WEMA Water Efficient Maize *for* Africa

Factsheet on *Bt* maize

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Case for *Bt* maize as an option to increase maize productivity in Kenya

Maize is the most important cereal crop in Kenya and is an important staple food for more than 80 percent of the population.

It is a multi-purpose crop whose grains are widely consumed as food while the stover is fed to livestock.

The average per capita consumption of maize in Kenya is estimated at 103 kg per person (Pingali, 2001), one of the top five in Africa. The crop accounts for 3 percent of Kenya's Gross Domestic Product (GDP), 12 percent of the agricultural GDP and 21 percent of the total value of primary agricultural commodities (Government of Kenya, 2009). Maize is both a subsistence and commercial crop, grown on an estimated 1.4 million hectares by large-scale farmers (25 percent) and smallholders (75 percent). Small scale producers mainly grow the crop for subsistence, retaining up to 58 percent of their total output for household consumption (Mbithi, 2000; Kenya National Bureau of Statistics, 2014). Current trends show that Kenya is struggling to achieve self-sufficiency in major staple foods including maize.

Maize production in Kenya remains low

For years, maize production in Kenya has remained low, averaging 1.8 tonnes per hectare (equivalent to 20 bags of 90 kilogrammes each (Nyoro, 2002) compared to the global average of 5.0 tonnes per hectare (Shiferaw et al., 2011). In 2013, Kenya produced a total of 38.9 million bags of maize, which was a deficit of 2.0 percent compared to 39.7 million bags in 2012 (Kenya National Bureau of Statistics, 2014). This low production is attributed to a wide range of causes including erratic climatic conditions, use of unimproved maize varieties, low use of improved agronomic technologies and high incidence of diseases such as maize lethal necrosis (MLN) and pests such as stem borers.

Kenya's Vision 2030 has identified agriculture as one of the key sectors to deliver the 10 percent annual economic growth rate envisaged under the economic pillar. To achieve this growth, transforming smallholder agriculture from subsistence to an innovative, commercially oriented and modern agricultural sector is critical.

Genetic modification offers potential to increase agricultural productivity in Kenya

Agriculture is the backbone of Kenya's economy contributing approximately 25 percent of the GDP, and employing 75 percent of the national labour force. However declining agricultural production in Kenya occasioned by abiotic and biotic challenges coupled with rapidly increasing population poses challenges to food security in the country. Genetically modified (GM) crops have the potential to increase agricultural production on existing arable land; reduce losses related to pests, diseases, and drought; increase access to food through higher farm incomes resulting from higher yields; raise nutrition levels; and promote sustainable agriculture.

For Kenya, the need has never been greater for GM crops, which are bred to have traits beneficial to farmers, consumers and the environment. This is important now especially with an estimated three million Kenyans already relying on food aid due to a cereal shortfall in the country.

Adoption of improved and innovative agricultural technologies, including biotechnology can be used to improve maize yields in Kenya.

Effects of insect pests on maize production in Kenya

Insect pests in the field and in storage reduce yields and food availability in Kenya, constituting a major problem to the agricultural sector in the country. Field stem borer insect pests essentially steal from farmers' fields, reduce their profits and make it harder for households to put enough food on their table. These limitations could be overcome by the use of modern biotechnology (Glover, 2001).

In Kenya, stem borers are known to reduce maize production by an average of 13 percent or 400,000 tonnes of maize, equivalent to the normal yearly amount of maize the country imports. This damage is valued at more than USD 90 million per year for maize (De Groote et al., 2011). The loss can increase to 100 percent during drought years or when measures are not taken to manage the pests appropriately.

Bt technology can help control insect pests in maize

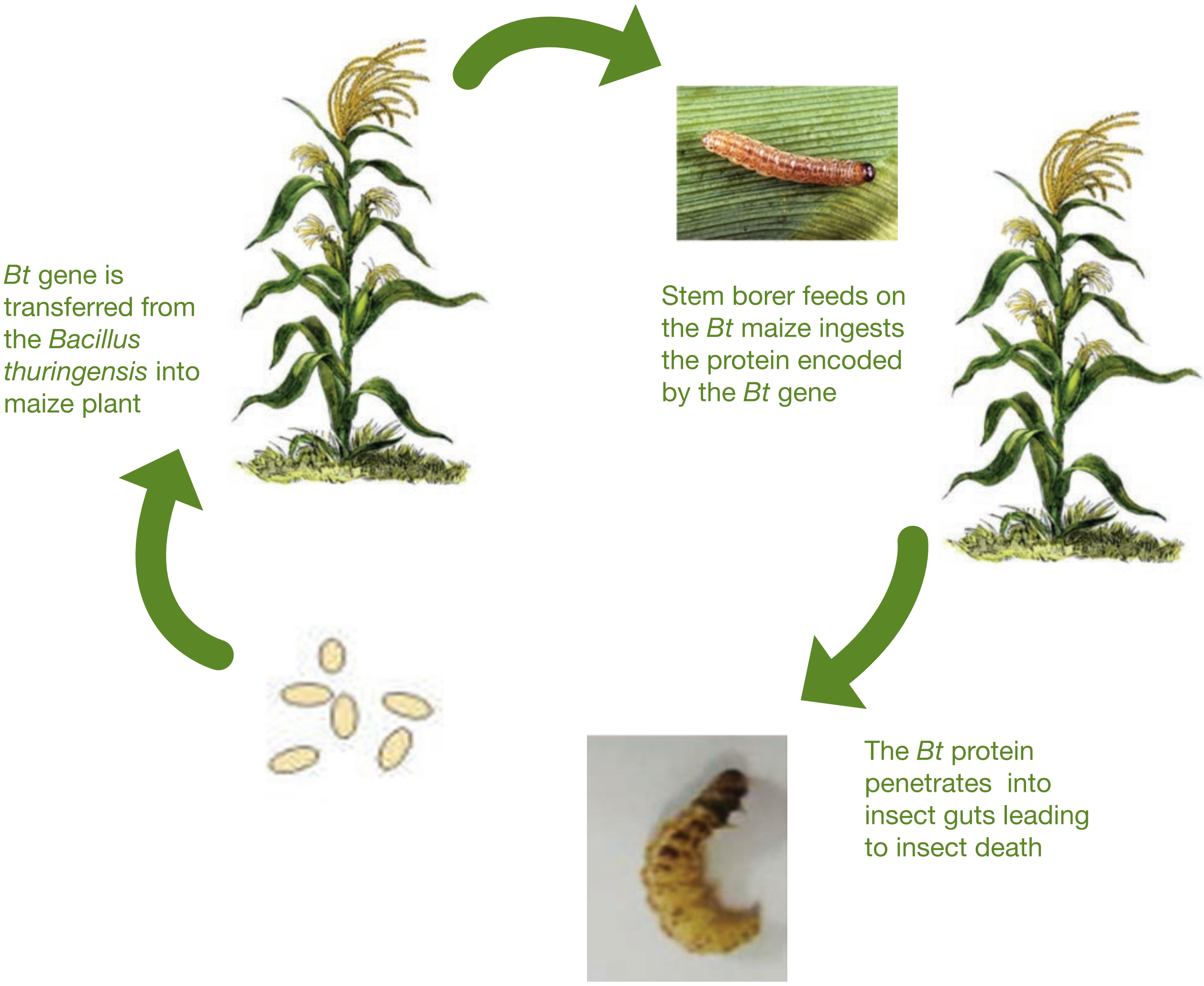
With recent advances in molecular and cellular biology, it is now possible to provide built-in protection (into a plant) against stem borers. Such novel technological approaches have to-date delivered several specific agronomic traits that have overcome a number of production constraints including insect pests for many farmers. GM crops have been successfully used to improve agricultural productivity around the world. These crops can offer African farmers an alternative insect-pest control method to chemical sprays (Hofte and Whiteley, 1989; Sims, 1997; Huesing et al., 2004).

Bt maize, developed by the Kenya Agricultural and Livestock Research Organisation (KALRO) in collaboration with other organisations is one such crop that will offer farmers innovative alternatives to address the challenges posed by stem borer insect pests. *Bt* maize is maize that has the ability to control certain insects that damage maize plants as a result of a gene derived from *Bacillus thuringiensis* (*Bt*), a soil dwelling bacterium. Through biotechnology, the *Bt* gene becomes part of the plant where it produces a protein or toxin that allows the plant to protect itself from insect pests without being frequently drenched with expensive chemical sprays that are harmful to humans and the environment.

How *Bt* maize will transform Kenya's agriculture

GM crops provide an alternative that creates opportunities to increase and provide more stability in agricultural production and improve income and contribute to meeting immediate food needs. Biotech insect-protected maize varieties will provide better seed choices and enhance food security for millions of farmers in Kenya by helping them produce more reliable harvests and better grain quality.

How it works?



Some of the important impacts arising from adoption of insect pest protected (*Bt*) crops technology include:

- **Grain yield increase:** The first major advantage of *Bt* crops is increase in grain yield and the related economic returns, through better pest control (Brookes et al., 2010; Brookes et al., 2011).
- **Improved grain quality:** There is research evidence indicating better grain quality of GM insect-pest protected maize with lower levels of mycotoxins (poisonous chemical compounds produced by certain fungi) compared to conventional maize (Folcher et al., 2010). The control of stem borers is key to improving grain quality by reducing mycotoxin contamination, which is a potential health hazard to both humans and animals.
- **Improved health and safety for farm workers:** GM insect-pest protected maize reduces the need for application of broad-spectrum insecticides which reduces exposure of farmers to insecticides, especially for those using hand sprayers and therefore, brings benefits to both the environment and human health. The application of insecticides leads to poisoning resulting from exposure in the course of preparation of the spray solution, during application in the field, and waste handling.
- **Reduced negative environmental impact:** *Bt* crops contribute towards reduced negative environmental effects of chemicals due to high reduction of conventional insecticides (Zilberman et al., 2007). Insect pest protected crops negate the persistent pollution of the environment by the disposal of empty plastic containers.

GM crops have been safely used for nearly 20 years worldwide

GM (biotechnology) crops have been safely used in the global food system for nearly 20 years and have been repeatedly proven to be safe; and successfully used to improve agricultural productivity around the world. GM crops, especially maize, continue to be safely used in South Africa, USA, and Canada among other countries. Multiple health societies, hundreds of independent scientific experts and dozens of governments around the world have determined that foods and ingredients developed through biotechnology are safe. No other food crops in history have been tested and regulated as thoroughly as foods developed through biotechnology. The first GM crops development and testing began in the 1980s. Third parties like the World Health Organization, the American Medical Association, the Food and Agricultural Organization, and the European Food Safety Authority have reviewed the data on GM crops and are in agreement as to their safety. To date more than 2,500 regulatory approvals have been granted by 60 countries for more than 300 GM products globally.

Kenya has the necessary legal and policy frameworks for governing modern biotechnology

Kenya has taken steps to develop adequate capacity and a regulatory framework to guarantee responsible and safe transfer, adoption, deployment and trade in GMO products in the country. Kenya was the first country in the world to sign the Cartagena Protocol on Biosafety, way back in 2000. This is an international instrument for ensuring adequate levels of safety in all activities involving GMOs.

The country ratified the Protocol in 2003 and thereafter took the necessary steps to implement its obligation as a contracting party to the Protocol. The country's legal and policy frameworks and institutional arrangements for governing biotechnology include:

- The National Biotechnology Development Policy approved in 2006;
- The Biosafety Act enacted in 2009;
- The National Biosafety Authority (NBA) created in 2010; and
- Implementing regulations on contained use, environmental release, import/ export and transit published in 2011.

The policy commits the government to give priority to provision of relevant infrastructure, legal framework, facilities and other resources for rapid, safe development and application of biotechnology in industry, agriculture, food, environment and health sectors.

The National Biosafety Authority (NBA) in Kenya is the competent authority for the regulatory process to authorise commercial release of the *Bt* maize, which helps protect against insect-pests. All State regulatory agencies, including Ministry of Public Health, Kenya Medical Research Institute (KEMRI), Kenya Bureau of Standards (KEBS), National Environmental Management Authority (NEMA), Kenya Plant Health Inspectorate Services (KEPHIS), among others, are members of the NBA Review Board.

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