

The Case of Tomato in Ghana: Productivity

Elizabeth J.Z. Robinson and Shashi L. Kolavalli

Development and Strategy Governance Division, IFPRI, Ghana

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Ghana Strategy Support Program

Postal Address:

c/o International Water Management Institute (IWMI)

PMB CT 112, Cantonments, Accra, Ghana

Local Address:

CSIR Campus (Opposite Chinese Embassy)

Airport Residential Area

Tel: +233-(0)21-780716

Fax: +233-(0)21-784752

<http://www.ifpri.org/themes/gssp/gssp.htm>

IFPRI HEADQUARTERS

International Food Policy Research Institute

2033 K Street NW

Washington, DC 20006-1002 USA

Tel. +1-202-862-5600

Fax +1-202-467-4439

E-mail ifpri@cgiar.org

www.ifpri.org

For further information:

Shashi Kolavalli, Senior Research Fellow and Program Leader

s.kolavalli@cgiar.org

THE GHANA STRATEGY SUPPORT PROGRAM (GSSP) WORKING PAPERS

ABOUT GSSP

IFPRI's Ghana Strategy Support Program (GSSP) was launched in 2005 to address specific knowledge gaps concerning agricultural and rural development strategy implementation, to improve the data and knowledge base for applied policy analysis, and to strengthen the national capacity for practical applied policy research. The primary objective of the Ghana Strategy Support Program is to build the capabilities of researchers, administrators, policymakers, and members of civil society in Ghana to develop and implement agricultural and rural development strategies. Through collaborative research, communication, and capacity-strengthening activities and with core funding from the U.S. Agency for International Development/Ghana (USAID), GSSP works with its stakeholders to generate information, improve dialogue, and sharpen decisionmaking processes around the formulation and implementation of development strategies.

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Introduction

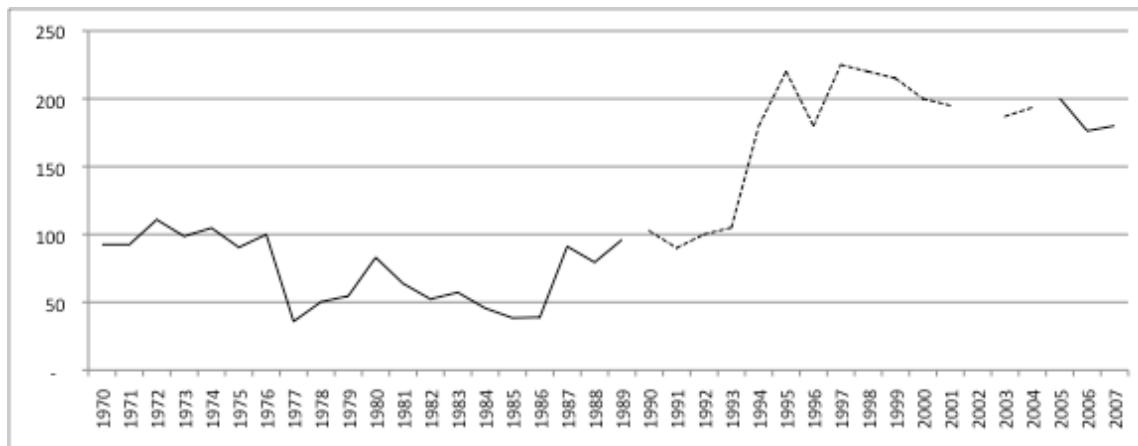
The tomato sector in Ghana has failed to reach its potential, in terms of attaining yields comparable to other countries, in terms of the ability to sustain processing plants, and in terms of improving the livelihoods of those households involved in tomato production and the tomato commodity chain. Despite government interventions that include the establishment of a number of tomato processing factories, tomatoes of the right quality and quantity for commercial agro-processing are not being grown. Many farmers still prefer to plant local varieties, typically with a high water content, many seeds, poor color, and low brix. Land husbandry practices are often suboptimal. Average yields remain low, typically under ten tons per hectare. Because of production seasonality, high perishability, poor market access, and competition from imports, some farmers are unable to sell their tomatoes, which are left to rot in their fields. Yet other farmers in Ghana have achieved higher tomato yields, production is profitable, and many farmers in Ghana continue to choose to grow tomatoes over other crops.

One of the key issues for tomato farmers in Ghana is high per-unit input costs. When farmgate prices are high, this is not such a concern for individual farmers—farmers in Greater Accra, for example, incur large irrigation costs while yields remain low to grow for the off-season when prices are more likely to be high. But when farmgate prices are low and variable, as is often the case for rainfed farmers who plant according to the rains and accordingly typically all harvest at a similar time, reducing per unit input costs is essential. Further, for tomato processing to be competitive in Ghana, average per unit production costs need to be considerably lower so that farmers can sell their tomatoes profitably at the low but guaranteed prices offered by processors. In these papers we therefore focus on farmer productivity: how it varies by region, the drivers of high and low productivity, and implications for the profitability of tomato farming and the viability of the processing sector. The information in these papers is based largely on a survey of about 100 growers we conducted in three regions covering the 2008–2009 season: Greater Accra, Brong Ahafo, and Upper East.

Tomato production appears to be falling since 2000

Data for the tomato sector have not been collected consistently at a national level since the 1980s and so it is not possible to make strong statements concerning trends over area farmed to tomato, yields, or productivity. However, the available data suggest that overall production doubled between the 1970s/80s and the 1990s. In the 1970s and early 1980s tomato production fell from around 100,000 tons per year to around 50,000 tons per year, then in the late 1980s increased back to around 100,000 tons. During the 1990s production expanded again, averaging around 200,000 tons per year by the end of the decade (Figure 1). However, during the 2000s, production appears to be falling gradually. A small proportion of Ghana's domestic production is exported to Ghana's neighbors, and domestic production is supplemented by imports from Burkina Faso during the December to May harvest season, estimated to be as high as 100,000 tons per year.

Figure 1. Ghana's Tomato Production Trends ('000 tons per year)



Source: Composite graph using data from FAOSTAT; SRID; MoFA; Asuming-Brempong and Asuming Boakye 2008.

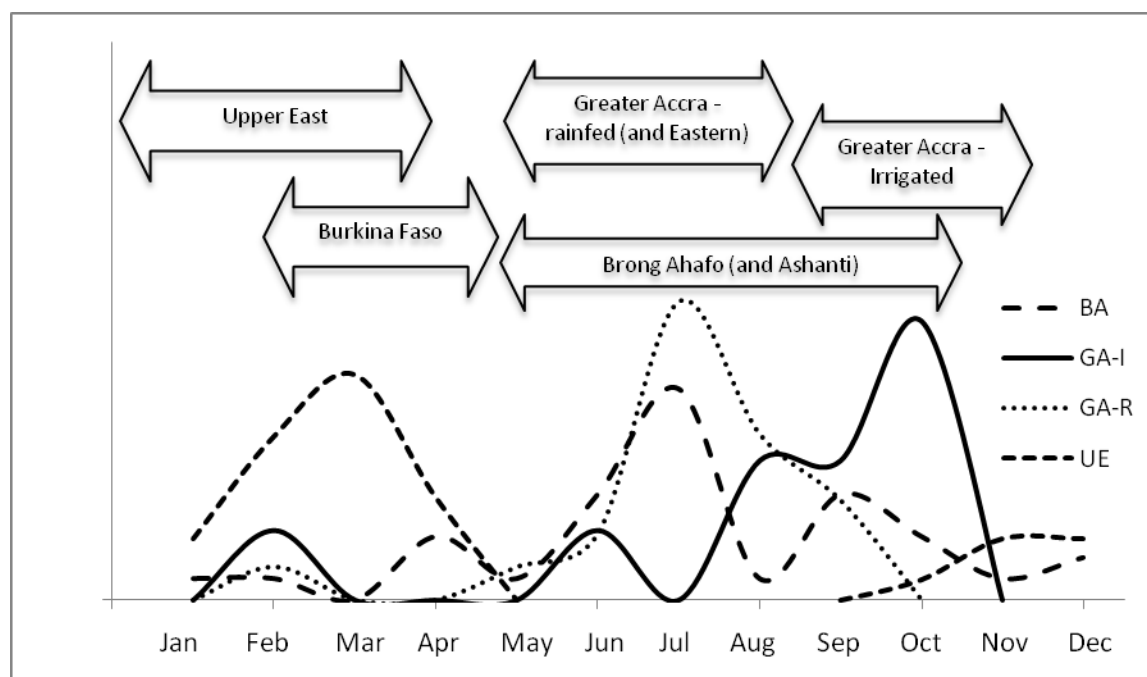
During the 1970s and 1980s, when data were being collected systematically by SRID/MoFA at the national level, average yields fluctuated around 4.8 tons per hectare with little upwards trend. In the 1990s, average yields in the country were estimated to be just over 13 tons per hectare (Wolf 1999). More recent country-wide estimates (albeit based on limited samples) suggest average yields of 7.5 tons/ha in the early 2000s (ISODEC 2004, quoting SRID 2003 data) and 6.7 tons/ha more recently (Asuming-Brempong and Asuming Boakye 2008). Our own three-region survey suggests average yields for these three regions of 10.6 tons per hectare. Although difficult to make generalizations because of the limited data available, all recent estimates of yields, though higher than data from the 1970s and 1980s, are lower than Wolf's 1990s estimate, suggesting little if any yield increases over the past two decades and possibly falling yields. Comprehensive time series data available for the Greater Accra region between 1998 and 2008 show low overall yields, compared to estimates from other regions, but growing gradually from 4.3 tons/ha to 5.5 tons/ha.

These data suggest that, over the past two decades, the tomato sector has been stagnant and possibly declining, both in terms of area cropped and yields.

Production is highly seasonal

Tomato production in Ghana is highly seasonal, reflecting differences in access to water and rainfall patterns, as illustrated by the variation in harvest periods.

Figure 2. Seasonality among tomato farming – peak harvest seasons



Source: Three-Region Survey 2009 (100 farmers); Trader Report to IFPRI.

Within the calendar year, different regions of the country produce tomato at different times of the year (Figure 2). From late December through April/May, Ghana's Upper East region and Burkina Faso supply almost all the fresh tomato in the country. From June onwards the harvest picks up in the rainfed areas, with a longer season in Brong Ahafo and Ashanti regions (reflecting bi-modal rainfall patterns) and shorter seasons in Greater Accra. Irrigated tomato from Greater Accra dominates the market later in the year.

Production practices vary regionally

Farmers' agronomic practices are part choice, part constrained, and are influenced by agroclimatic conditions, opportunities, and culture. Our three-region survey confirms significant differences in cultivation practices in the three regions that influence yields, costs, and returns.

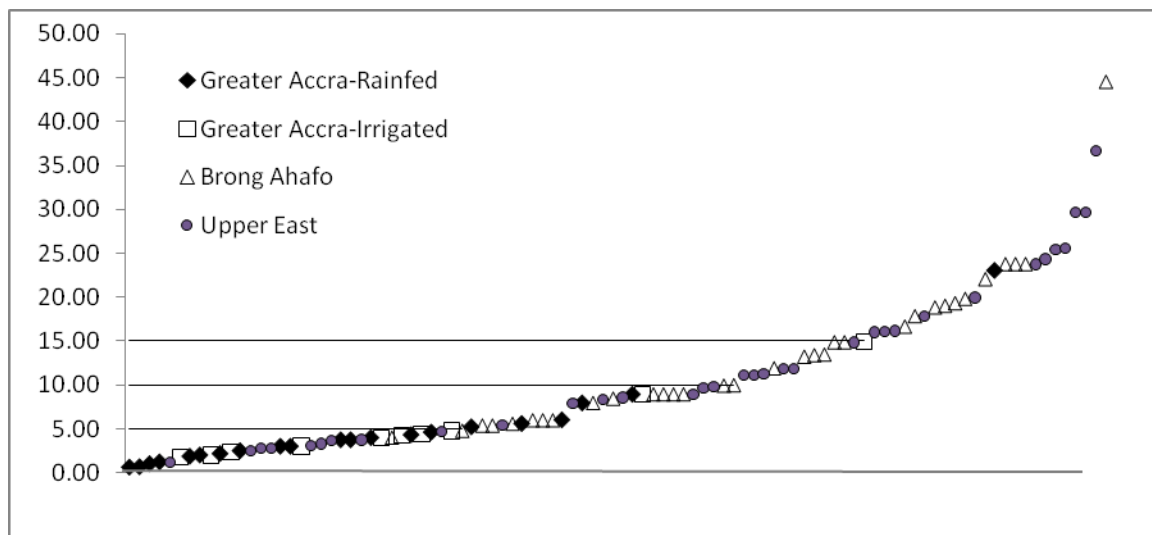
Two thirds of farmers have yields less than 10 tons per hectare

In our own farmer survey, almost two-thirds of farmers had yields of less than 10 tons per hectare, with about one fifth achieving yields of over 20 tons per hectare (and just 5 percent achieving yields greater than 25 tons/ha) and one third with yields less than 5 tons per hectare

(Figure 3).¹ There is little available systematic documentation concerning how far tomato farmers in Ghana

Our estimates of farmers' yields take into account the quantity of tomatoes that the farmers sold and the farmers' estimates of the proportion of their production that they were not able to sell are from reaching the realistic potential of different varieties under irrigated and rainfed conditions, nor the extent to which improved farmer practices can reduce costs and increase yields. However, a third of our sample achieved yields of between 10 and 25 tons per hectares, suggesting that under realistic current best practices farmers could nationally achieve average yields of around 17.5 tons per hectare (a similar figure to the "achievable yield" of 15 tons per hectare suggested by SRID, as quoted in ISODEC, 2004). If low-yielding farmers could increase their yields to 15 tons per hectare, domestic production would outstrip consumption (including current fresh tomato imports).

Figure 3. Distribution of yields by region (tons/hectare), farmers ordered on x-axis by yields



Source: Three Region Survey 2009.

Overall, in our survey, farmers in Brong Ahafo and Upper East reported higher yields (averaging above 14 tons per hectare), with much lower yields being reported in Greater Accra (averaging around 5 tons per hectare). The data for Greater Accra, the only region in which tomatoes are grown under both rainfed and irrigated conditions, suggest that average yields under irrigation are not significantly greater than those under rainfed conditions (Table 1). These averages hide significant variation in yields within regions and within the country as a whole, and they may be biased possibly because of some intercropping with other crops such as pepper.

Choice of varieties influences yields but depends on other conditions

Varietal choice influences yields (Table 1). Two varieties, Power Rano, a variety that is grown widely in Brong Ahafo under rainfed conditions, and Pectomech, a variety suitable for processing that is grown widely in the Upper East and in Burkina Faso as well, outperform other varieties under most conditions. “No name” is also believed to be Pectomech; and “Burkina” is likely Pectomech from Burkina Faso. Surprisingly, the yields of Nimagent F1, an expensive variety supplied by Trusty foods, are low in Greater Accra.

Table 1. Farmers’ choice of variety and average yields, 2008/9 tomato season

	Average yields (and number choosing variety in parentheses)			
	Greater Accra (Rainfed)	Greater Accra (Irrigated)	Brong Ahafo (Rainfed)	Upper East (Irrigated)
Power Rano			16.0 (17)	
Pectomech		8.8 (4)	10.1 (13)	13.8 (14)
Ada Lorry Tyre	4.8 (8)			
Burkina	14.6 (2)			
“No Name”				15.7 (18)
Meenagiant	2.0 (1)			
Nimagent F1	2.8 (4)	3.1 (5)		
Techiman	4.2 (2)			11.1 (1)
Wosowoso	1.1 (2)			
Other	1.8 (2)	1.8 (1)		8.9 (1)
Average yields	4.5 (21)	5.2 (10)	13.7 (30)	14.6 (34)

Source: Three Region Survey 2009.

A fifth to a third of the growers still use washed seeds

Farmers’ choice of varieties influences and is influenced by access to seeds, growing technologies, available markets, potential yields, prices, and risk. In Asia, during the Green Revolution, farmers embraced the purchase of improved seeds, yet farmers in Ghana have historically appeared reluctant to purchase seeds (Orchard and Suglo 1999). This is, however, changing. Although seed “recycling” has been reported to account for up to 85–90 percent of seed supply in the past (Orchard and Suglo 1999; Horna et al. 2006), recent surveys suggest that only 33 percent of farmers were exclusively using their own seed (extracted from tomatoes, washed, and dried), with another 20 percent using both recycled seed and purchased seed, or seed from other farmers; with the remaining 47 percent purchasing all their required tomato seed (Monney et al. 2009). Our three-region survey suggests that only 20 percent of farmers exclusively use recycled seeds, with the others either combining recycled and purchased seeds or only using purchased seeds. Other studies have found that tomato accounts for 13 percent of all seed sales, the highest share of all crops listed in the study (Horna et al. 2006).

Seed costs vary considerably according to variety. Farmers can recycle their own seed (extracting seed from local varieties grown on farm) at very little cost; can purchase local seeds for approximately GH¢20 per planted hectare; or can purchase improved varieties such as Nemagent F1, introduced and preferred by Trusty Foods, for between GH¢100 to 200 per planted hectare. Although farmers can save money by recycling their own seeds, they risk reduced yields from inbreeding and disease transmission, especially of fungal diseases. Key local open pollination varieties that farmers can wash and recycle are Rasta, Power, Power Rano, and Wosowoso, with Power Rano often being preferred due to its high tolerance and/or resistance to diseases. Typically local varieties have plants that grow vigorously; fruits that are often spherical with crevices; have a low total soluble content; high water content; and are acidic with a “biting” taste. Because they are open pollinated, a range of varieties have emerged over time from uncontrolled crossing.

Key improved high yielding varieties are Pectomech, Heinz, and Nimagent F1. High yielding and disease resistant varieties, necessary but not sufficient to increase yields, have been the most important driver of yield improvements in the sector, particularly under irrigated conditions. Improved varieties can also do well under rainfed conditions, though our survey suggests that Nimagent F1 has not performed well in Greater Accra.

All available evidence including our small survey suggests that seed varieties can influence yields. Yet tomato growers in Ghana are constrained by the absence of national seed strategy that provides farmers with a reliable source of appropriate seeds and technical support. Farmers have a dichotomous choice between costly hybrids sold by private seed companies and inexpensive local varieties that have emerged out of uncontrolled crossing. Although some improved varieties are available, many farmers are still choosing to use local varieties, particularly in Brong Ahafo, and indeed in this region the yields for the local Power Rano are better than for the improved Pectomech.

Production costs vary but market conditions permit high cost producers to survive

Costs of production, which provide a lower bound for the price that farmers need to receive to break even, vary significantly by region (Table 2) and within region (Figure 4). Comparing production costs and yields, we can classify the different production regimes in the different regions. Rainfed farming in Greater Accra is low input - low yield, and so is low risk and can be profitable at low output prices. Irrigated tomato farming in Greater Accra is high input - low yield, but farmers are able to attract consistently higher prices by harvesting during the “lean” season when few other regions are producing and so the farmers bear little risk of not selling (refer back to Figure 2). In Brong Ahafo, tomato farming can be described as low input—high yield. Here, where there is little irrigation, farmers are typically growing local varieties which though favored by neither consumers nor processors, sell to the fresh market. In the Upper East region, where nearly all production is irrigated and most farmers use improved varieties such as Pectomech that are suitable for processing, production costs per hectare are similar to Greater Accra-Irrigated, but per ton of tomato are considerably lower, due in part to the higher yields achieved.

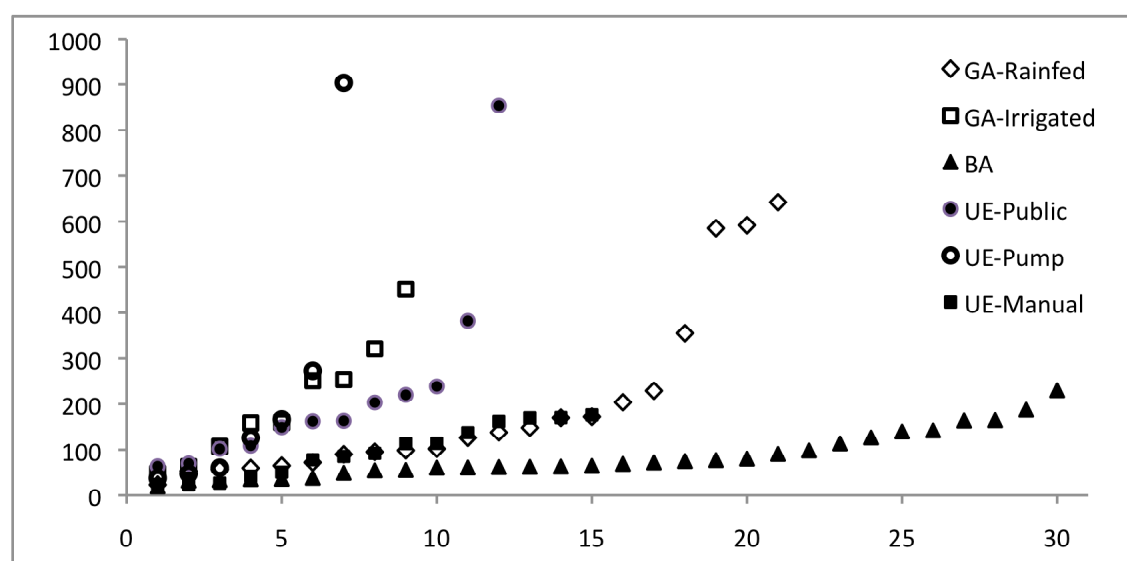
Table 2. Input costs, yields, and per unit costs

	Average input costs (GH¢/Ha) ex own labor	Average yields (tons/Ha)	Average unit input costs (GH¢/ton) ex own labor	Unpaid family labor “days”**
Greater Accra Rainfed (21)*	418	4.6	91	48
Greater Accra Irrigated (10)	1225	5.3	231	53
Brong Ahafo Rainfed (30)	972	13.8	70	35
Upper East Irrigated (34)	1288	14.6	88	97

Source: Three Region Survey 2009.

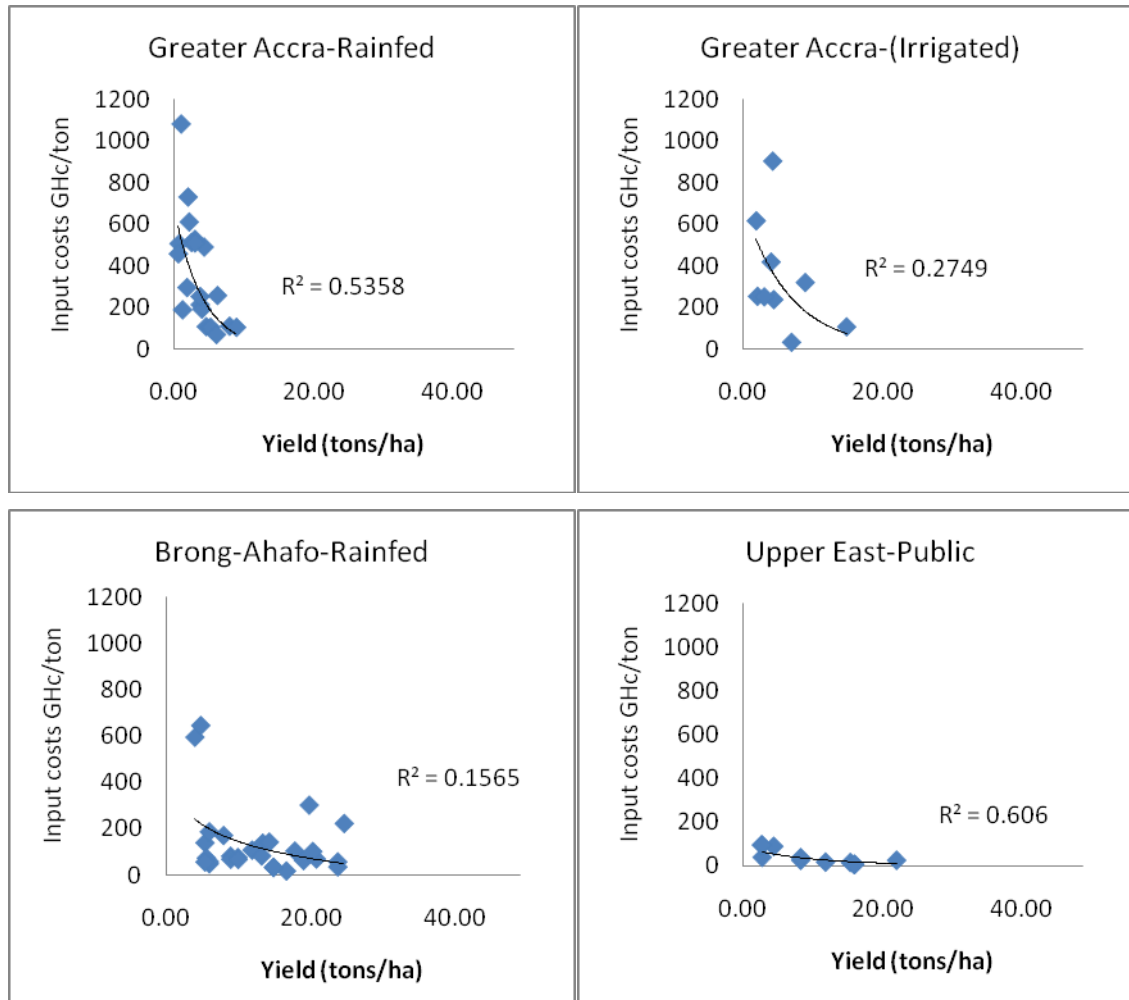
* Sample size; ** Farmers state the number of days that they spend doing an activity, but typically 2-3 hours per “labor day” are actually spent on the activity.

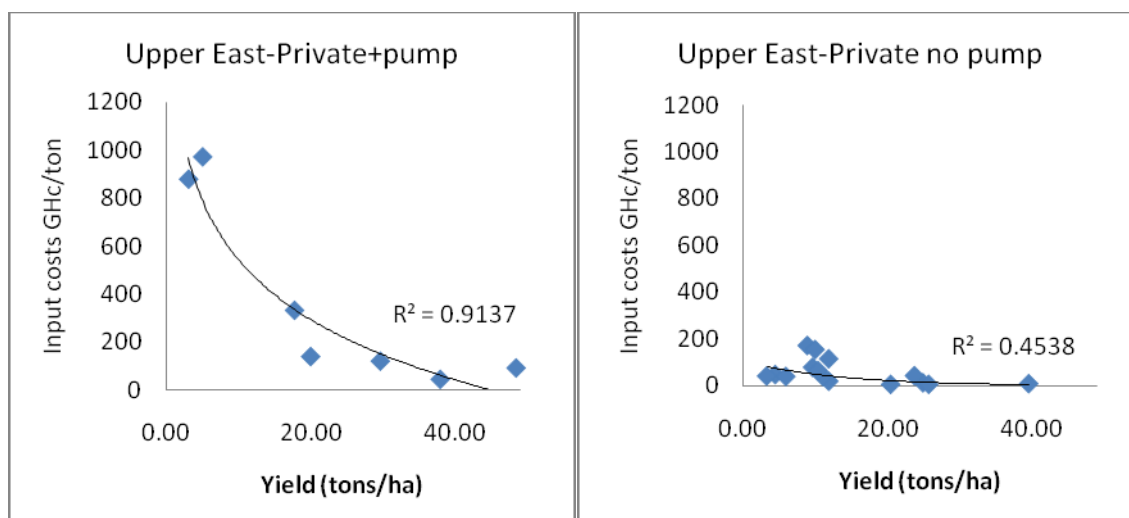
Figure 4. Cost of production per ton (GH¢/ton), excluding harvesting and own labor costs



Yield increasing technologies are also cost reducing. Although this relationship is difficult to see across the regions because of differences in production systems—low input–low yield rainfed cultivation in greater Accra in particular also has low unit costs—it is fairly evident within regions (Figure 5).

Figure 5. Productivity yield graphs in three regions under different technologies





Source: Three Region Survey 2009 costs exclude own labor and land rental,

Depending on the region the key drivers of production costs are labor, irrigation and fertilizer

We address the components of the input costs in more detail below, focusing on the key drivers of costs—irrigation; purchased inputs (seed, fertilizer, pesticide, fungicide); and labor—the importance of each of which varies by region (Figures 6a and b).

Figure 6a. Breakdown of input costs (GH¢/ha and own labor days/ha) by region

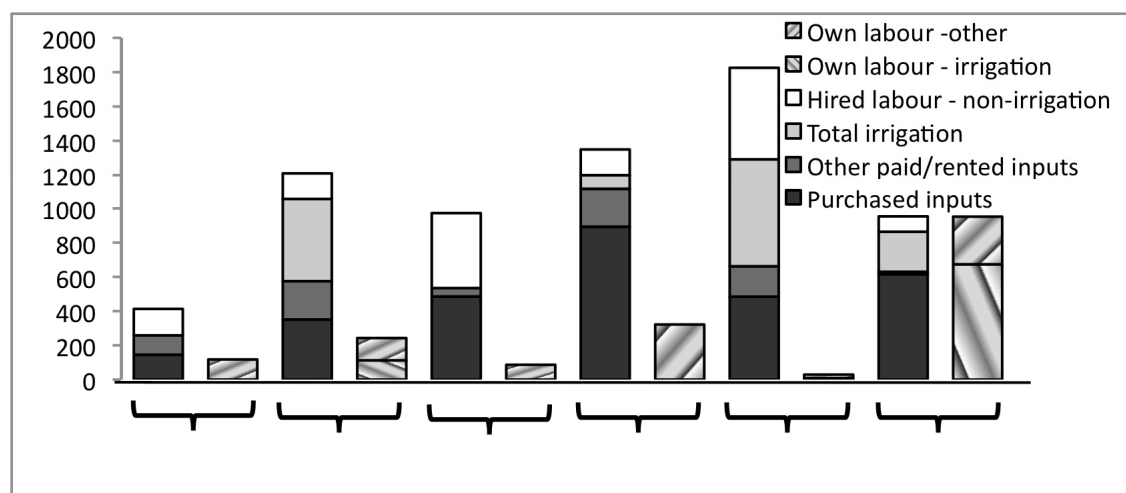
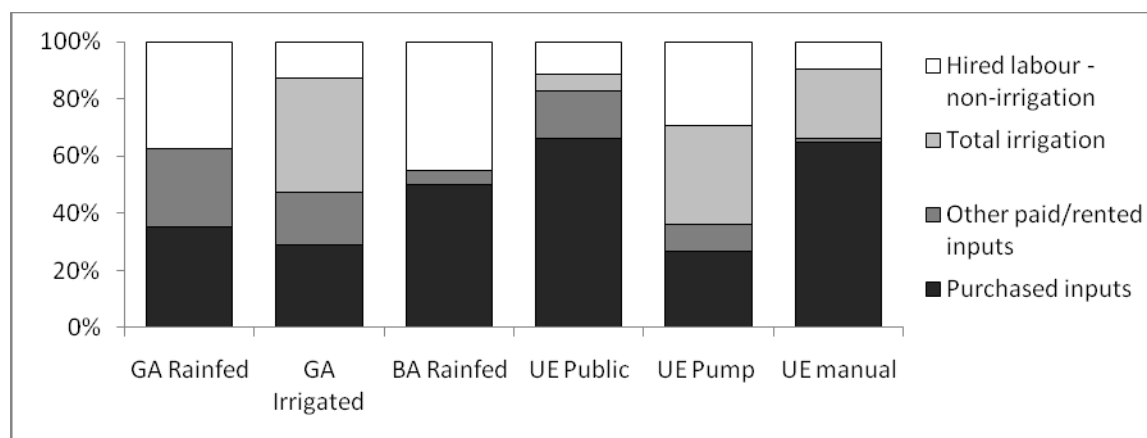


Figure 6a. Drivers of costs, excluding own labor by region



Source: Three Region Survey 2009.

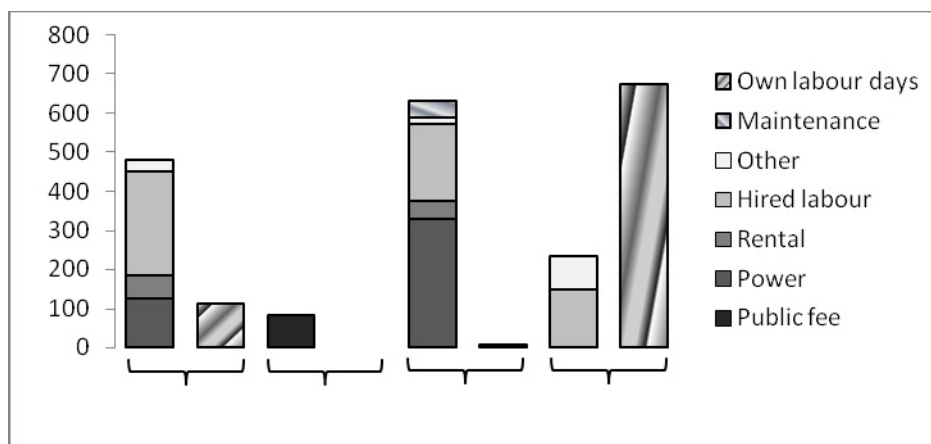
Purchased inputs (seed, fertilizer, pesticide and fungicide) are a key driver of costs in the Upper East (manual private irrigation and public irrigation) and Brong Ahafo; irrigation costs are key drivers for private irrigation in the Upper East and Greater Accra, but not for farmers using public irrigation. Hired labor is a key driver of costs in rainfed Greater Accra and Brong Ahafo, and private pump irrigation in the Upper East, whereas own labor is particularly important in Upper East manual irrigation. Overall, purchased inputs are significant in both irrigated and rainfed conditions. It is possible that in the Upper East own labor substitutes for purchased inputs: farmers using pumps have the highest costs and lowest own labor requirements, farmers using manual irrigation have the lowest costs and highest own labor requirements, and farmers using the public irrigation schemes have intermediate costs and own labor requirements.

Irrigation costs vary depending on the extent of use of labor

Although irrigation does not appear to have a significant impact on yields, it is a key driver of input costs, accounting for over 40 percent of production costs in Greater Accra-Irrigated. Irrigation technologies and costs differ by region and within regions. We find within Upper East three distinct irrigation technologies. Some farmers in the Upper East (12 in our sample) have access to publically provided irrigation (such as from Tono and Veia) and pay a fixed fee per hectare of tomato irrigated—this appears to be the lowest-cost irrigation. Others must rely on lifting water from rivers with (7) or without (15) pumps. We can see from Figure 7, in which we break down irrigation costs into more detail, paid costs are highest for Greater Accra and Upper East farmers who use pumps, but Upper East farmers without pumps use large quantities of family labor.

Yields in the Upper East differ according to irrigation technologies—though the relationship between yields and irrigation may be due to other factors. In our sample, farmers using public schemes had average yields of 9.3 tons/ha, those using private irrigation with pumps a high average of 18.3 tons/ha and those using private irrigation with no pump 13.5 tons/ha.

Figure 7. Average irrigation costs per hectare (GH¢ or own labor per ha)

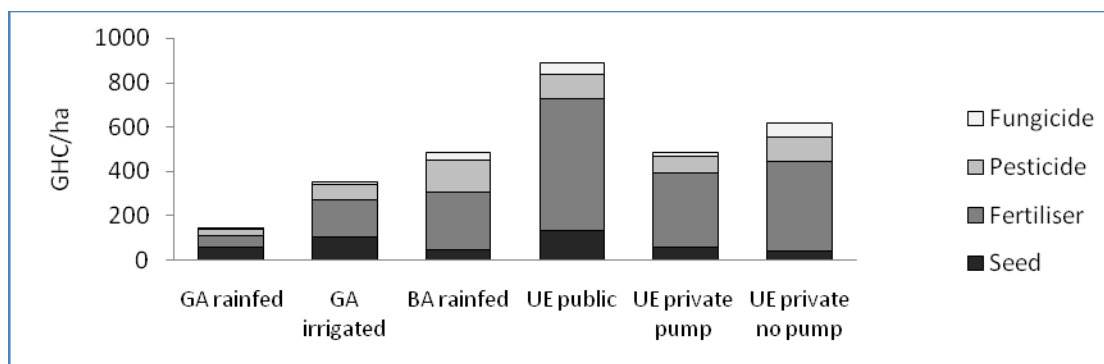


Source: Three Region Survey 2009.

Fertilizer use is higher under irrigated conditions; purchased inputs account for a significant share of costs in all production systems

Fertilizer is the largest component of purchased inputs for Ghana's tomato farmers (Figure 8). Absolute spend on fertilizer is greatest in the Upper East, and lowest in Greater Accra. We can see that farmers in the Upper East who use the cheaper public irrigation facilities spend more on purchased inputs, particularly fertilizer and seed. Although we cannot prove it, these farmers may have more available cash to spend on purchased inputs because their irrigation costs are low. However, for them greater use of purchased inputs does not appear to translate into higher yields. These differences could be due to the farmers using the public irrigation having less control over water management.

Figure 8. Input costs (GH¢/ha) by region



Source: Three Region Survey 2009.

Watering and weeding are two labor demanding activities

Labor, hired and family, is an important driver of input costs. Own labor is particularly important in Upper East region for farmers who irrigate privately without a pump, whereas farmers in the same region who have a pump almost exclusively use hired labor (refer back to Figure 7). A lack of access to labor has been shown to constrain tomato farmers in Ghana. For example, in

Brong Ahafo's Tano district, watering and weeding were key constraints to farmers' choices over the area of land to plant to tomato as these are the labor activities that they undertake themselves rather than hiring in labor (Dorward et al. 2009). Such a constraint could be due to poorly functioning labor markets or a lack of upfront cash to pay hired labor.

Other impacts on productivity

Yields can be increased through improved land husbandry and disease management that often adds little to the costs of production. Land husbandry practices in Ghana's tomato sector vary by farmer and by region. Our survey and focus group discussions identified a number of poor practices suggesting poor land husbandry are common to tomato farmers throughout the country. Nursery management is often poor. Farmers broadcast seed in their nurseries, and so seedlings compete for nutrients and light. There are often fungal and viral infestations in the nursery beds, including tomato yellow leaf curl virus, whose vector is the whitefly. Continuous tomato cropping rather than rotating the land used for tomato production has increased the prevalence of soil borne pathogens. Weed control could be improved through the use of more appropriate tools. And water management appears suboptimal. Farmers typically mix combinations of insecticides and fungicides to spray their farms. They rarely know the name of the chemicals they used. In the Greater Accra and Upper East region, farmers call insecticides DDT while in the Brong Ahafo they are called poison. Another common problem noticed was farmers' inability to tell which chemical was fungicide and which was insecticide. Producers in Brong Ahafo who incur lower costs under rainfed conditions appear to get the best prices.

Farmers in Brong Ahafo appear to get very good prices, despite growing rainfed tomatoes. Several farmers reported prices as high as GH¢200 per 120kg crate, equivalent to almost GH¢1700 per ton, with average prices around GH¢500 per ton. Although these prices seem high, they have been confirmed by several farmers contacted after the survey. In part the farmers attribute the high prices to competition from traders coming from Cote D'Ivoire and from scarcity of tomato in the system in May–June when only some farmers harvest early.

For farmers in the Upper East, prices are relatively low, whether the farmers are selling to the local market or to the traders. In our sample, all the farmers using the public irrigation system sold to local markets, and the prices that they received were on average low, GH¢120 per ton, supporting complaints that tomato production in the Upper East is no longer profitable and that the farmers are often ignored by the market traders coming from the larger wholesale markets.² Farmers in our Upper East survey who had their own private irrigation received higher prices averaging GH¢230 whether they sold to the traders or the local markets, but these prices are low compared to the other regions.

In Greater Accra-Irrigated, we found that about half of our sample were growing for Trusty Foods, the tomato processor in Tema, and the other half sold to the market queens, typically coming from Accra. Trusty Foods, which also purchased from some farmers in Upper East, paid an average of GH¢154 per ton, which is low compared with the fresh market but the highest price that a domestic processor can pay and still remain competitive with imported tomato paste (Robinson and Kolavalli 2010, 21) Although average prices during the irrigated season paid by traders to farmers in Greater Accra were lower than those paid to farmers during the rainfed season, price variation was lower during the irrigated season (Table 3). Farmers can therefore

be more confident of covering their costs and not making a loss during the irrigated season in Greater Accra.

Table 3. Farmgate prices (GH¢/ton) in the different regions

	GA-R	GA-I	BA-R	UE Public	UE Pump	UE Manual
Average lowest price	200	243	339	78	95	98
Average highest price	667	440	883	199	371	490

Source: Three Region Survey 2009.

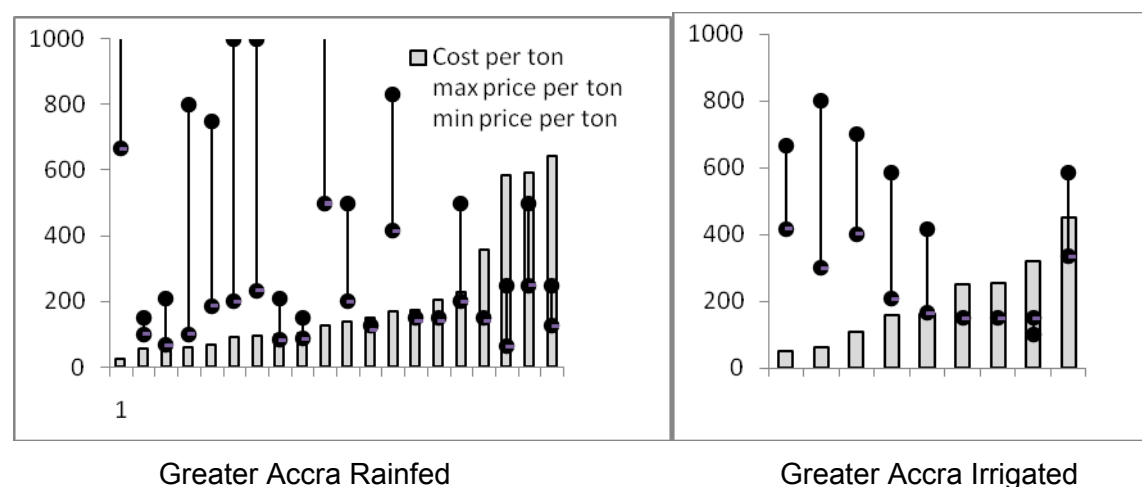
***Because we do not have prices for each individual tomato sale by the farmer, we use a weighted average of the highest and lowest prices the farmers received. We weight the lowest price by 0.67 and the highest by 0.33 to reflect the reality that higher prices are typically only available for a short period.

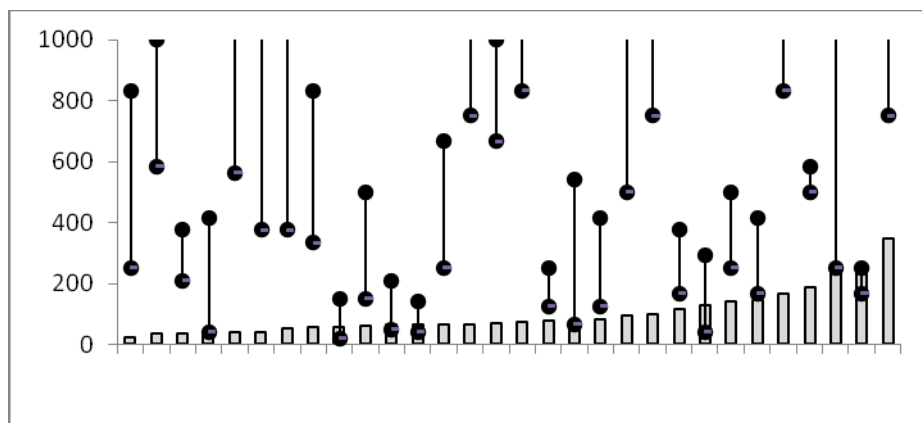
Profitability of the different farming systems

Profitability of tomato production varies both across regions and within region. Figure 9 compares input costs per ton for each individual farmer (ordered by input cost on the x-axis, excluding own labor and harvesting costs) in our Three Region Survey with the highest and lowest price that each farmer received during the season. Overlapping costs and prices suggests absence of profits. Where both the maximum and minimum price per ton is below the cost per ton, an individual farmer unambiguously makes a loss. Where the input costs are in-between the maximum and minimum price per ton, an individual farmer may or may not break even. Where the minimum price per ton is above the cost per ton, an individual farmer unambiguously covers his costs (though we have not accounted for own labor in these graphs).

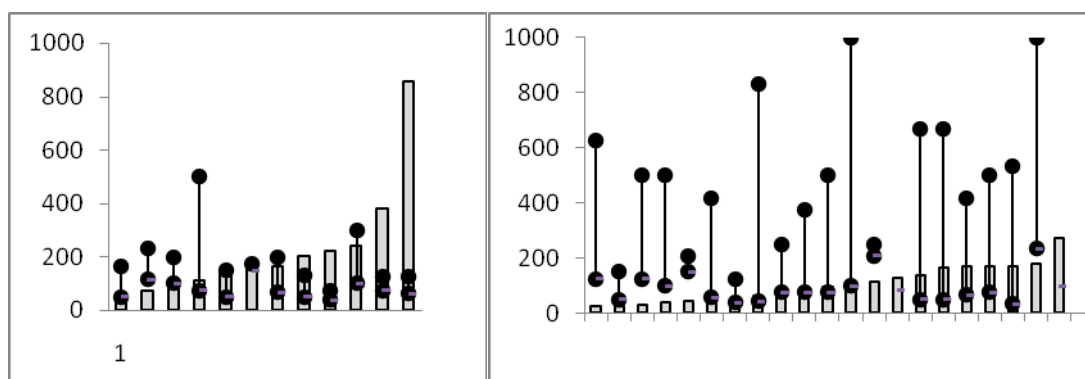
From Figure 9 we can highlight a number of points: the prices that farmers receive vary considerably; tomato production in Brong Ahafo is particularly low risk with low input costs and relatively high prices; although yields relatively high in Upper East, low prices limit the profitability of farmers using public irrigation; farmers growing for Trusty Food in Greater-Accra-Irrigated have high per unit costs and low prices and so make losses.

Figure 9. Costs and revenues (GH¢/ton) for individual farmers, ordered by input costs





Brong Ahafo Rainfed



Upper East Public Irrigation

Upper East private Irrigation

Source: Three Region Survey 2009.

Farmers need to produce in sufficient quantities to attract traders and gain access to larger markets

In the two-level marketing system found in Ghana's tomato sector (Robinson and Kolavalli 2010, 20), traders typically only go to areas where there is a critical mass of a particular crop for it to be worthwhile. Farmers therefore find it hard to change crops in a particular area for fear of losing market access via the traders (Orchard and Suglo 1999). "Lead boys" provide an important way for farmers to connect with traders, particularly if they are not in an area known for production. Traders and lead boys naturally prefer to source tomatoes from better known areas, closer to main roads, where there are sufficient growers to fill a truck. Lead boys in the Upper East appear increasingly to prefer to take traders to Burkina Faso to source tomatoes. This may explain why none of the farmers in the Tono-Vea area that we surveyed sold to traders but rather to the local markets.

Traders restrict access to the main wholesale markets to reduce the probability that they are unable to sell all their produce at a price that covers their costs (Robinson and Kolavalli 2010, 20). Restricting access implies that some farmers cannot sell their tomatoes where they would prefer to and so get lower prices (or do not sell at all), whereas other farmers who are able to sell to the restricted markets may get higher prices if they share the "rents" or excess profits with

the traders. Overall we found that in the Upper East farmers were more likely to tell us that they were unable to sell all their tomatoes because traders did not come to their fields and they could not get the tomatoes to a local market. Farmers often respond to their perceptions of changes in the market by varying the area they plant to a particular crop.

Cultivation on smaller plots of richer land, climatic conditions, and irrigation practices appear to give Burkinabe farmers competitive advantage

During our field visit to Burkina Faso³ we identified a number of differences between disease and pest management, and husbandry practices in Burkina Faso compared with Ghana (see Table 4). Overall, farmers in Burkina Faso appear more able to achieve higher yields, in part due to more intensive cultivation of small plots; cultivation on dam catchment areas that are highly fertile; fewer years of cultivation on the same plot resulting in lower incidence of soil borne diseases. Farmers in Upper East appear divided as to whether they believe that traders prefer tomatoes from Burkina Faso because the tomatoes are of a better quality and transport better and the farmers are more responsive to the traders' needs, or because of their dual interest in cross border trade. Lead boys may also encourage traders to bypass Upper East for Burkina (Robinson and Kolavalli 2010, 20).

Table 4. Observed differences between Ghana's Upper East region and Burkina Faso

Observation	Burkina Faso	Ghana (Upper East Region)
Location of farms	Many farm catchment along the edge of the dam, where the land is particularly fertile. Fewer years of cultivation on the same plot resulting in lower incidence of soil borne disease	Farming in the catchment is illegal in Ghana. Farmers rely on dugwells or pumping from irrigation schemes for water Insufficient crop rotation
Diseases and Pest Control	Insecticides use to control pests. No fungal diseases because of drier climatic conditions and cooler nights.	Farmers use both insecticides and fungicides.

³ A team with representation from MoFA, researchers, traders, and the private sector, made a brief visit to key tomato production areas in Burkina Faso to understand the factors that seem to give them competitive advantage over Ghanaian producers, those in the Upper East in particular. This visit has been followed by detailed surveys in both Burkina Faso and the Upper East to rigorously examine the hypotheses that emerged relating to differences in production conditions and quality of tomatoes produced.

Husbandry practices	<p>Farms that we visited are small, around 0.25-0.5 acre, and more intensively cultivated</p> <p>Land preparation costs lower as rarely clear and destump.</p> <p>Yearly purchase of seed a common practice</p> <p>Hoeing as common tillage practice</p> <p>Migrant farmers living adjacent to their plots are able to give them more attention</p> <p>Better water control practices. Higher temperatures may necessitate daily irrigation. Farmers in catchment typically use buckets of water from the dam or shallow dugwells to irrigate and so use less water than farmers in Upper East.</p> <p>Use NPK fertilizer and manure but not sulphate of ammonia. Fertilizer appears to be distributed over a longer period within the plant gestation period</p>	<p>Similar small farm sizes in terms of well irrigation. But large sizes of more than an acre under rainfed and river lift system.</p> <p>Land preparation costs higher as farmers clear and destump.</p> <p>Recycling of seed still a common practice for a sizeable minority of farmers</p> <p>Farmers use both hoe and tractor to till the land</p> <p>Farmers may apply too much water, resulting in large but less firm and less transportable tomatoes. In part because many farmers are part of an irrigation scheme, relying on water flowing through the furrows in their fields</p> <p>Farmers use both NPK and manure. Also use sulphate of Ammonia</p>
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Source: Team observations 2009.

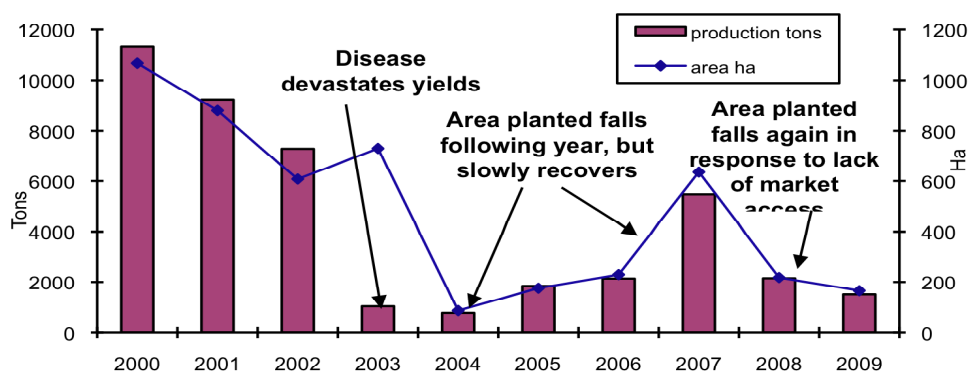
Poor access to markets and greater incidence of diseases seem to disadvantage equally enterprising farmers in the Upper East

Farmers in the Tono and Veia irrigation systems have reduced considerably their production of tomato in response to disease and lack of market. Our survey suggests that they have poor access to markets, with none of the farmers we surveyed who use these public irrigation systems selling to traders from the large wholesale markets, and the prices they get in the local markets are low. In this section we give a brief discussion of tomato farming in this area over the past decade.

ICOUR manages the Tono and Veia irrigation systems in the Upper East region, which support 4,500 and 1,500 farmers respectively. The dry season is between October and May, when vegetables such as tomato, onion, and pepper are grown, as well as sorghum and maize on the uplands, and rice on the lowlands. Up to 2,500 hectares can be cultivated in the Tono area and 800 hectares at Veia.

Farmers in the Tono-Veia irrigation areas have been growing tomatoes for many decades. As one member of ICOUR told us, if there is water, farmers will crop tomatoes; they will grow whether or not there is a market. However, despite this sentiment, the farmers have demonstrated a strong supply response in terms of area planted, as a response to both market conditions and pests and diseases. Over the past decade, other than one year in which disease devastated the crop, there has been little variation in yields but has been considerable variation in area planted to tomatoes and therefore, total production (Figure 10).

Figure 10. Tomato planted area and yields in Tono-Veia Irrigation Areas 2000–2009



Source: ICOUR

Up to 2002 the market for tomato was good and farmers received what they considered to be a good price. In 2003, yellow leaf curl devastated the crop resulting in big losses for the farmers. In the following year when farmers were reluctant to grow tomatoes, the market queens travelled to Burkina Faso to source tomatoes as they could not get sufficient quantity from the Upper East region.

Collaborating with MoFA and SARI, ICOUR made efforts to help farmers reduce losses from disease and pest outbreaks and generally improve their agronomic practices. ICOUR made

efforts to implement the series of recommendations that emerged through extension activities. Farmers were encouraged to rotate their cropping to reduce soil borne diseases; reduce their water application to avoid over-ponding; not to plant pepper and tomato together because it increases the whitefly population; and to plant maize along the border to attract the whitefly away from the tomato. Farmers were also encouraged to adopt varieties such as Pectomech to protect their nurseries and to reduce diseases; to spray recommended insecticides weekly; and to practice good field sanitation.

Farmers slowly started to increase the area planted to tomato, and rapidly increased the area planted in 2007 to 636 hectares because they were told that the Pwalugu factory would be reopening and would be able to purchase the farmers' tomatoes. Farmers achieved good yields reducing losses due to diseases. However, the market failed: Pwalugu did not begin operating as planned (Robinson and Kolavalli 2010, 21).

Overall, Ghana's tomato farmers seem to receive little technical support. Because of Ghana's focus on food security crops, even data on tomato production are not collected in a systematic way. There are no breeding programs and tomato doesn't appear to be a crop that receives attention in the agricultural extension system. .

Previous research efforts appear to have had little impact

A research team led by the Natural Resources Institute in the UK (NRI) conducted a research project in the Brong Ahafo region in Ghana between 1994 and 2000. The project focused on pure line selection of vegetable landraces, including tomato, aiming to produce a source of pure strains of particularly good open-pollinated varieties because it was observed that most farmers could benefit sufficiently from modern varieties to be able to pay the high price demanded for their seeds. Six varieties (three of which were local) were identified that were preferred by farmers and traders. Qualities that were valued in these varieties included fruit quality, taste, and shelf life. A tomato breeder seed production trial was established seemingly successfully at Wa in the Upper West region with five of the selected varieties. The expectation was that the Varietal Release Committee of Ghana would supervise a trial as part of the variety registration process leading to the registration of Ghanaian tomato varieties. Yet these varieties were never released. The project documentation stated clearly that "outputs [of the project] will have minimal impact unless sustainable seed distribution systems are in place to ensure that resource-poor farmers (particularly in rural areas) have access to newly developed material" (Orchard and Suglo 1999).

This research project appears to have been a well-implemented action research project that has not resulted in any long-term impact because of a lack of follow through. Since this project, there has been no breeding programs, and no systematic seed multiplication in the country. However, Power Rano (a cross between the Power and Laurano varieties), identified by NRI researchers in the 1990s as having good properties for production and local processing, has remained popular in Brong Ahafo where the NRI project was located.

Since the NRI-led study, any new varieties used by farmers have either been introduced by the private sector; by processors trying to encourage farmers to grow varieties suitable for processing; by seed companies; or by farmers bringing in seed from Burkina Faso or other neighboring countries. For example, in Greater Accra, we found 9 farmers (out of 31 farmers) growing Nimagent 1, an expensive seed introduced for its high yield potential and suitability for processing by Trusty Foods (Expom) who have a tomato processing plant nearby (though admittedly the farmers we sampled had poor yields). Some farmers, though none in our sample, are using seeds introduced by Heinz when they were undertaking trials in collaboration with MoFA and ICOUR and considering purchasing the Pwalugu (Northern Star) factory in the region

(before determining that it could not purchase tomato at a sufficiently low price to be profitable). Pectomech, popular throughout irrigated areas, was introduced into Ghana by Technisem France through Agrimat Limited. Technisem is one of the best-known seed companies in Africa, especially for the supply of dry season vegetable seeds. The company opened a subsidiary in Ghana around 2006/7 with the name TropicaSem and later on changing to Agri Seed in 2009. It has been the only private sector company investing in the vegetable sector in West Africa over the past fifteen years.

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