Title of the Paper

Title: Producers and Consumer attitudes toward Biotechnology in Ghana.

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Title: Producers and Consumer attitudes toward Biotechnology in Ghana.

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Abstract:

Over 265 million people in Sub-Saharan Africa face malnutrition, chronic hunger, and poverty. One of the technologies that could help alleviate the perpetuating cycle of chronic hunger is biotechnology. Genetic modification (GM) has the potential to enhance agricultural productivity and improve Africa's food security, but little is known about the potential benefits and costs of using genetically modified maize in Africa - Ghana.

African and Ghanaian policy makers, farmers, and consumers often have difficulty accepting new technologies. Their reluctance is due to the investment required for new technology, - aversion to risk, the changes required to traditional production practices, and incomplete- knowledge of new technologies. This study elicits the knowledge, views, acceptability, preference, adaptability, and willingness-to-pay for genetically modified GM corn (maize). A survey instrument was used in two corn growing areas in the Ashanti Region of Ghana, to identify the barriers to the adoption of GM corn. The results of the study suggest that maize growers in the Ashanti region are willing to try GM maize, contrary to the current government restrictions.

Introduction:

Agricultural biotechnology has the potential to improve Africa's food productivity and security, but it will not be successful without investing in education. African farmers often have difficulty accepting new products unless they fully understand the product's potential. This reluctance is due to the large investment that farmers have in their farms. Farms serve as a

store of wealth, creating financial independence. Farms provide the basic necessities and tuition to send their children to school. Without a guarantee for success, farmers will be reluctant to try a new product or technology. Through education and demonstration, African farmers may overcome aversion to innovations.

Corn is an important food commodity and local policymakers and experts have stressed the importance of supporting corn research to boost yields. Based on current growth rates, the world population is projected to double from more than 6 billion to more than 12 billion in less than 50 years (Mataruka, 2009). And, as the world's population increases so too does the number of people who are malnourished. To keep up with this growing population, farmers are required to produce more food in the next 50 years than they have over the past 10,000 years (www.Monsanto.com). According to the Executive Director of the African Agricultural Technology Foundation, Dr. Daniel Mataruka, "Africa needs economic and agricultural revolutions greater than the one observed in Asia. With a population of 770 million people that is estimated to rise to 1.75 billion by 2050, and a poorly performing farm sector that is aggravated by invasive pests, weeds, land degradation, erosion, droughts, and the effects of climate change, assuring an increasing population a sustainable food supply will be one of Africa's biggest challenges."

In the US, Europe, and Asia, improvements in agricultural productivity have led to improvements in economic development. In Africa, agricultural productivity suffers from under-investment in agricultural research, education, farm mechanization, and infrastructure (such as roads, electrification, and irrigation) (Mataruka, 2009) Helping farmers in developing countries is essential to eradicating the perpetuating cycle of hunger and poverty. Dr. George Acquaah, a native of Ghana and the chair of the Department of Agriculture at Langston

University, explains that " Growing up in Africa, I saw firsthand so many of the problems that people in the United States only read about: chronic hunger, children going blind from malnutrition and people dying from treatable diseases. As a scientist, I find biotechnology a challenging field, but as an African, I am genuinely encouraged by its potential to help alleviate these problems that plague Africa and developing countries around the world" (Acquaah, 2007).

Agricultural biotechnology companies in the United States spend millions of dollars educating American farmers. "Monsanto spends, on average, $2.6 million a day on research and development, enabling us to develop the most robust pipeline of products in the industry"(www.monsanto.com). Programs such as farm shows give the biotechnology companies an opportunity to showcase their products and often provide discounts, resources, and other incentives. However, little agricultural outreach is done for African farmers.

Agricultural biotechnology includes a range of tools such as traditional breeding techniques and in vitro genetic modification. Both techniques alter living organisms, or parts of organisms, to make or modify products, improve plants or animals, or develop microorganisms for specific agricultural uses (USDA, year).

According to Kenyan Agriculture Secretary Wilson Songa "African policy makers and stakeholders should stop thinking that Africa can produce enough food through organic technology alone. We must adopt all the available technologies if we are to feed our people and have surplus for export" (Mboya, 2009). Furthermore, lack of political will and slow deliberation on bio-safety legislation is the main stumbling block towards realizing Africa's agricultural potential.

The Director of West Africa Biosciences Network (WABNet), Diran Makinde, believes that countries within the same agro-ecological zone should harmonize their biotechnology policies and partner on research to save money and time. Makinde explains that countries that have not started work on bio-safety regulations should share with countries that are already ahead in this area. Given that Africa has few experts capable of developing policy and laws on bio-safety and biotechnology, neighboring countries should team up and borrow from one another" (Duncan Mboya March 11, 2009)

In addition to the lack of policy to support the use of biotechnology, there is a lack of consumer and producer education about biotechnology. Following the debate on transgenic crops in Europe, farmers and consumers were found to base their decisions on ethical, socioeconomic and anti-multinational concerns, lack of knowledge or misinformation, environmentalism, and food labeling (Wambugu, 1999). Education will assist famers and consumers in making informed decisions about biotechnology.

Agricultural biotechnology is the foundation needed for African farmers to rise out of poverty and achieve financial freedom. However, this accomplishment will not be possible without investing in education and bridging the education gap between producers and consumers. According to the 2009 World Food Prize recipient Ejeta, "African higher educational institutions still lack the faculty strength and infrastructure to regularly produce high- quality graduates and postgraduates in numbers needed to promote change"(Ejeta 2009).

An educational gap exists between producers and consumers in agricultural biotechnology. This problem exists because of a lack of investment in education and outreach. In most cases, African consumers are skeptical of biotechnology because they have no knowledge or experience with it. Developing countries are at a disadvantage and lack access to modern

technologies when it comes to agriculture and other innovations. Millions of dollars have been invested in improving crop yields, and research has been conducted to find insect resistance and other environmental stressors that affect crop yields. While investments are also made to help farmers produce and conserve crops more in the United States, not enough is done to help African farmers. Capacity building and strengthening of local institutions are the areas in which foreign assistance is badly needed." (Ejeta, 2009). To provide insight into prospective policy developments, this study examines producer and consumer "beliefs" about current biotechnology and conventional techniques used in the development of corn varieties and assess whether policy arguments for, and against the use of biotechnology tools such as GMOs in Ghana are consistent with these beliefs.

Genetically modified (GM) maize is a new technology that could increase yield, increasing productivity, and alleviating hunger to propel Ghanaian farmers to finical freedom. However, the debate on biotechnology with respect to food- GM maize continues. Despite the significant contributions in advanced breeding techniques and technology, the use of GM maize still poses concern among the uninformed citizens of Ghana- especially the farming community. Emerging technologies and biotechnology are crucial to the development agriculture and the sustainability of food production in Ghana. The impact of this new technology on producers and consumers in Ghana is unknown, and it is this fear of the unknown, misinformation and speculation about GM maize that has hindered its acceptance in Ghana (Dale et. al., 2002).

Consumer fears	Real impact
Chemical interaction with living things	Small, targeting pest
Change in persistence or invasiveness of the crop	Small assessed case-by-case
Gene flow by pollination to weeds and feral plant	Potential for production of novel crop
Reduced efficiency of pest, disease, and weed control	Chemical control
Effect on soil and water	Decrease in herbicide use

Objectives

The objectives of this study are to:

1. Identify producers' and consumers' attitude and beliefs about GMOs.
    a. Determine the current varieties of maize being used in Ghana
    b. Identify policies preventing Ghanaian farmers from using GMO crops.
2. Contrast attitudes and beliefs of farmers and consumers with GMOs available for Ghana
    a. Evaluate GMO acceptance in Ghana
3. Determine the consistency of producers' and consumers' attitudes and beliefs with existing policy.

If GM maize turns out to be beneficial to both producers and consumers than the policy related to seed sector in Ghana which is preventing farmers from planting GM maize should be analyzed and changed. The objective of this study were accomplished by testing the hypotheses that Ghanaian producers and consumers of corn have established adverse beliefs about biotechnology that interfere with the adoption of GMO corn varieties. The underlying assumption is that misinformation and the lack of education about biotechnology in corn production is a barrier to the adoption of specific, high yield varieties of corn?

Data and Methods:

The purpose of this study is to determine the importance of specific factors in preventing the adoption of genetically modified grain varieties in Ghana. Specifically, the study will identify the concerns of Ghanaian farmers, consumers, policymakers, and Kwame Nkrumah University of Science and Technology (KNUST) faculty members pertaining to genetically modified corn (maize). This project started in January 2010 and interviews and fieldwork were carried out in May and June of 2010. A survey that included a sample of 111 individuals was conducted with same set of questions in two regions of Sekyere-West and Ejura- Sekydumase Ghana. In-depth interviews were also conducted with Scientist and faculty members to elaborate on their understanding of GMOs, their willingness to try GMOs, and their overall perceptions about GMOs.

Fieldwork in Ghana

In the West Africa region, Ghana is a key target country for development, implementation and other economical initiatives. Agriculture is the foundation of the Ghanaian economy. Through modernization and the introduction of innovative agriculture practices, Ghana can become a major provider of food within and beyond its own borders. Therefore, Ghana was targeted to provide insight about the decision-making process behind the hesitation of a west African culture to adopt GMOs.

The two regions of Sekyere-West and Ejura- Sekydumase within Ghana are both at similar stages of economic development and were chosen to provide an analysis of the consistency between the arguments for and against biotechnology adoption by producer, consumers, policymakers, and (KNUST) scientist in Ghana.

A questionnaire was constructed and used in the Ashanti Region, Ghana. A total of 111people were surveyed in the Ejura- Sekydumase District of the Ashanti Region, These locations are recognized as important maize growing areas in the Country. Both farmers and consumers were targeted at local markets in the district. Scientists of CSIR-CRI maize program and lecturers in KNUST Faculty of Agriculture were also interviewed. The common questionnaire includes eight major sections including; Personal information, Education level, Family size, Decision-making about GMOs, Understanding of GMOs, Exposure/ Usage of GMOs, The data collected pertaining to decision making and understanding of GMOs includes;

I. Farmers' perceptions of biotechnology and, - literacy, and understanding of the technique:
    a. Producer and consumer concerns about biotechnology
    b. Politics affecting biotechnology acceptance
    c. Effect on export markets
II. Farmers' willingness to plant biotechnology depends on perception on consumers, loss, export markets, and other factors.
    a. Farmers' willingness to purchase (WTP) biotechnology and plant GM corn
    b. Price of GM corn
    c. Inability to replant GM corn
III. Factors that may influence adoption of biotechnology in Ghana:
    a. Price of GM corn
    b. Adverse beliefs (fear of biotechnology)
    c. Risk associated with biotechnology
    d. Changes to traditional production practices (such as annual seed purchases)

e. Adoption/ Farmers willingness to plant GM crops = f (price of biotechnology, adverse beliefs, risk associated with biotechnology, changes in practices)
f. Farmers' perceptions of why biotechnology is not accepted in Ghana= f(consumer concerns, politics, export opportunities)

Data was collected on the risk associated with GM corn (maize) use in Ghana. According to Lusk and Hudson "there are several methods available to estimate consumer or producer WTP for novel goods or changes in the qualities of existing goods. In outlining the advantages and disadvantages of elicitation methods, several factors are important to consider.(Lusk and Hudson 2004). One of the primary issues surrounding the credibility of an elicitation technique is that of incentive compatibility. An elicitation mechanism is considered incentive-compatible if an individual's dominant strategy is to truthfully reveal their preference for the good in question. A closely related issue is that of hypothetical bias: that individuals respond differently when responding to hypothetical questions than when confronted with real payment. Because many valuation questions involve asking hypothetical questions where incentives may not be properly aligned, this issue is an important consideration.

Theoretically, WTP measures the maximum amount of money an individual is willing to give up to either: (*a*) obtain a product with quality q or (*b*) exchange a product with quality q_0 for a product with quality q_1 as discussed in the second section of the paper. Practically, how can agribusiness use these measures? At this point, an important distinction must be made. The discussion in the second section of the paper was related to measurement of an individual's WTP. However, agribusinesses will typically be interested in the distribution of WTP in a particular market" (Lusk and Hudson 2004). Careful consideration of bias, opinion, and personal views

must be evaluated prior to conducting this survey so that the responses are not swayed in any shape or form.

To assess farmers' preferences without an actual product test, a willingness to-pay survey was carried-out among selected farmers in the Ashanti Region. Responses to the questions were elicited verbally from farmers. Explanations, questions and responses were translated in the local dialect (Twi). Farmers provided responses to questions about the advantages and disadvantages of GM corn seeds as well as their willingness-to-pay for the GM seeds. Data collected from farmers, consumers, policymakers, and KNUST faculty members were analyzed and the results are presented below.

Ghanaian farmers have incomplete knowledge and / or cultural based beliefs about biotechnology; the stigma of GMOs is engraved in their minds, and they are unaware of the diversity of biotechnology. African policymakers impose the fear of biotechnology crops on citizens of their country; this fear is derived from European anti- biotechnology, misinformation, and cultural beliefs. With terms such as "terminator technology" coined by Europeans- the fear of the unknown coupled with their aversion to risk is preventing African farms from exploring new technologies. According to Wambugu (1999) "the report, by a group led by Patrick Wall, the authority's chief executive, says that concern in Europe is based on ethical, socioeconomic and anti-multinational issues; lack of knowledge or misinformation; environmentalism; food labeling; and consideration of the needs of developing countries". Since most undeveloped countries cannot afford to conduct the research on their own and often do not have access to recent technologies, they often look to developed countries for answers. The general public values the input of academia and normally does not question information printed by a reputable institution. While some social and cultural factors are preventing or reducing the rate of

adoption of biotechnology in African countries, lack of complete information appears to be a major factor influencing its adoption. While biotechnology has been used in the pharmaceutical industry – for antibiotics and other medications and has resulted in significantly high side effects, the same technique has been applied to GM crop production with low or no side effects. GM/ transgenic foods are consumed everyday in the United States and no publications or incidents have yet supported side effects from GM crop consumption in the United States. Africans must be equipped with information about biotechnology to help ease their fears and concerns about biotechnology. Without education-, the epidemic of malnutrition, chronic hunger, and death will continue to be a perpetuating cycle.

Successful completion of this study should aid in the efforts of introducing, educating and implementation of regulations that promote safe practice of GM maize into the hands of Ghanaian farmers. The outcome of the study will facilitate the policy related to the adoption of GM technology in Ghana and other developing countries.

Literature Review:

Guimaraes et. al. (2006), explain the challenge to meet increased demands for food from a growing population by developing new varieties and improving agricultural production methods that are sustainable in the long term. This challenge has become perpetual in crop production in developing countries. Moreover, it is important to increase food production as populations' increase. The authors also discusses the significance of a strong plant breeding program that should include- crop science, entomology, forestry, genetics, horticultural science, and plant pathology. Knowledge in these areas is fundamental in agricultural research, and he explains how sustainable plant breeding programs can aid in the process and benefit mankind. Humanitarian efforts to help third-world countries develop are admirable; but money will not

solve development problems. The authors conclude that "ensuring strong plant breeding programs in national agricultural research systems (NARS) will be essential in ensuring the sustainable use of plant genetic resources for the benefit of mankind." Biotechnology will not aid in development if practiced in the United States alone: we must first identify the problems affecting different African countries and then develop a technique that is unique to their particular problems. Biotechnology capacity and development of African countries can become a reality when Food and Agricultural organizations (FAO), donors, and policymakers come together under one accord and agree to implement and embrace modern technology developed for respective countries.

Quaye et. al. (2009) illustrated the social and cultural implications of biotechnology in Ghana. The authors explain that although major scientific progress in advanced technology has been made in the application of agricultural biotechnology, the public has a mixed feeling toward GM foods, some are pro-biotechnology and others are against the use of biotechnology as they fear it will put the nation at the mercy of profit-driven, foreign biotechnology companies. They reached this conclusion after conducting a stockholder survey in Accra, Ghana. Furthermore, Quaye et.al. explained that the critics of GM foods in Ghana claim that the research conducted on biotechnology is carried out by the very biotechnology companies who have the most to gain.

Policymakers in Ghana will have to determine whether or not to accept biotechnology as they face devastating problems such as food insecurity, poverty, and malnutrition. Regarding the social and cultural implications of biotechnology, Quaye et.al. explain that the biggest question deals with how biotechnology/ GM foods are developed. This question, unanswered for most Ghanaians, is rooted in the educational gap that exists between scientists, policymakers,

consumers and producers. According to Dr. George Acquaah (a Ghanaian), who is Chair and Professor, Department of Agriculture and Natural Resources, Langston University "I see both the enormous challenges facing the people of Africa and the potential solutions. Growing up in Africa, I saw firsthand so many of the problems that people in the United States only read about: chronic hunger, children going blind from malnutrition, and people dying from treatable diseases. As a scientist, I find biotechnology a challenging field, but as an African, I am genuinely encouraged by its potential to help alleviate these problems that plague Africa and other developing countries around the world". Educating African consumers and producers about biotechnology will help them to accept it. Currently, the lack of acceptance comes from the fear of the unknown.

Quaye, et.al.90discuss the social- and cultural implications and mixed perceptions about biotechnology among Ghanaians. However, little is known about the perceptions of biotechnology held by Ghana's policymakers. Because these perceptions are an important part Ghana's solution regarding malnutrition, chronic hunger, and poverty, these perceptions should be illicited.

According to Jesse Machuka (2001) an urgent need exists to eliminate the perpetual cycle of hunger, malnutrition, and death in a world of plenty. The African scientist and farmer must feed their own people, but they must be equipped with the right training, information, and tools to do so. Biotechnology research is often conducted in developed countries with access to resources. However, if significant progress is to be made in eradicating the perpetual cycle of hunger and malnutrition in Africa, then an investment must be made in education. Biotechnology research for Africa should be done in Africa by Africans. Machuka explains this can be done with consensus and goodwill. Many development organizations and agencies have

promised to help increase food security and eradicate poverty; none have implemented sustainable programs or practices to help empower Africans to help themselves. Machuka further explains "because of history, some are either pessimistic or skeptical, but the majority remains cautious and optimistic, that modern biotechnology opens new opportunities to address constraints that have led to declining harvests in farmers' fields in the midst of an expanding population."

Machuka makes a good point when he says "agricultural scientists and extension specialists interact with farmers to attain acceptance and use of new technologies for sustainable food production and development." He later stresses that technology should not only reach the farmers, but they must also understand it and be empowered to use it. In order to prevent what Jesse Machuka refers to as the "cut and paste" approach that results in a short-term, quick-fix to unique problems, collaboration from different sectors such as scientists from research institutions, national agricultural research centers, and farmers is essential to development.

Machuka, references Florence Wambugu' and discusses how biotechnology could help Africa. Wambugu explains that the debate and controversy surrounding a transgenic crop in Europe is centered on fear and misinformation based on the "mad cow disease" experience. Furthermore, Wambugu cites a recent study from the Food Safety Authority of Ireland addressing concerns of GM crops to conclude that there is no evidence that transgenic foods are unsafe.

The fear of the unknown is preventing Ghana and many African countries from using a technology with great potential. Wambugu makes an important point: "transgenic foods are eaten daily in the United States, Australia, Canada, Mexico, and elsewhere with no reported

undue effects". Furthermore, she explains a concern promoted by critics of biotechnology is the use of toxins and allergies. When the public is misinformed they create a defense and do not want to use a technique that has a vocal and trusted critic such as Arpad Pusztai, - who is viewed to be reputable because of his association with the Rowerr Research Institute of Scotland. According to Wambugu, Pusztai suggests that rats fed with GM potatoes were slowly being poisoned. In an independent scientific review, these results were found to have been misinterpreted and therefore misleading. When respected individuals like Arpad Pusztai impose their own negative views and opinions, the public will be biased against biotechnology. Wambugu, further illustrates the need for biotechnology in Africa particularly as the population rate exceeds food production. Although biotechnology is not the only answer to this perpetuating problem, Africa could certainly benefit in many ways from its use. For example, the average corn yield in Africa is about 107 tonnnes per hectare compared to a global average of 4 tonnes per hectare. Some biotechnology applications can be used to reduce this gap, such as for maize streak virus (MSV), which causes losses of 100% of the crop in many parts of the continent. With problems such as pest, weed resistance, land degradation, erosion, and droughts, Africa needs biotechnology to solve its environmental problems. Wambugu concludes, "After working at KARI for nearly a decade to help improve sweet-potato production using traditional breeding and agronomy methods, I made no progress." She later had the opportunity to work on an transgenic variety -which involved collaborations between KARI, the US Agency for International Development (USAID) and Monsanto Company. The project is called Agriculture Biotechnology for Sustainable Productivity, which has allowed the advancement in research to aid the development of transgenic varieties that are resistant to feathery mottle virus, which can reduce yield loss by 20- 80%. Finally, it is important to find a

balance. The crop researchers and private sectors must be transparent with their findings and share it with the locals. Africa must strengthen its capacity to deal with various aspects of biotechnology and encourage the emergence of a local biotechnology private sector. The great potential of biotechnology to increase agriculture production in Africa lies in its "packaged technology in the seed", which ensures technology benefits without changing local cultural practices.

According to Gebisa Ejeta the 2009 World Food Prize recipient, Sub-Saharan Africa remains the only region in the world where hunger and poverty prevail. This is a problem, as climate change will impact agriculture development. Ejeta believes Africa has the capacity to feed itself and become a net exporter of food. He further explains that much of the human capacity essential for an agriculture revolution in Africa is weak or nonexistent. The discoveries of miracle crop varieties that ignited the Asian Green Revolution were in wheat and rice not in sorghum, millets, maize, or cassava the critical crops for Africans. Dr. Ejeta further explains that Africa was not ready for such science-based development, but today there is a developing, although not yet robust, human capacity based agricultural research infrastructure focused on solutions for local problems. Moreover, collaborations between African scientists and foreign agencies have resulted in the biological control of major insects' pests of cassava and drought, parasitic- weed-resistance sorghums. Dr. Ejeta further explains the need for Africa to produce the infrastructure necessary to regularly develop high- quality graduates and postgraduates in the numbers needed to promote change. Capacity building and the strengthening of local institutions are key development areas that would benefit from foreign assistance. However, Dr. Ejecta also elaborates on the over-reliance on external funding for agricultural development programs in Africa. He explains that this lack of a strategic frame-work for national development

has created an unhealthy partnership with aid recipients. Strengthening human capacity and institutional infrastructure in the areas of education, research, and technology is key to development. Dr. Ejecta concludes that " I am optimistic: African leaders have put agriculture on their agenda and made a historic pledge to commit 10% of their national budget to food security and agriculture- led growth through the Comprehensive Africa Agriculture Development Program. Finally, he states that no amount of funding will bring about change unless it is locally led by an inspired citizenry and driven by an unequivocal support and commitment from African leaders and policy makers.

Findings:

Results for famers' perception on GM maize

Out of the 57 famers surveyed in Ejura and Seky-dumase, only 8.8% famers claim they know what GM maize means, 59.6% answered no and 31.6% do not know what it is nor are they aware of it.

Table 1. Socio-economic characteristics of sample respondents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	86	76.8	77.5	77.5
	Female	25	22.3	22.5	100.0
	Total	111	99.1	100.0	
Missing	Missing	1	.9		
Total		112	100.0		

Table 2. Age of respondents for Farmers and Consumers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	10-20	3	2.7	2.7	2.7
	21-30	28	25.0	25.0	27.7
	31-40	37	33.0	33.0	60.7
	41-50	30	26.8	26.8	87.5
	Over 50	14	12.5	12.5	100.0
	Total	112	100.0	100.0	

Table 3. Education level of respondents for Farmers and Consumers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Primary	27	24.1	24.8	24.8
	Secondary	40	35.7	36.7	61.5
	University	3	2.7	2.8	64.2
	Others	39	34.8	35.8	100.0
	Total	109	97.3	100.0	
Missing	99	3	2.7		
Total		112	100.0		

Table 4. Household of Respondents for Farmers and Consumers

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1-10	98	87.5	88.3	88.3
	11-20	11	9.8	9.9	98.2
	Over 20	2	1.8	1.8	100.0
	Total	111	99.1	100.0	
Missing	Missing	1	.9		
Total		112	100.0		

Table 5. Producer and consumer sources of information about GMOs

Sources	**Frequency**	**Percentage (%)**
Radio	52	80%
TV	2	3%
Friend	9	14%
Family	2	3%
Neighbor	0	0%
Journals	0	0%
Government Publication	0	0%
Other	0	0%
Total	65	100%

Table 6. Important characteristics in selecting crop variety

Factors	Frequency	Percentage (%)
Better Yield	37	39
Drought Tolerance	24	25
Pest Resistance	20	21
Easier Harvest	5	5
Greater Weight	9	9
Total	95	100

Table 7. Farmers' Willingness to plant GMO maize

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strongly support	54	94.7	96.4	96.4
	Neither support nor oppose	2	3.5	3.6	100.0
	Total	56	98.2	100.0	
Missing	Missing	1	1.8		
Total		57	100.0		

Table 8. What producers and consumers use maize for:

Factor	Producer	Consumer	Frequency	Percentage (%)
Feeding Family	39	28	67	34%
Feeding Animal	12	8	20	10%
Selling At Market	56	51	107	55%
Others	0	2	2	1%
Total	107	89	196	100%

Table 9. Producers able to plant GMOs

Factor	Producer	Consumer	Frequency	Percentage %
Yes	1	13	14	17%
No	45	3	48	58%
Don't Know	9	12	21	25%
Total	55	28	83	100%

Table 10. GMOs will provide benefits such as pest and weed resistance, land degradation, erosion and drought compared to current methods

Factors	Producer	Consumer	Frequency	Percentage %
Yes	33		33	61%
No	1		1	2%
Don't Know	20		20	37%
Total	54		54	100%

Table 11. Producers source of seed maize

Sources	Frequency	Percent (%)
Own Field	51	78
Input Seller	1	2
Ministry of Food And Agriculture (MOFA)	10	15
Other Farmers	3	5
Total	65	100

Decision-making about GMOs

The Surveys in Ejura and Sekydumase along with in-depth interviews with scientist suggest that producers are willing to plant GMOs considering its benefits, and crop scientist are willing to educate famers by implementing demonstration plots with the intension to first test the maize variety on their soil/ environment understand its interaction with the local environment and then educate the producers and consumers. Of the 11 scientist interviewed, 100% know what GMOs means and 72% support planting of GMOs.

Conclusions and Recommendation:

This study focuses on perceptions of GM maize in the Ashanti region of Ghana, specifically Sekyere-West and Ejura- Sekydumase districts. In each district a sample of 57 famers were selected randomly to be surveyed. To test producers and consumers awareness of GM maize without actual physical sample test. The study was carried out in two phases, the first phase was an introduction and purpose of the study and the second phase was the actual survey incorporating "Cheap talk" "Cheap talk refers to the process of explaining hypothetical bias to individuals prior to asking a valuation question" (Lusk 2003). The survey focused on farmers and consumers involved in the marketing, production, storage, and demand perceptions of maize aimed is to evaluate their awareness on the production and marketing of GM maize.

The producers and consumers than provide an answer based on the available options (e.g. true or false, yes, no, or don't know) and were asked to rank their views and perceptions on GM maize. In addition, farmers and consumers were also asked to provide an advantage and disadvantage of GM maize based on what they know.

The study confirms that the farmers understanding of GM technology is limited as hypothesized. Based on the analysis the farmers understanding of the questions on GM is limited therefore their answers are based on speculation. Some of the response do not match- which made me question the basis of the support of the current restrictions. There is also a question as to whether or not the farmers actually understand the questions being asked- because some of the famers' answers were contradicted- some of the questions asked whether or not they support or oppose current restrictions- the same individuals who strongly support placing more restriction on GM maize acceptance in Ghana also support planting GM maize

which leads to me question whether or not the famers actually understood what they were being asked.

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