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Policy Brief

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The Role of Biotechnology in mitigating impacts of drought on maize production in Kenya

About AATF

The African Agricultural Technology Foundation (AATF) is a not-for-profit organisation that facilitates and promotes public-private partnerships for the access and delivery of appropriate proprietary agricultural technologies for use by resource-poor smallholder farmers in Sub-Saharan Africa (www.aatf-africa.org).

About WEMA

The Water Efficient Maize for Africa (WEMA) project is a public-private partnership coordinated by AATF to develop drought-tolerant African maize using conventional breeding, marker-assisted breeding, and biotechnology and make it available royalty free to small holder farmers in Sub-Saharan Africa.

Introduction

In the past ten years, three out of every four global drought events occurred in Africa. Kenya experiences drought in a cyclic manner. Like in many African states, Kenya's agriculture is highly vulnerable to effects of drought because of its heavy dependence on rainfed agriculture.

Although about 90 percent of rural people in Sub-Saharan Africa depend on agriculture, it's the only region where food insecurity has worsened, with over 265 million people being classified as food insecure.

Recent studies by the International Food Policy Research Institute (IFPRI) indicate that by 2050 average maize yields in Africa will decline significantly as a result of climate change, especially due to drought negatively impacting the continent in different ways such as reduced crop yield from rain fed agriculture; increase in arid and semi-arid areas; decreased rainfall; reduced soil moisture storage capacity, poor quality fertility; reduced length of growing seasons; and increased proliferation of pests and diseases. This will lead to increased food insecurity and poverty.

Climate change has increased incidences of drought, higher temperatures and greater evapo-transpiration. These trends coupled with expansion of farming to marginal and water catchment areas, such as the Mau Forest Complex, are increasing drought-prone maize production environments. The use of biotechnology to improve drought tolerance in maize to provide yield stability is critical.

This brief highlights some of the challenges posed by drought to maize farming in the country. It observes that developing countries like Kenya will continue to experience a sharp decline in maize yields due to drought unless new measures are put in place. The Water Efficient Maize for Africa (WEMA) is given as a promising technological intervention that requires support of the policy makers.



Impacts of drought on maize production in Kenya

Maize is the most important staple food crop in Kenya, with more than three-quarters of the country's population depending on it as their main source of food. Availability of the grain is so crucial to the nation it is equated with food security. Perhaps that is why before the advent of the Structural Adjustment Programmes (SAPS), maize was a state controlled commodity, with strictly regulated pricing and movement. But even with the liberalisation of its pricing, production levels of the grain have remained dismally low compared to the rising demand.

Poor planning and lack of introduction of new technologies into the agricultural system have been blamed for the country's inability to achieve food self-sufficiency. Yield losses in maize, for example, are expected to increase significantly with global climate change as temperatures continue to rise and rainfall distribution changes in key traditional production areas.

It is therefore time to rethink farming practices to insure the country against famine as a result of drought-induced crop failure. Modern biotechnology coupled with other best agronomic practices offer some viable options.

Role of modern biotechnology

What is biotechnology?

The Food and Agriculture Organization (FAO) has offered one of the most widely used definitions of biotechnology. It terms it as 'any technique that uses living organisms or substances from these organisms to make or modify a product for practical purposes'. Among other uses, biotechnology is the technique used to isolate, select and transfer beneficial genes from one organism into another through a process known as genetic engineering.

Benefits of modern biotechnology

The benefits of adopting biotech crops have been documented since 1996. They include contributing to food security and lowering of food prices; conserving biodiversity; reducing the impact of agriculture on environment; alleviating poverty and hunger; mitigating climate change impacts (such as drought-induced crop yield losses); and reducing emissions of greenhouse gases (GHG). One of the direct benefits of crops improved through genetic engineering, such as maize, is enhanced grain quality that helps to ensure food and feed safety. Research shows that the reduction of insect damage with use of these improved maize varieties results in lower levels of grain contamination by mould and mycotoxins. Furthermore, increased drought tolerance and reduced insect damage to these improved biotech varieties also means that the healthier maize plants will utilise soil nutrients more efficiently, leading to higher yields.



Status of modern biotechnology in Kenya

The government supports application of modern biotechnology to improve agricultural production (GoK, 2006). The country has the 'National Biotechnology Development Policy' and 'The Biosafety Act 2009' to govern research, development and deployment of modern biotech products. The policy, for example, clearly states that the 'government will adopt productivity enhancing agricultural biotechnologies that can substantially reverse the fast deteriorating food security and nutrition, farm incomes, spawn the agro-industry, and reduce environmental degradation'.

Kenya is not alone in the quest to use modern biotechnology to improve agriculture. In Africa three countries, South Africa, Burkina Faso and Egypt, have commercialised biotech crops. Notable developing countries whose farmers are already growing biotech crops are China, India, The Philippines, Argentina and Mexico, among others.

The Kenya Agricultural Research Institute (KARI) has been conducting trials of various GM crops including virus resistant sweet potato, insect resistant maize and insect resistant cotton among others.

Role of WEMA in drought mitigation

WEMA is an innovative public-private partnership that was formed in response to a growing call by African farmers, leaders, and scientists to address the effects of drought cost-effectively. The project is funded by the Bill and Melinda Gates and the Howard G. Buffett Foundations. WEMA is initially being implemented in Kenya, Uganda, Tanzania, Mozambique and South Africa.

Benefits to smallholder farmers

- Availability of drought tolerant maize royalty-free to smallholder farmers in Sub-Saharan Africa.



- More reliable harvests for small scale farmers – most of whom are women – so they can feed their families and increase their incomes.
- Confidence for farmers to improve their techniques arising out of reliable harvests – risk of crop failure from drought is one of the primary reasons why small-scale farmers in Africa do not adopt improved farming practices.
- Stronger rural economies due to farmers' success.

Conclusion

Drought is a perennial source of food insecurity and suffering for many people in Sub-Saharan Africa, where over 300 million rely on maize as their main source of food. In Kenya, for example, drought can cause up to 100 percent maize crop failure, leading to millions of people going hungry. Hence, conducting agricultural business as usual will drive more Kenyans into deep poverty and hunger and drastically reduce the country's chances of making significant steps towards achieving any of the UN Millennium Development Goals by 2015.

Drought mitigation initiatives, such as the WEMA project, should therefore be given strong support by the government and other stakeholders to ensure its success.