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Confined field trials in Africa: a key step to safely perform experiments with genetically modified crops

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Africa is faced with the challenge of meeting the food and energy needs of its ever growing population that will soon reach a billion people. The use of science and technology in agriculture stands to be one of the major opportunities for African stakeholders to transform the agricultural potential of the continent into a force that will drive the economic growth. African scientists, researchers and farmers can tap into agricultural technologies including plant breeding and modern biotechnologies to make significant progress in addressing the current low agricultural productivity challenge. This policy brief provides policy makers and stakeholders with an overview of confined field trials (CFTs) of genetically modified (GM) crops with an emphasis on how CFTs enable research to move forward so that informed science-based decisions can be made on the safety of GM crops and products for food and feed.

Field-testing as a necessary step in developing new crop varieties

Like any other crop, regardless of how it is developed (through conventional breeding or other means), GM crops are required to go through field-testing so that they can be evaluated for their agronomic and other performances before being released to local farmers. Because GM crops contain one or several additional genes than the conventionally bred crops, their field-testing is carried out under conditions to ensure that the materials tested remain within the trial site; and hence, are referred to as confined field trials (CFTs). Some examples of GM crops fully or partially developed in Africa and currently undergoing confined field-testing on African soils are; insect resistant cotton, insect resistant maize, cowpea and sweet potato, herbicide tolerant soybean, drought tolerant maize, nutritionally enhanced cassava and banana.

Confined Field Trials of GM crops: achieving safety and scientific goals

Since CFTs are conducted in an open field, scientists design them to prevent the escape of the new genes and other plant material outside the experimental sites. While CFTs allow scientists to collect data on the performance of a particular GM crop, they can also be used to demonstrate a new technology to farmers and other stakeholders.

Generally, CFTs are conducted under the responsibility of scientists from public or private research institutions. These trials are usually carried out on a small scale, often on not more than one hectare area, at experimental stations such as those under the control of national agricultural research systems (NARS), local universities, or private sector research units. Such institutions are staffed by competent scientists with sound experience in the safe conduct of field trials and have capacity to evaluate the performance of new varieties for farmers.

As required by the Cartagena Protocol on Biosafety (CPB) that has been ratified by most of African countries, CFTs, as well as other activities involving genetically modified organisms, must be regulated and approved by the national governments. Hence, functional regulatory systems and competent Biosafety authorities are needed to review and

evaluate biosafety applications for conducting CFTs. Once the GM crops are assessed for their performance under CFTs, a science-based decision can be made on whether one should move forward to the commercialization stage.

Current status of CFTs of GE crops in Africa

Three countries in Africa namely, South Africa (ranked number eight in the world with regard to GM crop area cultivated), Burkina Faso and Egypt have made decisions to commercialize GM crops upon completing CFTs. In recent years, additional African countries have approved CFT applications of genetically modified crops and are conducting CFTs in their local environments. The following table summarizes countries in Africa that are conducting CFTs of GM crops.

Table 1: Summary of CFTs of GM crops in African countries

Country	**CFTs for Crop/Trait**
Burkina Faso	Bt cotton (approved for commercialization), Cowpea (insect resistance, Application pending)
Egypt	Maize, (insect resistance; approved for commercialization), Cotton (salt tolerance), Wheat (drought tolerance), Potato (viral resistance), Cucumber (viral resistance), Melon (viral resistance), Tomato (viral resistance)
Kenya	Maize (insect resistance), Cotton (insect resistance), Cassava (viral resistance), Sweet potato (viral resistance)
Nigeria	Cassava (nutrient enhancement), Cowpea (Maruka insect resistance)
South Africa	Maize (drought tolerance), Maize (herbicide tolerance), Maize (insect resistance), Maize (insect & herbicide tolerance), Cassava (starch enhancement), Potato (insect resistance), Sugarcane (alternative sugar), Cotton (insect and herbicide tolerance)
Uganda	Banana (fungal resistance), Maize (drought tolerance), Bt Cotton (insect resistance), Cotton (herbicide tolerance), Cassava (viral resistance), Sweet potato (weevil resistance)

Despite these efforts, modern biotechnology research and the adoption of biotechnological applications are still in the embryonic stage in Africa compared to other regions in the world. While ultimate commercialization of GM crops will depend on a number of factors, CFTs allow the research to move forward to promote scientific progress and inform decision making processes. This is why research is actively continuing in many countries despite controversy; for example, many countries in Europe routinely perform GM field trials. A total number of 2296 notifications for confined filed trials of GM plants was recorded in 21 EU member countries from 1992 to 2008. Of these countries, France alone received 598 CFTs notifications, followed by Spain with 437, Italy 295, United Kingdom 248 and Germany 196. A recently published report of the results accumulated over the decade 2001-2010 of European Commission sponsored biotechnology research projects mentioned the conclusion that genetically modified organisms are not more risky than conventional plant breeding technologies. United States of America approved a total number of 13702 notifications for CFTs between 1992 and 2008 while Canada approved 1707 CFTs from 2004 to 2008. In India, several food crops including rice, maize, tomato, watermelon, papaya, cotton, sorghum and brinjal have been approved recently for CFTs.

Enabling conditions required for conducting CFTs of genetically modified crops

Conditions favoring the review and testing of biotech crops in a country include: 1) commitment of local government to harness new science and technology to enhance food and nutritional security; 2) enabling and functional regulatory system to evaluate biosafety applications and make science based informed decisions on new technologies, 3) institutional capacity to conduct research and technology transfer with vibrant crop improvement programs and seed sector, either public or private, that bear public confidence and trust, 4) enabling policy environment for public-private sector partnerships for commercialization of new technologies.

The absence of functional biosafety regulatory systems in many African countries remains a barrier for making decisions for conducting CFTs and ultimately utilizing new technologies developed through genetic modification. The other constraints to the development of biotechnology in Africa include limited resources, poor access to research networks and scientific information, and negative perceptions on genetically modified products. When addressing these issues, it is also critical to build a shared understanding that Biosafety regulations are put in place in countries to safely access technical tools. Biosafety regulations must be fully internalized by African regulators, stakeholders and policy makers and be adjusted as necessary on a case-by-case basis to allow scientists to carry out research activities in new competitive areas. African policy makers and regulators can learn and benefit from years of biotechnology experiences of other countries around the world in deciding whether modern biotechnology applications in agriculture could help transform the agricultural potential of the continent towards economic growth. A step in this direction would be to allow science and research to move forward to help in their decision making process.

This is the second of a series of policy briefs to be developed by the African Union/NEPAD - African Biosafety Network of Expertise (ABNE) addressing environmental safety aspects of modern biotechnology.
This policy brief is targeted for regulators and decision makers.

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Confined field trial of GM Cassava for nutrient enhancement, in Umudike, Nigeria (© ABNE, 2010)

Confined field trial of Bt Cotton in Kenya (© Margaret Karembu, 2009)

Confined field trial of GM Banana for resistance to Black Sigatoka Disease, in Uganda (© NARO, 2007)

Confined field trial of Bt Maize in Kenya (© Margaret Karembu, 2009)

Confined field trials of Bt Cotton in Burkina Faso (© INERA, 2005)

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Working towards building functional biosafety systems in Africa

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