Evidences

Study #4600

Contributing Projects:

- P2097 - Fighting back against fall armyworm (FAW) in Bangladesh
- P2140 - Breeding for native genetic resistance to FAW in maize germplasm adapted to eastern Africa YB
- P2142 - Breeding for resistance to FAW in southern Africa
- P1847 - validate available conventionally developed lines for resistance/tolerance to FAW to identify key lines for hybrid development
- P2141 - Breeding for native genetic resistance to FAW in maize germplasm adapted to eastern Africa- DM
- P1235 - Broadening the Genetic Diversity of FAW resistance in White Maize Germplasm Adapted to sub-Saharan Africa (GMP Challenge Contest winner)
- P1894 - Initiate a pilot work on the use of digital imaging for quantification of maize leaf/canopy damage by FAW
- P1983 - Breeding for native genetic resistance to FAW in CIMMYT's African mid-altitude maize germplasm
- P1998 - Coordinating and implementing IPM R4D against Fall Armyworm (FAW) in Africa and Asia, and implementing MLN management in Africa and LatAm
- P1982 - Stacking MLN resistance, SPT, and FAW tolerance in elite hybrids
- P2161 - Implementing an IPM-based strategy for FAW control in Africa and Asia, and MLN management in Africa
- P1874 - Strengthening capacity of breeding for native genetic resistance to FAW in ESA
- P1297 - Identifying/developing Improved Tropical Maize Germplasm with Native Resistance to Fall Armyworm (FAW) in Sub-Saharan Africa
- P1850 - Discovery of genomic regions for resistance to FAW in Africa.
- P1227 - Fall Army Worm (FAW) Response

Part I: Public communications

Type: OICR: Outcome Impact Case Report

Status: Completed

Year: 2021

Title: Collective efforts to fight fall armyworm (FAW) led to FAW-tolerant varieties in only 2 years and dedicated IPM extension efforts reaching 187,000 farmers

Short outcome/impact statement:
Fall armyworm has become an endemic pest across Africa and Asia. International efforts enabled monitoring and surveillance and dissemination of sustainable and affordable Integrated Pest Management and breeding-based solutions. Control strategies that combined intercropping, crop rotation and adjusting planting/harvesting dates have proved promising. Within 2 years, CIMMYT made available FAW-tolerant hybrids for sub-Saharan Africa (SSA). In 2021, National Agricultural Research System (NARS) partners started national performance trials. In Asia, smallholder extension efforts in Bangladesh reached 187,000 farmers during 2020-2021.

Outcome story for communications use:
The fall armyworm (FAW) is an invasive pest that affects more than 80 different crops, with a particular preference for maize. Native to the Americas, it was first reported in Africa in 2016 and quickly spread throughout the continent. It reached India in 2018, then many other countries across Asia and the Pacific and reached Australia in 2020. FAW has become an endemic pest across much of Africa and Asia.

Major international efforts led by FAO, CIMMYT, CABI and USAID and involving many national partners, initiated monitoring and surveillance actions, as well as developing and promoting sustainable and affordable Integrated Pest Management and breeding-based solutions. R esearchers concluded that using a diverse combination of tactics is the best way to manage FAW safely, effectively, and sustainably in SSA, while minimizing the use of broad-spectrum insecticides. More generally, the promotion of affordable, accessible and ecologically friendly control strategies are needed (Abro et al, 2021) https://doi.org/10.1002/fes3.281 (2021, CABI).

Control strategies that combine intercropping maize, crop rotation, soil fertility, and adjusting dates for planting and harvesting have proved promising. Because of their low cost and safety, these approaches particularly suit smallholder farmers in SSA.
Within two years, CIMMYT (2020) combined insect-resistant maize germplasm from Mexico and USDA-ARS germplasm with stress-resilient maize germplasm from SSA. In December 2020, CIMMYT announced the release of fall armyworm tolerant hybrids. In 2021, NARS partners started national performance trials, which will be followed by variety release and registration by public and private sector seed companies for the deployment in eastern and southern Africa. Similar activities by IITA in West Africa and ICRISAT in Southern Africa (for sorghum) complement germplasm-based efforts. Another solution is the introgesion of Bt maize via the TELA Project, a public-private partnership led by the African Agriculture Technology Foundation. The aim is to provide SSA smallholder farmers with Bt maize producing four or more distinct and highly effective Bt toxins that will provide sustainable control of this pest, with the potential for benefits lasting decades.

The Cereal Systems Initiative for South Asia's (CSISA) co-support of the USAID/Bangladesh Mission and Michigan State University-funded FAW Activity in Bangladesh reached 187,000 farmers wit FAW Integrated Pest Management advice in collaboration with the Bangladesh Department of Agriculture Extension (DAE)

Links to any communications materials relating to this outcome:

- https://tinyurl.com/ybr24u75
- https://tinyurl.com/yb6yv7hd
- https://tinyurl.com/y76xm6b2
- https://tinyurl.com/ya6tudty
- https://tinyurl.com/y8ftc8sz
- https://tinyurl.com/yauu5236
- https://tinyurl.com/y79swsxe
- https://tinyurl.com/y7ga6k4n
- https://www.cimmyt.org/multimedia/in-case-of-fall-armyworm-watch-this-video/

Part II: CGIAR system level reporting

Link to Common Results Reporting Indicator of Policies : No

Stage of maturity of change reported: Stage 1

Links to the Strategic Results Framework:
Sub-IDOs:
- Adoption of CGIAR materials with enhanced genetic gains
- Increase capacity of beneficiaries to adopt research outputs

Is this OICR linked to some SRF 2022/2030 target?: Yes

SRF 2022/2030 targets:
- Increased rate of yield for major food staples from current 1%/year
- # of more farm households have adopted improved varieties, breeds or trees

Description of activity / study: <Not Defined>

Geographic scope:
- National
- Regional

Region(s):
- Sub-Saharan Africa
- Southern Asia

Country(ies):
- Bangladesh

Comments: <Not Defined>

Key Contributors:
Contributing CRPs/Platforms:
- Maize - Maize

Contributing Flagships:
- FP3: Stress Tolerant and Nutritious Maize

Contributing Regional programs: <Not Defined>
Contributing external partners:
- IITA - International Institute of Tropical Agriculture
- ICRISAT - International Crops Research Institute for the Semi-Arid Tropics
- DAE - Department of Agriculture Extension (Bangladesh)
- FAO - Food and Agriculture Organization of the United Nations
- CABI - Centre for Agriculture and Biosciences International
- USAID - U.S. Agency for International Development

CGIAR innovation(s) or findings that have resulted in this outcome or impact:
Sustainable and affordable Integrated Pest Management & breeding-based solutions (FAW-tolerant hybrids)

Innovations: <Not Defined>

Elaboration of Outcome/Impact Statement:
The Fall Armyworm Challenge Survey conducted in Kenya showed that about a third of the (maize) harvest was lost, confirming estimates from other socio-economic surveys. Perceived yield losses by maize farmers stood at 40% (range 25–50%; Ghana) and 45% (22–67%; Zambia). Extrapolating the results, MAIZE scientists estimated that FAW in Africa might cause maize yield losses ranging from 8.3 to 20.6 million tons p.a., valued at US$ 2.4–6.2 billion, if left uncontrolled.

Researchers concluded that using a diverse combination of tactics is the best way to manage fall armyworm safely, effectively and sustainably in sub-Saharan Africa, while minimizing use of broad-spectrum insecticides. Control strategies that combine intercropping maize, crop rotation, soil fertility, and adjusting planting and harvesting dates have proved promising. Because of their low cost and safety, these approaches particularly suit smallholder farmers in SSA. At two field sites in Ghana (2018-2019), the FAW damage score was 68% lower and maize yield was 47% higher in push–pull plots than control plots of maize alone (Yeboah et al. 2021).

Withn two years, CIMMYT combined insect-resistant maize germplasm from Mexico and USDA-ARS germplasm with stress-resilient maize germplasm from SSA. In screenhouse trials conducted in Kenya (2020; under artificial infestation), mean grain yield was eight times higher for 3 FAW-tolerant hybrids (7.9 tons per ha) compared to 2 susceptible commercial hybrids. In December 2020, CIMMYT announced the release of fall armyworm tolerant hybrids. In 2021, NARS partners started national performance trials, upon which variety release trials and public and private sector seed companies' new varieties' registration will follow, for deployment in eastern and southern Africa. Similar activities by IITA in West Africa and ICRISAT in Southern Africa (for sorghum) complement those germplasm-based efforts. NARS in sub-Saharan Africa (especially Uganda & Malawi) have also initiated germplasm screening to identify tolerant/resistance materials.

Another solution pathway is the introgression of Bt maize as part of the TELA Project, a public-private partnership led by the African Agriculture Technology Foundation (AATF). Bt maize that produces 4 or more distinct Bt toxins highly effective against FAW could provide sustainable control of this pest, with the potential for benefits lasting decades.

The Cereal Systems in South Asia (CSISA Phase III) projects' support of the USAID/Bangladesh and Michigan State University-funded Activity has been extremely successful. Initially targeting 33,000 farmers and extension agents, they trained 187,000 farmers in Integrated Pest Management, in collaboration with the Bangladesh Department of Agriculture Extension.

References cited:

•[1] L.M. Burtet et al, Managing fall armyworm, Spodoptera frugiperda (Lepidoptera: Noctuidae), with Bt maize and insecticides in southern Brazil (https://doi.org/10.1002/ps.4660)
•[2] Spread and impact of fall armyworm (Spodoptera frugiperda J.E. Smith) in maize production areas of Kenya, Agriculture, Ecosystems & Environment (https://doi.org/10.1016/j.agee.2019.106804)
•[3] Fall armyworm-related information on IITA website (https://www.iita.org/search_gcse/?q=fall%20armyworm)
•[4] J.S. Bale et al, Herbivory in global climate change research: direct effects of rising temperature on insect herbivores (https://doi.org/10.1046/j.1365-2486.2002.00451.x)
•[5] J.E. Huesing et al, Fall Armyworm in Africa: A Guide for Integrated Pest Management, CIMMYT, USAID, México (2018), pp. 1-9 (https://tinyurl.com/236dkekz)
•[6] Eshome Kumela et al, Farmers' knowledge, perceptions, and management practices of the new invasive pest, fall armyworm (Spodoptera frugiperda) in Ethiopia and Kenya, International Journal of Pest Management (https://doi.org/10.1080/09670874.2017.1423129)
•[7] P. Abrahams et al, Fall Armyworm: Impacts and Implications for Africa Evidence Note (2), September 2017 (https://tinyurl.com/2bugd57c)
•[8] Fall armyworm-related information on CIMMYT website (https://www.cimmyt.org/tag/fall-armyworm/)
•[9] F. Baudron et al, Understanding the factors influencing fall armyworm (Spodoptera frugiperda J.E. Smith) damage in African smallholder maize fields and quantifying its impact on yield. A case study in Eastern Zimbabwe (https://doi.org/10.1016/j.cropro.2019.01.028)

Quantification: <Not Defined>

Gender, Youth, Capacity Development and Climate Change:
Gender relevance: 1 - Significant
Main achievements with specific **Gender** relevance: applied research about gender differences in access to and use of FAW-relevant farm inputs and resources (for example Gender Platform briefing: https://gender.cgiar.org/news-events/how-do-we-sustainably-manage-transboundary-diseases-and-crop-pests; project partner CABI https://doi.org/10.1016/j.scitotenv.2020.140015; FtF Lab on IPM: https://vtx.vt.edu/articles/2021/08/outreach-Bangladeshagriculture.html?utm_source=cmpgn_news&utm_medium=email&utm_campaign=vtUnirelNewsDailyCMP_081821-fs; https://agrilinks.org/post/nepali-women-improve-inclusive-access-inputs-insights-field).
Youth relevance: 0 - Not Targeted
CapDev relevance: 1 - Significant
Main achievements with specific **CapDev** relevance: training provided to farmers for alternative and sustainable management practices, see 187,000 in Bangladesh. MAIZE training database lists 13 train-the-trainer events in Bangladesh & 3 PhD/Master students working on fall armyworm-related research.
Climate Change relevance: 1 - Significant
Describe main achievements with specific **Climate Change** relevance: Climate change is a significant factor driving the spread of pests and diseases, along with increasing global trade. Climate change can affect the population size, survival rate and geographical distribution of pests; and the intensity, development and geographical distribution of diseases.

Other cross-cutting dimensions: No

Other cross-cutting dimensions description: <Not Defined>

Outcome Impact Case Report link: Study #4600

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