Food Security and Biotechnology in Africa

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MODULE 3: PUBLIC RESPONSE TO THE RISE IN BIOTECHNOLOGY

Unit 5: Dealing with public response in the context of African agriculture (4 hrs)

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Introduction

According to Johnson (2013), half of the world's labour force is now engaged in farming. Also, at the time of American in-dependence approximately 90 percent of their labour force was agricultural however, currently, only 3% is in farming. The great wealth of today's industrial nations and the remarkable improvements in the well-being of the people of the developing nations over the past half century have been made possible by the farm people who had a crucial role in this transformation of agriculture. Stakeholders include farmers, those who invented and produced farm machines, who developed new seeds, who discovered the nutritional requirements of plants, who learned how to extract nitrogen from the air, who developed the transport and communication systems that increasingly integrated farming into the rest of the economy, and who brought education to all levels of the rural community. The link between the level of agricultural growth and the wealth of nations /economic growth has long been recognized (Johnson, (2013 quoting Adam Smith). This is because when 99 percent of the labour force is used to produce food, there is little left for other forms of consumption: "But when by the improvement and cultivation of land the labour of one family can provide food for two, the labour of half the society becomes sufficient to provide food for the whole. The other half, therefore, or at least the greater part of them, can be employed in providing other things, or in satisfying the other wants and fancies of mankind" (Smith, 1937 p. 63). Wither the African farmer and productivity growth? Why are third world countries not able to feed themselves? Why is the yield of their crops poor than the other parts of the world?

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According to Schultz (1964), the productivity differences between farmers in the developed and underdeveloped countries were due to the technological constraints under which they operated; farmers in the developing countries were efficient and responded to economic incentives as did farmers everywhere. It is quite remarkable that millions of independent farmers have been so responsive to new and improved opportunities to save resources that they have had a higher rate of productivity change than the industrial sector. Farm people have benefited from research (much of it undertaken at public expense), from the supply of non-farm inputs, from improvements in infra-structure such as roads and communication, and in the industrial countries from a significant degree of protection.

Despite the contribution of agriculture to the economy of African countries, its level of development is abysmal, while its current yields remains the lowest in the world. Factors responsible for this poor agricultural status in Africa can be attributed to issues like climate and abiotic variables. African farmers, who are predominantly smallholders, make a living from small plots of family gardens, typically measuring 1/2 ha, on soils that have over the years become impoverished and in tropical environments prone to frequent drought, soil erosion and floods. Farm inputs, such as chemical fertilizers and pesticides, are prohibitively expensive and are therefore hardly ever used at the recommended rates (Nang'ayo et al., 2014).

Addressing these challenges call for a number of imperative actions that span macro-economic policy prescriptions and technological interventions, with the aim of ensuring the access of vulnerable rural populations to technologies that are able to catalyze adequate food production. For instance, some technological applications can certainly raise farmers' yields, reduce excessive use of pesticides and other agro-chemical inputs, increase the nutritive value of basic foods and contribute to the development of elite crops adapted to tolerate drought, salinity and low soil nutrients (Nang'ayo 2014). Access to these tools and products by African small-scale farmers will improve their livelihoods. It is believed by some authors that modern biotechnology, including the use of GE technology, offers the potential of raising agricultural productivity in developing countries, especially in those African countries that are currently reeling from the constraints outlined above. According to James (2012), the global adoption of biotech crops has progressively increased by nearly 100-fold since 1996 when GM crops first became available commercially, making modern biotechnology one of the most rapidly adopted technologies in history. Moreover, the estimated value of GM crop products in 2010 was conservatively put at US$ 150 billion, and in 2012 alone, a total of 17.3 million farmers in 28 countries grew biotech crops on an estimated 170 million hectares (James 2012). In spite of the above impressive account of GM crops in industrialized and developing countries, efforts to roll out GM products in African countries during the past decade have noted little progress due to the number of monumental challenges associated with national policies, legislation and public concerns about the safety. Farmers have embraced biotechnology because it makes them more efficient, protects or increases yields, and reduces their reliance on chemicals that, other things being equal they would prefer not to use. In-spite of the adoption rate quoted above with their evident benefits, and the fact that there is no unequivocal evidence of harm to our health and environment, there is intense controversy over their value and safety.

According to Prakash (2001) societal anxiety over the so called GM foods is understandable and it is fuelled by a variety of causes including consumer unfamiliarity, lack of reliable information on the current safeguards, negative opinion from the news media, opposition from the activist groups, growing mistrust of the industry and a general lack of awareness of how our food production system has evolved. The scientific community has neither adequately addressed public concerns about GM foods nor effectively communicated the value of this technology. Surely, societal acceptance is pivotal to the continued development and application of biotechnology in agriculture and food. From the onset, many breeders saw in the technology a complimentary role in achieving crop improvement. The strong trust of the American public in its regulatory agencies has fostered higher public acceptance of GM food in America than elsewhere. For 30 years, there has been broad agreement among plant scientists that use of recombinant DNA methods generally called gene splicing or genetic engineering creates no new or unique risks compared to conventional plant breeding. Long before the advent of GE, plant breeders routinely used conventional breeding methods to introduce the same kinds of new traits into crops/plants- including insect and disease resistance and herbicide tolerance that are now treated as unique when developed through biotechnology (Prakash, 2001). As a matter of fact, GE are methods more specific and precise, with breeders having more information about the traits they introduce into new varieties and that greater precision makes for easier testing of the new plant for environmental or health / safety / impacts.

Expediency of GM Adoption in Africa

Food security does not only depend on the availability of food but also its nutritional quality. As it is today, most rural African citizens generally rely on a monotonous staple diet. Since most plants are deficient in certain vitamins, minerals, and essential amino acids, a diet restricted to one major staple will tend to be nutritionally incomplete (Christou and Twyman, 2004). GE strategies have been used to tackle nutrient deficiencies with the prospect of nutritionally complete staple crops that could realistically address malnutrition globally. Also, any long term strategy to tackle poverty that is the origin of malnutrition in developing countries, must address the underlying problem of poverty and poor health by increasing the level of rural employment - based income through increased agricultural productivity (FAO, 2009). The production of crops with higher nutritional value would add to the yield improvement made possible by GE and would translate to a smaller proportion of the farmers output being needed for subsistence and more could be sold resulting in lower burden of disease caused by malnutrition.

Are GM Crops Risky to Health and Environment?

Concerns by various interest groups over crop biotechnology can be grouped into two classes; Concerns arising from personal beliefs, moral values, religious leanings, lifestyle preferences and methods of food production or from socioeconomic concerns about multinational companies that own the patents on many of the genes. Others do not just trust scientists. It is instructive to note that these concerns are not related to any risk of the GM crop. The other class of concerns relate to hazards identified as possible outcomes from growing GM crops. In as much as these concerns should not be waved aside, it does not appear very tidy to deny other of a technology they perceive as beneficial.

Although little doubts exist that GE technology can improve crop yields and the nutritional value of food, these benefits are rubbished by perceived risks to health and environment. The global area of GE crops has steadily increased over the years despite much public distrust and political controversies. There had been no evidence of any adverse health impact or environment. It is however, confusing to find other technologies with quantifiable risks being accepted with far less protests that the case with biotechnology. For example, greater risks and the controversy attached to near imperceptible risks of horizontal gene transfer from transgenic crops containing antibiotic resistance genes to pathogenic bacteria in the gut whereas the much more quantifiable risks of pesticide exposure is routinely neglected.

It may seem logical to express the concern ‘I do not know what am eating with GM foods’. However, it must be remembered that we never have that information with classical bred crops. With GM crops, at least we know what gene is being introduced, so we can test for predictable and even many unpredictable effects. In classical breeding practices, several genes with unknown functions are introduced with the risks that some may code for toxins or allergens-armaments that wild plants deploy to survive. Yet, we never tested conventionally bred varieties for any food safety and environmental hazards or to any regulatory oversight. There is a lot of politics in biotechnology.

Addressing concerns over long term health consequences of GM foods, it is also instructive that we never worried about such impacts when massive amount of new proteins were introduced into our foods from wild species or when unknown changes were created through mutation breeding. When new foods from exotic crops are introduced, we readily assimilate them into our diets and rarely if ever ask the same questions posed to GM foods. There is no such thing as safe food, and just as there is no zero risk in anything we do, we have to acknowledge the fact that trace levels of toxins, and carcinogens are present in everything we eat (Prakash, 2001).

Addressing the environmental concerns, we should reflect on our experience with traditional crop variety development. Via conventional breeding, we have continuously introduced genes for resistance to diseases and pests into all our crops. Traits such as stress tolerance and herbicide tolerance have also been introduced in many plants and the growth habits of every crop have been altered. The risk of crop gene flow to weedy relatives has always existed. It is comforting however, that no super weeds have developed following the advent of modern plant breeding although cases of plants becoming weedy or of weeds becoming more invasive due to gene transfer from crops may exist. Crop biodiversity is another issue threatening the overall outcome of biotechnology in agriculture. Even through conventional breeding, the popularity of high yielding varieties has already narrowed the genetic variation found in major crops. Biotechnology if strategically applied can reverse this through the recovery of older varieties that were discarded for lack of certain features like susceptibility to new pathogen, because modern gene transfer can restore such traits. Reflecting that corn is not native to America or even parts of Africa, it’s planting over the decades with its full gene compliment, have not caused significant ecological distortion, one wonders how introduction of corn with one single Bt gene has led to its environmental effects.

BIOTECHNOLOGY AND THE SEED SYSTEM

Another controversial transgenic technology has been described recently and has become known as "Terminator Technology" (Service, 1998; Crouch, 1998). This has raised substantial ethical concerns in that it provides a means of ensuring that seed cannot be saved at the end of one crop cycle for sowing at the following cycle. It is argued that this technology places the farmers at the mercy of the multinational companies that own biotech corporations. However, there was concerted effort by the International Maize and Wheat Improvement (CIMMYT) in co-operation with French scientists (ORSTOM) and the Mexican government to develop apomictic maize which would allow resource poor farmers to gain from the benefits of hybrid vigour and have the advantage of not having to buy new seed from year to year (Reeves, 1997). This fit has long been achieved.

Furthermore, ownership of genes and the need for patents is a further area for ethical debate against crop biotechnology. Luther Burbank, a plant breeder in the 1920s, questioned why years of dedicated research and development work in plant breeding did not result in any material benefit for the breeder. Patents and plant breeders' rights have largely corrected for this unfairness, but what of transgenes? Uncountable numbers of exotic genes have entered crop varieties through conventional crossing programmes, and it would be impossible to trace them back to their origins and compensate the owners. Conscious efforts should be made to compensate inventors but public funding of researches is also to be encouraged so as to spread the financial responsibility of projects.

IMPROVEMENT IN COMMUNICATION CHANNELS AND MORE OPEN DEBATE

In efforts to move towards a more informed dialogue on GE foods and crops, policy makers and biotechnology advocates need to look beyond the public opinion pools. Communicating the perceived/potential benefits of agricultural biotechnology must also be constrained by reality. It is imperative not to oversell the technology by focusing on the benefits that are largely hypothetical especially consumer benefits when the vast majority of the accrued benefits have been to the farmers and multinational companies that patented the genes. There is the need for evidence based open debate on GMOs for every party to reach at the heart of others and decision taken. Currently, what exist is the hecterages of GM crops planted year by year, countries where they were planted and the accrued benefits. Information regarding the results of the researches on GM crops should enjoy massive and widespread dissemination and discussion. It is advocated that farmers should be involved in the early researches on GM crops and the related standard setting processes and structures. The mass media represent the main sources of information for consumers on all nutrition and food safety issues including biotechnology. Public information sources such as the government agencies and scientists are not popular sources of information about food. Thus, it will be commendable if an inter agency or agency- media collaboration is established to enable the media get properly informed in matter such as biotechnology.

Moreover, in considering the benefit of the technology, the benefit cost analysis should also consider the cost of non adoption. Trade on GMOs should be properly monitored. It was discovered that lack of information on GMOs was found to cause uncertainty about the risks and benefits of GM foods and hence, negative evaluation of the whole technology. In past, elite groups in the scientific community have underestimated the ability of non-experts to understand scientific uncertainties associated with technical risk estimates (Frewer, 2004). In short, it was assumed that providing lay people with this information would have very negative effects on the public perceptions and related attitudes. Now, providing the public with objective information that would enable the consumers to rationalize, weigh risks against benefits, proceed to positive attitude and act on this in an informed purchase decision will be a solid rock upon which to build trust on GM crops and foods. Furthermore, societal values are likely to contribute to consumer acceptance of GM foods and this need to be included in the debate about regulation of products and associated communication strategy. Some of these cultural allegiances could be religious or just cultural values for group identity. Communication strategies that observe these non tangible human feelings will be useful in communicating biotechnology to the society.

Elite models of control and information dissemination driven by science and technology rather than public need are probably of limited use in the short to medium future. Simply providing the public with information in whatever form does not work. It is imperative that the organization of science, its methods and disciplinary diversity, multiple institutional settings in which it is conducted makes it remarkably a potent catalyst for political dispute. There is a current anxiety over the fear of multinational corporations controlling the global food system in the guise of fighting global food insecurity. Moreover, there is doubt in the mind of the people over the consequences of adopting GE crops that have in its repertoire mainly non native crops with the potential for loss of food variety and local /cultural food types. Some of these fears should be addressed in public oriented fora with wide publicity in the media and language of the people.

Finally, as available policy option for addressing the controversy over GM crops are sufficiently broad or appealing to attract a political consensus, let the involvement of scientists be limited to scientific issues to avoid over ‘scientization’ which may undermine the social value of science at the long run. The intersection of key value chain stakeholders, consumers, policy makers and scientists suggest an interdisciplinary approach to the conceptualization of GMOs. The ability of these various stakeholders to come together to address the controversy will enable humanity reap all the promises of the technology.

REGULATION OF GENETIC ENGINEERING TECHNOLOGY

Without exception biotech companies have participated in a “voluntary consultation” with the regulatory agencies-FDA before bringing a new biotech food to market. During these consultations, companies are expected to provide FDA with data on the agronomic and quality attributes of the plant, genetic analysis of the modification and stability of expected genomic traits, evaluation of the safety of newly introduced proteins (*e.g.*, for allergenicity), and chemical analyses of important toxicants and nutrients. When all safety and regulatory issues have been resolved, FDA provides written notification to the company. Thus, thorough and methodical approaches are followed to ensure that no new GM crops/food should pose any undue risk to either to human health or environment. Also, tests are carried to ensure that the new product is substantially equivalent to its non genetic counterpart.

The principle of “substantial equivalence” has been adopted by many national and international governmental and scientific organizations as a way to assess the risk of biotech food products. This principle holds that the risks of a new food variety produced using biotechnology are the same as those for an existing variety with essentially the same characteristics. It therefore establishes existing varieties, the vast majority of which have a history of safe use, as the standard for safety. Indeed, there needs to be greater recognition that regulations that discriminate against the products of biotechnology, based on their method of production, create disincentives for researchers and plant developers. Unwarranted regulations also will have an impact on the academic community engaged in biotechnology research. It is already happening in Europe, where researchers reportedly either are leaving the field or are seeking opportunities elsewhere. If the United States is to keep its lead in this area, it is important to maintain a top-notch research capacity. Tangling up researchers in red tape will waste research dollars and stall progress. Ironically, increasing the regulatory burdens on agricultural biotechnology, which many biotechnology critics advocate, would succeed only in giving a distinct competitive advantage to large companies able to pay the added costs of regulation. This is hardly the way to promote competition or to foster the spread of this technology to developing countries.

The biotechnology industry also has been criticized for being concentrated in the hands of a few large multinational companies based in economically-advanced countries. This concern also is misplaced. Developments in agricultural biotechnology represents a technological revolution comparable to those that gave birth to the power, transportation, and computer industries, each of which has conferred tremendous benefits to consumers. It is expected that as agricultural biotechnology becomes more industrialized, increasing competition will lead to consolidation within the industry and adoption of the technology by consumers worldwide, similar to what has happened in these other industries. But consolidation will not lead to monopoly, as entrepreneurs will develop niche markets for specialty products, similar to those that have developed in other mature industries

POLICY PERSPECTIVES AND CHALLENGES ON GM CROPS IN AFRICA

Although the application of GM technology is hailed as a major success in many parts of the world, there are persistent concerns about the safety and ethical and trade-related aspects of GM products to consumers and the environment, necessitating the need for their regulation. In formulating a national regulatory policy for GM technology and GM food, countries often take into consideration both the opportunities presented by the GM crops and the potential risks associated with them. In Africa there are 55 nation states with diverse political persuasions, trade considerations and environmental interests. As such, Africa is characterized by a mosaic of national policy positions on GM technology, ranging from those which can be considered to be permissive to those which are more pre-cautionary and ultimately to those which are prohibitive. Many African countries are grappling with development of policies that will guide their adoption of biotechnology including training of personnel and infra-structure. According to Jaffe (2004), the purpose of a national biosafety regulatory system is to scientifically assess the safety of genetically engineered (GE) organisms to humans and the environment, manage any potential risks and authorize the development and marketing of safe GE organisms and their products.

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