Consumer Acceptance of GMO

Cowpeas in Sub-Sahara Africa

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Cowpea is the most important indigenous African grain legume for both home use and as a cash crop. Because of its tolerance to drought it is especially important for the Sahel. Genetic transformation of cowpea with Bachilius Thurengius (Bt) genes to control pod boring insects has many advantages, but little is known of the potential consumer response. This paper analyzes and reports the results of a survey of 200 consumers in northern Nigeria in early 2003 concerning consumer awareness of and acceptance of biotechnology. Ninety percent of the respondents were aware of GM products. Those respondents who were most concerned about the ethics of genetic transformation were likely to disapprove of such products, while those individuals who identified international radio as an information source were more likely to approve of GM technology..

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A consortium of national agricultural research programs in West Africa, assisted by US, European and Australian researchers, has proposed development of a genetically modified (GM) cowpea to manage pod boring insects. Cowpea grain yields can potentially be doubled when pod bugs are controlled. They can be controlled with insecticides, but these pesticides are either unavailable or not affordable by West African small holder farmers. Also when insecticides are applied in West Africa, illiterate farmers often misuse them resulting in serious health and environmental problems. From a technical perspective, genetic transformation of cowpea with Bachilius Thurengius (Bt) genes has many advantages, but little is known of the potential consumer response. The objective of this paper is to analyze and report the results of a survey of consumer awareness of biotechnology in Nigeria.

Cowpea is the most important indigenous African grain legume. It is grown throughout West and Central Africa and because of its tolerance to drought is especially important for the Sahel. Cowpea's economic importance stems from the fact that it is used for both family consumption, as well as a cash crop. Nigeria is the largest producer and consumer of cowpea grain in the world, with an average production of about 1.7 million MT annually in the 1990s (Langyintuo et al, 2003b). It is a major item in regional trade with official statistics showing over 300,000 MT crossing borders annually. Langyintuo et al. (2003a) showed that significant increases in both consumer and producer welfare are associated with increased cowpea yields.

The Network for Genetic Improvement of Cowpea in Africa (NGICA) is leading the effort to develop a Bt Cowpea (Bean/Cowpea CRSP, 2001). The African Agricultural

Technology Foundation (AATF) has made cowpea one of its three priority crops. Rockefeller Foundation is funding research at CSIRO in Australia on developing a reliable transformation technique. Research on transformation methods has also been carried out at the International Institute for Tropical Agriculture (IITA), in Nigeria, by EMBRAPA in Brazil, at various U.S. universities. USAID, through the Bean/Cowpea Collaborative Research Support Program (CRSP), is funding the entomological and genetic studies needed to develop a resistance management plan. NGICA has organized efforts to deal with intellectual property issues, biosafety, and seed industry issues.

One gap in the NGICA effort has been research to understand the likely consumer response to a Bt cowpea. Recent events worldwide have demonstrated that technological development alone will not guarantee the welfare increases that Langyintuo et al. identified as potential. It is necessary first for farmers to adopt the new product and second for consumers to be willing to purchase and consume the product. There has been negative consumer and political reaction to genetically modified organisms in Africa. In 2001-2002 governments of several southern Africa countries refused donations of U.S. maize because the U.S. could not guarantee the absence of genetically modified organisms in the product (Economist.com). Within NGICA there has been a debate about the awareness of African consumers about GM products. Some said that African consumers were largely unaware of what GM means, while others note that many Africans have access to shortwave radio broadcasts with information about GM products in their native languages, and in Islamic communities the Imans have had a vigorous debate about the ethics of genetic modification that was eagerly followed by believers.

The objective of this paper is to investigate the level of awareness of GM crops among consumers in Africa, which is an important first step toward a better understanding of consumer response to GM products in West Africa.

Data

This paper reports the results of a survey of consumers in northern Nigeria in early 2003. It was a "person-on-the-street" survey conducted in the metropolitan areas of Gombe, Adamawa, Jigawa and Kano in northern Nigeria. Some 200 consumers were interviewed. In addition to obtaining demographic information respondents were asked to identify sources of information about GM products. Respondents also were asked to indicate their reaction to GM products and how they perceived the advantages as well as disadvantages of GM with respect to quality of output, quantity of output, ethical considerations, potential disappearance of germplasm and uncertainty.

Almost ninety percent of the respondents were aware of GM terminology (Figure 1). Just over 11% of the respondents approve of GM technology while 66.5% disapprove and 22% are indifferent (Figure 2). About 40% reported first becoming aware of the term on international radio broadcasts of the British Broadcasting Company (BBC), Voice of American (VOA) or Deutsche Welle (DW) Radio, all of which have Hausa language broadcasts to the region (Figure 3). The second most common source was from friends, neighbors and other social contacts (27%). The third category was internationally distributed English language television programs from the Cable News Network (CNN) and the Discovery Channel (18%). Other sources that were mentioned include print media (6%), extension (6%) and local radio (3.5%).

Just over 11% of the respondents approved of GM technology. They identified higher yields and improved quality as key benefits of GM technology (Figure 4). Almost 70% of respondents indicated that they did not approve of the technology and noted concerns about risks related to GM products, the ethics of genetic transformation and the disappearance of indigenous germplasm (Figure 5).
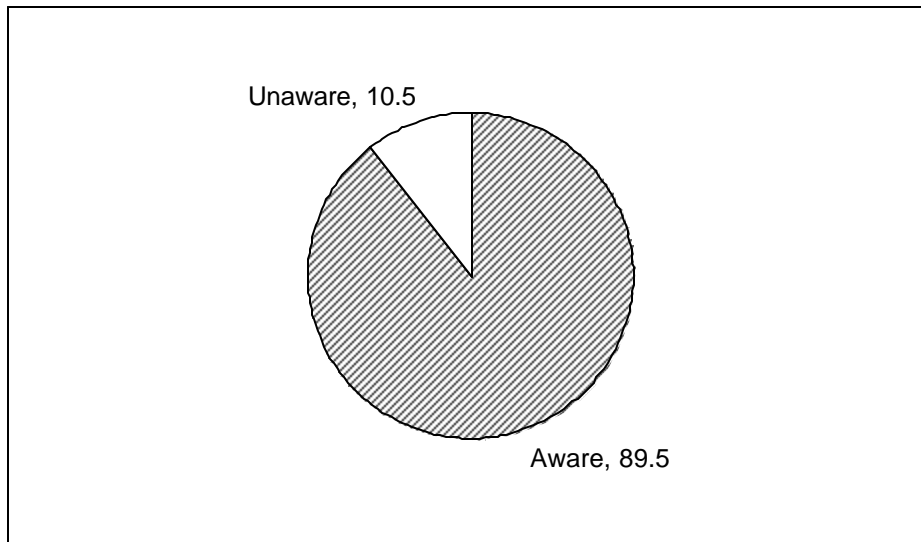

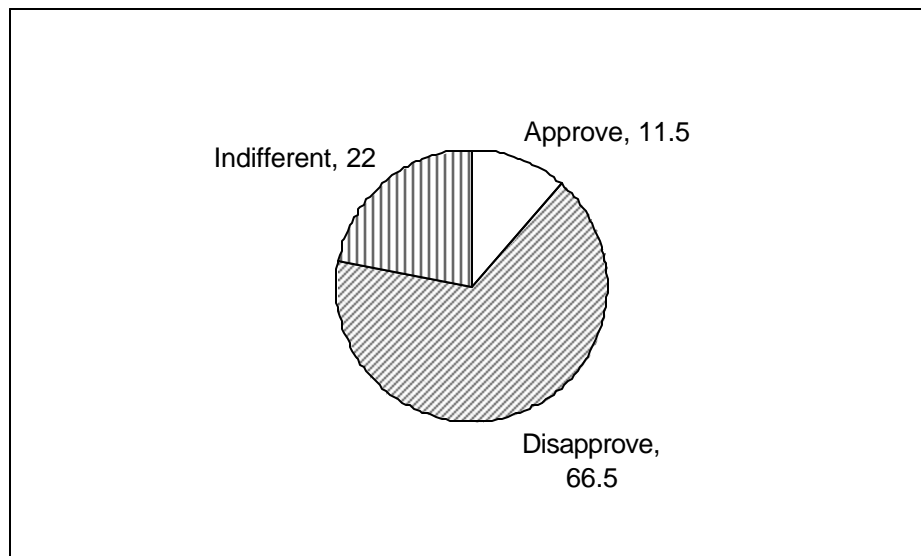Figure 1: Percentage of Respondents that were Aware of GM Terminology

Figure 2: Percentage of Respondents that Approved of GM Technology
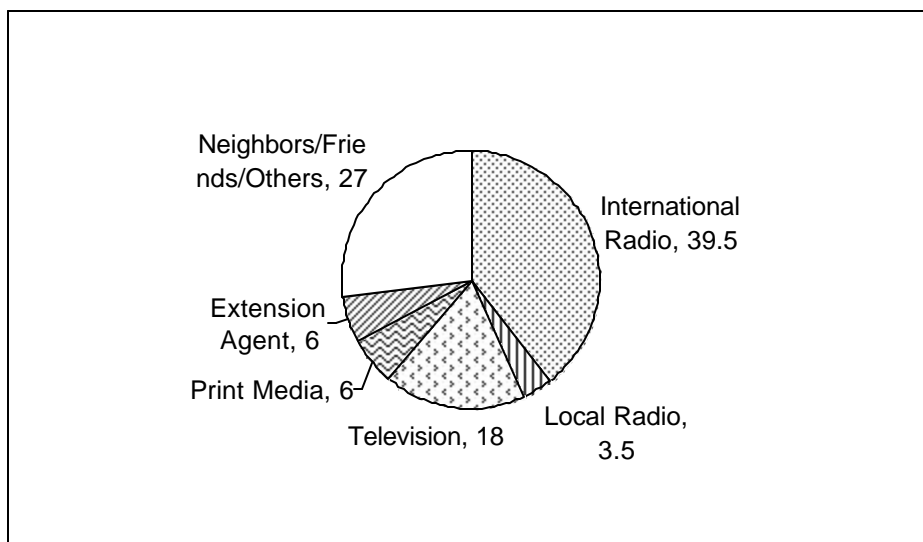
Figure 3: Percentage of Respondents Indicating Source of Information about GM Technology
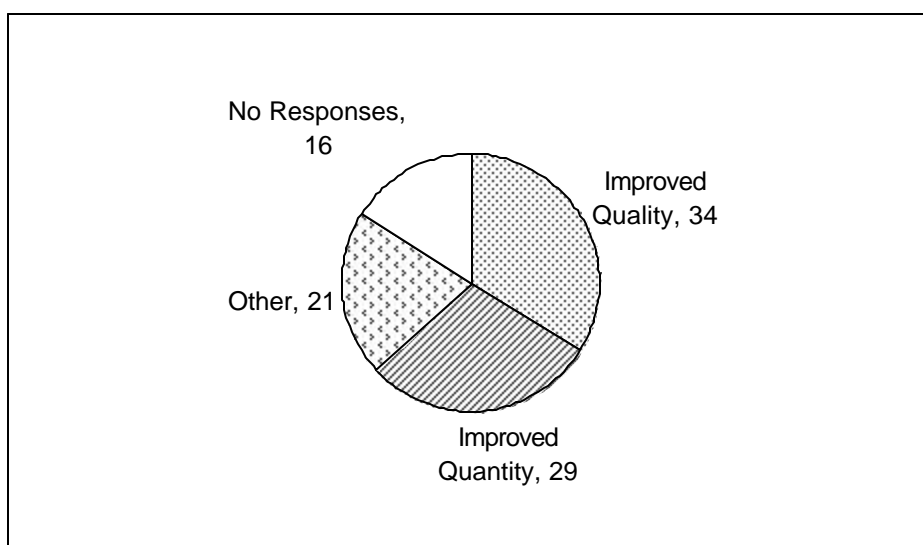
Figure 4: Advantages of GM Technology by Percentage of Respondents
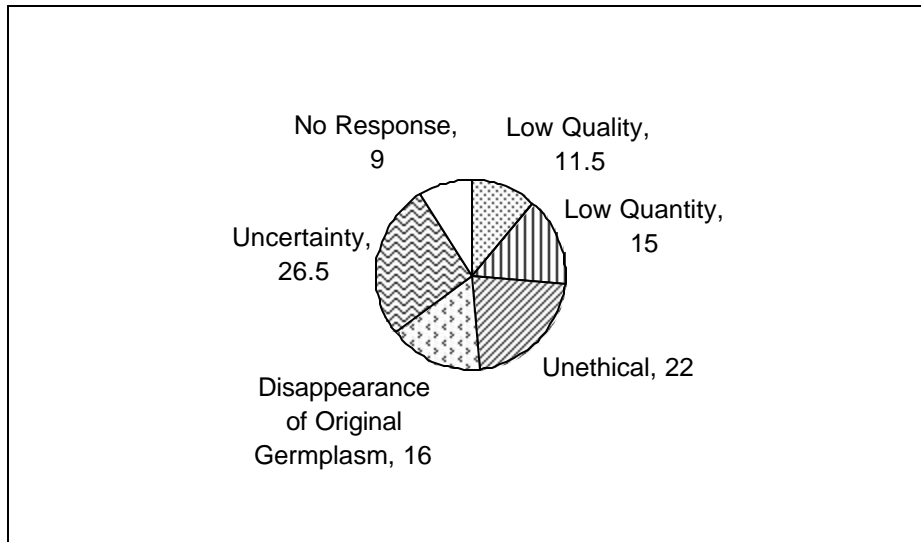
Figure 5: Concerns about GM Technology by Percentage of Respondents

Given the debate concerning the level of awareness of African consumers about GM technology it is useful to explore the characteristics of those respondents who identified they were aware or unaware of GM terminology. Table 1 reports the number and percentage of respondents who are aware (unaware) by demographic and personal factors. Respondents who indicated that they were aware of GM terminology were more likely to indicate that they approved of the technology and less likely to indicate that they disapproved. The respondents who indicated awareness of GM terminology were more likely to be younger, compared with the respondents who were not aware. Almost 60% of the respondents who indicated "Aware" were under the age of 40 while not quite 48% of the respondents who indicated "Unaware" were under the age of 40. The respondents who indicated "Aware" were more likely to be male with 77% of the "Aware" respondents being male and 67% of the "Unaware" respondents being male.

Table 1: Number of Respondents by Awareness of GM and Demographic Characteristics

	AWARE		UNAWARE	
	Number	**Percentage**	**Number**	**Percentage**
Disposition towards GM				
Approve	22	12.3%	1	4.8%
Disapprove	118	65.9%	15	71.4%
Indifferent	39	21.8%	5	23.8%
Age of Respondent				
21-30	15	8.4%	1	4.8%
31-40	91	50.8%	9	42.9%
41-50	69	38.6%	7	33.3%
Older than 50	4	2.2%	4	19.0%
Gender				
Male	138	77.1%	14	66.7%
Female	41	22.9%	7	33.3%
Household Size				
Less than 10	137	76.5%	13	61.9%
11-20	31	17.3%	7	33.3%
Greater than 20	11	6.2%	1	4.8%
Education				
Primary	94	52.5%	0	0%
Koranic	46	25.7%	8	38.1%
Secondary	32	17.9%	2	9.5%
Other	7	3.9%	11	52.4%
Occupation				
Farming	107	59.8%	13	61.9%
Civil Service	55	30.7%	5	23.8%
Other	17	9.5%	3	14.3%
Information Source				
International Radio	72	40.2%	7	33.3%
Local Radio	6	3.4%	1	4.8%
Television	31	17.3%	5	23.8%
Print Media	11	6.2%	1	4.8%
Extension Agent	12	6.7%	0	0%
Neighbors	12	6.7%	0	0%
Friends	12	6.7%	4	19.0%
Social Groups	9	5.0%	1	4.8%
Other	14	7.8%	2	9.5%

It is interesting to note that the respondents who indicated they were aware of GM terminology were more likely to come from a household with fewer people. Almost 77% of the "Aware" responders were from households with 10 or fewer people while not quite 62% of the "Unaware" responders were from households in this smallest size category. Respondents who reported being aware of GM terminology in general had more education than those who reported being unaware. International radio is a more important information source for the respondents who reported being aware, whereas television is a more important information source for the respondents who reported being unaware.

Results of Logit Analysis

Logit analysis was conducted to determine how demographic factors, occupation, information source and perception of advantages/disadvantages affect consumer reaction to GM products. The results of the logit analysis are presented in Table 2. The dependent variable was assigned a value of 1 for those respondents that approved of GM technology and zero otherwise. Several models were considered and four are presented here. The independent variable "Ethical Concern" is a dummy variable with a value of one for those respondents who identified "Ethical Concern" as the major disadvantage of GM technology and zero otherwise. International Radio is also a dummy variable taking on a value of one for those respondents who identified international radio as the source where they heard of GM technology and zero otherwise. Respondents were asked about the number of people living in their household. In this model household size is modeled with two dummy variables; household size of 11 to 20 people and household size of greater

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than 20 people. The household size of 1 to 10 people is the group left out and the

reference group. The independent variable "Male" is assigned a value of one for male

respondents and zero for female respondents. The ages of the respondents were

categorized into four groups. Three dummy variables are utilized here, for those

respondents in their 40's, those in their 20's and those older than 50. The reference

group, therefore, are those respondents in their 30's.

Table 2: Results of Binary Logit Analysis Explaining Approval of GM Technology

	Model 1	Model 2	Model 3	Model 4
Constant	-2.1631** (0.3207)	-2.1176** (0.3484)	-2.4209** (0.4322)	-2.0337* (0.4918)
Ethical Concern	-1.3370* (0.7698)	-1.3468* (0.7804)	-1.3841* (0.7733)	-1.3395* (0.7698)
International Radio	0.7292* (0.4535)	0.8916* (0.4697)	0.8072* (.4636)	0.7359* (0.4541)
HSize 11-20		-1.7962* (1.0508)		
HSize Greater 20		0.8764 (0.7300)		
Male				-.1757 (0.5152)
Age (40s)			0.4466 (0.4894)	
Age (20s)			0.2585 (0.8390)	
Age (50s)			0.6737 (1.1626)	
Chi Squared	5.7817*	12.4387**	6.7634	5.8957
% Correctly Predicted	88.5%	88.5%	88.5	88.5
Pseudo R-Squared	.0405	.0871	.0474	.0413

* Indicates statistically significant at the 10% level
** Indicates statistically significant at the 5% level

The coefficients for the "Ethical Concern" variable are negative and statistically

significant in all of the models, suggesting that consumers in northern Nigeria who

identified the disadvantage of GM technology as unethical are more likely to disapprove of this technology. In addition, the coefficients for the "International Radio" variable are positive and statistically significant in all models. Respondents who identified international radio as their source of information about GM technology are more likely to approve of GM technology. In the second model the coefficient for the household size dummy variable (11-20 people) is negative and statistically significant. This suggests that individuals from larger households are less likely to approve of GM technology compared to those from households with less than 10 people. The coefficient for the dummy variable representing the largest household size is not statistically significant. Although the pseudo R2 values are low at .04 and .08 the Chi Squared values of 5.78 and 12.44 indicate that the set of explanatory variables, as a whole, are statistically significant.

Models 3 and 4 consider variables for the respondent's age and gender. The coefficients for the 3 dummy variables for age are all positive, but not statistically significant. In the fourth model the coefficient for the dummy variable for male is negative and not statistically significant. Once again the pseudo R2 values are very low. In these two models the Chi Squared values of 6.76 and 5.89 indicate that the set of explanatory variables as a whole are not statistically significant.

The results presented here suggest that ethical concerns and international radio as a source of information are important factors in whether consumers approve of GM technology. Further insights on these factors could be important for policy makers as well as businesses and they implement policies to introduce GM technology.

Table 3 presents the number and percentage of respondents who indicated "Ethical' as the disadvantage of GM technology by personal and demographic categories. In general there is little difference between the respondents who indicated "Ethical" as the disadvantage of GM technology and those who indicated another disadvantage. Respondents who indicated ethical concerns were slightly older with over 45% being over age 40 compared with 41% of the respondents who indicated another disadvantage. Just over 22% of the respondents who indicated ethical as a disadvantage had some secondary education, while about 14% of the respondents who indicated another disadvantage had some secondary education.

Table 3: Number and percentage of Respondents by whether they Indicated "Ethical" as the Disadvantage of GM Technology

	Ethical Concerns		No Ethical Concern	
Indicated Awareness of GM Technology	Number	Percentage	Number	Percentage
Aware	38	86.4%	141	90.4%
Not Aware	6	13.6%	15	9.6%
Age of Respondent				
21 – 30	3	6.8%	13	8.3%
31 – 40	21	47.7%	79	50.6%
41 – 50	17	38.6%	59	37.8%
Over 50	3	6.8%	5	3.2%
Gender				
Male	33	75.0%	119	76.3%
Female	11	25.0%	37	23.7%
Household Size				
1 – 10	34	77.3%	116	74.4%
11 – 20	9	20.5%	29	18.6%
Over 20	1	2.3%	11	7.1%
Education				
Primary	17	38.6%	77	46.1%
Koranic	12	27.3%	42	25.1%
Secondary	10	22.7%	24	14.4%
Other	5	11.4%	24	14.4%

Table 4: Number and percentage of Respondents by whether they Indicated "International Radio" as their Information Source for GM Technology

	International Radio		Not International Radio	
Indicated Awareness of GM Technology				
Aware	72	91.1%	107	88.4%
Not Aware	7	8.9%	14	11.6%
Age of Respondent				
21 – 30	7	8.9%	9	7.4%
31 – 40	45	57.0%	55	45.5%
41 – 50	26	32.9%	50	41.3%
Over 50	1	1.3%	7	5.8%
Gender				
Male	62	78.5%	90	74.4%
Female	17	21.5%	31	25.6%
Household Size				
Less 10	58	73.4%	92	76.0%
11 – 20	18	22.8%	20	16.5%
Over 20	3	3.8%	9	7.4%
Education				
Primary	42	53.2%	52	43.0%
Koran	21	26.6%	33	27.3%
Secondary	13	16.5%	21	17.4%
Other	3	3.8%	15	12.4%
Occupation				
Farming	40	50.6%	80	66.1%
Civil Service	30	38.0%	30	24.8%
Trade/Other	9	11.4%	11	9.1%

Table 4 presents the number and percentage of respondents who indicated "International Radio' as the source of information on GM technology by personal and demographic categories. For most of the categories there is little difference between the respondents who identified international radio as the source of information and those who indicated another source of information. However, the respondents who indicated international radio as their information source were younger with 66% of those

respondents being younger than 40 years and only 53% of the respondents who indicated another information source being younger than 40. In addition, respondents who noted international radio as their information source were more likely to be employed in the civil service (38% of respondents) compared to those who identified another information source (25% of those respondents were employed in the civil service).

Conclusions and Suggestions for Further Research

Genetic transformation of cowpea with Bachilius Thurengius (Bt) genes has many advantages. Cowpea grain yields can potentially be doubled when pod bugs are controlled and a GM cowpea could result in significant increases in both consumer and producer welfare resulting from increased cowpea yields. However, consumer acceptance of GM technology is vital to the successful introduction of any products utilizing this technology. To date, little has been known about consumer acceptance of GM technology in Africa. The objective of this paper was to investigate the level of awareness of GM crops among consumers in Africa and to gain some insights on the factors affecting their acceptance of this technology.

This paper reported the results of a "person-on-the-street" survey of consumers in northern Nigeria in early 2003. From the survey conducted for this paper there is reason to believe that there is a high level of awareness of GM technology among African consumers. Almost 90% of the respondents in this study indicated that they were aware of GM technology. Furthermore, the results presented here suggest that consumer acceptance of GM technology will be an important issue with respect to the adoption of a GM cowpea. Only about 11% of the respondents indicated approval of GM technology.

Ethical concerns about GM technology and utilizing International Radio as a source of information were important factors in whether a consumer approved of GM technology. Individuals who were concerned about the ethical issues of GM technology were less likely to approve and individuals who identified International Radio as an information source were more likely to approve.

The results reported here must be considered preliminary. While the sample size was 200 the survey was conducted in one region of Africa, northern Nigeria. Further study that expands the sample size and sampling region is needed before definitive conclusions can be drawn. In spite of the preliminary nature of the results two important conclusions are apparent. First, policy makers and business people must pay attention to the ethical concerns that people have about GM technology since this is an important factor with respect to whether people approve or disapprove of GM technology. Secondly, international radio is listened to widely by all members of the population and represents an important vehicle for education.

References:

Bean/Cowpea CRSP, "The Dakar Symposium/Workshop on the Genetic Improvement of Cowpea," Jan. 8-12, 2001.

Economist.com. "GM Crops in Africa: Better dead than GM Fed." September 19, 2002. http://www.economist.com/science/displayStory.cfm?story_id=1337197 Accessed May 11, 2004.

Langyintuo, Augustine, J. Lowenberg-DeBoer, and Thomas C. Arndt, "Potential Impacts of the Proposed West African Monetary Zone on Cowpea Trade in West and Central Africa," AAEA Selected Paper, Montreal, 2003a.

Langyintuo, A., J. Lowenberg-DeBoer, M. Faye, D. Lambert, G. Ibro, B. Moussa, A. Kergna, S. Kushwaha and G. Ntoukam, "Cowpea Supply and Demand in West Africa". *Field Crops Research.* 82 (2003b) p. 215-231.