WFL Publisher
Science and Technology
Meri-Rastilantie 3 B, FI-00980
Helsinki, Finland
e-mail: info@world-food.net

Journal of Food, Agriculture & Environment Vol.5 (3&4) : 12-16. 2007 *www.world-food.net*

The market factor in the processing of tomato (*Lycopersicon esculentum*) in Ghana

M. Aggey [1], Y. Amoah [1] and R. J. Bani [2]
[1]Institute of Industrial Reasearch, Council for Scientific and Industrial Research, Ghana. [2]Department of Agricultural Engineering, Faculty of Engineering Sciences, University of Ghana, Legon, Ghana.
e-mail:aggeym@yahoo.com, joeamoah@yahoo.com , *rjbani@ug.edu.gh*

Received 10 April 2007, accepted 27 July 2007.

Abstract

Local industrial tomato processing in Ghana remains insignificant in the mist of perennial tomato glut in the Upper East region of Ghana. A basis for processing decision making has been provided using exploratory research techniques to review tomato consumption, market segmentation and structure, production surpluses, prices and buying process of fresh and paste tomato. Fresh tomato surplus projects at 23,000 to 118,000 t p a (2000-2007) though actual glut period is short, occurring from February to March when 92 percent of farmers harvest, and traders use hedging tactics to avoid tomato spoiling on their hand. With the short glut period, large-scale processing requires planning and investment in semi-processed or cold storage facility, integrated project with cultivation of tomato variety suitable for harsh lean season climatic conditions and production staggering to prolong harvesting. Projected paste from surplus produce exceeds catchments area market, yet access is in competition with established brands such as Salsa, La bianca, Bonito, Tomaroma and Obaapa. Processing could target a paste market of 2,000-3,000 t, requiring l6,470 t fresh tomato, at a processing capacity of 2.3 t per hour, 24 hour-day and for 300 days p a, with plans for future expansion. This study was conducted in the last quarter of 2002.

Key words: Tomato consumption, market segmentation and structure, production surplus, price, buying process, fresh and paste tomato.

Introduction

The perennial tomato glut in the Upper East Region has become a proverbial national food production system concern. Yet local industrial processing of tomato remains insignificant as. The 100 ton per day Pwalugu Tomato Processing Factory, installed in the region since 1962, is stuck on government divestiture list. The only functional processing unit in Ghana at the moment appears to be an Adventist Development and Relief Agency (ADRA) promoted small technology factory, located at Tuobodum, more than 500 km down south in the Brong Ahafo region, processing a mere 1 ton of fruits a day, very intermittently. Several other tomato processing facilities around the country are either closed down, being rehabilitated or near commissioning.

On-farm tomato losses due to improper handling and sorting, in the Upper East Region may average 22 percent [4] comparing well with general postharvest losses of 30 to 40 percent quoted for Ghana [1,2]. However, direct interactions with individual farmers suggest limited market options may cause losses of more than 60 percent during the glut period, severely limiting farmers' earnings, reducing national food security, and contributing, in part to farm-gate tomato price fluctuations in excess of 300 percent in some years [5]. It has been emphasized that the existing marketing system in Ghana is still at the rudimentary level and therefore unable to absorb excess produce during the harvesting seasons [1]. As a result, several works have recommended improvements in tomato market information, market transparency, physical distribution and processing for domestic and export markets as approaches to solving the problem [3, 5]. This paper reviews tomato consumption, market segmentation and structure, production surpluses for processing, as well as prices and the buying process of fresh and paste tomato in the Upper East Region of Ghana: by there providing an indispensable basis for processing decisions.

Material and Methods

The study area: The study area was the Upper East Region of Ghana which was confirmed as the area where a large proportion of Ghanaian tomatoes are grown [7].

Methodology: Exploratory research techniques were used including a review of official documents from the Ministry of Food and Agriculture (MoFA) [6], Statistical Services Department and the Irrigation Company of the Upper East Region (lCOUR), market visits and observation, informal interviews with tomato farmers, traders and consumers as well as distributors, retailers and consumers of canned paste tomato in selected towns including Bolgatanga, Navrongo, Tono, Vea, Paga, Paga-Nania, Sandema, Bongo and Pwalugu all in the Upper East Region. The sample of consumers included women, students and restaurant chefs. Household and per capita fresh and paste tomato

consumption was derived from the interview responses, allowing for consumption variations in the lean and major seasons as well as accounting for urban-rural and tomato producing and non-producing area consumption patterns. The qualitative data and aspects of the quantitative data were triangulated with a focus group of MoFA field officers from Bolgatanga, Bawku, Navrongo, Paga and Sandema. Follow-up visits were also made to selected tomato markets in Kumasi (Ashanti Region) and Accra. Straight line projections were combined with population figures to compute market sizes and trends. This study was conducted during the last quarter of 2002.

Results and Discussion

Tomato forms on the market and their uses: The main forms of tomato available in markets in the Upper East Region are fresh tomato, paste tomato, dried tomato, tomato puree and tomato powder. Consumption of tomato puree and tomato powder appears to be low; the former being used only in selected dishes in restaurants. In terms of market visibility and quantities consumed, fresh tomato is the prevalent form observed in the project area; followed by the canned paste form. The end-uses of fresh and canned paste tomato are similar. Both are used in a variety of soups, sauces, stews to impact mainly flavors and carotene red color. Fresh tomato is used exclusively in food garnishing and raw pepper sauce.

Consumer preferences: More than 90 percent of persons interviewed preferred fresh tomato to canned paste citing freshness and absence of added chemicals as reasons for this preference suggesting that paste tomato without additives could have more appeal to consumers in the study area.

Bright glossy red color (well riped) and freshness suggesting freshly plucked with no physical blemish are key preference attributes for most direct consumers in buying fresh tomato. Shape is secondary but size may become an issue if the color is not bright red. Also tomato that yields dense paste on grinding is preferred to watery tomato. An additional attribute valued by tomato traders is firmness and hardiness to withstand the rigors of long-distance haulage. Tomato taste and flavour, according to interviewees, might only be discerned after use and thus do not feature much in a purchase decision. Likewise nutritional requirements are seldom considered in both fresh and paste tomato purchase.

Key attributes preferred by paste tomato consumers, on the other hand, are good flavour, red color, both in depth and consistency and less sourness in taste. More than 80 percent of respondents also reported that canned paste tomato adds bulk to prepared dishes as it rises or bloats during cooking. Fresh tomato on the other hand is perceived to shrink or ''reduce'' during cooking.

Both fresh and paste tomato purchases are influenced by price. About 85 percent of respondents affirm that they use less fresh tomato in the off-season because it is expensive and several female tomato farmers reported that although they liked canned paste tomato they preferred to cook without it even in the off-season as they consider it too expensive. In Navrongo, up to 70 percent of families who use canned paste tomato in the lean season still use it in the fresh tomato season suggesting a year round market for paste if the price is affordable.

Fresh tomato consumption and market size trends: The demand for fresh tomatoes in the Upper East Region is not exclusive to that region alone. Evidence from the survey suggests that in the tomato season from December to May each year, traders from all regional and many district capitals in Ghana, and some towns in Burkina Faso and Togo converge in the Upper East Region to buy tomatoes. This larger market comprising Ghana and parts of Burkina Faso and Togo is served by producers in the Upper East Region in competition with other producing areas such as Akomadan and Wenchi in Brong Ahafo, Ada in the Greater Accra Region and even southern Burkina Faso. This supports the observation, that tomatoes are harvested and head-loaded across the northern and north-western borders of Ghana using a maze of footpaths and livestock trails [7].

Though fresh tomato market available to producers in the Upper East Region covers the whole country, Table 1 summarizes the estimated consumption in only the Upper East Region and surrounding areas, as a processing plant in the region would be in direct competition with these market segments for raw materials, especially if the crop variety is not differentiated. In this area comprising the Upper East, Upper West and Northern Regions in Ghana and portions of Togo and Burkina Faso, with a population of more than 3.6 million (Ghana portion only), more than 121,000 tonne of fresh tomato was consumed in 2000. Rising at an annual rate of 2,399.5 t, consumption is projected at almost 138,000 t by 2007. Per capita consumptions of 52 kg and 29 kg were derived for tomato producing and non-producing areas, respectively; while on average 65 percent of consumption occurs in the harvest season and 35 percent during the lean season.

Buying and distribution: About 33 percent of fresh tomato produced in the Upper East Region is purchased by traders from outside the region (Table 7) while some l0 percent is carried by local traders. These traders come from Accra-Tema (45 percent), Kumasi (15 percent), Cape Coast and Mankessim (18 percent) and the rest from Obuasi, Nkawkaw, Koforidua, Aflao, Lome (Togo) and parts of Burkina Faso. About 40 percent of these traders, especially those from Cape Coast and Kumasi areas, pay cash, but the remaining 60 percent buy tomato from the farmers on credit. These wholesale traders deliver their tomato to retailers in the various market centers down south returning in a week or two weeks to start another cycle of purchases.

Canned paste tomato: It was found that 71 percent of respondent households use canned paste tomato in the lean season suggesting that at least 7 in 10 households combine fresh and paste tomato in preparing their meals during the lean season.

Table 1. Fresh tomato consumption trends in selected regions (1000 t).

	Consumption (1000 t)							
Region	2000	2001	2002	2003	2004	2005	2006	2007
Upper East	47.8	48.3	48.8	49.4	49.9	50.5	51.0	51.6
Upper West	16.5	16.6	16.9	17.2	17.4	17.6	17.8	18.0
Northern	51.0	52.5	54.0	55.6	57.1	58.7	60.4	62.0
Togo	3.9	3.9	3.9	4.0	4.0	4.1	4.2	4.2
Burkina Faso	1.9	1.9	1.9	2.0	2.0	2.1	2.1	2.1
Total	121.2	123.3	125.7	128.2	130.0	133.0	135.5	137.9

Table 2. Canned paste tomato consumption projections for catchment area (1000 t).

Region	2000	2001	2002	2003	2004	2005	2006	2007
Upper East Region	2.2	2.2	2.2	2.2	2.3	2.3	2.3	2.3
Upper West Region	1.7	1.8	1.8	1.8	1.9	1.9	1.9	2.0
Northern Region	4.0	4.1	4.2	4.3	4.4	4.5	4.7	4.8
Togo	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.013
Burkina Faso	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.013
Total	7.924	8.124	8.224	8.324	8.624	8.726	8.926	9.126

Table 3. Potential geographic market segments available to the pilot plant (2002).

Region	Market size t	Proportion (%)
Upper East	2,667.9	28.2
Upper West	2,036.8	21.5
Northern	4,733.9	50.0
Togo	13.7	0.4
Burkina Faso	14.5	0.2
Total	9466.8	100

The percentage reduces to 50 percent in the tomato harvest season implying that 70 percent of households using paste tomato in the lean season still use it in the harvest season.

Canned paste tomato consumption projected for the area is in Table 2. In 2002, more than 8,200 tonne of paste was consumed in the catchment area. Consumption is projected to rise at a rate of 177.5 t p. a. to more than 9,000 t in 2007. Compared to 16,000 t of tomato products imported into Ghana at USD 8 million, and rising at 10 percent p. a. [8], it appears that close to half Ghana's canned tomato paste imports are consumed in this catchment area. The estimated consumption for Burkina Faso and Togo provides for only paste crossing the border from Ghana and does not represent total consumption in these countries. Evidence from the study suggests that trade in paste tomato as in the fresh fruit is either way depending on which side of the border the product is cheaper.

Market segmentation and structure: Geographic market segments in the Upper East, Upper West and Northern Regions in Ghana, and portions of southern Burkina Faso and northern Togo are all in the catchment area of any processing plant located in the Upper East Region. The estimated market shares of the above segments in 2002 are presented in Table 3. Comprising half the market share, the Northern region is the largest segment. Next is the Upper East regional market (28.2 percent) which is also the nearest in proximity to the key tomato producing area and hence will be most easily accessible to products from a processing plant in the region.

The consumer survey suggests additional market segments of canned paste tomato consumers, including those consuming paste in: household/family meals; restaurant/chop-bar meals; self-cooking student meals; and meals from institutional kitchens. These segments also exhibit seasonal and packaging size dimensions with important implications for paste packaging from the plant. The 2002 estimates of these market segments in Navrongo (Upper East Region) are presented in Table 4.

The restaurants and chop bars segment buys the largest quantity of paste, that is 32.7 t, comprising 49 percent of the total market share. Since consumers in this segment regularly and consistently use relatively large quantities of paste in preparing commercial meals and invariably possess cold storage facilities to store any leftover paste for future use, their preference is for the largest size of packaging available on the market. That is the 2.2 kg size of can.

The household/family meal users follow with 38 percent of the market share. Consumers in this segment prefer smaller packaging sizes, especially the medium (400 g) and sometimes the smallest size (70 g). This is probably because these consumers use far smaller quantities of paste in a meal than the restaurant/chop bar market. Together, these two segments, forming 87 percent of the paste market, present an expedient target market with a focus on mega (2 to 3 kg) and a meso (400 to 500 g) package sizes.

The market sizes derived from the household survey triangulate well with the structure of canned tomato paste sales obtained from a survey of super markets in Navrongo (Table 5) as well as data from a major paste distributor in Bolgatanga, the Upper East regional capital (Table 6). Both the seasonal variation in sales and the packaging size dimensions are clearly visible in both data sets. The percentage of paste sales during off-season estimated from consumers survey is 60.5 percent (Table 4), comparing well with supermarket sales structure, 59.0 percent from Table 6 and 59.9 percent (Table 5) from the main wholesale paste distributor. Furthermore the percentage of mega and meso size packages from Tables 5 and 6 are 94.8 percent and 87.4 percent respectively; very close to 87 percent estimated from the consumer survey.

Serving five key towns, Bolgatanga, Navrongo, Sandema, Bawku and Walewale, the main paste distributor in Bolgatanga sold 166 t of paste in 2002. This quantity exceeds those from both the consumer and supermarket sources, suggesting some of this quantity might have gone over the border. The evidence also suggests urban and rural segments with the former probably forming more than 70 percent of current consumption.

Major paste distribution outlets were found in Tamale (Northern Region), Wa (Upper West) and Bolgatanga (Upper East) all in the catchment area. Sankase in northern Togo and Ouagadugou in Burkina Faso are also paste tomato distribution locations serving the project area. All these distributors stock various imported brands.

Only two segments appear important in the fresh tomato market; the wholesale long-distance traders and local retailers and users. The traders prefer just plucked, glossy red ripe but firm and hardy tomato while the local user may not be extremely fussy about hardiness. Some local consumers go for cheaper overriped and partly blemished fruits if they are for immediate use. The other dimensions of segmentation observed in the paste market do not appear important as all fresh tomato consumers appear to be driven mainly by availability and price factors.

Table 4. Canned paste tomato consumption in Navrongo (Estimate for year 2002).

Market segment	Quantity consumed, t			Package size		
	Off season	In season	Total			
Household/Family meal	15.7	9.8	25.5	70	400	g
Restaurants/Chop bars	19.5	13.2	32.7	2.25		kg
Self cooking students	3.1	2.1	5.2	70	400	g
Institutional kitchens	2.1	1.4	3.4	2.25		kg
Total	40.4	26.4	66.8			
Percentage	60.5	39.5	100.0			

Note: In and Off season refers to fresh tomato seasons in the Vea, Tono, Paga, Pwalugu tomato producing areas.

Table 5. Supermarkets canned tomato paste sales information in Navrongo (2002).

Can size	Fresh tomato off season	Fresh tomato in season	Total	Percent
Small size (70 g)	1.9	1.0	2.9	5.1
Medium size (400 g)	12.0	9.6	21.6	38.3
Large size (2.25 kg)	19.4	12.5	31.9	56.6
Sum	33.3	23.1	56.4	100
Percent	59.0	41.0	100.0	

Table 6. Canned tomato paste distributor sales information in Bolgatanga (2002).

Can size	Fresh tomato off-season	Fresh tomato in-season	Annual total (t)	Percent
Small size (70 g)	13.8	7.2	21.0	12.6
Medium size (400 g)	28.8	22.8	51.6	31.1
Large size (2.25 kg)	57.0	36.6	93.6	56.3
Sum	99.6	66.6	166.2	100.0
Percent	59.9	40.1	100.0	

Production surpluses and processing plant capacity: The trends in fresh tomato surpluses in the Upper East Region together with corresponding projected paste output from the surplus quantities are summarized in Table 7. Fresh tomato surplus projections for the region range between 23,000 and 118,000 t p.a. from 2000 to 2007. At a paste recovery rate of 17 percent these waste figures project to 3,900 to 20,000 t of paste which could be preserved by canning. In the year 2002, more than 67,000 t of fresh tomato surplus equivalent to about 39 percent of that year's production was wasted. Some figures reported from ICOUR (Irrigation Company of the Upper Region) suggest that some farmers produced 92.3 crates of tomato in a season, consuming 4.6 crates, selling 67.7 crates and losing 20 crates equivalent to 22 percent confirming that tomato postharvest losses in the region are generally high.

Thus, projected paste from surplus produce, 4,000 to 20,000 t, far exceeds 9,000 to 10,500 t potential paste market in the catchment area (Table 2), albeit access to this market will be in stiff competition with more established imported brands including Salsa, La bianca, Bonito, Tomaroma and Obaapa. A market size of 2,000 to 3,000 t paste, requiring a maximum 16,470 t fresh tomato and processing capacity of 2.3 t per hour, 24 hours a day and 300 days p.a., would be easy to capture with plans for future expansion.

This market could be doubled if the huge rural market potential could be developed as more than 70 percent of the population in the area live in the country side but only 30 percent of current canned paste market is rural. Processing total surplus available in the region would imply target market of Ghana and West Africa, albeit in competition with other suppliers.

Conclusions

Key attributes preferred by paste tomato consumers are good flavour, red color, in depth and consistency, less sour taste, denseness and adding bulk to prepared dishes by rising during cooking. Package size, affordability and availability are also important, varying with the market segment.

In a catchment area with a population of more than 3.6 million, fresh tomato consumption is projected to rise from 121,000 t (2000) to 138,000t (2007). Per capita consumption is estimated at 52 kg and 29 kg for tomato producing and non-producing areas, respectively, while on average 65 percent of consumption occurs in the harvest season.

Unexploited demand for canned paste tomato is projected at 1,238 t in 2002, rising to 1,300 t in 2007. Considering a low price strategy and 15 percent of the current market share to be captured, a processing plant in the area may target market share of 2,000 to 3000 t p.a. with plans for future expansion.

Fresh tomato surplus projections for the region range between 23,000 and 118,000 t p.a. from 2000 to 2007 though the actual glut period is short, occurring from February to March when 92 percent of farmers are harvesting while traders employ hedging tactics and manipulation to avoid tomato spoiling in their account. The glut is temporal and transient and large-scale processing would require planning and investment in either semi-processed or cold storage facilities or an integrated project involving selection of tomato varieties to withstand the harsh climatic conditions of the lean season, production staggering to extend the harvesting period.

Projected paste from surplus produce, 4,000 to 20,000 t p.a. far exceeds 9,000 to 10,500 t potential paste market in the catchment area, albeit access to this market is in stiff competition with established imported brands.

This market could be doubled if the huge rural market could be developed as more than 70 percent of the area's population live in the country side, but on1y 30 percent of current paste market is rural. Processing total surplus produce would, however, require the total Ghanaian and West African market targets, albeit in competition with other suppliers.

Table 7. Fresh tomato surplus (1000 t) in Upper East Region.

Year	2000	2001	2002	2003	2004	2005	2006	2007	Y2002 %
Production	156	166	173	185	197	208	221	233	100
Consumption	48	48	49	49	50	50	51	52	28.3
Sales (Export)	88	73	57	44	59	59	62	64	32.9
Surplus wasted	24	45	67	91	89	89	108	118	38.8
Projected paste output from surplus	4	7	11	15	15	16	18	20	

"Note: Y2002 means Year 2002.

References

[1]Andah, A., Adu-Amankwa, P., Amoa-Awua, W. and Halm, M. 1996. Problems of Food Storage and Post Harvest Losses in Ghana. Food Research Institute Technical Report AA019, MEST / FRl, Accra.

[2]Bani, R. J. 1991. The significance of post-harvest food losses in Ghana. The Legon Agricultural Research and Extension Journal **3**(1):43-46.

[3]Bell, A., Mazaud, F. and Muck, O. 1999. Post-production and Marketing Systems for Yams and Tomatoes in Ghana, in Guidelines for the Analysis of Post-Post Production Systems. Food and Agricultural Organization and Agro-Industries and Post Harvest Management Service (AGSI), Rome.

[4]ICOUR 2001. Annual Report 2001. Irrigation Company of the Upper East Region, Navrongo.

[5]Institute of Industrial Research – IIR. 2003. Small Scale Processing Plant for Tomato Paste Production in the Upper East, Region, MoFA-AgSSIP, Ghana.

[6]MoFA 200l. Files of the Ministry of Food and Agriculture in Bolgatanga, Upper East Region, Ghana.

[7]Morris, G. A. and Dadson, J. A. 2000. Ghana: Cross-Border Trade Issues. African Economic Policy Paper, Discussion Paper No. 22.

[8]Weidinger, R. 2004. Partnership towards Viable and Sustainable Value Chain Management: The Case of Wenchi Tomato Processing Project. Sedentary Farming Systems Project, Sunyani.