FAST-TRACK CLIMATE-ADAPTED CROP BREEDING TO SECURE THE UGANDAN ECONOMY

TECHNOLOGY DESCRIPTION

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Crop breeding technology for resilience to and adapting to changing climate involves proactive generation of varieties that are tolerant of the effects of erratic weather patterns. It applies genetic principles to generate varieties with climate-adapted traits combining high productivity with tolerance to stress due to high temperature, flooding, drought, pests and diseases. Important steps include collection and evaluation of germplasm to identify individuals with desirable characteristics/traits, followed by developing new varieties, evaluation in performance trials, variety release, registration, multiplication, continued inspection, certification and distribution.

CURRENT TECHNOLOGY READINESS

The Technology Readiness Level (TRL) for breeding for climate-adapted crop breeding in Uganda is between 4 (technology validated in laboratory) and 5 (technology validated in relevant environment). Given the wide variety of crops, the heterogeneous contexts of farming conditions and the changing climatic conditions, it could be argued that some of the needed climate-adapted crop varieties are still at TRL 1 (basic principles observed).

Uganda has a formal and informal seed system. Crop breeding in the formal seed system is led by the National Agricultural Research Organization (NARO), which develops regulated certified seed with high Standard Quality Control and Certification procedures. Commercialization of certified seed is not taking off due to inadequate funds and lack of regulatory framework thus, distribution is limited and prices remain high. The formal seed system so far accounts for only 15% seed on farmed area (which covers about 23% of agricultural households).

The informal seed system deals in seed saved from previous harvests as well as community-based variety development. This system is progressively being improved through establishment of the Quality Declared Seed (QDS) system which operates through participatory breeding and creation of seed schemes for villages and farmer's groups, and local seed businesses with support from NARO, the extension service and Non-Government Organizations. The QDS system has minimum certification requirements targeting specific food crops which are self-pollinated or vegetatively propagated. It focuses on increasing access to affordable quality seed by smallholder farmers. It is therefore more ready and preferable for climate change adaptation.

CLIMATE RATIONALE OF THE TECHNOLOGY

Crop breeding for climate change adaptation is critically needed because agricultural sustainability depends on crop varieties with traits that combine high productivity with tolerance to projected climate-related stresses such as erratic weather extremes, flooding, drought, pests, diseases and rising temperature. Given the rapid progression of climatic conditions (e.g., an estimated 0.37°C rise in temperature every decade), the generation and large-scale adoption of climate-adapted crop varieties cannot be delayed if the livelihoods and food security of smallholder farming households are to be ensured, and the national economy sustained. Breeding climate-adapted crop varieties is also needed to avert threats to markets and enable diversification of agricultural investments and businesses.

AMBITION OF THE TECHNOLOGY

SCALE FOR IMPLEMENTATION AND TIME-LINE

The ambition is to build human and technological capacity for breeding climate-adapted crop varieties in the formal and informal seed systems, and to increase the number of smallholder farming households with access to climate-adapted seed of critical staple and cash crops by 200,000 countrywide by 2030.

AMBITION FOR TECHNOLOGY READINESS LEVEL OR COMMERCIAL READINESS INDEX

The ambition for generation and deployment of climate-adapted crop varieties is to reach at least Technology Readiness Level 8 (system complete and qualified) for 5 key staple food crops and 5 priority cash crops.

EXPECTED IMPACTS OF THE TECHNOLOGY

Strengthened human and technological capacity for crop breeding in the formal and informal seed systems will potentially:

- Reduce vulnerability of farming households to yield losses and safeguard food and income security.
- Increase options for farmers in different contexts e.g., there is high potential for genetic improvement of many neglected and underutilized crops for increasing food security.
- Ensure that many farmers can access improved varieties.
- Increase farmer participation and the responsiveness of breeding programs to farmers' needs.
- Protect the environment by reducing reliance on agrochemicals.
- Secure markets and employment in the crop-based value chain.
- Motivate private sector investment including financial and insurance services providers in crop farming and marketing due to reduced risk.
- Motivate innovation in identifying efficient procedures and fabricating equipment that is affordable.
- Increase awareness of improved varieties and their potential in minimizing negative climate impacts.

POLICY ACTIONS FOR TECHNOLOGY IMPLEMENTATION

EXISTING POLICIES IN RELATION TO THE TECHNOLOGY

There is one existing policy: Uganda National Seed Policy (2015).

The Genetic Engineering Regulatory Bill 2018, formerly called the National Biotechnology and Bio-safety Bill 2012, is still before parliament for debate.

PROPOSED POLICIES AND MEASURES TO ENHANCE TECHNOLOGY IMPLEMENTATION

a) *Mitigate cost of producing climate-adapted crop varieties*

- Invest in precision equipment and methods for crop improvement processes.
- Strengthen regional cooperation in crop improvement and adopt international Quality Control measures
- Establish seed banks at lower government levels and deliberately link farmers to genuine seed companies

b) Strengthen community involvement in the development of improved seed

- Strengthen the capacity of research-extension systems to nurture farmer engagement and build farmers' voices and local knowledge into breeding processes to enhance context relevance.
- Document traditional knowledge of plant genetic resources and operationalized community intellectual property rights in the National Seed Policy 2018.

c) Strengthen enforcement of regulations to reduce counterfeits

- Develop an up-to-date participatory tracking system to ensure authenticity of seed.
- Strengthen coordination between the National Seed Certification Services, the Uganda National Bureau of Standards and police to prevent counterfeits
- Establish information hubs to make seed quality standards widely known

d) Improve research capacity to generate improved varieties for different contexts

- Conduct studies to map farmer contexts, traditional knowledge of seed varieties and assess potential of breeding programs to achieve multiple wins
- Invest in decentralized seed breeding programs, and seed certifying services

COSTS RELATED TO THE IMPLEMENTATION OF POLICIES

Accelerating the generation of crop varieties for climate change adaptation and deploying them to 200,000 farming households countrywide by 2030 will require about US dollars 2,080,940.

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LINKS TO TNA REPORTS

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