals	36	100.0

them mainly due to high cost of inputs (74.4% of the respondents), distance (20.7% of the respondents) and sometimes the inputs are not available at proper time (12.2% of the respondents).

Regarding quality of chemicals and tomato seed, more farmers (47 % of the respondents) are able to know viability or quality of the seed (germination). This is done by observing expiry date probably because majority of the respondents are literate and can ably read the label. 13.9% of the respondents indicated to have no knowledge on the importance of knowing the quality of seed or chemicals before use. On the hand, 39.1% of the respondents use their previous experience, try and error (by chance) and they are assured of getting quality seed or chemicals when they buy from reliable shops.

Role of input suppliers (agro-dealers)

The survey exercise also interviewed 36 input suppliers to get information regarding their experiences with selling agriculture inputs specifically for tomato (Table 12).

Demographic characteristics of input suppliers

The inputs sold by the input suppliers include various seeds including tomato, fertilizers, chemicals and various tools and equipment. Among the input suppliers, 75% of the respondents were males and 25% of the respondents were females. This trend is similar to the earlier findings in this document where male dominate as tomato farmers. 75.1% of the respondents have been selling inputs for less than 10 years and 25.0% of the input suppliers have been selling inputs for more than 10 years. Among the various reasons that prompted the input suppliers to start selling the inputs were mainly due to increase in demand for inputs in the area as a source of income. To ensure quality inputs are sold, the Pesticides Control Board in Malawi inspect the input suppliers' outlets. The board verifies if inputs are not expired and ensures that all sellers have license to sell

the inputs.

Input sales

Table 13 indicates seasonality of input sales, repackaging, source of information and major problems faced by input suppliers. In terms of variation of sales among seasons, most sales are done during irrigated/winter season (72.2% of the respondents) as compared to rainy season sales (27.8%). As reported earlier in this paper and as stated by Mango et al. (2015), most of the tomato production in Malawi is done under small-scale irrigation system in dambos (with residual moisture). Therefore, it can be suggested that more farmers purchase more inputs during the dry season compared to rainy season where few inputs are bought as farmers divert resources to other crops (Osawere, 2010). Since some inputs such as seed, fertilizers and chemicals are usually sold in larger packs which either may be more than farmers requirement or not affordable for a particular farmer, 58.3% of the respondents indicated the need to repack the input to suit their needs and financial status.

Apart from selling inputs, input suppliers also provide extra information to farmers when they are buying various inputs such as safe use of chemicals, toxicity, plant spacing and storage of pesticides. In terms of obtaining information on where to obtain inputs, input suppliers primarily rely on electronic media (Radio, Television and Newspaper) (47.2% of the respondents) followed by information sourced from fellow input suppliers (25%).

Input suppliers indicated that they face several constraints in the course of selling inputs mainly lack of capital (27.8% of the respondents), scarcity of quality inputs (19.4% of the respondents) and poor coordination between agriculture office and input suppliers (16.7%).

Conclusion

The study on status of tomato production in selected

Table 13. Input sells.

Variable	Association	Frequency	Percentage
Seasonal variation in selling of inputs	Winter/Irrigated	26	72.2
	Rainy	10	27.8
	Totals	36	100.0
Need to unpack inputs	Yes	21	58.3
	No	15	41.7
	Totals	36	100.0
Source of information regarding inputs	Radio/television/newspaper	17	47.2
	Fellow inputs sellers	9	25.0
	Farmers	7	19.4
	Extension workers	3	8.3
	Totals	36	100.0
Major problems faced by agro-dealers	Lack of capital	10	27.8
	Scarcity of quality inputs	7	19.4
	Poor coordination between agriculture office and agro-dealers	6	16.7
	Disagreements among on prices	4	11.1
	High costs of inputs	4	11.1
	Long distance to the markets	3	8.3
	Farmers prefer small quantities	2	5.6
	Totals	36	100.0

districts in Malawi, which are known to be major tomato producing districts, reveal male dominance in tomato production and input selling. Tomato farmers cultivated the crop on less than 1 ha mostly on their own land without title deed (88.3%). With regards to education, majority had attained primary school suggesting that they can be innovative and able to easily understand concepts of tomato production. It was observed that most farmers are within the active stage (31-52 years), with average family size of more than 5, hence they rely more on family labour (58.4% of the respondents).

The survey found that none of the tomato growers use greenhouses or tunnels, preferring instead to grow their crops in open fields, most likely due to a lack of understanding of their usefulness and the fact that they are capital intensive. Tomato producers prefer to cultivate the crop during the dry season, using residual and other forms of irrigation, because disease and pest pressure is lower, and farmers have more time to focus on tomato production than during the rainy season. Indeed, there is increased production during the dry season which results into low prices compared to tomato production during the rainy season. This price fluctuation can be easily controlled by producing tomato in greenhouses to attain year-round tomatoes on the market. Tengeru 97 is most preferred tomato variety followed by Rodade mainly due to their long shelf life. Usually, farmer purchase the seed from shops and they rarely buy seedlings but rather raise

their own seedlings.

The study further revealed that tomato farmers face several challenges such as pest, diseases, marketing and high input costs. The major pests cited include red spider mites, aphids and nematodes and bacterial wilt, early and late blight are the major diseases. Control of these pests and diseases is mainly chemicals, a catalyst for environmental pollution and a health hazard for human beings.

Apart from price fluctuation, unorganized marketing of tomato is a major concern. These problems are compounded with the fact that most farmers do not work as a group in a cooperative where they can do collective marketing and also get loans. Similarly, input suppliers face hiccups in accessing funds to run their business.

Therefore, it is recommended that Ministry of Agriculture should intensify demonstration for increased adoption of improved technologies such use of greenhouse/tunnels and grafting to increase tomato production among smallholder farmers. In addition, the Government of Malawi should also support tomato production by providing subsidies similar to the support that is provided to maize production (such as providing subsidies on seed, fertilizer, chemicals and green house construction materials). The government also should consider developing adequate infrastructure to support marketing and transportation. Lastly, farmers should be encouraged to form cooperative to have a more

bargaining power.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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