PLANT VARIETY PROTECTION: A CATALYST FOR DEVELOPING CLIMATE SMART CROP VARIETIES IN SUB-SAHARAN AFRICA

Prof. Hans Adu-Dapaah, FGA[2] **Dr. Micheal Osei Kwabena[1]** **Dr. Stephen Yeboah[1]**

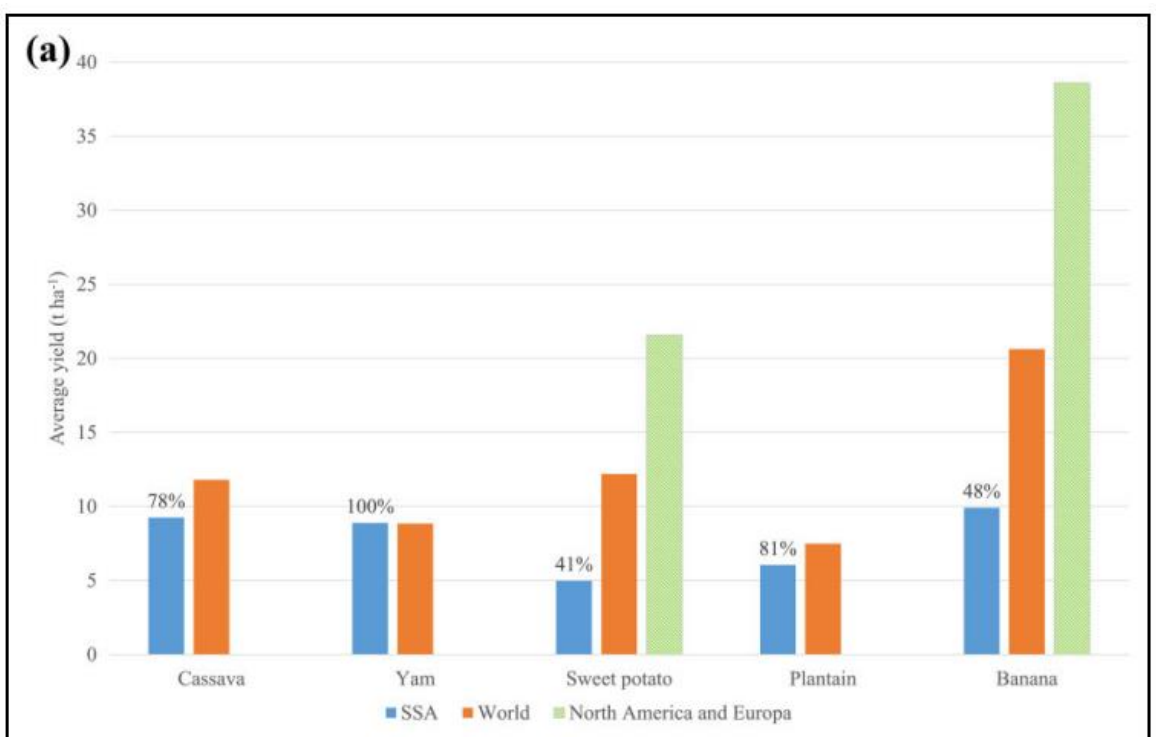
[1]CSIR-Crops Research Institute, P. O. Box 3785 [2]CSIR-College of Science and Technology, P. O. Box 3785

Introduction

- As Africa's population continues to grow(projected to be 2b by 2050) and arable land and other resources become scarce, there is the need to increase agricultural productivity (i.e. increase yields and quality using less input).

Introduction

Agricultural productivity in Africa is low compared to other parts of the world



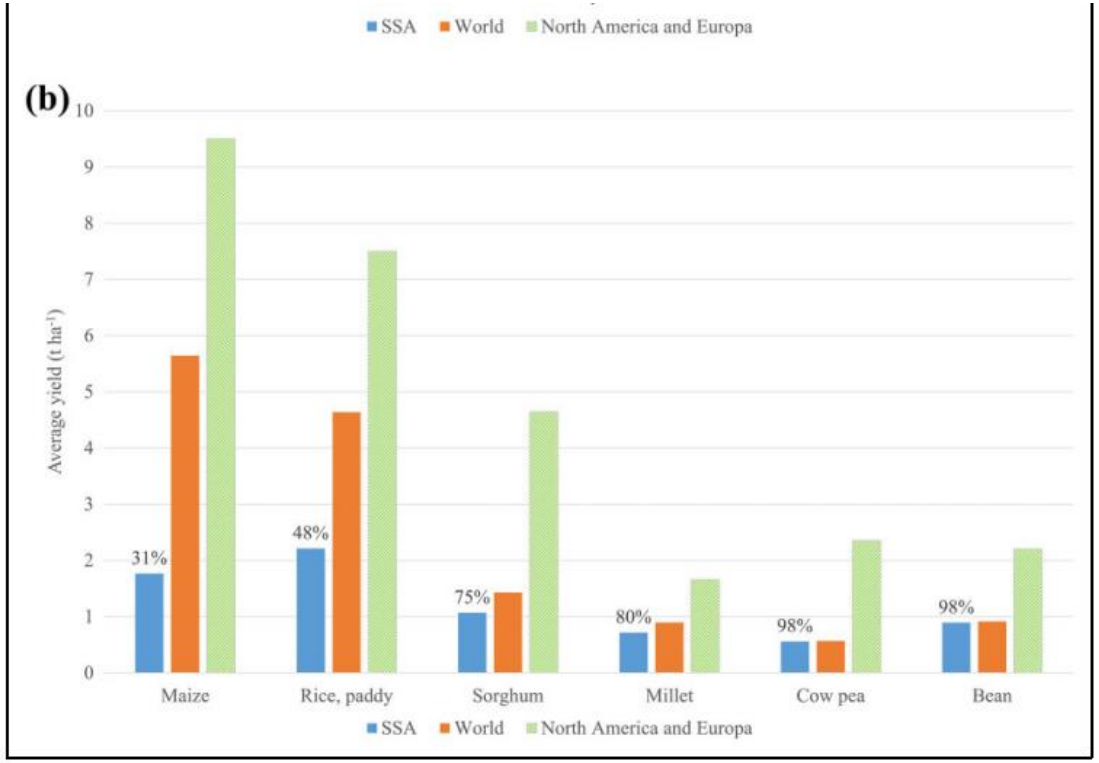
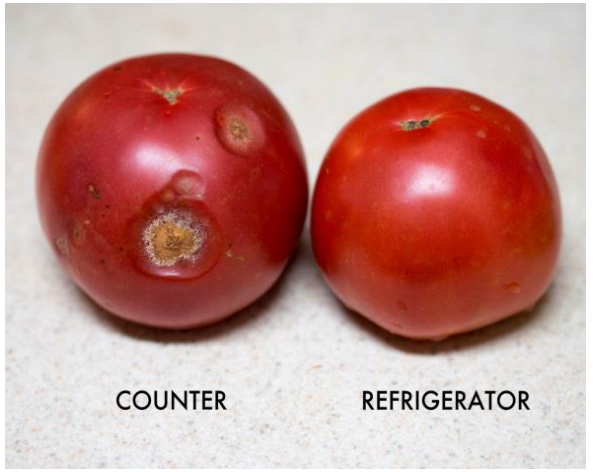


Figure 1(a) and (b) average yields (t/ha) of the 10 selected staple crops, for SSA, the world, and north America/ Europe. FAOSTAT, 2016. SSA: sub-Saharan Africa.

Challenges to agricultural production in Africa

- Rapid declining soil fertility (especially nitrogen)
- Increased complexity of pests and diseases of crops.
- Postharvest losses and short shelf- life of produce



Fall armyworm on corn / Photo by Billy R. Wiseman | USDA Agricultural Research Service, Bugwood.org

- Inherent low yields of crops
- Lack of labour
- Bush fires leading to
- Loss of biodiversity

- Ecological concerns
- Illegal mining activities destroying agricultural lands and water bodies and distorting ecologies
- Loss of biological diversity
- Land constraints

Achieving food & nutrition security in 2050

- Africa imported roughly $81b of food in 2019. The continent's food demand will double in the next decade.
- Crop production will have to double/triple by 2050, using limited resources (land, water, nitrogen etc.)
- Need to increase productivity per unit area (intensification)
- Smart breeding has a role to play to achieve food and nutrition security.

- Over the years the national agricultural research systems(NARS) in SSA have developed and released a number of improved crop varieties.
- Most of these varieties are being commercialised without any return on investment to the breeders who developed them.
- Funding for sustainable development of climate smart crop varieties is difficult to come by in SSA.
- PVP, when well implemented may be a catalyst for sustainable development of CSCV, since it will attract investors.

- Pre-breeding: germplasm assembly, characterisation, evaluation, selection of potential parents for breeding
- Breeding: cross, evaluate, select, evaluate multiple sites, release
- Release & registration: Assessment and release by NVRRC at vegetative and maturity stages
- Post release: seed increase, disseminate, maintenance breeding

- Smart breeding is an integration of conventional breeding strategies with advanced molecular, genomic and phenomic tools to efficiently and effectively breed resilient crop varieties.
- The varieties should possess enhanced yield potential, resistant to biotic and abiotic stresses with consumer- preferred traits.
- There are array of tools and resources available to the breeder.
- These tools and resources include the following:

- Genetic resources conserved in situ,or in vitro; gene banks, core and representative collections, diverse panels in research centers, bi-parental, recombinant inbred lines, nested association mapping, advanced generation inter-cross(MAGIC), &

training populations.

As well as those that can be used to characterise, evaluate, select and release to end-users.

The first generation breeding tools include domestication/selection, hybridization, as well as vegetative propagation techniques

- The 2nd generation breeding tools include: in vitro propagation techniques, organogenesis &embryo rescue, anther culture, somaclonal variation, in situ conservation and in vivo dissection and analysis.

- The 3rd generation B/Ts : molecular biology tools, QTL mapping, marker assisted breeding, sequencing, targeting induced

local lesions in genomes.

The 4^{th} generation B/Ts: next generation sequencing, genome aided breeding, epigenomics, transcriptomics, gene expression regulation

- Metabolomics, proteomics, gene editing & comparative genomics.
- The third & fourth generation tools outlined above add speed and precision to the array of tools currently available to fast track the development of improved climate smart crops.
- The need to evaluate each climate change scenario with the view to decide appropriate strategies to use based on available tools and resources cannot be over-emphasised.

Achievements

Examples: The devastating nature of rosette virus in groundnut

Variety susceptible to rosette virus

Resistant variety

Achievements

CSIR-CRI developed high-yielding drought tolerant maize variety

Etubi Hybrid

Local Var

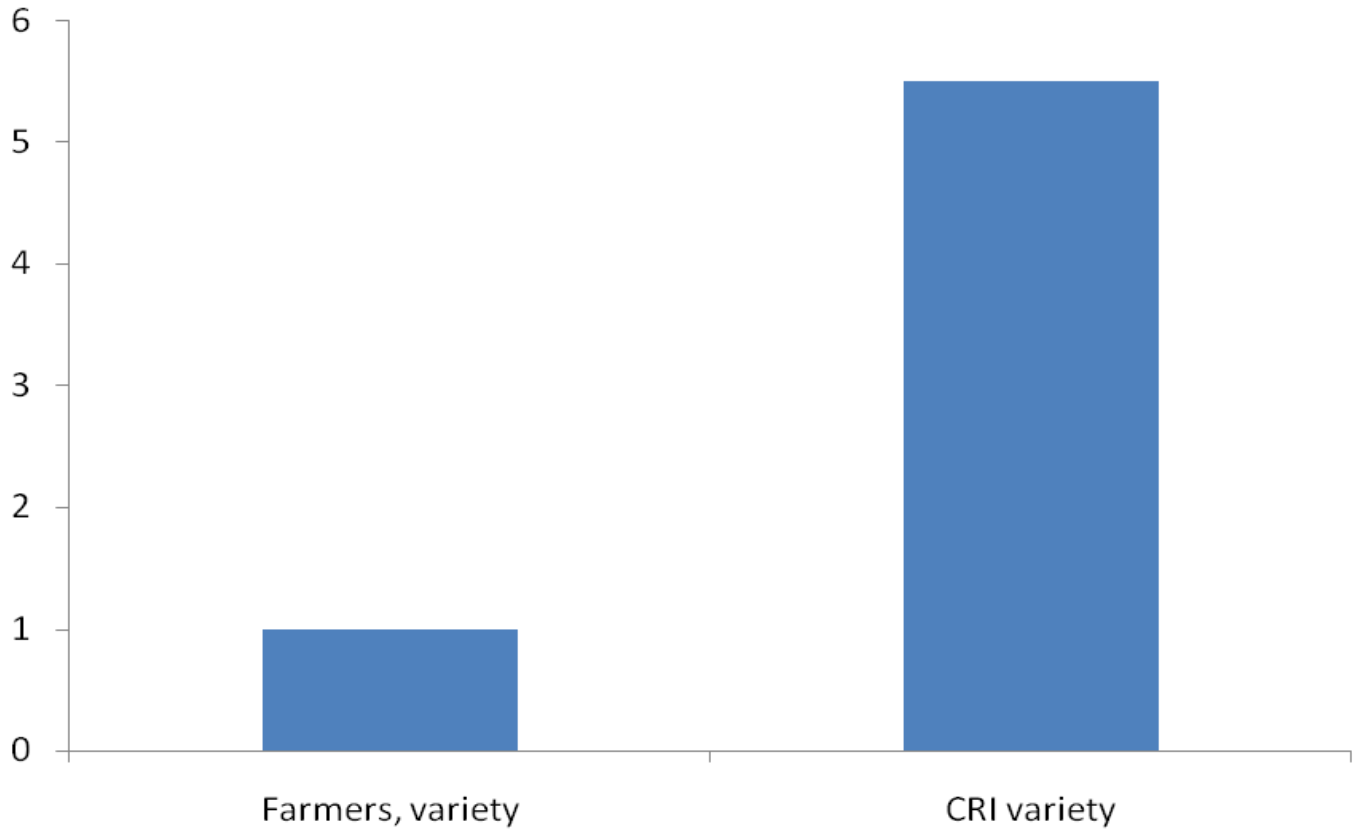
Etubi Hybrid

Achievements

Effect of flooding

Achievements

CSIR-CRI rice varieties compared with farmers varieties



PLANT VARIETY PROTECTION SYSTEM

- The adoption of agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) required that contracting parties protect plant varieties either by **patents or by an effective *sui generis* system of protection or by a hybrid of these two systems. (**Article 27),3b) Patents and plant breeders rights are separate intellectual property rights with different conditions of protection scope and exceptions.

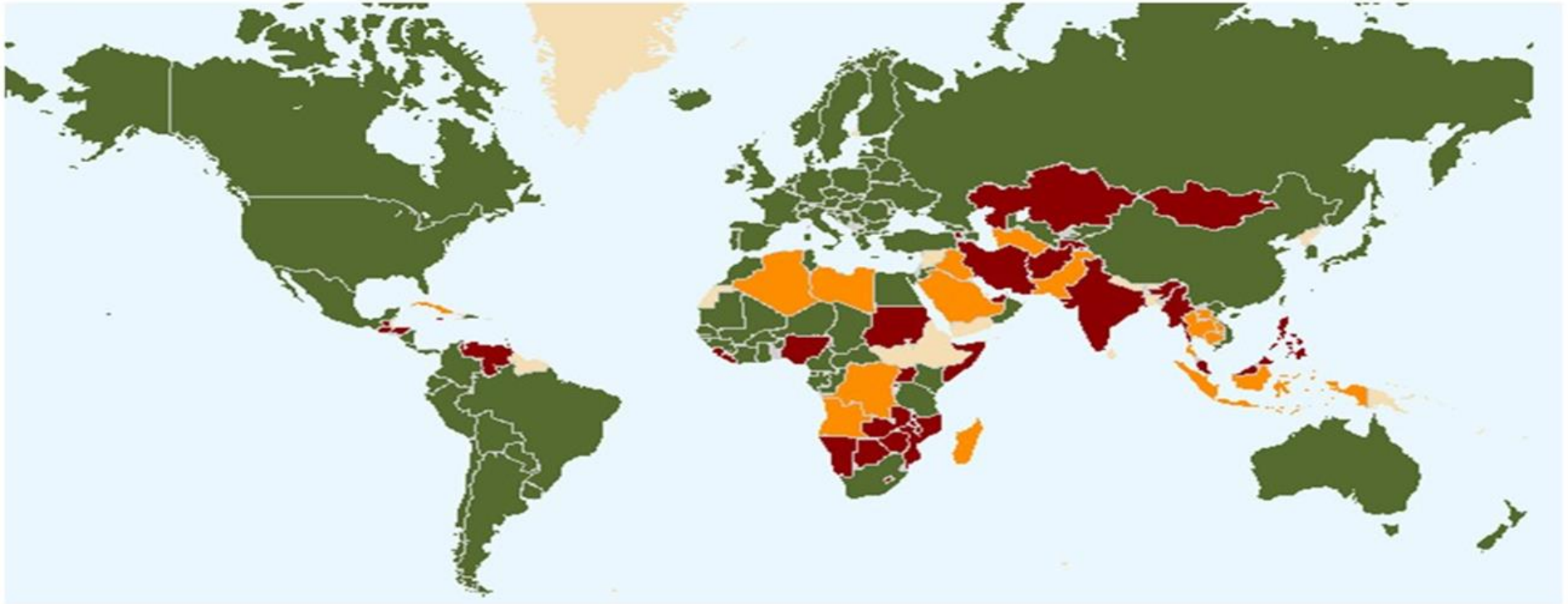
What is a Plant Breeder's Right?

- Plant Breeders' Right is a form of intellectual property right that seeks to grant plant breeders exclusive right to the varieties they develop.

- Plant Breeders Right aims at making sure that:
  - New varieties become available to society
  - Breeders have access to foreign varieties
  - Genetic diversity will be used sustainably
  - Export trade is supported

UPOV STATUS

on November 3, 2021



The boundaries shown on this map do not imply the expression of any opinion whatsoever on the part of UPOV concerning the legal status of any country or territory

Members of UPOV (78) (covering 97 States)

Initiating States (19) and Organization (1)

States (22) and Organization (1) in contact with the UPOV Office

UPOV

SCOPE OF BREEDER'S RIGHT

- Those acts are the following:

- Production or reproduction (multiplication)
- Conditioning for the purpose of propagation
- Offering for sale
- Selling or other marketing
- Exporting
- Importing
- Stocking for any of the above purposes

EXCEPTIONS TO THE PLANT BREEDER'S RIGHT

- The UPOV Convention establishes compulsory and optional exceptions.
- **Compulsory exceptions**
- UPOV members must provide for these exceptions. The compulsory exceptions are established in Article 15(1):
- Acts done privately and for non-commercial purposes;
- Acts done for experimental purposes and
- Acts done for the purpose of breeding other varieties, and, except where the provisions of Article 14(5) apply, acts referred to in Article 14(1) to (4) in respect of such other varieties
- **Optional exceptions**
- Farm safe seed

BENEFITS UPOV SYSTEM OF PLANT VARIETY PROTECTION

- Encourages the breeding of new varieties – enabling farmers to respond to the environmental and economic challenges confronting agriculture.
- Provides farmers and growers with access to the best local and global varieties
- Enables variety choice to be combined with information and delivery of good quality planting material
- Offers a tool for capturing value through farmers and breeders

BENEFITS CONT'D

- Enables any farmer or grower to use the best available, protected varieties for breeding work
- Offers an effective and transparent system that is easily accessible for small and medium –sized enterprises
- Enables farmers and growers to develop local, national and international businesses
- Empowers farmers and growers in the production chain

CASE STUDY

- PVP Implementation in Kenya
- Status of Plant Variety Protection
- A total of 1639 applications for PVP received by April 2018
- Local (Kenyan) = 31.21% applications
- Foreign = 68.79% applications
- Local applicants are from:
- Public institutions = 80.55%
- Private institutions =19.45 %

Impact of PVP in Kenya

- Employment creation: estimated at over 500,000 people (including over 100,000 flower farm employees) depend on the horticulture industry.

- Increase in introduction of crop varieties as a result of enhanced variety description- the latter made possible by: (i) readily available UPOV test guidelines for most agricultural crops (ii) Trained personnel by UPOV on development of national test guidelines (iii) Collaborations and cooperation between the breeders and the testing authorities on variety description.

CONCLUSION

- The PVP system is a positive development which seeks to address the interests of plant breeders and other stakeholders along the seed value chain.
- The benefits of PVP cuts across several sectors of the economies of sub-Saharan African countries and will promote national development.
- The PVP has an enormous potential to improve productivity, the seed system, protect genetic diversity, and empower farmers to access new markets and attract private sector investments in plant breeding.

CONCLUSION

- The formation of African Plant Breeders Association in 2019 with branches in most African countries is a positive development for PVP implementation in SSA.