Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 5, Issue, 12, pp.4102-4107, December, 2013

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

THE TOMATO INDUSTRY IN GHANA – FUNDAMENTAL CHALLENGES, SURMOUNTING STRATEGIES AND PERSPECTIVES. - A REVIEW

***[1]Inusah I. Y. Baba, [2]Julius Yirzagla and [1]Michael Mawunya**

[1]CSIR-Savannah Agricultural Research Institute, Box 52 Nyankpala, Tamale, Ghana
[2]CSIR-Savannah Agricultural Research Institute, Box 46 Manga, Bawku, Ghana

ARTICLE INFO

Article History:
Received 18th September, 2013
Received in revised form
20th October, 2013
Accepted 19th November, 2013
Published online 25th December, 2013

Key words:

Red cocaine,
Tomato Disease Complex,
Value chain.

ABSTRACT

In recent years, Ghana has been cited in several local *Newspapers* as the second largest consumer of paste tomato in the world. According to the Ghana National Tomato Producers' Federation, Ghana imports up to 7,000 metric tons (t) of fresh tomato per month from its neighbors, along with 27,000 t of processed tomato from Europe. It is a common practice for the Ghanaian tomato marketers called "market queens" to travel all the way to neighboring Burkina Faso, usually in March and May, to scout for tomatoes, encountering several hazards on the highways. The collapse of the tomato industry in northern Ghana is associated with a complex of biotic, abiotic and institutional challenges. The event adversely affected the fortunes of thousands of farmers and other stakeholders and their families for whom, tomato then dubbed "red cocaine" production has for several decades constituted a major source of income. The remote causes of the disaster in the tomato industry included a pandemic in all the growing areas in the north of Ghana referred to as "the Tomato Disease Complex" - the result of the adverse influence of excessive build up of soil nematodes and uncontrollable proliferation of fungal, bacterial, viral and other diseases in all the major growing areas in northern Ghana. "The Tomato Disease Complex" in some seasons, culminated into total crop failures for countless farmers, resulting in bankruptcy and several reported cases of attempted suicide. This work reviews the key challenges that have confronted the tomato industry in Ghana over the last three decades and proposes fundamental pathways for the way forward for this industry to develop to its full potential and contribute more significantly to the growth of the economy of Ghana.

INTRODUCTION

The collapse of the tomato industry in recent times, in northern Ghana adversely affected the fortunes of thousands of farmers and other stakeholders and their families, for whom, as far back as in the early 1960s, market gardening of the crop had been a very important dry season economic activity (Clottey *et al.,* 2009). The demise of the tomato industry in Ghana is associated with a complex of biotic, abiotic and institutional challenges, which can be traced back to as early as 2000 (MoFA, 2009). The adverse influence of excessive buildup of soil nematodes and the uncontrolled proliferation of fungal, bacterial, viral and other diseases in all the major tomato growing areas in northern Ghana came to be widely referred to as the "Tomato Disease Complex" (Inusah, 2005; Tanzubil *et al.,* 2004). "The Tomato Disease Complex" was pervasive throughout all cropping areas of Tono and Vea irrigation schemes, and at Pwalugu in the Basin of the White Volta River (WVB). In some seasons the diseases culminated into total crop losses, with hundreds of prominent tomato farmers thrown into bankruptcy and a number of them resorting to suicide (Asuming-Brempong and Asuming Boakye, 2008; Evans Mensah/IRIN, 2009). In recent years, Ghana has been cited in several local *Newspapers* as the second largest consumer of paste tomato in the world. According to the Ghana National Tomato Producers' Federation, Ghana produces 510,000 metric tons (t) of tomato each year, while she imports up to 7,000 t per month from its neighbors, along with 27,000 t of processed tomato from Europe. It is now an annual ritual (between March and May) for the Ghanaian controversial tomato "market queens" to travel all the way to neighboring Burkina Faso to scout for tomatoes, encountering several hazards on the highways. Some of the main factors that led to the closure of the three Ghanaian tomato factories by the late 1980s included structural reforms promoted by the World Bank and IMF; frequent breakdowns resulting from a lack of spare parts and obsolete machinery; lack of technical competence and financial management and poor marketing.(Robinson and Kolavalli, 2010a, 2010b, 2010c). In this work we review the major challenges that have confronted the tomato industry in Ghana over the last three decades and propose fundamental pathways for its recovery

***Corresponding author: Inusah I. Y. Baba,** CSIR-Savannah Agricultural Research Institute, Box 52 Nyankpala, Tamale, Ghana.*

MAJOR CHALLENGES

It is impossible to rejuvenate the tomato industry in Ghana if the following fundamental production, policy and institutional challenges are not overcome. These strangle holds on the industry include: declining tomato production and productivity; declining fruit quality and storage capacity; processing challenges and institutional challenges such as out-grower scheme development and management, credit and marketing, non-sustainable value chain linkages and others.

Declining production and productivity

Successive Governments investments have been made in large scale tomato processing plants at Pwalugu in the Upper East, Wenchi in the Brong-Ahafo and Nsawan in the Eastern regions of Ghana yet Ghana's tomato farmers have not been able to produce tomato at sufficiently high levels of output, at sufficiently low cost and at sufficiently high quality to enable domestic processing to be competitive with imported tomato paste from the EU and China. (Asuming-Brempong and Boagye, 2008; Mooney et al, 2009; Robinson and Kolavalli 2010a, 2010b). Available data indicates significant decline in overall production since 2000 with domestic production being regularly supplemented by imports in the range of 100,000 tons per year from Burkina Faso during the harvest season of December to May (Robinson and Kolavalli, 2010a). ISRID/MoFA monitored tomato yields in the 1980s were reported at 4.8 t-ha^{-1}.But Wolf (1999), reported the national average yields to be 13 t-ha^{-1}, while ISODEC (2004) reported the 2000s average as 7.5 t-ha^{-1}; Asuming-Boateng and Asuming Boakye estimated national average for 2008 at 6.7 t-ha^{-1} whilst a recent survey by Robinson and Kolavalli (2010a) suggests 10.6 t-ha^{-1} average for three major tomato growing districts in Ghana. In summary thus, over the past two decades, the tomato sector in Ghana has been stagnant or possibly declining both in terms of area cropped and yields per hectare.

Declining fruit quality

IRIN-Ghana in 2009 reported that as a result of cross-border price under cutting engineered by tomato merchants called "market queens" several of Ghana Upper East region farmers confronted with mounting debts and lack of buyers, were resorting to suicide. The "market queens" denied engineering the market and one of them, Maame Dufie, at Abeka Market in the capital Accra, told IRIN that Burkina Faso tomatoes are of higher quality and sell more quickly than local varieties:"Burkina tomatoes are bigger, harder, far superior in taste and last longer in storage," she said. "We are business women, not charity organizations, so we will only buy the best that will guarantee our profits.

Processing challenges

Some of the main factors that led to the closure of the three Ghanaian tomato factories by the late 1980s included structural reforms promoted by the World Bank and IMF; frequent breakdowns resulting from a lack of spare parts and obsolete machinery; lack of technical competence and financial management and poor marketing. (Robinson and Kolavalli, 2010c). Processing challenges also included the fact that farmers were unable to supply the factories with a continuous sustainable flow of *processing tomatoes* such as *H 3044* and *H 7151* (Table 3) which were tomato varieties evaluated by H.J. Heinz Co. International at Tono and Vea Projects (ICOUR Ltd) and found to be both high yielding (32.5-36.1 t-ha^{-1} and excellent for processing. Improving tomato processing in Ghana would not only reduce the country's dependence on imported tomato paste and so improve foreign exchange reserves, provide employment and development opportunities in poor rural areas of the country, but would also offer a way of "buying the glut" which infamously frequently triggered reported suicide attempts by farmers in the growing areas (Gross and Clottey, 2005). Recent government attempts to rejuvenate the processing industry have been characterized by unimaginable and intricate challenges.

STRATEGIES FOR SURMOUNTING CHALLENGES

A complex system failure such as that of the tomato industry in Ghana requires short and long term strategies to surmount the challenges. These include the following:

Improved Crop management and HYV

Research conducted by CSIR-SARI at Tono and Vea irrigation schemes in 2005 has demonstrated that the yields of tomato at these sites could be enhanced from 11.81 t-ha^{-1} for Petomech VF (a favorite locally available improved variety), to 22.2 t-ha^{-1}. for Nema 5230 an imported high yielding variety (HYV) (Table1 and Figure 1). Prof. Antonio Calado of the H.J. Heinz demonstrated at in the Upper East Region, from 2003 to 2004 that the use of improved crop management practices and HYVs could improve yields of tomato significantly. For instance, farmers could obtain mean yields of 31 at Tono and 18 t-ha^{-1} at Vea sites (Table 1).

Figure 1. Strain B.I. a High yielding variety from Dzingoff Ghana Ltd/Hazera Genetics International

Table 1. Comparison of means of yields by varieties at Tono & Vea Schemes

		Mean Yields. t-ha^{-1}	
	Varieties	Tono	Vea
1	Petomech V.F.	11.810ab	6.375 bc
2	Nema 5230	22.202 a	16.300 a
3	**Missouri**	**11.693ab**	**5.675 c**
4	St. Ruff	18.903ab	9.250 bc
5	Strain B. I	9.193 d	11.700 ab
6	R. Fugo	14.787 bc	10.025 bc

Means followed by the same letters are not significantly different from one another

The use of Integrated Pest and Diseases Management (IPM) techniques was also demonstrated by CSIR-SARI workers to significantly improve tomato yields to 20 and 13 t ha^{-1} at Tono and Vea sites in the Upper East Region of Ghana respectively (Table 2). The key therefore, to improving the yields, productivity and quality of tomatoes in Ghana is by employing improved crop management practices such as IPM together with HYVs which have good resistance to pests and diseases of tomato. Water, soil fertility and fertilizer management regimes at all sites need to be improved. In particular all hot spots of white fly (lateral and main drains, etc.) should be sprayed periodically with ecologically friendly pesticides such as neem seed oil or *Horticultural Mineral Oil* (HMO) (Schuster et al*.,* 1996) to minimize white flies' infestation and advanced methods should be used to control nematodes. To attain this requires major investments in intensive and wide scale retraining of tomato farmers over a reasonable length of time of say, two years.

Table 2. Comparison of means of Yields by Management strategies at Tono and Vea Irrigation Schemes

	Management practice	Yield. t-ha^{-1}	
		Tono	Vea Project
1	Farmers' practice	10.430 b	7.0167 b
2	Chemical pesticides only	13.643 ab	8.8167ab
3	Botanicals only	14.727 ab	10.767 ab
4	IPM	20.177 a	12.950 a

Means followed by the same letters are not significantly different from one another

Improved Soil Fertility Management and Integrated Pest and Diseases Management

Research work carried out by CSIR-SARI at irrigation schemes in northern Ghana in 2005 underlined that the levels of nematodes in the soils of the growing areas were relatively high (Table 4) and nematode control should be mainstreamed into the crop protection programs of all the schemes. Improved tomato varieties such as Nema 5230 and IPM techniques employed in the study significantly improved the yields and quality of tomato under irrigation (Tables 1 and 2). White flies, were observed to be in excessive and abnormal numbers in most sites monitored by the research team. White flies are known to be precursors, transmitting several viral diseases to tomato e.g. tobacco and tomato yellow leaf curls viruses (Centre for Overseas Pest Research,1983; Sastry and Singh, 1974) which all went to constitute the "Diseases Complex" widely observed at the sites in the north. Soil investigations led by Dr. Bonaventure B. Aligebam (CSIR-SARI) in 2004 at the key tomato production sites of Tono, Vea and Pwalugu are summarized in Tables 5.1-5.2. The data show the indicators of pH, % OC, N, P and K. The following recommendations were made by the research team:

Table 4. Nematodes status of soils of Tono Project, Ghana

No.	NEMATODE SPECIES*	ACTUAL COUNTS
1	Helicotylenchus stubby root	215
2	Xiphinema (dagger)	708
3	Longidorus	502
4	Dorylaimus	911
5	Aphelenchus	207

*Extracted from 100 g of soil sample.

Table 3.Heinz Tomato Variety Trial in Ghana (Tono and Vea Areas).(Factional analysis; 2 sites x 18 varieties x 4 reps).

Variety	Total Production. (t-ha^{-1}) ,	Brix	Fruit Weight (g)	Variety	Green Production (%)	Variety	Rot Production (%)
H 4002	22,6			VIS	8,3	H 9314	3,2
H 9382	26,7			H 9476	11,3	H 9036	3,4
Chico III	27,3			Petomech	12,2	H 9665	3,4
H 9144	28,2			Chico III	12,2	H 9553	3,8
H 1999	28,2			H 4002	12,4	H 1999	4,0
VIS	29,3	3,4	71	H 1999	12,5	Roma	4,2
H 9491	30,1	3,5	77	H 9314	13,7	H 9144	4,5
H 9425	30,6			H 3044	13,7	H 9491	5,6
Petomech	31,1			H 9382	16,1	H 8892	5,6
H 9478	31,3	3,6	57	H 8892	18,3	Petomech	8,1
H 97151	32,5	3,6	88	H 7151	19,6	H 7151	8,5
H 7151	32,5	3,9	81	Roma	21,7	H 4002	7,1
H 9865	32,6			H 9144	21,9	H 9383	8,5
H 8392	33,4			H 9036	23,4	VIS	8,7
H 9553	34,2	3,5	55	H 9491	24,1	H 9478	9,6
Roma	34,6	3,4	58	H 9665	25,3	H 3044	10,1
H 9314	35,3	3,5	51	H 9425	27,5	H 9425	11,6
H 9036	36,1	3,5	67	H 9553	29,0	Chico III	14.5
H 3044	36,1	3,3	70				
Average	30,9			Average	17,9	Average	6.7
LSD	11,7			LSD	10,5	LSD	8.5
SITE	Total Production t-ha^{-1} ,			SITE	Green Production %	SITE	Rot Production %
VEA	27,5			VEA	13,4	VEA	3,7
TONO	34,3			TONO	22,4	TONO	9,8
Average	30,9			Average	17,9	Average	8,7
LSD	3,9			LSD	3,5	LSD	2,5

N OTE: LSD = Lower Significant Difference.

From: H.J. Heinz International Co. & MoFA Ghana

The analysis of PH, %OC and NPK

The results of the soil analysis indicated that soils of Tono, Vea and Pwalugu tomato cropping areas in northern Ghana, all ranged from acidic to very acidic and liming or farming practices which are capable of moderating soil acidity such as application of organic fertilizers are recommended. It was observed that farmers usually top dressed their tomato farms with sulphate of ammonia fertilizer, which over several years, may have contributed to making the soils more acidic. This could be minimized by changing to ammonium nitrate or diammonium phosphate fertilizers for top dressing as these chemically have less acidifying effect to the soil (Tanzubil *et al.,* 2004). The analysis of %OC and NKP indicated a regular pattern of NPK deficiency in soils from all three sites since N P and K were all only moderately available at Pwalugu and low in the other sites. Farmers will be well advised to minimize the practice of slash and burn since bush burning is a contributory factor to the reduction of the organic matter content of the soil. Farmers should be encouraged to plough back stubble of the tomato and other crops in order to help reduce disease and pests build up and also improve the %OC content. There is the need to introduce liming into the various three sites to take care of the acid nature of the soils. K is low in most of the areas, there is also the high need to introduce a combination of nitrogen fertilizers and *muriate of potash* as basal fertilizer to take care of the missing or low N and K; the introduction of organic mature in the dam sites is highly recommended to take care of the %OC that is found to be low and moderate in most of the sites (Tables 5.1-5.2).

Table 5.1a Analyses for indicators for pH, %OC, N P K

Serial	Lab No.	I. D. No		pH	% OC	% N	Avail P	Exc. K
1	40738	Tono	1	5.11	0.66	0.02	43.24	11.9
2	40739		2	6.02	0.63	0.02	48.92	23.9
3	40740		3	5.35	0.61	0.02	60.91	16.8
4	40741	Pwalugu	1	4.66	2.38	0.11	14.91	109
5	40742		2	4.56	2.42	0.11	21.56	110
6	40743		3	5.1	2.57	0.08	18.11	117
7	40744	Vea	1	4.82	0.67	0.1	28.81	17.9
8	40745		2	5	0.61	0.1	23.65	16.9
9	40746		3	4.59	0.69	0.08	24.42	15.9
10	40747		4	5.68	0.62	0.06	28.92	20

Table 5.1b pH indications From : CSIR-SARI, Ghana

Site	pH Values	Indication
Tono	5.11 – 6.02	Acidic
Pwalugu	4.56 – 5.10	Very Acidic
Vea	4.59 – 5.68	Very Acidic
Ranges	6.50 – 7.0	Normal

Table 5.2. Analyses of %C, N., P and K

Site	Values %C	Indicator	Values, N	Indicator	Values, P	Indicator	Values, K	Indicator
Tono	0.66	LOW	0.02	LOW	60.91	LOW	23.9	LOW
Pwalugu	2.57	MOD	2.570.11	MOD	21.56	MOD	117.06	MOD*
Vea	0.69	LOW	0.69	LOW	28.92	LOW	19.96	LOW
Normal	Less than 1.5	LOW	Less that 0.1	LOW	Less than 10	LOW	Les that 50	LOW
Ranges	Between 1.6 – 3.0	MOD	Between 0.1 – 0.2	MOD	Between 10 – 20	MOD	Between 50 – 100	MOD
	Greater than 3.0	HIGH	Greater than 0.2	HIGH	Greater than 20	HIGH	Greater than 100	HIGH

MOD* - moderate, From: CSIR-SARI, Ghana

Improving Fruit quality and Post-harvest storage capacities

Agricultural scientist from the CSIR-SARI (personal communications) have cited the following to be the main factors that have contributed to the declining quality of tomatoes produced in northern Ghana: use of inappropriate varieties such as Laurano 50; declining soil fertility levels compelling farmers to apply more and more chemical fertilizers especially sulphate of ammonia and over irrigation.

Contract farming (Nucleus out grower scheme)

In this recommendation the factory engages with selected large scale nucleus out grower farmers. Under the contract terms the out grower is provided with HYVs of tomato seed and other agro inputs on credit and also assisted with technical and extension services that could improve production in his catchment area. Signed credit and marketing agreements enjoin the farmer to pay back in kind over a stipulated period. Similar out grower schemes have been successfully implemented in India and Kenya. In recent years, out grower schemes have been considered as a preferred working model for *VegPro* Gh. Limited for irrigated large scale production of vegetables for export on the Kpong Left Bank (Torgome) scheme developed under the MCA Ghana project

Captive farming or Nucleus estate model

In this contract farming model the sponsor of the project also owns and manages an estate plantation, which is usually close to the processing plant. The estate is often fairly large in order to provide some guarantee of throughput for the plant, but on occasion it can be relatively small, primarily serving as a trial and demonstration farm. The British-based Commonwealth Development Corporation was a pioneer of the nucleus estate model. A common approach is for the sponsors to commence with a pilot estate then, after a trial period, introduce to farmers (sometimes called "satellite" growers) the technology and management techniques of the particular crop. This involves

the processing investor to get involved in direct tomato cultivation which some economists may argue does not constitute part of the processor's core business. The strategy however can constitute a crucial reliable back up or insurance to sourcing fresh fruit for the factory in the event that other arrangements are unable to live to scratch.

Improved credit and marketing and transport arrangements by factories

Poor credit and marketing and transport arrangements have been cited as some of the reasons the Ghanaian tomato plants were unable to obtain sustained supplies from farmers they contracted to produce fresh tomatoes boxes or crate sizes and cost per box/crate were not well defined, standardized and universally agreed upon, transport arrangements to retrieve produce from farms were poor and erratic, and payments for delivered produce to the factories were reported to be delayed (Robinson and Kolavalli, 2010a). The processors will need to address these challenges with al seriousness if future transitions with farmers are to be sustainable.

Improved communication and education between processors and farmers

The processors accuse farmers of the following: poor farm management, including unwholesome tomatoes in the product meant for the factories, selling or diverting some of the agro inputs supplied to them for tomato farming, reneging on contract terms and wanting to renegotiate at the slightest excuse, for exorbitant prices for a box of tomatoes, diversion to the fresh market when outside prices hike significantly above agreed credit and marketing contract prices agreed between farmers and the processors, Farmers on the other hand, among others, hold the following against the managers of the factories: Not providing transport and enough boxes at farm gate to receive harvested tomato, delaying both in the start of business of buying and also in the payments of purchases and offering ridiculously low prices for a box of tomatoes. it appears that it is necessary for all major stake holders in the tomato value chain to be well educated on the vital nature of their relationships and inter dependences of their roles if the value chain in which they operate would be vibrant and sustainable. The Ministries of Food and Agriculture (MoFA) and of Trade and Industries (MoTI), the National Vegetable Growers Association (GNVGA)and other developmental partners such as ADRA Ghana will need to provide this key institutional support for the industry to hold together.

Incentive Schemes for foreign investors in processing

Within the framework of current World Trade Organization (WTO), Economic Community of West African States (ECOWAS) and Economic Partnership Agreement (EPA) arrangements, the Government of Ghana is constrained in the use of import tariffs as a regulatory tool to protect domestic tomato production to thus enable the country's processors to be more competitive.(Asuming-Brempong and Asuming Boagye, 2008). However, investors can explore certain incentive schemes put in place by Government to make the agro-processing sector of the economy more attractive. These include tax holidays for certain industries in agriculture and agro-processing and relatively much lower taxes for factories located in the hinterland.

THE WAY FORWARD

The way forward for managing the complex problems of tomato in Ghana, is for the Government and major stake holders in the tomato industry to address the following in an integrated and urgent manner:

High powered Government intervention

Government should constitute a high powered team comprising policy advisors, developmental workers (such as ADRA (Gh), ADVANCE (Gh) the MoFA and MoTI) soil scientists, plant protectionists to work together for at least five years to resolve these complex issues that have undermined to tomato industry in the last three decades.

Comprehensive Tomato Breeding Programme

Government should put in place a well resourced and permanent tomato breeding programme under the CSIR, charged to develop disease resistant, high yielding varieties capable meeting the high demands of a modern Ghanaian tomato industry.

Improved Crop management Strategies

Farmer Field Schools should be organized on a more regular basis to train more and more farmers and Extension agents in IPM methods and techniques of sustainable and environmentally friendly vegetable farming.

Crop Rotation and closure of season for Solanaceace crops

Tomato growing areas in Ghana should evolve and practice crop rotation systems as a matter of policy to help curtail the development cycle of most of the insect pests and diseases encountered in such "closed" environments. It is highly recommended that after a major season of any one *Solanaceace* family crop (tomato, pepper, garden egg and others), the following (minor) season should be very strictly "closed" to all members of the same family. This is because mono-cropping of the same family crops sustains their pests and diseases cycles.

White fly control - Mass Spray Programmes

White flies are known to be the vectors transmitting several virus diseases observed in the study areas. A program of timely mass spray of the 'hot spot' areas in all growing areas in the *off-season* (end of dry season) by use of eco-friendly insecticides such as *Horticultural Mineral Oil* as proposed by some IPM researchers could help to control the explosion of white flies in these areas.

Improved Integrated Soil Fertility Management

Soil scientists have proposed the need among others to improve the organic carbon content of the soils by increased use of organic fertilizers and ploughing back of stover. Appropriate fertilization together with liming at the Tono, Vea and Pwalugu sites in particular, would take care of the acid nature of the soils and improve fertility.

Acknowledgement

The author wishes to acknowledge the efforts of H.J. Heinz International, the Ministry of Food and Agriculture (MoFA),Ghana, the CSIR-SARI and ICOUR Limited Ghana for all the ground breaking work they carried out that have informed this work.

REFERENCES

Asuming-Brempong, S and Asuming Boakye, A. 2008. Socio-economic analysis of tomato production in Ghana, Technical report prepared for the Ghana Trade and livelihood coalition.(GTLC) University of Ghana Affiliates: Accra, Ghana. Mimeo.

Inusah I.Y.B. 2005. Technical Report: Integrated crop management strategies and the improvement of the yields, quality and productivity of tomato under irrigation. Submitted to: the Deputy Director, AFFSDF-CSIR, P. O. BOX M. 32, Accra, Ghana.

Centre for Overseas Pest Research, 1983. Pest control in tropical tomatoes. Centre for Overseas pests Publications. London, UK.

Clottey, V.A., Karbo, N and Gyasi, K.O. 2009. The Tomato Industry in Northern Ghana: Production Constraints and Strategies to improve Competitiveness. *Afric. J. Food, Agric., Nutr. & Dev*.,9:6. Pp.1436-1451

Evans, Mensah/IRIN, 2009. Engineering Services Directorate, Ministry of Food and Agriculture. Accra, Ghana. 17 April 2009: Plummeting profits drive tomato farmers to suicide. Available on line: http://www.irinnews.org/Report/83980/ GHANA-Plummeting-profits-drive-tomato-farmers-to-suic...

Gross, M.S., Maatman, A and Clottey, V.A. 2005. Linking Producers and Markets: Learning Plots as an Entry Point Methodology to Promote Sustainable Agricultural Intensification. Technical Note N°2. International Fertilizer Development Center (IFDC).

Integrated Social Development Center (ISODEC) 2004. The economic partnership agreement: poultry and tomato case studies. Accra. http://www.isodec.org.gh/Papers/EPA Report-Final.pdf

Ministry of Food and Agriculture (MoFA) 2009. Baseline survey of tomato production in Ghana: A study of twelve production districts in four regions: The Horticulture Development Unit, Directorate of Crop Services and Post Harvest Management Unit, Agriculture Engineering Services Directorate, MoFA, Accra, Ghana.

Monney, E., Edusei Poku, V and Armah, E. 2009. Baseline survey of tomato production in Ghana: A study of twelve production districts in four regions. Ghana: The Horticulture Development Unit, Directorate of Crop Services and Post Harvest Management Unit, Agriculture

Robinson, Elizabeth J.Z and Kolavalli, Shashi L. 2010a. The Case of Tomato in Ghana: Production. GSSP Working Paper #19. Accra, Ghana: International Food Program. (IFP).

Robinson, Elizabeth J.Z and Kolavalli, Shashi L. 2010b. The Case of Tomato in Ghana: Marketing. GSSP Working Paper #20. Accra, Ghana: International Food Program.

Robinson, Elizabeth J.Z and Kolavalli, Shashi L. 2010c. The Case of Tomato in Ghana: Processing. GSSP Working Paper #21. Accra, Ghana: International Food Program.

Robinson, Elizabeth J.Z and Kolavalli, Shashi L. 2010c. The Case of Tomato in Ghana: Productivity. Working Paper #19. Accra, Ghana: International Food Program

Sastry, K.S.M and Singh, S. J. 1974. Control of the spread of tomato leaf curl virus by controlling the whitefly (Bemisia tobaci) population. *Indian J. Hort.* 31(2):178-181.

Tanzubil, P. B., Annor-Nyarko, F. O., Aligebam, B and Inusah I.Y.B. 2004. Update on diagnosis of pest and disease problems in the Upper east Region-2003/2004.A report on the "*Tomato Disease Complex*" presented to the MoFA UE/R at a stake Holders meeting held at Bolgatanga, March 2004.

Wolff, H. 1999. Economics of tomato production with special reference to aspects of plant protection: A case study of two tomato production systems in Brong-Ahafo region, Ghana. Prepared for Ghanaian–German Project for Integrated Crop Protection. GTZ: Eschborn.

******