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Biofortified Foods and Crops in West Africa: Mali and Burkina Faso

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Micronutrient deficiencies, especially deficiencies of Vitamin A, iron, and zinc, are widespread in Burkina Faso and Mali and contribute to high mortality rates. Biofortification of the major food staple crops consumed in these countries has considerable potential to increase the micronutrient status of vulnerable populations if the challenges of seed distribution can be overcome. This article examines the political landscape for the introduction of biofortified crops, including those developed through genetic engineering. Based on the experience with current strategies of food fortification, it is shown that the political environment for biofortified crops developed through conventional breeding is highly favorable. Analyzing the current state of biosafety legislation and the political debates regarding genetically modified (GM) crops in the region, where the current focus is on Bt cotton, this study concludes that the political environment for introducing GM biofortified food crops is at present not conducive. Strategies that prioritize the introduction of GM crops may jeopardize the favorable environment to welcome non-GM biofortified crops.

Key words: biofortification, genetically modified crops, micronutrient deficiencies, Burkina Faso, Mali.

Introduction

West African countries account for some of the most nutritionally at-risk and food-insecure populations in the world. Biofortification of crops offers a considerable potential to address the micro-nutrient deficiency problems in this region. This case study describes the political landscape with regard to the introduction of biofortified crops, including those developed through genetic engineering, in Burkina Faso and Mali. The two countries are similar with regard to agricultural production, predominant diets, and associated micro-nutrient problems, but they differ with regard to the political situation for genetically modified crops (Linacre et al., 2007). While Burkina Faso is the first country in West Africa to enact a biosafety law and start confined field trials of Bt cotton, in Mali the political opposition against GM crops is substantial and has, so far, prevented a biosafety law from being passed in Parliament and field trials from being approved. Both countries participate in efforts to bring regional biosafety legislation in West Africa. This case study is based on a review of the available literature, including project documents and information published on websites, and on a series of interviews held by the authors with experts and stakeholders in Burkina Faso and Mali in the period from July to September 2006.

Nutritional Situation: Prospects for Biofortified Crops

Burkina Faso and Mali are among the poorest countries in the world. Almost half of the population in Burkina Faso and more than half of the population in Mali live below the international poverty line of US$1 per day (World Bank, 2004). Agricultural production is subject to high climate risk as well as locust attacks. Production is dominated by cereals, mostly sorghum and millet, resulting in diets that are mainly based on these crops. According to the Demographic and Health Survey conducted in Burkina Faso in 2003 (Institut National de la Statistique et de la Démographie [INSD], 2004), 42% of the children in rural areas and 20% of the children in urban areas suffer from malnutrition. Thirty-nine percent of the children suffer from stunting (reduced height for age, an indicator of chronic malnutrition), and 19% from wasting (reduced weight for height, an indicator for temporary malnutrition). The Demographic and Health Survey conducted in Mali in 2001 (Cellule de Planification et de Statistique du Ministère de la Santé [CPS/MS] & Direction Nationale de la Statistique et l'Informatique [DNSI], 2002) shows that 38% of the children there were subject to stunting, and 11% were subject to wasting. Table 1 shows the estimated incidence of major micronutrient deficiencies, which include Vitamin A, iron, and zinc. There are also indications of iodine deficiencies.

Table 1. Estimated prevalence (%) of micro-nutrient deficiencies.

	Burkina Faso	Mali
Vitamin A deficiency among pre-school children	46	47
Iron deficiency anemia among pre-school children	83	77
Anemia among pregnant women	68	63
Population at risk of inadequate zinc intake	13	11

Note. Data from CPS/MS and DNSI (2002); HarvestPlus (2006a); HarvestPlus (2006b); and INSD (2004).

The prevalence of micro-nutrient deficiencies indicates that Burkina Faso and Mali, like other West African countries located in the semi-arid and arid zones, would benefit considerably from a biofortification of the cereals that form the major staple food crops: sorghum and millet, and—to a lesser extent—rice and maize. The biofortification of the leguminous plants would also be beneficial, especially for the (sedentary) populations of these countries for whom these crops are particularly important. There is also a potential for the biofortification of roots and tubers.[1] In principle, genetic engineering would make it possible to increase the density of multiple micro-nutrients in a shorter period of time, but the time required for regulatory approval needs to be taken into account. Moreover, some biofortified crops developed through conventional breeding that are important for the region are either already available (orange-fleshed sweet potatoes) or rather close to release (millet and beans), which is not the case for GM-biofortified crops. In view of the comparatively low urbanization and school enrollment rates in the two countries (World Bank, 2004), biofortified crops have a higher chance to reach a large share of the population than other strategies of food fortification, if the challenge of seed distribution can be met. Control of Vitamin A deficiency has a considerable potential to reduce under-5 mortality of children (Aguayo & Baker, 2005), and control of iron deficiency will contribute significantly to the reduction of maternal mortality.

Current Strategies to Deal with Micronutrient Deficiencies

Improving Nutritional Knowledge and Fortification of Food

Policies to combat micro-nutrient deficiencies in both countries include promoting food supplementation with locally available resources, promoting the use of iodized salt, and providing Vitamin A supplements. Promoting breast feeding and improving the nutritional knowledge of mothers have also been important strategies. Both countries have developed specific policies. Burkina Faso has a National Plan of Action for Nutrition, and Mali a National Program for Food Fortification.

In both Burkina Faso and Mali, enriching infant porridge with local products has been promoted through the public health system, such as mother-and-child clinics. Likewise, pre-prepared flours such as Misola (millet, soya, and peanut) have been promoted. In Burkina Faso, this approach was supported in the beginning of the 1990s by the Netherlands Development Organisation and the General Directorate for International Co-operation. Another example of fortification activities is a pilot project in the Mopti region of Mali, where a micro-nutrient pre-mix is distributed to local mills, which are used by the rural population to get their maize milled. Information on the outreach and effectiveness of these programs remains limited (Tuinsma, 2006).

Among the international non-governmental organizations, Helen Keller International (HKI) has been playing a major role in combating micro-nutrient deficiencies in both countries. In Burkina Faso, HKI has supported the National Plan of Action for Nutrition. Working with government support, HKI completed a study in 2000 to evaluate the most adequate vehicle for fortification with Vitamin A in Burkina Faso, which was identified to be cottonseed oil. HKI also serves as a coordinating body for the National Fortification Committee. Since 2001, HKI has promoted the increased production and consumption of Vitamin A-rich foods through school and community gardens in the region of Fada, working with women's groups and village animators to reinforce nutrition education lessons learned in the primary schools and brought home by the students.

In Mali, HKI-Mali has concentrated on Vitamin A deficiency, anemia, and iodine deficiency disorders. In collaboration with its partners, HKI-Mali has been providing technical assistance to the Nutrition Division of the National Health Directorate in Mali, among others, to organize weeks for nutrition activities. HKI-Mali has

1. *In the West African countries where roots and tubers are not the lead staple crops, their relevance tends to be significantly underestimated in official agricultural statistics (S. Baker, personal communication, 10/13/06).*

also been providing key technical assistance to implement the National Program for Food Fortification, with a project for Vitamin A-fortified cotton oil underway. The organization is also promoting the use of media, including radio (e.g., radio-listening clubs) and internet, to increase people's knowledge and awareness on health. In both countries, HKI is a leader in supporting the twice-yearly distribution of Vitamin A capsules for children (6-59 months) in combination with other child-survival interventions.

Two other international organizations are also active in the area. The Micronutrient Initiative (MI), a Canada-based NGO, supports the production and marketing of nutrient-rich red palm oil in Burkina Faso. In Mali, the Global Alliance for Improved Nutrition (GAIN) provides competitive grants for the fortification of cotton-seed oil with Vitamin A. Local NGOs are engaged in activities to overcome micro-nutrient deficiencies, too. For example, in Mali, the NGO AMPE (Association Malienne pour la Protection de l'Environnement—Mali Association for Environmental Protection) has a nutrition program that promotes vegetable gardening.

Crop Breeding

The International Institute for Tropical Agriculture (IITA) is working with HarvestPlus on the biofortification of maize, focusing on provitamin A, but iron and zinc are also being considered. For the dissemination of biofortified maize, it will be useful to draw on the positive experience with Quality Protein Maize (QPM), one in which the West and Central Africa Maize Network (WECEMAN) has played an important role.[2] It proved to be useful not only to promote exchange among crop breeders from the national agricultural research systems in the region, but also to develop and implement a recommendation for the dissemination of QPM. Among the crops to be promoted in the next phase of HarvestPlus, millet, sorghum, cowpeas, and groundnuts will be of particular relevance for the Sahelian countries of West Africa. The International Crops Research for the Semi-Arid Tropics (ICRISAT) has already launched a research program on the biofortification groundnuts in 2005, focusing on provitamin A.

National research organizations in Mali and Burkina Faso are also engaged in biofortification activities. The McKnight Fund and HKI-Burkina Faso have been collaborating in a pilot program to improve the Vitamin A intakes of women and children through the production and consumption of orange-fleshed sweet potatoes ("Eat Orange!" program). In Mali, the McKnight Foundation has supported a research program on using local diversity for enhancing nutrition, especially iron and zinc bioavailability in sorghum and pearl millet. National agricultural research institutes, such as the Institut d'Economie Rurale of Mali, have also been engaged in other strategies to deal with micro-nutrient deficiencies, such as supplementation.

Policy Initiatives at the Regional Level

The West African Health Organization (WAHO), the official health organization of ECOWAS (Economic Community of West African States) and partner organizations organized two private- and public-sector dialogues on food fortification in West Africa in 2002 and 2006. The Assembly of Health Ministers of WAHO adopted a recommendation for mandatory fortification of cooking oil and wheat flour in ECOWAS countries during their meeting in Abuja in July 2006. While this recommendation is not binding, there is also an initiative of the West African Economic and Monetary Union (WAEMU), which covers the French-speaking West African countries, to make the fortification of cooking oil mandatory.

State of Regulating Genetically Modified Crops

The state of regulatory systems for GM crops is an important condition for the introduction of biofortified crops developed through genetic engineering. Both Burkina Faso and Mali have ratified the Cartagena Biosafety Protocol and completed a National Biosafety Framework in May 2005 under the project "Development of National Biosafety Frameworks" of the United Nations Environment Program and the Global Environmental Facility (UNEP-GEF). The project promoted a country-driven process with broad stakeholder consultation.

Burkina Faso has passed a biosafety law, and it is the only country in West Africa that has taken this step thus far. Law No 005-2006, entitled "Pertaining to the security system as regards to biotechnology in Burkina Faso," was passed in early 2006 by the National Assembly. The law establishes a National Biosafety Agency to be in charge of biosafety regulation with the help of several different governmental and non-governmental advisory committees. Burkina Faso is also the only country in the region that has started confined field trials of Bt cotton.

2. *M. Abebe, personal communication (9/21/06).*

In Mali, a draft law has been developed together with the National Biosafety Framework. In view of political obstacles to table this law in the National Assembly, the Ministry of Agriculture drafted a decree to allow for the approval of confined field trials without the biosafety law being enacted. However, this decree was not passed by the Cabinet either. It was only in February 2007—shortly before the Presidential elections—that the Cabinet passed the draft law so that it could be submitted to the Assembly. Elections for the National Assembly were held in July 2007 and the new Assembly was expected to debate the draft law in Fall 2007. At the time of submitting this article in November 2007, the law still had not been passed.

At the regional level, four organizations promote initiatives for establishing a regional system for biosafety regulation in West Africa: the Permanent Inter-State Committee on Drought Control (CILSS), the Economic Community of West African States (ECOWAS), the West African Economic and Monetary Union (WAEMU), and the Central and West African Council for Agricultural Research and Development (CORAF). Since Burkina Faso and Mali are members of all these organizations, they are involved in all four initiatives. The most advanced initiative thus far is "The Framework Convention Introducing a Common Biosafety Regulation for the Prevention of Biotechnological Risks in the CILSS Countries." The documents to establish this convention have been prepared by the Institute du Sahel (INSAH), one of the CILSS institutions. The texts were approved by the CILSS Council of Ministers in March 2006, but the member countries need to ratify the Convention and pass a respective national legislation. This process is not expected to be completed before 2008. According to this convention, the authority to approve field trials and commercial releases will rest with national biosafety authorities, but a regional body yet to be established will provide technical expertise and guidance (Linacre et al., 2007).

Another initiative, which covers most countries in West Africa, and also some Central African countries, is the CORAF's Biotechnology and Biosafety Program. Since CORAF is the technical arm of ECOWAS, this initiative was adopted by ECOWAS. At a conference of Ministers of Agriculture in West Africa, under aegis of ECOWAS held in Bamako, Mali, in 2005, it was decided to establish a regional framework for biosafety regulation and to integrate the initiatives of CILSS, CORAF, and ECOWAS. Meanwhile, a fourth initiative has emerged: WAEMU, the regional community comprising eight francophone countries in West Africa, including Burkina Faso and Mali, is in the process of developing a regional system of biosafety regulation, envisaging the support of GEF and the World Bank. Processes to harmonize these initiatives are still ongoing.

The Political Landscape with Regard to Biofortified Crops

This chapter describes the different political actors in Burkina Faso, Mali, and at the regional level and assesses their positions and strategies with regard to biofortified crops, including those derived from genetic engineering.

Research Organizations

The main National Agricultural Research Institute (NARI) in Burkina Faso is INERA (Institute of the Environment and Agricultural Research). INERA is organized under the National Center of Scientific and Technological Research (CNRST), which falls under the jurisdiction of the Ministry of Secondary and Higher Education and Scientific Research. INERA has six research stations and operates, among others, research programs on millet, sorghum, and maize. Another institute under CNRST is IRSAT, the Institute of Applied Science and Technology. IRSAT's Food Technology Department currently undertakes testing of Vitamin A-fortified oil for the World Food Program. In Mali, the main NARI is IER (Institute of the Rural Economy), which falls under the jurisdiction of the Ministry of Agriculture, Livestock, and Fisheries. IER is divided in eight research centers, with research programs on millet, sorghum, cowpea varieties, as well as a food technology lab, which is working on fortification and supplementation of food. Crop and nutrition-related research is also conducted at the University of Bamako in Mali and the University of Ouagadougou and the Polytechnical University of Bobo-Dioulasso in Burkina Faso.

In both countries, the research organizations can be considered as important actors in biofortification activities as they are already involved in other fortification strategies. The crop-breeding programs in the two countries have mainly focused on yield increase and disease and drought tolerance, but there has also been experience with QPM. One can expect that the agricultural research centers will be very interested in including a focus of micronutrients into their breeding programs, especially if they can get access to the resources that will allow them to do so. HKI noted considerable enthu-

siasm for biofortification among researchers once they were familiarized with the concept.

One can also expect that the agricultural research institutions will promote biofortified crops developed by genetic engineering because in both countries they have been very interested in conducting research on GM cotton (Linacre et al., 2007). Monsanto contacted Burkina Faso in 1999 to discuss the potential of experimenting with Bt cotton. Confined field trials with Bt cotton, carried out in collaboration with INERA, began in 2003 and have continued since then. In conducting these experiments, Monsanto has collaborated with Syngenta and with the two major cotton industry enterprises SOFITEX and Faso Cotton. Since cotton production is highly vertically integrated in both countries, the cotton industry plays a major role in seed production and supply. In Mali, the agricultural research institutions have been assured USAID funding to conduct field tests for Bt cotton, but, as indicated above, the legislation required to conduct such trials has not been put in place.

The interviews held in both countries suggest the agricultural research community has been an important political advocate for GM crops and for passing legislation that makes at least field trials possible. The major political strategy seems to be lobbying with both the Ministries of Agriculture and the Ministries of Science and Technology. Agricultural and food scientists have been actively involved in the consultative processes of developing the National Biosafety Frameworks, and they serve on the technical committees established under these frameworks. Scientists have also used the media and interactions with farmers' organizations and NGOs to promote GM crops. It appears to be a commonly held view among natural scientists that African countries will fall further behind, and remain dependent on industrialized countries, if they do not develop their own capacity for biotechnology research. However, there are members in the scientific community, in particular environmental scientists, who promote a more precautionary approach to biotechnology.

The two major regional research organizations in West Africa, INSAH and CORAF, can also be considered as important actors with regard to promotion of both conventional and GM biofortified crops. Both organizations have played an active role in the establishment of a regional biosafety regulation. As the example of the QPM shows, crop-specific regional networks can also play an important role in scaling-up research activities across different West African countries. One needs to take into account, however, that all activities at the regional level have been rather dependent on donor funding. USAID has played an important role in this regard.

Governments, Ministries, and Agencies and Parliaments

In both countries, the four most important ministries with regard to biofortification are the Ministries of Agriculture, Health, Science and Technology, and Environment. Ministries of Agriculture and of Science and Technology are in charge of agricultural and food research. Interviews with members of these ministries suggest that they emphasize the advantages in genetically modified crop production. With regard to Bt cotton, they expect benefits for the farmers as well as for the competitiveness of the cotton industry. The fact that Burkina Faso has started field trials with Bt cotton has induced a sense that countries need to follow suit to stay competitive. One can, however, observe some problems of inter-ministerial coordination, especially between the Ministries of Agriculture and Environment regarding biosafety regulation in both countries. These problems are exaggerated by donor activities on biosafety, since some donors tend to work with the Ministry of Agriculture, while others work with the Ministry of Environment.

In both countries, the Ministry of Environment plays the leading role in biosafety regulation. In Burkina Faso, the National Biosafety Agency, which approves applications for field trials and commercial releases, is housed in the Ministry of Environment, even though this affiliation is not specified in the Biosafety Law. In Mali, it is also envisaged that the Ministry of Environment will play the key role in biosafety regulation. Interviews with members of the National Biosafety Agency in Burkina Faso suggest that the agency has adopted a rather promotional approach to biotechnology. The agency is playing a leading role in promoting a regional system of biosafety regulation at the WAEMU level. Interviews with members concerned with biotechnology in the Ministry of Environment in Mali indicate that the Ministry takes a balanced rather than a preventive position on GM crops.

For the promotion of biofortified crops, the Ministry of Health is obviously also is a major actor. There are several opportunities for inter-ministerial collaboration between the Ministries of Health and Agriculture. An important opportunity can be seen in using the agricultural extension service and the existing nutrition education activities jointly to promote biofortified crops. One can assume that the Ministry of Health will in any case

be an important actor in promoting biofortified crops developed through conventional breeding. In the case of GM biofortification, the Ministry of Health will play an important role in the approval process, especially with regard to food safety assessments, a dimension of regulation that has received limited attention thus far.

An important potential actor with regard to biofortified crops are the Parliaments (National Assemblies) since they represent local constituencies and they ultimately have to pass any legislation in this regard. The study showed that assembly members often lack access to relevant information since their access to the internet is limited, and they are frequently bypassed by information activities of donors and national, as well as international, research institutes. An interviewed member of the National Assembly in Mali, for example, reported considerable difficulties in getting access to reliable information on the potential benefits and risks of Bt cotton when preparing a debate in the National Assembly on the topic.[3] Against this background, efforts to promote biofortified crops may benefit from paying particular attention to working with parliamentarians.

Farmers' Organizations

Farmers, including smallholders, in Mali and Burkina Faso, as well as in other West African countries, are comparatively well-organized and play a role as political actors. This can be attributed to three factors: the vertically integrated structure of the cotton industry in West Africa in which a large share of small-holder farmers are involved, government efforts to create Agricultural Chambers (Chambres d'Agriculture) and other types of producer organizations, and the process of democratization, which created incentives for independent farmers' organizations to emerge and lobby for government support to smallholder agriculture.

In Burkina Faso, the Fédération Nationale des Organisations Paysannes (FENOP) was established at a conference of peasant organizations in 1994 and became formalized in 1996. FENOP was also one of the founders of ROPPA (Reseau des Organisations Paysannes et de Producteurs Agricoles de L'Afrique de L'Ouest), a regional farmers' organization covering the WAEMU countries. The Confédération des Paysannes du Faso (CPF) emerged in 2002 with assistance from the government. Because the CPF concentrates on promoting export, commodity-oriented agriculture, which contrasts with FENOP's focus on smallholder family farms, FENOP did not join the CPF. Instead, it transformed itself into a non-governmental organization (NGO) that today works with around 250 peasant organizations focused on cereal, fruit, and vegetable production. CPF consists of five major producer federations: the Fédération des Eleveurs du Burkina (FEB), Féderation Professionnels Agricoles du Faso (FEPAB), Fédération Nationale des Jeunes Professionnels Agricoles du Faso (FNJPAF), Fédération Nationale des Femmes Rurales du Burkina (FENARFERB), and the Union Nationale des Producteurs de Coton du Burkina (UNPCB). The cotton producers' organization (UNPCB) is widely considered to be the strongest of these organizations. The national Chambre d'Agriculture was established by law in 2003. It is a public organization intended to facilitate interaction between farmers and the state on agricultural policies. All Burkinabè who work within the agricultural sector are automatically members of the Chambre.

Mali has an umbrella organization of farmers' organizations, the Coordination Nationale des Organisation Paysannes du Mali (CNOP), which is also a member of ROPPA. CNOP's members include the Association des Organisations Professionnelles Paysannes (AOPP), Association des pêcheurs résidents du Mali (APRAM), L'APROFA (Association pour la Promotion des Filières Agricoles), L'UNCPM (Union Nationale des Coopératives de Planteurs et Maraîchers), La FEBEVIM (Fédération Nationale de la Filière Bétail et Viande), La FENAFER (Fédération Nationale des Femmes Rurales), La FNJR (Fédération Nationale des Jeunes Ruraux), Le CNU (Comité National des Utilisateurs des Résultats de la Recherche), Le Collège des Syndicats Paysans, Plate Forme Paysanne, and La FOPB (Fédération des Organisations Productrices de Banane). Mali also has a Chambre d'Agriculture. An important member of CNOP is AOPP, which—similar to FENOP in Burkina Faso—emphasizes smallholder family farms. Like FENOP, AOPP is itself an umbrella organization. It was formed in 1995 by 22 farmers' organizations and had 170 member organizations in 2005. According to their representatives, AOPP represents approximately 1 million families.[4]

One can assume that the farmers' organizations are interested in biofortified crops, as family farmers may be concerned about their families' health situation. In particular, the rural women's organizations could

3. *Member of National Assembly of Mali, personal communication (June 11, 2006).*

4. *Representative from AOPP, personal communication (July 12, 2006).*

become important actors in strategies to introduce biofortified crops. HKI's experience in working with farmers and using a women-centered approaches for the introduction of orange-fleshed sweet potatoes in Burkina Faso has been very positive.

However, it is also important to take into account that the positions of the farmers' organizations on GM crops differ. In Burkina Faso, FENOP (the organization focusing on smallholder agriculture) and FENAFERB (the women's organization), expressed a rather neutral position regarding GM crops in the interviews conducted for this study. They noted that while precautions are necessary, they favor any developments that will increase revenues for peasants and improve women's lives.[5] For UNPCB (the cotton farmers' organization), whose members are already worried about the declining price of cotton, there is a concern about whether the savings from decreased pesticide use will be negated by the cost of continually re-buying Bt seeds.

Mali's smallholder-oriented farmers' organization, AOPP, in contrast, takes a rather explicit position against Bt cotton.[6] The interviewed representative expressed particular concerns about the potential domination by multi-national companies, which may even provoke unrest in rural areas. He indicated that GM technologies that are produced by local research institutes without involvement of international companies would be more acceptable. AOPP also takes a rather critical view on the role of the farmers' organizations in Burkina Faso and their position on GM crops. According to AOPP, the farmers' organizations in Burkina Faso are not really independent from the government, as Burkina Faso is, according to their assessment, less democratic than other French-speaking West African countries. AOPP considers the plans of the World Bank to support a regional regulatory system at the WAEMU level as an effort to impose GM crops on West African countries, such as Mali, that would not otherwise approve this technology in view of civil society concerns.

The prospects for introducing GM biofortified crops in Burkina Faso and Mali, and West Africa more generally, may depend to a considerable extent on how the situation regarding Bt cotton develops. If the farmers do not experience benefits from this technology after it is introduced, they may not be very open to experimenting with GM food crops. The position of AOPP also indicates that GM biofortified crops that are produced in the public research system may have better prospects of avoiding political resistance.

As indicated above, the major umbrella farmers' organizations of Burkina Faso and Mali are members of the regional farmer's organization ROPPA. In view of their wide membership, ROPPA can be expected to play an important role in the political landscape for biofortified crops in the region. According to the interviews held for this study, ROPPA has a skeptical position towards GM crops, even though it is not principally opposed to the technology. ROPPA rather emphasizes the need for farmers to benefit from it.[7] ROPPA also expressed concern over how biotechnology will be transferred to small farmers, which they see as an important issue if poverty reduction is the ultimate goal of biotechnology adoption. ROPPA highlighted the financial gamble for smallholders, noting that if the technology is a failure, only the farmers lose, but if it is a success, multinationals present the results at international conferences.

Consumers' Organizations

Both Burkina Faso and Mali have a Consumer Organization (Association des Consommateurs). The president of the Consumer Organization in Mali was interviewed for this study. This organization has several hundred members, who are mostly urban-based. The organization is well-connected at the international level, as it is a member of "Consumers International"[8] as well as a regional network of consumers' organizations. Considering the widespread problems of malnutrition, nutrition is a top priority for the Consumer Organization of Mali. Hence, the organization could be considered as an important actor for the promotion of biofortified crops. However, this applies only to biofortified crops from conventional breeding. The organization has an explicit position against genetically modified food. This is also the position of Consumers International, which runs the campaign "Consumers say no to GMOs." This campaign demands the labeling of GM food.

NGOs

In both Burkina Faso and Mali, national NGOs play an important role both in conducting development activi-

5. *Representatives from FENOP (July 6, 2006) and FENAFERB (July 7, 2006), personal communication.*
6. *Representative from AOPP, personal communication (July 12, 2006).*
7. *Members of ROPPA, personal communication (July 5, 2006).*
8. *http://www.consumersinternational.org.*

ties and in engaging in advocacy. NGOs are involved in nutrition-related activities, and those NGOs can be important actors with regard to biofortified crops. These NGOs are not necessarily opposed to GM crops, even though their opinions differ. For example, the nutrition program manager of AMPE (Association Malienne pour la Protection de l'Environnement) expressed the opinion "if GMO is the right solution to the issue, why not?"[9]

Among the international NGOs, HKI is a leading actor in the political landscape for biofortified crops, as the organization has substantial experience in this field, including experience in working with multiple stakeholders and with policy-makers. Other international organizations, such as the McKnight Foundation, the Micronutrient Initiative, and GAIN are important actors as well. International environmental NGOs could play a role as potential opponents of GM biofortified crops. For example, a group of international NGOs, including the African Center for Biosafety, the ETC Group, and GRAIN, issued a statement that condemns the planned World Bank biosafety project with WAEMU and a similar regional biosafety project in Latin America as an effort to "undermine public debate and aggressively drive GM crops into the heart of peasant agriculture. The two projects…will hasten the spread of GM crops into farmer seed systems and even into certain centers of origin" (African Centre for Biosafety, ETC Group, GRAIN, & RALLT, 2006, p1).

Food Industry

The food industry has been involved in private-public partnership dialogues at the ECOWAS level and in ongoing fortification strategies, such as fortification of cooking oil, and sale of vitamin-enriched milk. It can be expected that the food industry in the formal sector has a strong interest in marketing biofortified food derived from conventional breeding, as this food will have an additional advantage for consumers. The experience of HKI in working with the food industry on conventional fortification, including the envisaged mandatory fortification of cooking oil, has been very positive. It is less clear what the position of the food industry will be regarding biofortified products developed through genetic engineering. Both the Biosafety Law in Burkina Faso and the draft law in Mali make labeling of GM products mandatory. In view of the need to label products from GM biofortified crops, international and national food companies may be concerned about NGO campaigns if the food companies place GM products on their shelves.

Considering the poverty status of both countries and the comparatively small share of the urban population, a considerable share of food crops in both countries are sold through traditional markets and traders rather than the food industry of the formal sector. Hence, special communication efforts may be necessary to reach the informal food marketing and trading channels, as they could play an important role in promoting the consumption of biofortified crops.

Conclusions: Strategies for Introducing Biofortification

This case study shows that one can expect a very favorable climate for biofortified crops developed through conventional breeding in Burkina Faso and Mali, which may also be the case more generally in West Africa. The experience with conventional fortification strategies in the region has shown that major stakeholders are positive and even enthusiastic about efforts to reduce micronutrient deficiencies, which are a serious problem in the region. The spectrum of organizations to work with on food fortification is rather broad in West Africa. A distinctive advantage of the region is the fact that small farmers, rural women, and consumers are comparatively well organized. Thus, they can play an important role for the promotion of biofortified crops in the region. This is important because—unlike in the case of cotton—there are hardly any formal seed distribution systems for food staple crops. The active role of regional organizations may also have important advantages for an efficient and rapid scaling up of experiences with biofortification gained in pilot countries.

In contrast to the case of biofortified crops developed through conventional breeding, the political climate for the introduction of biofortified crops developed through genetic engineering is currently not very favorable. This is mainly due to the intensive political controversy about GM crops, which has evolved in the region around Bt cotton in West Africa. In view of this fact, it appears an appropriate strategy to promote biofortified crops developed by conventional breeding first. This would avoid jeopardizing the currently positive environment for introducing non-GM biofortified crops. Demonstrating the advantages of non-GM biofortified crops may improve the prospects to move to biofortified crops developed by genetic engineering at a later stage. In the meantime, farmers may also have started to experience

9. AMPE representative, personal communication (September 29, 2006).

agronomic advantages of other GM crops such as Bt cotton, if such crops are approved for commercial release and if they have, in fact, agronomic advantages in the region. Since the farmers constitute the majority of the population in West African countries, the farmers' experience is most likely to be the strongest factor in determining the political future of GM technology in the region.

For the introduction of biofortified crops developed through conventional breeding, it may also be useful to consider a communication strategy that uses a different term than *biofortification*. As several respondents interviewed for this study emphasized, people who are not familiar with the topic tend to equate biofortification with genetic modification, partly because the terms *biofortification* and *biotechnology* seem closely related. A term that emphasizes the advantages of the product, rather than describing the process, may be more appropriate. Examples are *orange-fleshed sweet potatoes* or *nutra-millet*. The food industry, which has ample experience in testing consumers' reactions to different product names, may be a good partner to develop names for biofortified crops.

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