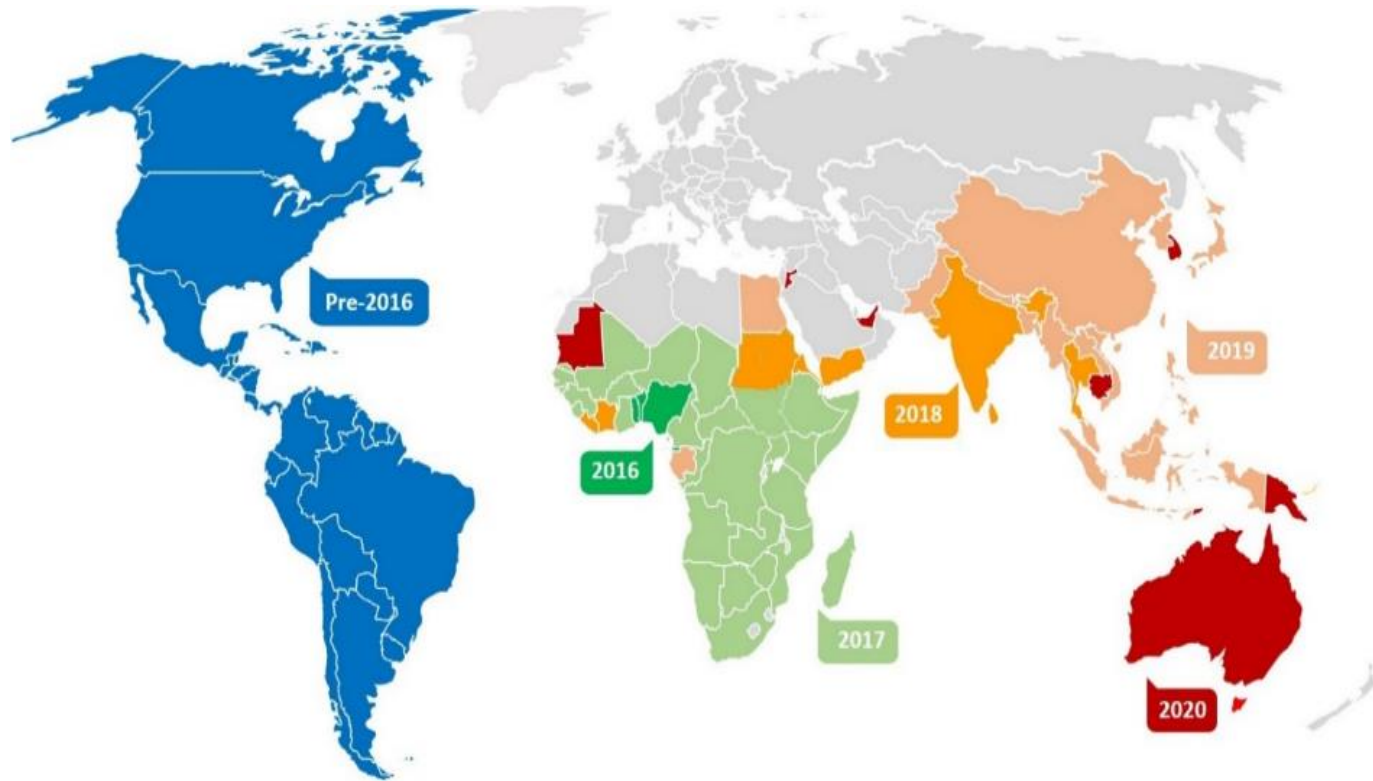


**Smart Agricultural Innovations to Address  
Emerging Threats like Fall Armyworm**

# Tackling the Challenge of FAW...



**Fall armyworm is now a global problem!**



# Bt Maize against FAW



*Journal of Economic Entomology* (2018)

## Efficacy of Bt Maize for Control of *Spodoptera frugiperda* (Lepidoptera: Noctuidae) in South Africa

A. S. Botha,<sup>1</sup> Annemie Erasmus,<sup>2</sup> Hannalene du Plessis,<sup>1</sup> and Johnnie Van den Berg<sup>1,3</sup>

<sup>1</sup>Unit for Environmental Sciences and Management, IPM Program, North-West University, Potchefstroom 2520, South Africa,

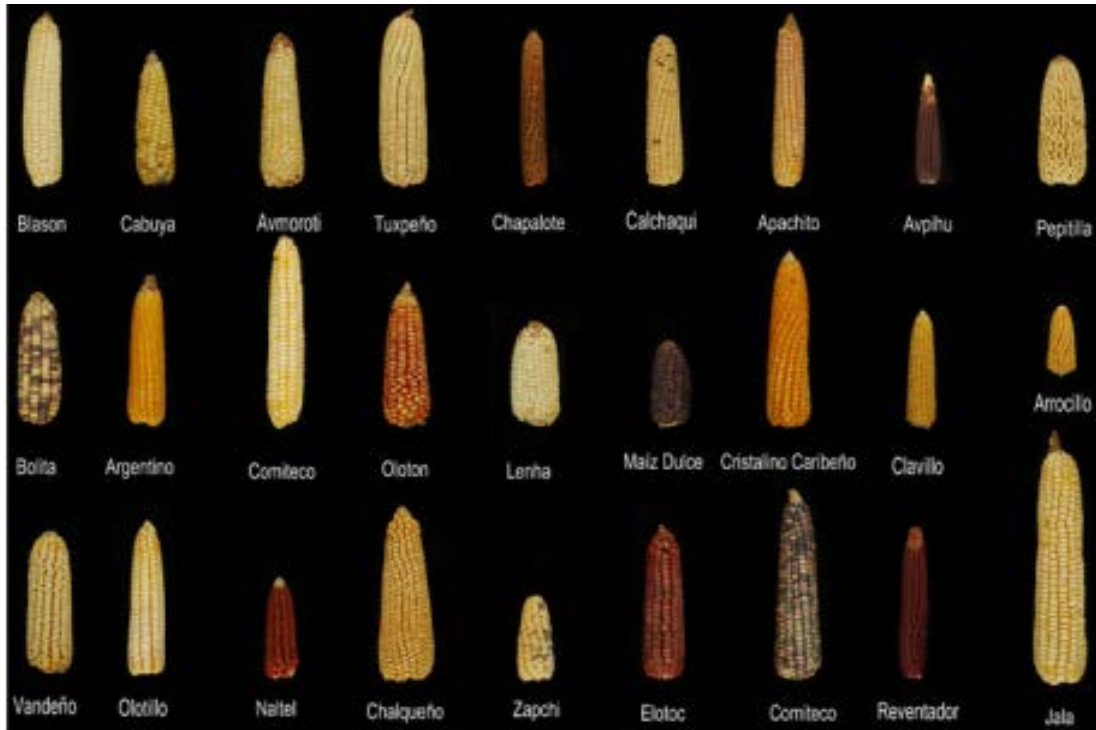
<sup>2</sup>Agricultural Research Council, Grain Crops, Private Bag X1251, Potchefstroom 2520, South Africa, and <sup>3</sup>Corresponding author, e-mail: [johnnie.vandenberg@nwu.ac.za](mailto:johnnie.vandenberg@nwu.ac.za)

In South Africa, *Bt* maize hybrids expressing the *cry1Ab* gene (MON 810) and the *cry1A.105+cry2Ab2* genes (MON 89034) are being planted over 1.62 million hectares, comprising 71% of the total maize area.

**MON89034** – excellent protection against FAW;

**MON810** – partial but significant protection against FAW.

# Native Genetic Resistance to FAW



In 1990s, CIMMYT maize team in Mexico unraveled native genetic resistance in some of the landraces (especially Cuban flints and Mexican Tuxpeños) to FAW.



More than **6000** CIMMYT maize germplasm entries screened so far against FAW under artificial infestation at Kiboko, Kenya, during 2017-2020

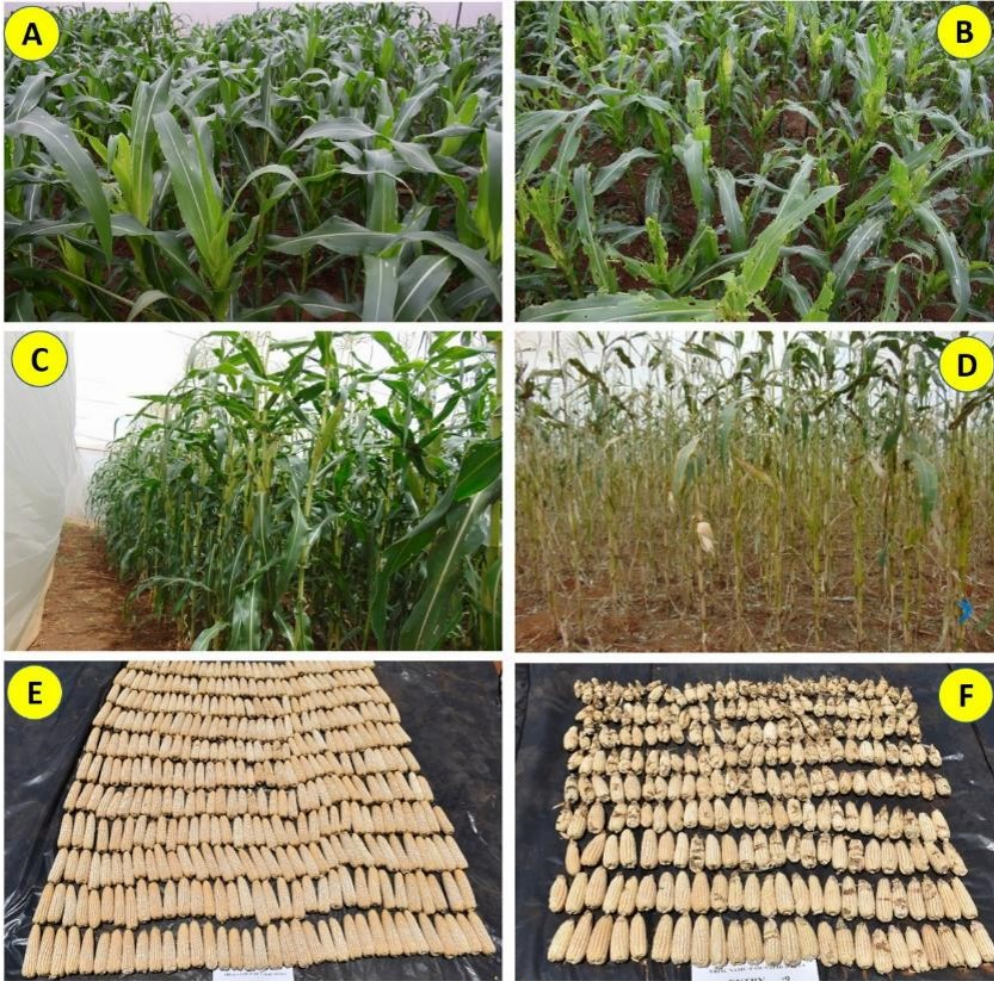
# FAW-tolerant CIMMYT Inbred Lines shared globally...



CIMMYT Maize Lines (CMLs) with native genetic resistance to FAW (e.g., CML71, CML125, CML330, CML338, CML370, CML574) disseminated to partners across Africa and Asia.

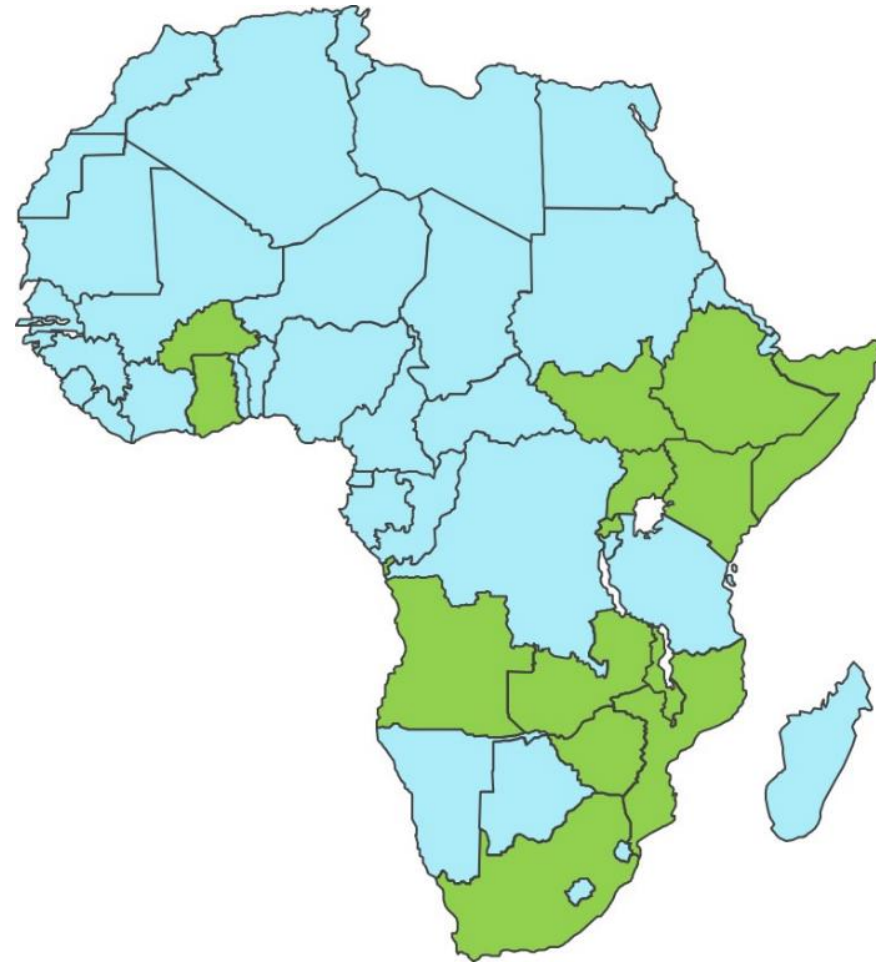
# Native Genetic Resistance to FAW

FAW-tolerant Maize Hybrids from CIMMYT



FAW-tolerant Hybrids

FAW-susceptible Checks



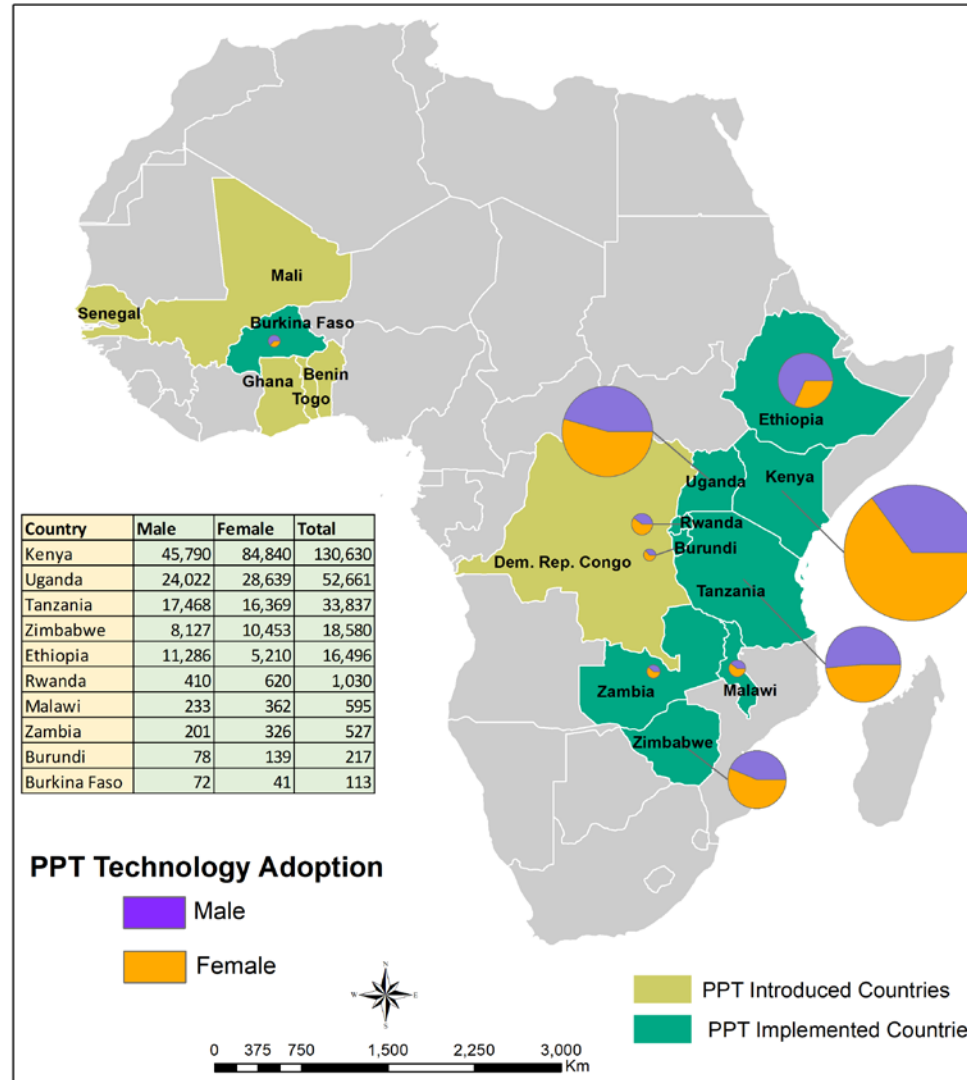
National Performance Trials (NPTs) in 2021 across Africa, including **Ethiopia, Kenya, Rwanda, Uganda, South Sudan, Somalia, Angola, Malawi, Mozambique, South Africa, Zambia, Zimbabwe, Ghana and Burkina Faso.**

# Push-Pull System for FAW Management

Climate-smart Push-Pull



Conventional Push-Pull



Source: *icipe*

<https://www.push-pull.net/>

## Adoption Status

- Adoption: ~254,971 farmers
- Partners: > 20
- Seed producers: <5

## Needs for further scaling

- Promotion of local production of companion crop seeds and distribution system
- Enhance awareness on the benefits of Push-Pull

# FAW-specific Biopesticides: AgBiTech's Fawligen™ as an Example

- Nucleopolyhedrovirus (NPV)-based biological insecticide designed to selectively control FAW.
- Unique mode of action (IRAC Group 31); no known cases of resistance to NPV-based insecticides anywhere in the world.
- OMRI-certified organic insecticide → highly selective, thus allowing valuable beneficial arthropods to thrive.
- Proven track record of managing FAW as a part of IPM program.



## Registered/Commercialized in...

Country	Year
USA	2016
Brazil	2018
Senegal (Emergency Permit)	2018
South Sudan (Emergency Permit)	2019
Sri Lanka	2019
Bangladesh	2020
Zambia (Conditional)	2020
Ivory Coast	2021
Kenya	2021
Australia (Emergency Permit)	2021
Cameroon, CILLS countries, Ghana, Nigeria, etc.	2021-2022 (Expected)

Source: Shachi Gurumayum (AgBiTech)



# Artificially Intelligent 'Smart' Traps for Pest Monitoring



TrapView in Dinajpur, Bangladesh  
(Source: CIMMYT)

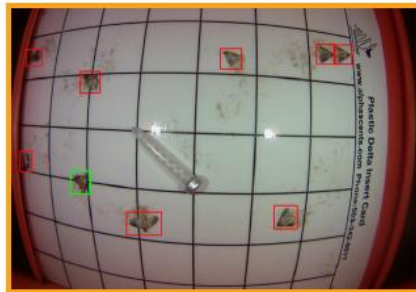
- *Example:* EU-funded **TrapView** system deployed in **over 40 countries in 6 continents**
- Combines daily information extracted from the insect images, with local weather data, historical trends and forecasting, to predict pest dynamics.
- Self-cleaning traps → ensure high catching efficiency and consequently high data quality → images sent to the cloud, processed and analyzed by machine learning to identify each of the insects pictured.

Source: [www.trapview.com](http://www.trapview.com)

# Smart Traps for FAW Monitoring: Another Example



DTN Smart Trap



## See counts and reports for target pests

The onboard camera detects, counts, and reports on pests in near real time, and can distinguish between target and non-target pests.

## Access daily insect counts

Daily insect counts make biofix and phenology models more precise, improving spraying operations.

## Mobile and web views

Conveniently check your trap counts on both mobile and web platforms. Photographs can be viewed on the web for verification.

## Spend less time in the field

Spend less time checking traps and more time evaluating the field's overall health.

Source: [www.dtn.com](http://www.dtn.com)

# Provivi's Mating Disruption Pheromone Technology



Technology registered in Kenya in Brazil in August 2020; in Mexico in Sept 2020; and in Kenya in April 2021.

- Pherogen™ SPOFR dispenser, developed by Provivi, has been recently registered in Kenya, in partnership with CABI.
- Pheromone-based pest control technology, that interferes with FAW's reproductive cycle.
- Dispensers installed at a specific spacing in the field → release a pheromone cloud in the field → In this cloud, FAW males cannot locate the females → FAW reproductive cycle disrupted.
- When the method is used area-wide and over several seasons, effect of pest population will be amplified.

# Oxitec's GM-based Self-limiting Insect Mating Technology



Source: Cornell Alliance for Science

Oxitec's "Friendly" self-limiting Insect Mating Technology registered for FAW control in Brazil in April 2021

- Species-specific technology
- Male self-limiting transgenic FAW moths find and mate with female FAW moths and make them infertile.
- Designed to work in tandem with existing IPM-based tools available to farmers
- Potential to delay, or even reverse, the spread of insecticide/*Bt* resistance in FAW populations

# IPM = Integrating People's Mindsets!

- The Fall Armyworm humbles us all!
- R4D is key for developing and deploying **sustainable solutions** for FAW management.
- Farmers need effective, science-/evidence-based, **robust and affordable** tools to combat FAW.
- **Enabling policies** to ensure that resource-constrained African smallholders gain **rapid access to smart innovations** for sustainable management of FAW.

# THANK YOU!

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