

ASEAN Action Plan on Fall Armyworm Control



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Acknowledgements

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Executive Summary

The Fall Armyworm (*Spodoptera frugiperda*) was first reported in Southeast Asia in late 2018 in Thailand and Myanmar. It has since rapidly spread, and its presence is now confirmed in almost all ASEAN countries. The pest, which feeds on more than 350 plant species, can cause major damage, particularly to maize crops. Now it is endemic in the region, management will need to be focused on control rather than eradication.

The impact of the Fall Armyworm's presence in the ASEAN region will be considerable. Estimates using 10% crop damage across ASEAN maize crops indicates an annual US\$884 million cost. Both in lost farmer income and as buyers are forced to import maize.

ASEAN farmers are in urgent need of effective, locally valid and regionally relevant management solutions. Appropriate, cost-effective and practical integrated pest management (IPM) methods also wait to be developed, validated, promoted and/or scaled up.

In 2019, ASEAN Ministers and senior officials responded to the threat that Fall Armyworm presents by supporting the development of a regionally coordinated response. In October 2019, the SOM-AMAF requested Grow Asia, in collaboration with ASEAN Secretariat to work with Viet Nam and the ASEAN Sectoral Working Group on Crops (ASWGC) to develop a regional FAW framework.

After an extensive six-month consultation process, the ASEAN Action Plan on Fall Armyworm presented here, clearly sets out the goals, objectives, implementation structure and work programmes of a comprehensive Action Plan to support countries to respond to, monitor and manage Fall Armyworm across the region (see Diagram 1).

The budget proposed is modest given the financial and social impacts of the Fall Armyworm. Due to the complexities caused by Covid-19 and possible constraints on funding, the program is divided into two. A core budget of \$750,000 annually towards vital, immediate and high priority actions identified through the consultation. This will drive immediate coordination, communications and policy responses, along with farmer support and learning, and targeted high priority projects. An additional budget of US\$1.5 million per year, which will support the implementation of an ASEAN research development and technology program. This will be managed transparently through a competitive funding platform, to drive swift innovation, validation and use of smart management solutions to control the pest in the future.

The benefits of a coordinated multi-stakeholder regionally-led approach are significant. By working together, sharing information, learnings, and pooling resources the region will accelerate new knowledge, reduce duplication, amplify positive field results and be able to deliver improved value for money. The program will build capability and networks and demonstrate the value of integrated ASEAN action for pest and disease control. It will form part of, and be supported by the FAO Global Action for FAW Control. And it will be an integral element of the FAO Regional Steering Group on FAW, made up of high-level country representatives from across the Asian region. This will ensure the ASEAN Action Plans' experiences and learnings on-the-ground help inform and support the wider Asia approach under the FAO Global Action.

Farmers will benefit from improved on-farm management practices and reduced crop damage. Effective management of FAW in the region, for example by reducing maize crop losses from 10% to 3% damage would likely represent at least USD\$600 million annual savings in lost farm income, and forex expenditure in imports necessary to make up for the production shortfall

A regionally coordinated ASEAN FAW Action Plan will be a practical demonstration of the ASEAN values of cooperation and partnership on common regional issues.

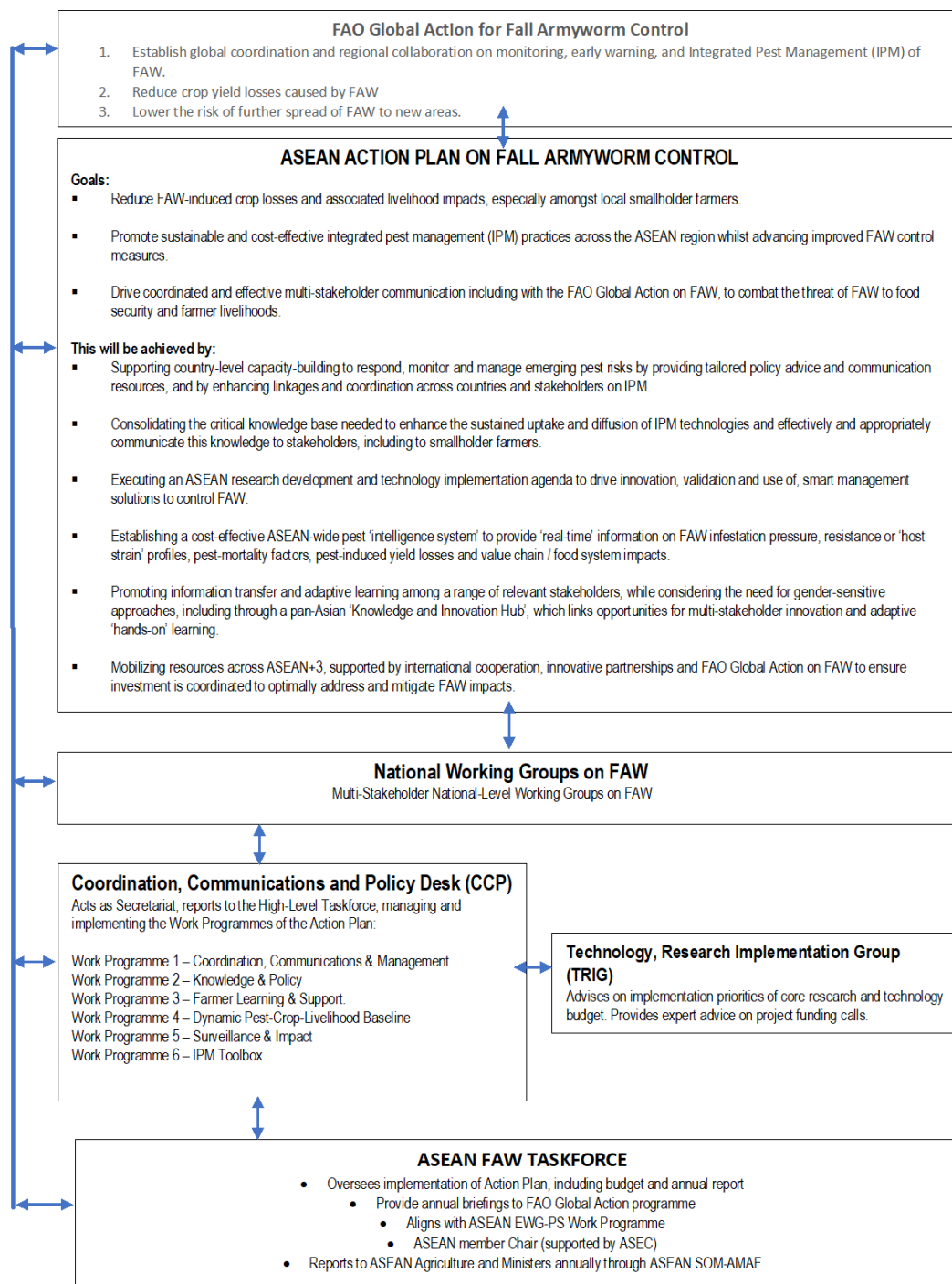


Diagram 1: Visual representation of the ASEAN FAW Action Plan

Acronyms

ASEAN	The Association of Southeast Asian Nations
ASEAN+3	ASEAN plus the three nations of China, Japan and South Korea
ASWGC	ASEAN Sectoral Working Group on Crops (ASWGC)
Bt	Bacillus thuringiensis
CABI	Centre for Agriculture and Biosciences International
CGIAR	Consultative Group for International Agricultural Research
CIMMYT	International Maize and Wheat Improvement Center
CPPO	Chief Plant Protection Officers
CSIRO	Commonwealth Scientific and Industry Research Organisation
DAWE	Australian Department of Agriculture, Water and the Environment
EWG-PS	Experts Working Group on the Harmonization of Phytosanitary Measures Among ASEAN
FFS	Farmer Field Schools
FtF	Farmer-to-farmer
FAO	Food and Agriculture Organization of the United Nations
FAO RAP	FAO Regional Office for Asia and the Pacific
FAW	Fall Armyworm
GHS	Globally Harmonized System on Classification and Labeling of Chemicals
GM	Genetically Modified
HHP	Highly Hazardous Pesticide
HPR	Host Plant Resistance
ICIPE	International Center of Insect Physiology and Ecology
IITA	International Institute of Tropical Agriculture
IPM	Integrated Pest Management
IPPC	Integrated Plant Protection Center
MARD	Ministry of Agriculture and Rural Development Viet Nam
NPPO	National Plant Protection Organisations
ToTs	Training-of-Trainers (ToTs)
USAID	United States Agency for International Development

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Problem Definition

The Fall Armyworm (FAW) is a serious pest that causes major damage to maize, and a wide range of other crops including rice, sorghum, sugarcane, wheat, as well as vegetable crops and cotton¹. Its arrival in Southeast Asia since 2018 has started to affect crop production in the region, in particular the maize systems. ASEAN is unprepared for this new pest. Local farmers are in urgent need of effective, locally valid and regionally relevant management solutions. Appropriate, cost-effective and practical integrated pest management (IPM) methods also wait to be developed, validated, promoted and/or scaled up. Furthermore, IPM-compatible agrochemical and biological crop protection products against FAW wait to be registered in ASEAN countries.

Figure 1 Global Distribution of FAW in April 2020 – Recent PNG Detection Not Included



Source: Centre for Agriculture and Bioscience International <https://www.cabi.org/isc/fallarmyworm>

The implications of the FAW infestation on farmers' income and livelihoods cannot be neglected. Maize is one of the primary agricultural goods that is impacted but rice and other crops could also be affected. Losses and impacts on maize are discussed as the illustrative main example of the scale of the problem but economic and food security issues could be even more severe given the potential impact of FAW on other crops.

Currently, the ASEAN produces some 52 million tonnes of maize² and imports another 23 million tonnes³. Predicted crop losses from FAW, with no effective control measures in place (estimated at 10% loss), would likely result in increased maize imports. Assuming low export levels remain constant and ASEAN then imports maize to make up for the shortfall, this could amount to an additional cost of around US\$884 million per year and corresponding impacts on ASEAN's foreign exchange. Higher costs of imported maize will likely result in higher prices and a disrupted supply of food, animal feed (e.g., chickens, hogs) and fibre (i.e., starch) – with cascading impacts along the food value chain.

The people who will suffer the most from these impacts will be the millions of small-scale producers who currently have a deficient understanding of how to effectively manage a fast-spreading and potentially debilitating pest. Indiscriminate use of inappropriate and unsafe agrochemicals sprays could also exacerbate

¹ The fall armyworm (*Spodoptera frugiperda*) is a lepidopteran pest that feeds in large numbers on leaves and stems of more than 80 plant species. See [CABI's Fall Armyworm Portal](#) for further information.

² Based on maize production for the year 2018 from FAOSTAT for all ASEAN countries. Data accessed 4 May 2020.

³ ASEAN Food Security Information System (AFSIS) Secretariat, [Agricultural Commodity Outlook \(ACO\) Report 2018](#). Published in December 2017. Note that imports were projected figures for 2018, imports are likely to be at least 23 million tonnes with the predicted trend towards increased imports of maize of around 4%.

the problem, disrupt the ecological resilience of local farming systems and hamper natural, cost-free biological control of FAW. It is likely that, in the absence of a regionally coordinated effective response, the food security and livelihoods of millions of small-scale farmers in Asia would be at serious risk.

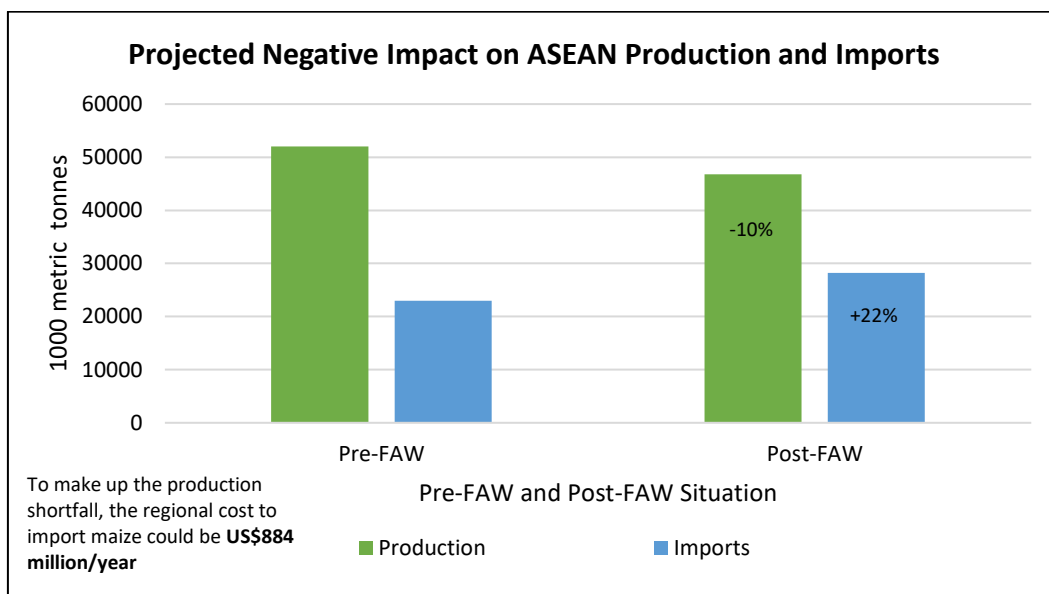


Figure 2: Projected negative impact on ASEAN maize production and imports.

Current Situation

ASEAN

Fall Armyworm (*Spodoptera frugiperda*) was first reported in the region in 2018 in Thailand and Myanmar. The rapid spread of the pest across the region has continued over the last two years; FAW presence has been now confirmed in almost all the ASEAN countries.

Annex 1 provides a summary of FAW impact across ASEAN countries, along with specific activities and potential gaps as indicated by stakeholders in various forums, including the [Regional Workshop for Asia Sustainable Management of Fall Armyworm](#) (November 2019), and in consultation and feedback on the development of this Action Plan.

Broader Asia-Pacific region

Sri Lanka, Bangladesh, India, Nepal

In Asia, FAW incidence was formally reported first in Yemen and then in the southern state of Karnataka in India in May 2018 (ICAR-NBAIR, 2018), and in Sri Lanka, Bangladesh, Myanmar, Nepal, Cambodia, and Thailand by December 2018 (<https://www.ippc.int>).

China, Japan, South Korea

In China, FAW was initially detected in mid-December 2018 in Yunnan Province (Pu'er City and Dehong). It has since spread to a total of 26 provinces in China⁴.

⁴ Molecular assays have revealed how the invasive FAW population in China comprises a complex inter-strain hybrid, primarily consisting of a corn-strain genetic background. Genetic analyses further indicated how invasive populations may have elevated risk of developing resistance to conventional pesticides although remaining susceptible to Bt toxins (Zhang et al., 2019, [BioRxiv](#)). This work accentuates the need to carry out real-time surveillance of likely arrivals of novel populations.

The first report of FAW occurrence in Japan was in a maize field in Kagoshima Prefecture in July 2019. Also, FAW was observed on sorghum and sugarcane fields. A FAW control manual was published by Ministry of Agriculture, Forestry and Fisheries in April 2020.

FAW was first detected in South Korea in June 2019 in 4 corn fields on Jeju island. The Ministry of Agriculture Food and Rural Affairs has established a committee for early detection and action for FAW to coordinate activities for monitoring, border inspection, and information collection.

Timor Leste, Papua New Guinea

FAW has recently been recorded in both Timor Leste and Papua New Guinea (PNG) in January 2020. In Timor Leste, damage has been reported in maize, sugarcane and from local pastures (grasses) which may have a broader impact on local livestock production. In PNG, fall armyworm has the potential to cause significant damage to village level crops such as maize, sorghum, rice and other crops (e.g., vegetables) but also cause significant impact to large commercial production crops such as sugarcane and rice crops.

Australia, New Zealand

FAW was formally detected in the Torres Strait islands of Saibai and Erub which formed parts of Australia's Permanent Biosecurity Monitoring Zone in January 2020, followed by detection in Bamaga (North Queensland) on Australia mainland in February 2020, and Katherine (Northern Territory) and Kununurra (Western Australia) in March 2020. At present, the most southern detections are in Bundaberg (Queensland) and Broome (Western Australia) and the pest is expected to continue to move southwards over the coming months.

The Australian Consultative Committee on Emergency Plant Pests has agreed that FAW is not technically feasible to eradicate in Australia and the government is working to prepare affected industries for ongoing, long-term management of the pest. The Australian pest and disease outbreak website can be used to access FAW information, reference, and resource materials (see <https://www.outbreak.gov.au/>).

FAW has not been reported so far in New Zealand.

Current ASEAN Initiatives

As part of the development of this Action Plan, a survey was undertaken to identify experts and initiatives in the region. Eighty-one individual responses were received on the survey. In addition, stakeholder outreach identified further contacts. This stakeholder database will be an important tool for communications and outreach at the launch of the ASEAN FAW Action Plan.

The spread of FAW into the ASEAN region means that there are fewer examples of established and coordinated multi-stakeholder projects. Examples provided were mostly of private sector work in the field with suppliers and farmers (e.g. East-West Seed project in the Philippines, CPP Crops project with farmers/suppliers, a Bayer initiative with farmers in Vietnam); Aid-focused projects (e.g. USAID IPM Lab projects in Cambodia and Viet Nam, Swiss Development (SDC) programme in Laos on FAW; Stakeholder Workshops on FAW Management (e.g. CIMMYT-organized workshops in India, Nepal and Laos PDR, with participants from various countries including the ASEAN); and exploration of future bilateral research partnerships (by various institutions). FAO has also organised two regional workshops in 2019 in Bangkok (Thailand) and Kunming (Yunnan, China), convening stakeholders to share information on key research advances and ecological insights from previously-invaded areas (e.g., Africa, India), endorsing Global Best Practices and discussing a potential regional FAW 'community of practice'.

Further clarity on the range of different stakeholder initiatives and the implementation of a coordinated multi-stakeholder approach to FAW would be hugely beneficial to more efficiently managing FAW across the region.

Other regions

Considerable efforts in other regions to control FAW have been undertaken such as in the Americas, and across Africa where the pest is either endemic or has become established. This has been accompanied by a substantial build-up of expertise in these countries, as well as in international research organisations and collaborations. It is important to note that all these prior efforts provide a substantial resource for the development of any responses in the ASEAN region. A non-exhaustive list of organisations and collaborations are provided in Annex 3.

Global Action on Fall Armyworm Control

In December 2019, FAO launched the three-year [Global Action for Fall Armyworm Control](#) to ensure a strong coordinated approach at country, regional and global levels. The ASEAN Action plan is designed to align with, and support implementation of this Global Action programme.

Development of the ASEAN FAW Action Plan

FAW was discussed at the ASEAN Special SOM-40th AMAF in August 2019 and the PrepSOM-41st AMAF in October 2019. The SOM-AMAF discussed the importance of developing regional cooperation and requested Grow Asia to work with the ASEAN Secretariat, Viet Nam and ASEAN Sectoral Working Group on Crops (ASWGC) in developing a regional framework to address the FAW invasions.

Subsequently, Grow Asia in collaboration with MARD Viet Nam and the ASEAN Secretariat as well as FAO RAP (as technical partner) initiated work to develop an ASEAN Fall Armyworm Action Plan. As part of that work, extensive consultation was carried out between October 2019 and April 2020, including diverse stakeholder input from across government, research and private sectors, including input suppliers (e.g., seeds, agro-chemicals, farm equipment, biological control solutions), maize purchasers (e.g., CP Group) and other value chain actors.

A public survey to collect feedback on initiatives, as well as identify stakeholders was conducted between 18 March and 5 April 2020. Participants of the survey, along with a broad range of agricultural stakeholders in the region were also given the opportunity to comment on the draft Action Plan through a Grow Asia-initiated public review process run from 24 to 30 April 2020.

An Expert Group was also formed consisting of 43 experts (Annex 4) who were asked to review and provide written comments on draft versions of the Action Plan. Five online workshops were also held between 21 to 24 April 2020.

Members of the ASEAN Sectoral Working Group on Crops (ASWGC) and Experts Working Group on Harmonisation of Phytosanitary Measures Among ASEAN (EWG-PS) were formally consulted on the Draft Action Plan from 15 April to 3 May 2020⁵.

This ASEAN FAW Action Plan represents the outcome of all these consultations. It reflects a regional multi-stakeholder approach involving extensive inputs from both the public and private sectors and being well-attuned to the needs of the region's agricultural sector.

The ASEAN Action Plan is cognizant of the work at the international level coordinated by FAO on the Global Action for FAW Control. The intention is that the ASEAN Action Plan will represent a key contribution at a regional level to global efforts and both contribute to and be supported by, the Global Action programme.

Finally, given the myriad ongoing FAW programs in Africa, Asia and the Americas, the ASEAN Action Plan emphasizes a collaborative approach which seeks to leverage efforts across partners, regions and

⁵ The initial consultation ended on 30 April 2020, however, an extension until 3 May 2020 was given to provide some countries additional time to review the document.

initiatives and avoid duplication of efforts. This will be particularly important given potential financial and resource implications resulting from the Covid-19 pandemic.

Three major components of an effective Action Plan

The FAW management package consists of three major components based on 1) Response, monitoring and management; 2) Innovative research development and technology implementation; and 3) Comprehensive regionally led communications on FAW.

All proposed FAW management technologies fall under integrated pest management (IPM) – i.e., integrated and rational use of mutually-compatible chemical, biological, genetic and agronomic technologies to lower FAW pest population pressure without compromising the overall ecological resilience of local farming systems.

As per definition (FAO, 2020), IPM entails a careful integration of appropriate measures that discourage the development of pest populations and keep pesticides and other interventions to levels that are economically justified and reduce or minimize risks to human health and the environment. IPM emphasizes the growth of a healthy crop with the least possible disruption to agroecosystems and encourages natural pest control mechanisms, leaving no room for the promotion of unguided prophylactic pesticidal interventions.

An IPM framework has several key objectives as outlined by the Guide for Integrated Pest Management of Fall Armyworm in Africa⁶ in figure 3.

- **Prevent or avoid pest infestations** using a combination of environmentally friendly approaches at the field, farm, and landscape scale, such as cultural control, landscape management, host plant resistance, and biological control.
- Implement routine scouting to **identify and respond to** potentially damaging pest infestations when they occur.
- In the event of a pest infestation, **suppress the pests** using a combination of biological, physical, and if necessary, chemical approaches – **leveraging interactions** between complementary approaches in order to maximize control of the pest while minimizing potential risks to human and animal health, the environment, and natural enemies of the pest.
- **Minimize the amount and toxicity** of chemical pesticides applied to achieve control of the pest.
- Provide **scientifically validated, evidence-based choices to farmers** on how to safely and effectively mitigate the potential damage of their crop(s) from a specific pest or combination of pests.
- **Maximize the contributions by all stakeholders, and incorporate new, practical findings** as they become available for **continuous improvement**.
- **Manage insect resistance to pesticides** by minimizing their use.

Figure 3: Key Objectives of an IPM Framework

Description of components

Component 1 focuses on the rapid introduction and/or scaling up of management solutions, to better respond to, monitor and manage FAW. This includes the promotion and scaling up of validated, IPM-compatible ‘Global Best Practices’, with the overall aim to prevent crop losses and economic damage, while safeguarding ecological resilience. Efficacy screening and economic valuation of IPM technology packages will be carried out under variable agro-ecological and socio-economic farming contexts, along with the development of better data systems, ‘real-time’ pest surveillance and crowd-sourcing or citizen science (i.e., low-cost provision of services or collection of data by large numbers of individuals, including farmers,

⁶ B.M. Prasanna, Joseph E. Huesing, Regina Eddy, Virginia M. Peschke (eds). 2018. Fall Armyworm in Africa: A Guide for Integrated Pest Management, First Edition. Mexico, CDMX: CIMMYT.

often enabled through digital applications). Community-based programs (e.g., farmer innovation hubs, farmer experimenter nuclei) on FAW control will also be implemented.

Component 2 focuses on the development of an **ASEAN research development and technology implementation agenda**. It will consider various elements for the short-term, medium-term and long-term integration of IPM-based FAW control measures and farm management practices, including pheromone/kairomone-based traps, biological control solutions, host plant resistance (including native genetic resistance and Bt maize, depending on county-level interest and regulation), chemical pesticides with a sound environmental profile (and proper application schemes), and innovative use of technologies, artificial intelligence (AI), robotics and decision-support systems.

Component 3 focuses on **the accelerated diffusion of locally validated IPM solutions** through a comprehensive regionally led two-part communication strategy. *One element* of the strategy will involve creating a multi-stakeholder regional innovation network and communications hub (including the private sector, government, researchers, technicians and ‘farmer experimenters’) to facilitate an ASEAN-wide exchange of best practices and knowledge sharing. *The second element* will focus on tactical use of communication tools for knowledge exchange, farmer advisory and adaptive learning, including the development of effective simple messages to help best drive adoption of smart management practices on-farm.

Advantages of the 3-pronged strategy

The benefits of such a program are significant. Though FAW is expected to become endemic throughout the ASEAN region, experience from other regions shows that the pest can be managed in an economically-sound and environmentally friendly manner. By using the three-pronged approach, overall losses could be as low as 3% per annum, instead of 10% as currently anticipated. The economic benefits could also accrue to \$619 million per year, as regional reliance on maize imports decreases. It is also important to note that these estimates are based on maize alone indicating that economic benefits could be considerably larger given potential economic impacts on other crops as well. Further, with the implementation of robust IPM strategies on-farm is likely to lead to other co-benefits on yield and management costs.

Regional-specific Considerations and Potential Solutions

Local agro-climatic conditions are highly suitable for FAW to the extent that this pest is likely to become endemic. Although there are multiple chemical, genetic and biological tools for FAW control, these are often not registered for use in the ASEAN Member States, or are yet to be fully implemented due to various reasons (e.g. not available for purchase, production/distribution systems not established, lack of education and training).

Given the rapid FAW invasion and farmers’ reliance upon synthetic pesticides, a comprehensive menu of IPM approaches will be offered that considers different resources, issues, farm typologies and anticipated FAW impacts on the agri-food systems of different ASEAN Countries. Due attention will be paid to the environmental profile, sustainability, safety and cost-effectiveness of individual technologies, especially when promoting them for use among local (often resource-poor) smallholder farmers. Policy guidance to help support government decision-making on requests for emergency approvals for IPM-compatible products (including biological control products and microbials) will be provided.

Many appropriate (low-cost) biological and ecologically centred management innovations wait to be developed, proof-tested and promoted in ASEAN. The removal of registration barriers and other obstacles that prevent sufficient sustained access to high-quality products by local farmers will be a key priority under the Action Plan.

Recommendations for FAW field-level scouting, pheromone-use, trap-cropping, and management (e.g., economic thresholds) will also be developed and tailored to the needs of the millions of ASEAN (small-scale) farmers. Digital tools and the use of a wide range of communication strategies will also be tailored

to different audiences to better convey information to different stakeholders with varying levels of education, language, and access to formal extension and information services.

An active and diverse network of scientists, farmer innovators, policymakers and private sector actors can accelerate the development of practical solutions, avoid redundancies and maximize resource-use efficiencies, while steadily consolidating a ‘community of practice’. As such, a broad range of regional and international stakeholders will join forces to seek sustainable mitigation solutions, protect crops and safeguard farmer livelihoods.

ASEAN Action Plan on Fall Armyworm Control (ASEAN FAW Action Plan)

The following sections outline the goals, objectives and tasks of the ASEAN FAW Action Plan.

Goals

The three goals of the ASEAN FAW Action Plan are to:

- Reduce FAW-induced crop losses and associated livelihood impacts especially amongst smallholder farmers.
- Promote sustainable and cost-effective integrated pest management (IPM) practices across the ASEAN region whilst advancing improved FAW control measures.
- Drive coordinated and effective multi-stakeholder communication including with the FAO Global Action on FAW, to combat the threat of FAW to food security and farmer livelihoods.

Objectives

The goals of the Action Plan will be achieved by:

1. **Supporting country-level capacity-building** to respond, monitor and manage emerging pest risks by providing tailored policy advice and communication resources, and by enhancing linkages and coordination across countries and stakeholders on IPM.
2. **Consolidating the critical knowledge base** needed to enhance the sustained uptake and diffusion of IPM technologies and effectively and appropriately communicate this knowledge to stakeholders, including to smallholder farmers.
3. **Executing an ASEAN research development and technology implementation agenda** to drive innovation, validation and use of smart management solutions to control FAW.
4. **Establishing a cost-effective ASEAN-wide pest ‘intelligence system’** to provide ‘real-time’ information on FAW infestation pressure, resistance or ‘host strain’ profiles, pest-mortality factors, pest-induced yield losses and value chain/food system impacts.
5. **Promoting information transfer and adaptive learning** among a range of relevant stakeholders, while considering the need for gender-sensitive approaches, including through a pan-Asian ‘Knowledge and Innovation Hub’, which links opportunities for multi-stakeholder innovation and adaptive ‘hands-on’ learning.
6. **Mobilizing resources** across ASEAN+3, supported by international cooperation, innovative partnerships and FAO Global Action on FAW to ensure investment is coordinated to optimally address and mitigate FAW impacts.

Work Programmes and Activities of the ASEAN FAW Action Plan

The Objectives of the Action Plan will be implemented through the following six work programmes:

Work Programme 1 – Coordination, Communications & Management

Work Programme 2 – Knowledge & Policy

Work Programme 3 – Farmer Learning & Support.

Work Programme 4 – Dynamic Pest-Crop-Livelihood Baseline

Work Programme 5 – Surveillance & Impact

Work Programme 6 – IPM Toolbox

These Work Programmes, along with their corresponding activities are set out in Table 1 on the following page.

Note that Work Programmes 1, 2 and 3 will be delivered under the core budget. A selection of activities defined within the first 3 months as priority research and technology activities will also be proposed as part of core budget activities.

The remaining activities, those not selected in the initial prioritisation for core budget across Work Programmes 4, 5 and 6 will be delivered through competitive and transparent annual funding calls, in which stakeholders will be asked to propose projects aligned with the ASEAN Action Plan goals, objectives and work programmes. All projects outside core funding will require at least one ASEAN partner, and matching funds of at least 30% to qualify for consideration.

Table 1: Work Programmes and Activities under the ASEAN Action Plan		
Work Programmes	Sub-components	Activities
Core budget		
WP 1. Coordination, Communications & Management	1-1: Set-up project management structure, implementation and ongoing management of Action Plan as Secretariat.	Activities will include: Coordinate overall implementation, including budget execution and evaluations, of the Action Plan and promote and manage partnerships with other organizations and donors.
	1-2: Establish multi-stakeholder communication and coordination strategy and networks	Develop a regional communication strategy, likely to include newsletters, periodic webinars, workshops and an annual conference with which to accelerate the exchange of learnings and promote emerging good practices. Maintain an ASEAN database of initiatives, research, extension activities and policy & regulatory support resources.
	1-3: Conduct project reviews and reporting	Establish a FAW IPM ‘Knowledge and Innovation Hub’ to enhance communication among a range of ASEAN, ASEAN+3, and Asia-Pacific-based stakeholders, including farmers, pest management professionals, extension personnel, and facilitate linkages with other regions working on ongoing initiatives related to FAW and other crop-specific IPM measures.
	1-4: Implement and manage funding platform.	Promote gender-sensitive approaches across the implementation of the Action Plan, including in projects and communications. Facilitate the work, coordination and reporting of the TRIG. Develop and manage a transparent and competitive process of funding for all research and technology implementation projects proposed by stakeholders, with expert input provided from members of the TRIG. Report biannually on implementation of the Action Plan to the ASEAN FAW Management Council, as well as provide regular updates to the FAO coordinated FAW Global Action Plan.
WP 2. Knowledge Generation & Policy Support	2-1: Employ existing knowledge to pre-define IPM-compatible products and emerging ‘Good Practices’	Activities will include: Collate experiences and datasets from ASEAN member states and other regions to formulate ‘best-bet’ IPM-compatible recommendations for FAW control.
	2-2: Define priority needs for local registration / implementation	Develop pesticide use and risk management guidelines that set out efficacious and economically justified low-risk pesticide use based upon guidelines as set out in Jepson et al. (2020) ⁷ , while at the same time providing IPM alternatives.
	2-3: Provide tailored policy support to national governments	Define economic thresholds and provide tailored advice to regulators, extension agents and farming communities to avoid unnecessary, environmentally damaging and costly pesticide use.

⁷ Jepson PC, Murray K, Bach O, Bonilla MA, Neumeister L. [Selection of pesticides to reduce human and environmental health risks: a global guideline and minimum pesticides list](#). The Lancet. Planetary Health. 2020 Feb;4(2):e56-e63. DOI: 10.1016/s2542-5196(19)30266-9.

	<p>2-4: Build capability within the ASEAN research and policy community</p> <p>2-5: Facilitate communication to address Covid-19 disruption in seed/pesticide supply chains</p> <p>2-6: Map ‘critical gaps’ and capacity needs</p>	<p>Provide first-rate policy support to government actors, regulators, and assist with the registration of IPM-compatible technologies, including by providing tailored policy advice to assist with the emergency registration of products with sound environmental, and safety profile for key beneficial organisms (e.g. pollinators and key natural enemies).</p> <p>Encourage active participation of ASEAN-based researchers on the Fall Armyworm R4D International Consortium</p> <p>Promote the participation of ASEAN-based researchers as key partners for FAW research projects based in the region</p> <p>Develop workshops, exchanges, research and other opportunities for ASEAN-based post-graduate, PhD and post-doctoral students working on FAW and IPM</p> <p>Consider implications of the Covid-19 emergency and the related disruption of seed and agrochemical distribution channels, and share, develop and distribute relevant resources (including digital training tools, knowledge materials or ‘video protocols’) and policy advice, where relevant, to stakeholders to support sound management responses.</p> <p>Undertake a systematic mapping exercise of ‘critical gaps’ and deficiencies in national response capacity to current (and future) invasive pest threats.</p> <p>Undertake a review of research to better understand if improved IPM measures to address transboundary pests such as FAW might also help farmers mitigate greenhouse emissions and adapt to climate change in ASEAN.</p>
<p>WP 3. Farmer Support & Learning</p>	<p>3-1: Integrate crowd-sourcing, FtF knowledge exchange and advisory tools</p> <p>3-2: Establish ToTs, digital FFS and farmer innovation hubs</p> <p>3-3: Develop efficient, simple-to-use, and targeted communications resources for farmers and extension service providers</p> <p>3-4: Promote multi-stakeholder learning alliances</p>	<p>Activities will include:</p> <p>Implement a dynamic farmer extension program, including Training-of-Trainers (ToTs), farmer-to-farmer (FtF) communication resources and digitally enhanced Farmer Field Schools (FFS) covering FAW biology, ecology and control, in conjunction with the TIG.</p> <p>Facilitate ToT training on FAW occurrence, identification and differentiation from other similar pests and in-field damage for different crop phenological stages and under variable crop management and agro-ecological conditions.</p> <p>Develop, validate and support the use of efficient, targeted and simple-to-use communications, agro-advisories and decision-support tools to guide effective FAW management by a range of stakeholders, in particular by farmers.</p> <p>Conduct study tours, workshops and/or webinars to generate broader awareness of suitable management options at a regional and country-specific level. Enable cross-regional knowledge exchange through innovation fairs and competitions within or among a select set of innovation hubs, FFS groups or farmer experiment nuclei.</p> <p>In close collaboration with individual growers, farmer cooperatives, FFS or farmer experimenter nuclei, establish demonstration models and conduct standardized surveys to evaluate efficacy and cost-effectiveness of proposed management solutions.</p>

Work Programmes	Sub-components	Activities
Additional Budget		
(Note that selected priority activities will be proposed from this list for the core budget, interested stakeholders will also be invited to propose projects based on these activities in competitive funding rounds)		
WP 4. Dynamic Pest-Crop-Livelihood Baseline	<p>4-1: Generate basic insights into FAW biology, migration dynamics and in-field ecology.</p> <p>4-2: Estimate FAW impact on maize agroecosystems, including genotype x environment interactions</p> <p>4-3: Quantify economic thresholds for maize and 1-2 crops with significant losses due to FAW in the ASEAN</p> <p>4-4: Assess constraints to farmer behaviour change and IPM technology diffusion</p> <p>4-5: Define FAW population dynamics and natural enemies across ASEAN geographies and agro-ecological contexts</p>	<p>Activities may include:</p> <p>Develop a dynamic crop-livelihood baseline, with site-specific metrics on pest pressure, maize yield and FAW-induced livelihood impacts – to facilitate further simulation modelling, feed the ASEAN pest ‘information system’ or enable M&E</p> <p>Describe locally abundant natural enemies, record their field colonization patterns and investigate their habitat associations / ecological requirements.</p> <p>Examine the monetary impact of fall armyworm attack (i.e., yield decline, revenue loss) for a panel of locally grown maize cultivars, besides FAW tolerant/resistant varieties (native genetic resistant and/or Bt maize, depending upon country-level interest and regulation).</p> <p>Conduct a multi-site assessment of on-farm economic impacts across seasons, geographies and agro-ecological contexts</p> <p>Develop economic thresholds for FAW in maize (and potentially 1-2 additional crops with significant yield losses due to FAW)) under different agro-ecological conditions, to facilitate an informed and targeted use of agrochemicals and other crop protection products.</p> <p>Evaluate system-level constraints to IPM technology uptake and farmer behaviour change. Participatory, gender-sensitive research methods will be employed to assess the extent of uptake of different IPM technologies either by individual farmers or through multi-stakeholder innovation platforms.</p> <p>Assess the potential for micro-finance services, including crop insurance, to assist smallholder farmers with FAW control and risk mitigation. Including consideration of the potential development and implementation of plot-scale crop insurance schemes to facilitate farmer behavioural change away from pesticides to supporting IPM approaches.</p> <p>Improve understanding of fall armyworm population dynamics and characterize the relative contribution of resident (invertebrate, vertebrate) natural enemies to field-level mortality and population regulation in a range of invaded maize ecosystems.</p>
WP 5. Surveillance & Impact tracker.	<p>5-1. Establish a pest monitoring network</p> <p>5-2. Understand and track pesticide resistance and ‘host strain’ profiles</p> <p>5-3: Geographic referencing of pest pressure and yield loss</p>	<p>Activities may include:</p> <p>Promote FAO’s FAMEWS crowdsourcing application to capture spatial-temporal patterns of FAW pest incidence and to facilitate cross-site information exchange, diffusion of best practices and adaptive (co)learning.</p> <p>Enhance insights into FAW related to seasonal and regional weather patterns.</p> <p>Formulate and implement standardized survey protocols, for pest scouting and data capture by plant health authorities, extension officers, farmer cooperatives or individual maize growers in the prevailing maize crop typologies and agro-ecological zones.</p>

	<p>5-4: Anticipate value chain/food system impacts</p> <p>5-5: Generate FAW pest risk correlates and online ‘interactive’ map</p> <p>5-6: Investigate the potential of sensing, AI and farm robotics</p>	<p>Generate, collate and compare data on pest sightings, (country-level, regional), resistance or ‘host preference’ profiles, FAW risk co-variates (e.g., climate) and the presence and abundance of natural enemies between and within key maize growing areas.</p> <p>Conduct GIS-based mapping and regular updating of either crowd-sourced or formally uploaded data on FAW pest presence, infestation pressure, yield impact and/or genetic profiles. This will culminate in the development of an interactive, ASEAN-wide pest intelligence system with ‘real-time’ online maps, overlaying maize growth stages with forecasted FAW abundance or pest pressure. Visualize cascading impacts on related value chains or food systems to yield ‘actionable’ knowledge to guide management interventions under varying geographies, crop typologies or agroecological contexts</p> <p>Use bioclimatic models, drawing on work already being progressed, to provide real-time forecasts of FAW impact in local maize crops, associated value chains (or food systems) and the broader farming environment (e.g., ‘One Health’ hazards). This will generate ‘actionable’ knowledge, feed the development of crop insurance schemes and contribute to a timely formulation of tailored, locality-specific advice on FAW management.</p> <p>Undertake an in-field evaluation of integrated resistance management (IRM) schemes and FAW tolerant/resistant varieties including Bt maize, depending upon country-level interest and regulation.</p> <p>Investigate innovative use of sensing technologies, farm robotics and drones (e.g., for damage assessment, natural enemy release).</p>
<p>WP 6. IPM Toolbox (including Integrative Host Plant Resistance, Biological Control & Precision IPM)</p>	<p>6-1: Validate of pheromone / kairomone-based trapping schemes and technologies</p> <p>6-2: Assess efficacy & cost-effectiveness of new and existing IPM schemes</p> <p>6-3: Characterize non-target impacts of current/future crop protection schemes</p> <p>6-4: Explore the potential for “agroecological approaches” measures</p> <p>6-5: Validate and deploy CIMMYT-derived maize hybrids with native genetic resistance to FAW as a part of the IPM strategy in the ASEAN region.</p>	<p>Activities may include:</p> <p>Evaluate (pheromone- or kairomone-based) trapping schemes and ‘attract & kill’ control strategies, including an assessment of trap type, lure and trap placement/distancing, overall efficacy and cost-benefits.</p> <p>Evaluation of pheromone-based technologies such as mating disruption/confusion.</p> <p>Test and validate performance in different countries, to shortlist for the further establishment or upgrade, at least 2 natural enemy mass-production units across the region (including equipment, supplies, protocols for rearing/distribution/release) and establish efficacy, including cost-benefit analysis for implementing at scale within the region</p> <p>Carry out a basic economic valuation of (single, combined) FAW management technologies, including a calculation of pest-induced impacts (i.e., yield decline, revenue loss) and cost-effectiveness of individual technologies and their combinations.</p> <p>Undertake a comparative assessment of IPM-compatible agro-chemicals and application modes including epigenetic priming agents and relevant info-chemicals (volatile repellents, attractants).</p> <p>Assess environmental sustainability of selected management options, specifically for pesticide-based measures, e.g., through standardized insect surveys This will equally involve the (laboratory-based and/or field-level) evaluation of non-target impacts on endemic natural enemies and associated biological control services.</p>

	<p>6-6: Integrate host plant resistance (including non-GM or GM cultivars with FAW resistance) & other IPM components (e.g., biological control)</p> <p>6-7: Define multi-functional benefits of best management practices in maize systems</p> <p>6-8: Investigate and optimize biological control tactics</p>	<p>Explore the potential for targeted habitat manipulation, for example through ‘push-pull’ systems and agronomic practices like sowing within short periods, intercropping, pre-sowing and post-harvest managements etc. to reduce FAW pressure.</p> <p>Refine, integrate and locally validate ‘Global Best Practices’ for FAW mitigation, including FAW-tolerant/resistant varieties – e.g., CIMMYT-derived native genetic resistant maize hybrids, Bt maize, pheromone- and kairomone-based trapping or mating disruption, and biological control tactics. This likely will involve a comparative (multi-site) assessment of different ‘integrated’ IPM tools and technologies.</p> <p>Establish at least two regional maize breeding platforms with capacity to screen maize germplasm under FAW artificial infestation; Validate CIMMYT-derived and Asia-adapted native genetic resistant maize germplasm (inbred lines and hybrids) at these regional phenotyping platforms; Disseminate promising breeding materials as international public goods in the ASEAN for deployment by the NARS/seed company partners.</p> <p>Evaluate agro-ecological solutions such as crop diversification (inter- or cover-cropping), rotation schemes and organic fertilization practices, manual control, poultry/crop integration. Emphasis will be placed on validating and optimizing management practices as to slow FAW spread, curb population build-up, alleviate yield impacts and improve overall farm-level revenue streams. These practices are to be tailored to the prevailing maize crop typologies, and different agro-ecological or socio-economic contexts.</p> <p>Assess the feasibility, efficacy and cost-effectiveness of the field-level release and conservation of natural enemies (parasitic wasps, predators or entomopathogenic nematodes EPN).</p> <p>Assess the feasibility, efficacy, cost-effectiveness as well as safety on the environment and human health of bio-products, including botanicals, microbials and biological pesticides.</p> <p>Carry out scientific exploration of opportunities for importation biological control (i.e., the judicious release of an exotic natural enemy for long-term invasive pest control) in close coordination with international co-operators, e.g., CABI.</p> <p>Investigate the efficacy, benefits and implementation modalities for insect radar & (high-altitude) light-trapping technologies. Explore the potential for remote-controlled pheromone traps (so-called ‘smart-traps’) – managed through wireless/cloud-based technologies for use in remote settings.</p>
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Implementation of the ASEAN FAW Action Plan

Implementation of the Action Plan proposed requires clear coordination and communication across the region along with strong linkages with other regional programmes and research organisations, including with the FAO Global Action on FAW.

Implementation of the ASEAN Action Plan will be achieved by the establishment and/or further strengthening of the following:

- Country-level Working Groups on FAW.
- Regional-level Coordination, Communications and Policy Desk (CCP)
 - Research Development and Technology Implementation Group (TRIG)
- ASEAN Taskforce on FAW

Figure 4 sets out a visual representation of the components of the Action Plan and its connection to national-level working groups, as well as the FAO Global Action programme.

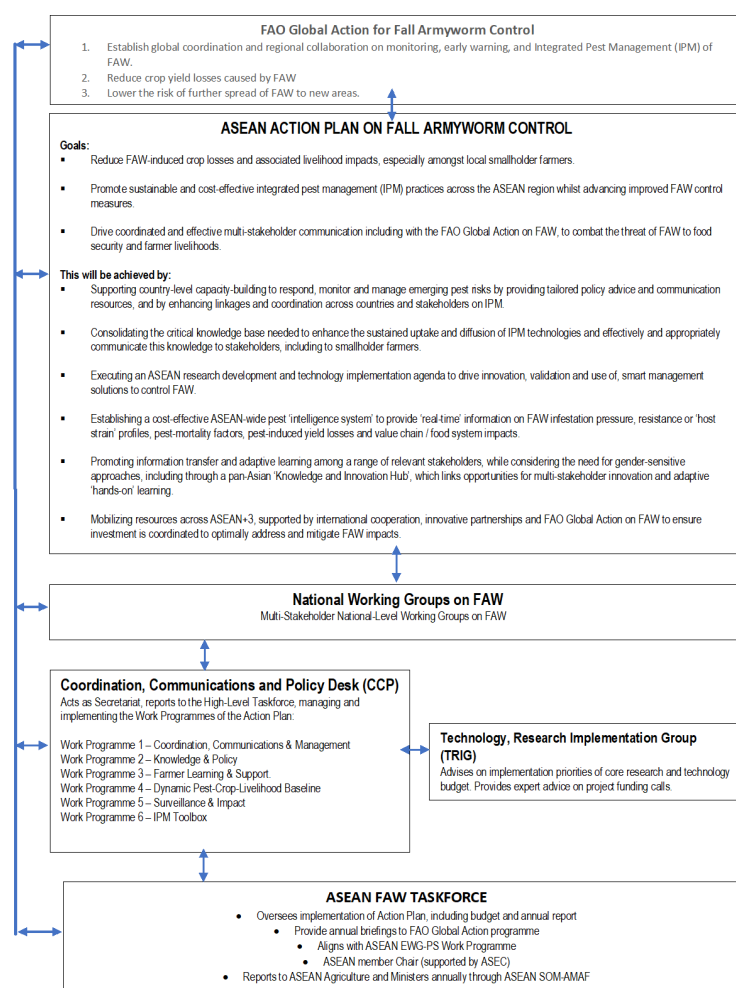


Figure 4: Visual representation of ASEAN FAW Action Plan

Country-Level Working Groups on FAW

Effective and efficient national-level actions to combat FAW are critical to the success of any regional strategy. This includes understanding the current barriers to the effective management of FAW, including policy.

The ASEAN FAW Action Plan is envisioned as supporting national-level implementation through the provision and coordination of resources at the regional level to assist countries to speed up the integration

and spread of potential FAW control solutions, along with offering policy support and guidance where relevant.

A menu of solutions will be proposed to which each country can effectively tailor to local conditions and decision-making.

It is envisioned that each country will nominate a national focal point from each National-level FAW Working Group to be a key point of contact with the ASEAN Action Plan, and nominate one senior representative to sit on the ASEAN Taskforce on FAW

Regional-Level Coordination, Communications and Policy Desk (CCP)

The CCP will operate as the secretariat for the delivery of the ASEAN FAW Action Plan, managing all aspects of its delivery and operating the core budget work activities, as well as the funding platform. The establishment of the CCP will be part of the core working budget.

The CCP will manage a collaborative coordination and communication programme across the various stakeholders and partners, ASEAN countries and connecting organisations and programmes, as outlined under Work Programme 1. This will involve connecting with country-level FAW Workings Groups and working closely with FAO to create a community of practice for the ASEAN region, as shown in Figure 5.

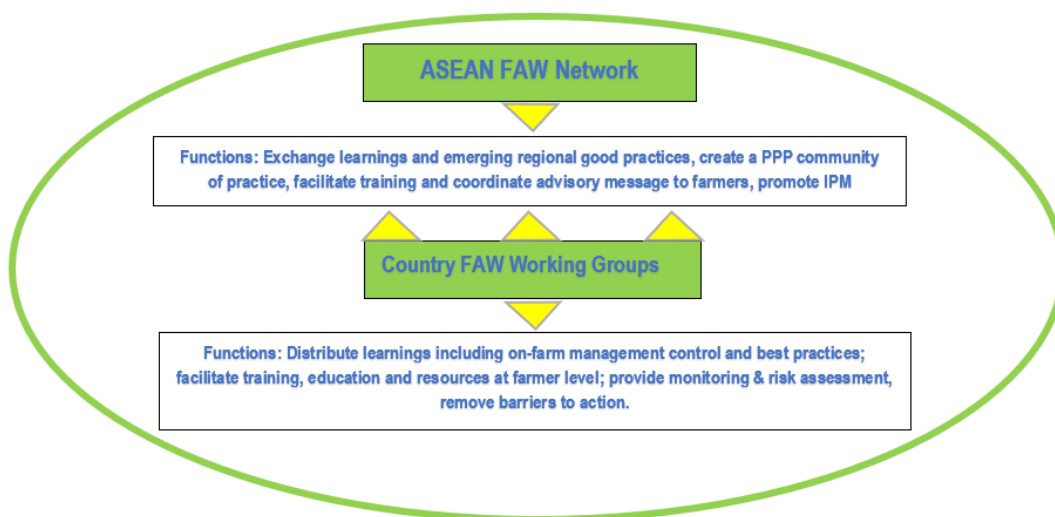


Figure 5: Regional communication model

The CPP will play an important role in smart communication and dissemination of all resources established under the Action Plan through targeted campaigns and by the establishment of an ASEAN FAW Knowledge and Innovation Hub. A critical role will be the development and dissemination of tailored simple messaging campaigns that can help drive change ‘on-the-ground’.

The CPP will also implement Work Programme 1, 2 and 3 as part of the core budget, as well as other activities under the other three work programmes which will be defined, with the expert guidance from the TRIG, within the first 3 months of the Action Plan’s implementation.

The CPP also had overall responsibility for managing a transparent and competitive process of funding for all research and technology implementation projects proposed by stakeholders, with additional input where relevant, provided by members of the TRIG.

Technology and Research Implementation Group (TRIG)

The TRIG will act as an expert advisory group and will help set priorities for implementation of research and technology activities out of the core budget to be implemented over the first 6-to-18 months. Members of the TRIG, up to a total of 10 persons, will be drawn from across stakeholder groups, and be convened by the CCP.

Within the first 3 months the TRIG will develop and present to the CCP, an assessment and selection of high priority activities that should be considered to be best implemented within the core budget, outside those activities already indicated in Work Programme 1, 2, and 3. The TRIG will be guided by the proposed list of activities listed under Work Programmes 4, 5, and 6 in Table 1. The TRIG will prepare a proposed budget and submit this along with recommendations to the CCP for approval.

The advice of the TRIG will also underpin the strong research development and technology agenda of this Action Plan. The TRIG will help set priorities and criteria for each funding call and up to three TRIG experts, on a rotating and/or availability basis will participate in the selection process of projects to be funded under each funding call.

ASEAN FAW Taskforce

The ASEAN FAW Taskforce will act as the Steering Committee for the ASEAN FAW Action Plan.

The Taskforce will be made up of representative stakeholders from across the region and will hold ultimate accountability for the Action Plan, including approval of the annual budget and report and ensure final reporting obligations required by donors/funding agencies are adequately provided. The CCP will act as secretariat to the Taskforce and manage implementation of the Action Plan.

The Taskforce will meet as part of the work of the ASEAN Expert Working Group on Harmonisation of Phytosanitary Measures (EWG-PS) whereby an open session of the EWG-PS will be convened with the invitation to all Taskforce members to attend. Any costs of physical attendance by individual Taskforce members to these meetings will be at the attendees own cost. The EWG-PS will report to the ASEAN Working Group on Crops, ultimately reporting to the SOM-AMAF.

The ASEAN Secretariat (ASEC) will provide additional support to an ASEAN Member representative to chair the Taskforce.

Figure 6 presents the proposed composition of the ASEAN FAW Taskforce. It is proposed that representatives for the private sector/industry, farmers, research organisations be appointed on an annual basis so that different stakeholders within each group can take turns in representation. For example, the private sector may wish (or not) to rotate the position across different companies on an annual basis. Decisions are encouraged to be made through consensus. In circumstances where consensus cannot be achieved a 2/3 majority vote can be taken.

Annual briefings on implementation of the ASEAN Action Plan will be made to FAO's FAW Global Action Plan by the SOM-AMAF.

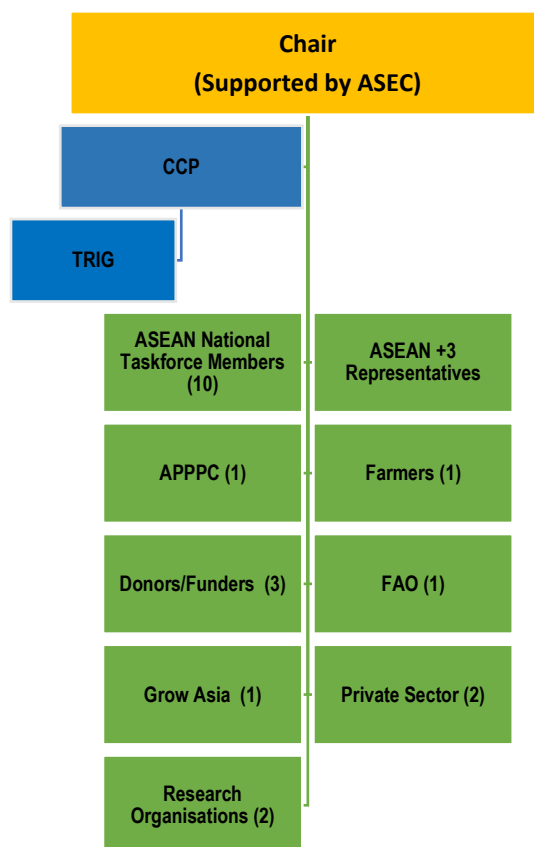


Figure 6: Structure of ASEAN FAW Taskforce for ASEAN FAW Action Plan

Expected Outcomes

Implementation of the ASEAN Action Plan aims to help address the considerable negative impacts that FAW presents in this region if not adequately and appropriately managed. By reducing overall losses to 3% per annum, by implementing the range of co-ordinated solutions indicated in this Action Plan, instead of 10%, the economic benefits would be some US\$619 million per year, as regional reliance on maize imports decreases. This does not account for other savings due to the reduction of losses in other crops that are also vulnerable to FAW. Foregone yield losses and averted control costs will provide additional income and prevent economic losses, thereby reducing poverty amongst smallholder farmers. Long-term FAW suppression will be achieved through active integrated pest management strategies providing considerable benefits to human health and environmental preservation.

Sustainable Development Goals

Any response to FAW that prioritises improved IPM at farm-level is likely to lead to a wide range of additional benefits and contribute to multiple Goals under the 2030 United Nations Agenda for Sustainable Development (SDG), including Goals 2, 12, 13, and 15. In addition, strong gender-sensitive and social inclusion approaches will be progressed across the implementation of the Action Plan. A successful regional approach on FAW might also offer the potential for a wider regional strategy on IPM. It will also be important to assess the potential for the ASEAN FAW Action plan to contribute to improved climate change mitigation and adaptation at the farm level. The Action Plan with its collaborative and coordinated approach to building capability and capacity to respond to FAW also sets the foundation for regional collaboration and preparedness for dealing with future novel agricultural pest threats.

Principal Beneficiaries

Small-scale maize growers across ASEAN will have their income and livelihoods safeguarded, while the productive capacity and ecological foundation of local farming systems will be preserved. This will be

ensured through a scientifically guided development and deployment of IPM packages - including biological control, cropping systems diversification and sanitary measures.

Maize processors, animal feed producers and livestock sector actors -within or beyond ASEAN- will realize savings through lowered input costs and/or stabilized commodity prices that are achieved when FAW is effectively managed or contained. National researchers from National Agricultural Research Institutes (NARI) will have their capacity on ecologically based pest management strengthened.

Reduced duplication of efforts and increased efficiencies in country-level responses will be achieved through a coordinated communication strategy at the ASEAN level and seamless integration of activities with FAO's FAW Global Action Plan, thus allowing for targeted use of resources, improved innovation capacity and enhanced dissemination of shared knowledge.

Principal Partnerships

Partnerships will be actively sought with a range of stakeholders to represent a multi-stakeholder approach to managing Fall Armyworm and ultimately improving IPM and sustainable farming across ASEAN.

Partnerships with national-level administration responsible for FAW control measures will be a key element of the partnership approach. It is proposed that national-level multi-stakeholder task-forces be set up and/or strengthened and that these national-level initiatives will be the key implementation bodies of the Action Plan at national and local levels. The Action Plan will work closely with FAO in this respect, who already have local country focal points in place.

Considerable support from plant protection departments (e.g. Plant Protection Research Institute (PPRI) and Maize Research Institute in Viet (MRI)) and applied research centres within ASEAN under the Ministries of Agriculture and Environment/Natural Resources of each country is envisioned, as well as with National Crop Protection Departments, government research centres and Departments of Agriculture and Agricultural Research. This will include National Plant Protection Organisations (NPPO's) and national Chief Plant Protection Officers (CPPO's).

Universities and research centres within the region will be encouraged to be involved in the implementation of the Action Plan, including Vietnam National University (VNUA), Nonglam University (NLU) Vietnam; Universitas Gadjah Mada & Institut Pertanian Bogor (IPB) in Indonesia; University of Philippines (UP), Kasetsart University (KU) in Thailand, Royal University of Agriculture and Prek Leap National Institute of Agriculture in Cambodia, NUoL in Laos, Yezin Agricultural University Myanmar, University Putra Malaysia (UPM) in Malaysia. Collaboration with SEARCA (Southeast Asia Regional Center for Graduate Study and Research in Agriculture) would also be welcomed.

Specialized support will also likely be provided through partnerships with research institutions, including universities outside ASEAN, including Chinese Academy of Agricultural Sciences (IPP-CAAS) and leading North and South American, Chinese, Japanese, South Korean, Indian, Australian UK and European institutions and universities. Opportunities for 'science buddy' programs, workshops, post-graduate exchanges or programmes to help develop capability within the ASEAN-based research community will be welcomed and encouraged. Technical backstopping and research coordination could also be provided through a regional institution.

Collaborations will be sought with CGIAR, UN Global Pulse, IUCN, CSIRO, CABI, IRRI, APPPC and IPPC, while close alliances with organisations and stakeholder will be sought in other regions with extensive experience with FAW (e.g. Africa, North and South America).

Consideration will be given to utilise this Action Plan as a pilot towards integration into a broader regional IPM-focused strategy on maize and other crops. Partnerships will be explored with APAARI (Asia Pacific Association for Agricultural Research Institutions), APAEON (Asia Pacific Agricultural Extension and Outreach Network), and SEARCA (Southeast Asia Regional Center for Agriculture).

The private sector has an important role to play in supporting the implementation of the Action Plan. Indeed, this sector has been active in working with farmers already to help control fall armyworm. This includes large users of maize for animal feed purposes, commodity traders, companies who develop tools and technologies for FAW control, and seed producers. Charoen Pokphand Crops (CPCrops), Bayer, Corteva, Syngenta, and East-West Seeds have all registered interest in the Action Plan.

Several Foundations also have objectives compatible with the goals of the ASEAN Action Plan. Innovative private-public partnerships aligned with the Action Plan will be actively encouraged.

Key partnerships include: Grow Asia, UN Food and Agriculture Organization, CIMMYT, IITA, Fall Armyworm R4D International Consortium (coordinated by CIMMYT), Crop Life Asia (CLA), and International Biological Control Manufacturers' Association (IBMA)

Given the importance of controlling FAW across the ASEAN region, the Action Plan acknowledges the need to connect with Governments outside ASEAN who also have a shared interest in supporting a coordinated ASEAN regional strategy to help secure sustainable development, food security and effectively control FAW in the broader Asia-Pacific region. Strong relationships will be sought with Australia, China, Japan, South Korea, the United States of America, and neighbouring ASEAN countries that are also tackling FAW, including India, Sri Lanka, Timor Leste and PNG.

Funding

It is estimated that the budget for implementation of the Action Plan will be approximately US\$ 750,000 per year for 5 years over the period 2020-2024 for implementation of the core budget, with an additional \$1.5 million per year over the same period to promote research development and technology implementation projects. These projects will be selected based on competitive funding rounds, in which proposed projects will require at least one ASEAN partner, and matching funds of at least 30% to qualify for consideration.

Funding will be sought from a mix of sources including:

- International organizations, governments and other donors, including under the FAO Global Action programme.
- Matching-funds from Asian countries through voluntary contributions.
- Private Companies, including through the donation of materials for trials and testing as well as active co-operation in training's, communication material and the distribution of resistant seed, baits, pheromone traps, fertilizers, pesticides (including bio-pesticides and microbials)
- Farmers' contributions in labour, agro-materials, tools and machines.
- Collaborative funding bids, involving coordinated cross-research projects

It is also envisioned that the Action Plan could help to coordinate additional projects at the request of donors and/or countries, on a project by project basis, that align with the work programme activities indicated in this Action Plan. Donors who contribute to the funding platform can also choose to include further conditions in the funding call for specific projects they may wish to support.

Donors and partners can also choose to pursue and manage their own projects but still align their projects with the Action Plan.

Budget

Because of the uncertainty on the amount of funding that will be secured, given the current Covid-19 situation, it is proposed that the programme be divided into two elements. A core program which focuses on urgent activities prioritised in the consultation processes, with secure funding. And a transparent grant-awarding program that provides a mechanism that can accommodate variable funding, and which can allocate funds based on need and likely on-the-ground impact.

An estimated budget of approximately US\$750,000 per year over 5 years over the period 2020-2024 is attached in Annex 2 to cover core work for implementation of Work Programmes 1, 2 and 3, as well as a targeted selection of priority actions across Work Programmes 4, 5, and 6. Matching funding for any projects under this core budget will also be sought where possible, including in-kind contributions.

To adequately fund the research and technology implementation needed to effectively manage FAW in the ASEAN region, an additional US\$1.5 million per year is needed to fund projects that will position ASEAN to be able to respond to, monitor, and manage FAW. The US\$1.5 million will be managed in a competitive annual funding call. Matching funding of at least 30% will be required, as well as an ASEAN project co-lead (could be from private, public, civil society or research sector).

The estimate of USD\$1.5 million per year for 5 years (2020-2024), not including the core budget of US\$750,000 per year, is based on extensive consultation carried out as part of the development of this Action Plan, as presented in the detailed Work Programmes set out in Table 1 of this document. The estimated budget for these activities is not included in this Action Plan. It will, however, be shared with potential donors and member countries as required to provide evidence of the cost and scale required to adequately control FAW in ASEAN.

ANNEX 1: Summary of ASEAN Country FAW Impact, Actions, Gaps and Opportunities

The information in this Table has been gathered from consultations carried out as part of the development of the ASEAN FAW Action Plan 2020. Information has also been used from the [FAO Regional Workshop on Sustainable Management of Fall Armyworm in Asia](#) (FAO 2019 Regional FAW WS). This has been indicated in either the text or footnotes of the Table.

The information does not represent a complete picture of work being undertaken by stakeholders in the region on FAW but seeks to provide a snapshot of activities communicated in the course of consultation on the ASEAN FAW Action Plan 2020.

Country	FAW Status	Actions	Gaps/Opportunities
Brunei Darussalam	<p>Identified in-country in November 2019, however, from subsequent conversations with farmers, likely to have arrived earlier.</p> <p>Estimated 40 ha to be affected by FAW.</p> <p>Note: Maize is not considered a major crop, sometimes farmers plant maize for crop rotation or as a result of drier seasons.</p>	<p>In Brunei Darussalam, FAW is currently managed by the Department of Agriculture and Agri-food. Management is focussed on the destruction of impacted maize plantations and chemical applications</p> <p>The decision to destroy affected maize crops was made due to a desire to immediately suppress the population of FAW and to ensure spreading is limited. As knowledge in FAW is very limited and we are aware of its polyphagous nature the Ministry has decided that all maize plantations are to be destructed and no maize to be planted for three months. This is in line with one of Brunei’s Laws (Agricultural Pests and Noxious Plants Act). Compensations (monetary) will be provided to the affected farmers.</p> <p>Farmer workshops have been implemented to provide information on how to address FAW issues, how to prevent, manage and control FAW. Fact sheets on FAW have been distributed. All information is based from FAO / CABI and translated to local language. Have reached out to other ASEAN countries for advice on chemical control, particularly seed treatment.</p>	<p>Gaps and opportunities include:</p> <ul style="list-style-type: none"> ▪ The Plant Entomology Unit has an inventory of natural enemies in Brunei Darussalam that could be explored for a project on production of biological control in the country. ▪ Since FAW is a transboundary pest, there is a need to emphasise countermeasures against the entry of FAW into the country e.g. topics on strengthening border inspection on imported agricultural commodities. ▪ Lack of research currently on biological control measures and underutilization of pheromones, biopesticides and natural enemies. ▪ Awareness of safe and proven crop protection solutions controlling FAW that are available/ in progress across Asia and other part of worlds. ▪ The existence of uncertainty of whether FAW will eventually spread to other crops considering its polyphagous nature. In Brunei Darussalam, maize production is relatively small compared to other crops such as rice.

<p>Cambodia</p>	<p>Four provinces are infested by FAW, with a total of 11 142 ha (Nov. 2019)⁸.</p>	<p>Activities identified at the FAO 2019 Regional FAW WS:</p> <ul style="list-style-type: none"> ▪ A FAW training workshop for extensionists, agricultural schools personnel and Farmer Field School (FFS) trainers was held from 3 to 4 July 2019. ▪ Information material for FAW identification and management was developed in collaboration with the International Rice Research Institute (IRRI). ▪ IRRI training for technical staff in the Cambodian Department of Plant Protection Sanitary and Phytosanitary for FAW identification was held from 21 to 25 October 2019. ▪ Cambodia participated in the Training Workshop on Biological Control of Fall Armyworm in Niger from 20 to 28 July 2019, organized by FAO and conducted by the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). <p>IRRI is assisting Cambodian agencies for monitoring of FAW, as well as doing research to compare available management options in Cambodia and supporting the production and dissemination of extension materials for FAW. (IRRI)</p> <p>Corteva Agriscience has trained its internal team for readiness to help farmer identify FAW as well as management solutions.</p>	<p>The three biggest gaps at the national level are:</p> <ul style="list-style-type: none"> ▪ Training of Trainer (ToT) programmes ▪ Farmer Field Schools ▪ Lack of Research on how to control FAW and implementation of a FAW Management Strategy Plan. <p>Gaps and opportunities identified at the FAO 2019 Regional FAW WS include:</p> <ul style="list-style-type: none"> ▪ Translate from English into the Khmer language the FAW animation video “How to Identify and Scout for Fall Armyworm” produced by Scientific Animations without Borders (SAWBO). ▪ Conduct FFS that focus on IPM management of FAW. ▪ Place more traps and lures to estimate the population of FAW. ▪ Implement the FAW Monitoring and Early Warning System (FAMEWS). ▪ Survey and monitor FAW parasitoids such as Trichogramma sp., Telenomus sp., Cotesia sp. ▪ Cambodia’s NNPO will create an animation video to use for FAW awareness; the video will be translated into Khmer language and posted on TV and social media for educational purposes. <p>Feedback from IRRI Scientist: “In my visit to a FAW infested field in Cambodia, I observed insect predators like earwigs, ants and a Pentatomid bug feeding on larvae. I am sure there are more native natural enemies in the field that need to be studied.”</p>
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⁸FAO 2019 Regional FAW WS.

<p>Indonesia</p>	<p>FAW in Indonesia has spread widely to 25 out of 34 provinces and across 9 954 hectares. As maize is the second-most important staple food of Indonesia and mostly produced by smallholder farmers, FAW poses a serious threat to food security and the livelihoods of millions of people⁹.</p>	<p>Activities identified at the FAO 2019 Regional FAW WS include:</p> <ul style="list-style-type: none"> ▪ Farmers and extension workers are actively involved in massive efforts to control FAW, and the control measures have effectively reduced FAW infestation in the field and yield losses. ▪ FAW workshop in Lampung, 31 July – 2 August 2019. ▪ Training on FAW Biological Control, 19 – 21 September 2019 ▪ FAW workshop in Yogyakarta, 19 – 20 September 2019. ▪ Set up of national FAW task force consisting of government officials, universities, stakeholders, daily online updates, capacity development for extension workers, laboratory staff, local government officers, and farmers. ▪ Trial of Control measures: mechanical and physical control (use of lime and ash); biological control (Metarhizium and Beauveria Bassiana); botanical pesticides (Aegle marmelos); chemical control. <p>GMU has published one article on FAW in Journal Perlindungan Tanaman Indonesia. The article is in English. Research on FAW is on-going looking at different aspects (Gadjah Mada University)</p> <p>ICERI completed an identification and control field trial and we have published a handbook (ICERI).</p> <p>Bayer developed FAW awareness and training deck for imparting knowledge and awareness to frontline trainers (ToT) in six major provinces. including Yogyakarta, Kediri, Medan, Lampung, Padang and Sulawesi, during August-September 2019. Bayer also launched a FAQs (translated into Bahasa) on key topics centred around Fall Armyworm for the benefit of internal frontline staff.</p>	<p>Gaps and opportunities identified at the FAO 2019 Regional FAW WS include:</p> <ul style="list-style-type: none"> ▪ Conduct more research on biological control based on IPM. ▪ conduct and evaluate pilot projects on FAW management. ▪ capacity building for extension officer. ▪ FAW field monitoring. ▪ FAW massive control by community. ▪ FAW - IPM Field School.
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⁹ FAO 2019 Regional FAW WS

		Corteva has worked actively with Plant Protection Division and Universities as well through Field School trainings to > 150 farmers. Corteva has developed detailed a technical module in multiple languages including Bahasa, covering biology and identification of FAW, its spread, damage identification as well the its management solutions	
The Lao People’s Democratic Republic	Maize is the second main crop after rice and is produced in only one cycle per year. As of July 2019, FAW had spread to 432 villages in 57 districts. FAW was found in all maize fields. In total 39 646 ha were damaged by FAW.	<p>The Laos Government issued a government Decree in July 2019 to ramp up efforts on monitoring and managing FAW in the country.</p> <p>FAW is mainly controlled using pesticides (Emamectin Benzoate). The country has no monitoring system in place and farmers do not know much about the pest.</p> <p>Lao Upland Rural Advisory Service (LURAS) initiative on FAW, including FAW extension services, language materials and resources, field visits, participatory action research. Translation of SAWBO video into the local language.</p>	<p>The Lao People’s Democratic Republic has identified priorities and plans for the way forward:</p> <ul style="list-style-type: none"> ▪ Active surveillance/ monitoring. ▪ Apply new experience (use of biocontrol agents). ▪ Technical training to farmers and FFS. ▪ Provide biopesticides. ▪ Set up monitoring and early warning system. ▪ Needed: enhanced information exchange among neighbouring countries and technical assistance.
Malaysia	FAW has been detected throughout the whole peninsular Malaysia (11 states) and the latest was in Kuching, Sarawak which was detected and confirmed in September 2019. The total area affected by FAW is estimated at 246.35 hectares with the percentage of severity between 50-100% for an age of planted maize less than 40 days. Sabah is free from FAW and DOA Sabah is currently conducting detection survey	<p>Activities include:</p> <ul style="list-style-type: none"> ▪ Malaysia has started the FAW detection surveillance in all states including Sabah and Sarawak in East Malaysia (Borneo). Complete detection survey data is in progress. ▪ The FAW related research by universities and research agencies are monitored by DOA Malaysia as NPPO of Malaysia. ▪ Researchers are working on the detection of available biocontrol agents and efficacy of pesticides for FAW management. Most of the projects are funded by available Malaysia’s research agency/government funds. <p>DOA Malaysia is currently coordinating national action, including¹¹:</p>	<p>Gaps and opportunities include:</p> <ul style="list-style-type: none"> ▪ Combination of control measures to reduce the FAW population instead of depending on pesticides. ▪ Relation of weather/environment and FAW population for control efficiency ▪ Capacity building for surveillance officer and farmer in FAW detection ▪ Use of apps/satellite/imaging sensor for detection/surveillance activity of FAW

¹¹ IPPC Report (2019). At https://www.ippc.int/static/media/files/pestreport/2019/12/06/2.1_VI_Report_FAW_.pdf

	<p>to observe any invasion of the pest¹⁰.</p>	<ul style="list-style-type: none"> ▪ Study on the control and management of FAW with collaboration between DOA Malaysia, research agencies and universities ▪ Control and Management Action Plan Program to be used by the whole country for FAW management ▪ Continuous surveillance activity to detect any new areas affected by FAW ▪ Awareness and campaign programme for stakeholders especially large- and small-scale maize plantation on detection and management for FAW. ▪ Scouting and monitoring for the FAW pest have been conducted continuously for the maize field. ▪ The use of in-country registered pesticides that are recommended to effectively control FAW (what pesticides are used?) ▪ Pest management of FAW through Integrated Pest Management (IPM) ▪ Other pest control methods used in conjunction with pesticides as part of an IPM approach. These include agronomic practices, cultural, physical and mechanical method. ▪ Farmers are advised not to practice staggered planting system for breaking the life cycle of FAW 	
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¹⁰ IPPC Report (2019). At https://www.ippc.int/static/media/files/pestreport/2019/12/06/2.1_VI_Report_FAW_.pdf

		<ul style="list-style-type: none"> Stakeholders are encouraged to report to the Plant Biosecurity Division or the nearest Department of Agriculture office if there is any infestation by FAW <p>Officials also effectively use Facebook communications to connect with farmers.</p>	
Myanmar	<p>The presence of Fall Armyworm (FAW) (<i>Spodoptera frugiperda</i>) was confirmed in Myanmar for the first time in late 2018, in maize fields in the Ayeyarwady region. According to a survey conducted by the Plant Protection Division (PPD) of the Department of Agriculture (DOA), by the end of the same year, the infestation had spread to 64540 hectares (Ha) of maize crops, being the Ayeyawady Region the most affected one with 63436 Ha infested.</p> <p>Other areas affected by the pest include Mandalay, Yangon and Sagaing Regions, as well as Shan State. These areas produce approximately 80 per cent of the maize in Myanmar, with the Ayeyarwady region being the main producers in</p>	<p>Activities include¹²:</p> <ul style="list-style-type: none"> 1 -year “Emergency response project to enhance technical capacity for early warning, monitoring and management of Fall Armyworm in Myanmar” completed in April 2020 with FAO. Myanmar has scouting and regular surveillance for FAW using different types of pheromones traps and manual checking of other potential host plants. Some egg masses (possibly FAW) were collected from the Sugarcane, Horse gram (<i>Dolichos biflorus</i>), and one weed plant, goosefoot (<i>Chenopodium album</i>). Now establishing <i>Trichogramma</i> rearing factory for rice stem borer in Myanmar and established the production of eggs parasitoids <i>Trichogramma</i> spp. specific for FAW. The Ministry of Agriculture, Livestock and Irrigation (MoALI) launched the website “Early warning for FAW incidence” (www.ppdmyanmar.org). A Special Task Force, which includes all the relevant government institution has also been set up. Supported by USAID scouting SAWBO video clips with our own languages USAID currently implements a joint project with the International Fertilizer Development Center (IFDC) that aims at building the capacity of agro-input dealers in Shan State and the 	<p>Gaps and opportunities include:</p> <ul style="list-style-type: none"> The need for carrying out a base-line survey for FAW in other potential host crops Raising awareness and approval for the control action for different stages of Maize plant and pest stages by using different types of pesticides (e.g. Biopesticides, Natural enemies, soft pesticides, safe crop protection pesticides). Building institutional capacity on early detection and effective and sustainable management of the FAW. Raising awareness of the farmers towards biologically based IPM strategies through ToT and FFS and use of demonstration plots. Mass production of effective biocontrol agents at country level. FAW is attacking also other crops, including rice, tomato, millet, green gram, sugarcane, some grass varieties and various vegetables; however, the extent and severity of the infestation in the various crops and parts of the country are still under investigation.

¹² Country Report under Emergency response to enhance technical capacity for early warning, monitoring and management of Fall Armyworm in Myanmar (TCP/MYA/3706 (E))

	<p>winter maize and also the one which has suffered the heaviest losses, with an estimated 4500 Ha of maize destroyed in the cropping season 2018-19.</p> <p>Maize growing in rainfed areas is 600,000 ha and Irrigated Maize is 150,000 ha in whole year round.</p>	<p>Delta region, to deliver better information and services to farmers. They have trained 90 retailers and 57 DOA agents and worked with retailers to manage 12 demonstration plots, on which farmers practised scouting for FAW and learned about action thresholds.</p> <ul style="list-style-type: none"> ▪ Started introduction of FAMEWS App for monitoring and early warning with pheromones traps. ▪ Guidelines for Suitable IPM package of Fall Armyworm for Extension and PPD staffs to farmers are being developed, along with other research work for biocontrol agents, E.g., Eggs parasitoids and Entomopathogenic fungi. 	
<p>Philippines</p>	<p>The first incidence of suspected FAW in the Philippines was reported on June 20, 2019, at Piat, Cagayan.</p> <p>Total infested hectares as of October 2019 was 224.1 hectares.¹³</p>	<p>The Bureau of Plant Industry¹⁴ is currently developing the National Fall Armyworm Action Plan, with the following activities:</p> <ul style="list-style-type: none"> ▪ Quarantine inspection and disinfestation at the ports (sea, air, land) ▪ Cultural management strategies (seed treatment, synchronous planting, weed management, plough-under after harvest, intercropping, crop rotation) ▪ Monitoring and detection (use of pheromone lures/traps) ▪ Scouting and validation ▪ Awareness and capability building (information dissemination, training, coordination with LGU partners, farmers and other stakeholders) ▪ Use of biological control agents and lures ▪ Use of organic and inorganic pesticides ▪ Research and development. <p>Information campaigns in rural areas among farmers to promote awareness on the threat of the pest are also being undertaken.</p>	

¹³ IPCC Report (2019). At <https://www.ipcc.int/en/countries/philippines/pestreports/2019/10/report-of-first-detection-of-fall-army-worm-faw-in-the-republic-of-the-philippines/>

¹⁴ IPCC Report (2019). At <https://www.ipcc.int/en/countries/philippines/pestreports/2019/10/report-of-first-detection-of-fall-army-worm-faw-in-the-republic-of-the-philippines/>

		<p>The Iloilo Provincial Agriculture Office (PAO) is promoting alternative ways in managing the pests, one of which is the spraying of water mixed with sugar in the affected and surrounding area¹⁵. PAO has also produced pamphlets containing protocol on the management of the fall armyworms. The education and information materials are being distributed to municipal agriculture technicians and farmers to empower them with knowledge¹⁶.</p> <p>East-West Seed Philippines have developed comprehensive advice on FAW internal field and office staff. Starting in June 2019, FAW awareness campaigns have been introduced in the field by providing farmers with demo and laymanized lectures on FAW integrated pest management. More than 20 field visits and lectures have been conducted since 2019. East-West Seed has recently purchased a microscope camera viewer and digital image capture for FAW morphological identification and documentation. EWS has upscaled it's rearing of earwigs for use against FAW.</p> <p>Undertaking species identification and fall armyworm management (University of the Philippines Los Banos).</p> <p>Bayer developed and rolled out Fall Armyworm Advocacy and Training resources since the time pest was observed in 2019. It involved training of channel partners, sales staff and farmers across the region.</p> <p>BPI-led CABI-SEA Scoping Mission on Fall Armyworm (FAW) discussions in the Philippines during April 2020.</p> <p>Corteva Agriscience participated and contributed to FAW awareness session organized by the National Crop Protection Center. Corteva has developed a detailed technical module in multiple languages for Asia, including English, covering biology and identification of FAW, its spread, damage identification etc.</p>	
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¹⁵ At <https://www.pna.gov.ph/articles/1085330>

¹⁶ At <https://www.pna.gov.ph/articles/1085330>

<p>Singapore</p>	<p>Singapore has started active surveillance for FAW.</p>	<p>Monitoring with FAW pheromone lures is in the pipeline. Also, biological controls will be explored. The National Parks Board is working with the Singapore Food Authority on local action plan and management. Will likely tap into local Institutes of Higher Learning (IHLs) to support training for farms.</p> <p>Bayer developed a training deck for internal training programs during early 2019 which was supported by a brochure with information on FAW biology, damage symptoms, integrated Bayer solutions and crop management. FAQs were also developed to support the awareness programs initiated in July 2019.</p> <p>Through its regional HQ in Singapore, Corteva has been actively engaged in developing detailed technical modules in multiple languages for Asia (Bahasa, Thai, Vietnamese, English, Hindi, Chinese) covering biology and identification of FAW, its spread, damage identification etc. Corteva has developed technical fact sheets on FAW for multiple stakeholders, local newspapers across Asia and social media, e.g. Linked-In articles as well as a documentary “For Food’s Sake” developed by ChannelNewsAsia (CNA) that was broadcasted in September 2019 across 30 countries. Detailed training charts on FAW awareness have been created and discussed throughout 2019 at multiple forums in Indonesia, Vietnam, Thailand and Philippines sharing Corteva experience from across Asia. Corteva has been involved in training more than 100,000 people including farmers across Asia Pacific (ASEAN, South Asia and China).</p>	<p>The concern is the impact of FAW on the garden city and edible crops currently grown in Singapore i.e. leafy & fruited vegetables as we only have one farm growing maize in Singapore.</p>
<p>Thailand</p>	<p>The Department of Agriculture (DOA) of Thailand confirmed that Fall Army Worm (Spodoptera Frugiperda) was positively identified in December 2018. Some 5.2 million tons of maize produced in Thailand are used for animal feed (chicken, layer, swine and fish). Around 500 000</p>	<p>Currently, Thailand had implemented significant research and activities on FAW, including:</p> <ul style="list-style-type: none"> ▪ Effective chemical pesticide and rate/cost ▪ Application techniques such as seed treatment, ground application and aerial application. ▪ Toxicity of recommendation insecticide in field population. ▪ Effective bio-agents: assassin bug, Earwig, green lacewing, Parasitoids, Entomopathogenic fungi/nematode, NPV. ▪ Study on Biology and ecology. 	<p>Since the occurrence of FAW in Thailand in 2018, synthetic insecticides have been widely used as an emergency response to slow the spread of the pest and minimize damage to maize fields. At present, farmers have complained that the currently used synthetic insecticides are not effective against FAW; hence, they are forced to use high doses with frequent applications, which will lead to the accumulation of pesticides in the environment and speed up resistance development. Therefore, we should pay attention to the insecticide resistance and its mechanism of FAW. JIRCAS and Thai-DOA have already started to develop a</p>

	<p>tons are used for human consumption and export. As of February 2019, 50 provinces throughout the country with maize growing areas had been infested by FAW, five heavily. Yield losses could reach 25–40 per cent, causing an economic loss of USD 130–260 million¹⁷.</p>	<ul style="list-style-type: none"> ▪ Future actions ▪ Monitoring using pheromone traps. ▪ Establishing Farmer Field School for FAW. ▪ Supporting Community Pest Management Center (CPMC) to produce bio-agents and use to control FAW. <p>The Department of Agriculture had provided the recommended control measures in various methods such as, chemical, mechanical, cultural and biological control that effectively controlled fall armyworm by conducting laboratory and field research for the recommendation guideline for controlling fall armyworm.</p> <p>A meeting to assess the research needs in establishing a comprehensive management system for the fall armyworm was co-organized by JIRCAS with Thailand’s Department of Agriculture (DOA), Ministry of Agriculture and Cooperatives from 17th to 18th October 2019¹⁸</p> <p>Bayer developed and rolled out Fall Armyworm Advocacy and Training since the time the pest was observed in 2019. It involved training of channel partners, sales staff and farmers across the region (ca. 11000) until late 2019. These efforts are being continued at field level.</p> <p>DoA-USAID-CropLife co-organized meeting on Fall Armyworm during May 13-14, 2019, Kanchanburi. An action plan for management with available solutions was discussed.</p> <p>Corteva has developed a detailed technical module in multiple languages for Asia including Thai covering biology and identification of FAW, its spread, damage identification etc.</p>	<p>standard protocol for pesticide susceptibility monitoring as a feasibility study. Our goal of this activity is the development of an information-sharing platform among several countries located in South-East Asia. Also, application method and equipment type must be determined to ensure that the product reaches the target efficiently and with minimal losses.</p> <p>FAO FAW WS 2019: Gaps and opportunities include:</p> <ul style="list-style-type: none"> ▪ train farmers on how to manage FAW in their fields and how to overcome the coincidence of drought and FAW. ▪ implement monitoring and early warning systems. ▪ increase public awareness. ▪ make biopesticides and biocontrol agents available. ▪ increase research on how best to manage FAW. <p>Priorities:</p> <ul style="list-style-type: none"> ▪ Encourage data- and knowledge-sharing across borders and regions. ▪ Capacity building, awareness and education on local levels. ▪ FFS. ▪ International research collaboration for the development of biopesticides. ▪ Harmonize national registration processes for biopesticides and mild synthetic pesticides.
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¹⁷ FAO 2019 Regional FAW WS.

¹⁸ At https://www.jircas.go.jp/en/program/program_d/blog/20191025

<p>Viet Nam</p>	<p>On April 24, 2019, the Ministry of Agriculture and Rural Development (MARD) officially announced the detection of Fall Armyworm (FAW), <i>Spodoptera frugiperda</i>, in Vietnam</p> <p>Viet Nam produces maize on a total of 221 000 ha of land, three seasons per year. In total, it is estimated that 46 000 ha are infested with FAW¹⁹.</p>	<p>Viet Nam has extensive activities on FAW, including:</p> <ul style="list-style-type: none"> ▪ Research on economic threshold ▪ Research and development of high yield maize varieties tolerant to stresses including FAW and climate change ▪ Investigation of change in Fall Armyworm density and evaluation survey about the effectiveness of Fall Armyworm control model ▪ Research on biological, ecological characteristics and management methodologies ▪ IPM, biological control, pheromone control methods <p>For example, we have collected FAW from various locations throughout the country. We have extracted DNA and tested the genetic variation based on the COI sequence. We plan to look at other gene/regions to determine the FAW strain and distribution of the strains in Viet Nam. Recorded natural enemies of FAW. (Plant Protection Research Institute)</p> <p>Bt maize technologies are approved in Vietnam</p> <p>Development of FFS training curricular on sustainable management of FAW for some provinces; Three-day Training & Planning Workshop on prevention of FAW (Initiate on Community Empowerment and Rural Development - ICERD) An August 2019 Workshop event and associated field visit on “Sustainable Solutions for Fall Armyworm Management” was held in the northern province of Thai Nguyen on August 9th and was jointly organised by the Vietnam Academy of Agriculture Sciences, the Plant Protection Department (PPD) under the Ministry of Agriculture and Rural Development (MARD), and Bayer. It attracted international experts across the region, including from India, Pakistan, Indonesia, Thailand, and the Philippines.</p>	<p>Gaps and opportunities identified at FAO 2019 Regional RAW WS include:</p> <ul style="list-style-type: none"> ▪ Strengthen monitoring and early warning systems; ▪ Increase outreach to farmers and inform them about FAW. ▪ Research to identify effective and sustainable control measures. ▪ Strengthen international collaboration, sharing knowledge and experiences/lessons learned.
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¹⁹ FAO 2019 Regional FAW WS.

		<p>Bayer continued its advocacy training across Vietnam past year and reached out to thousands of stakeholders through various media and communication channels. Examples 1 and 2 can be downloaded.</p> <p>Corteva has developed a detailed technical module in multiple languages for Asia including Vietnamese covering biology and identification of FAW, its spread, damage identification etc.</p>	
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ANNEX 2: Budget

Total	Over 5 years
Work Programme 1: Coordination, Communications & Management	3.75 million
Work Programme 2: Knowledge Generation & Policy	
Work Programme 3: Farmer Learning & Support	
+ Selected priority activities from WP 4, 5, 6	
Work Programme 4: Dynamic pest-crop-livelihood baseline	7.5 million
Work Programme 5: Surveillance & Impact Tracker	
Work Programme 6: IPM Toolbox (including Integrative Host Plant Resistance, Biological Control & Precision IPM)	
TOTAL	US\$ 11.25 million

Breakdown of Work Programmes

Work Programme 1: Coordination, Communications & Management						
1-1: Set-up project management structure, implementation and ongoing management of Action Plan as Secretariat.						
1-2: Establish multi-stakeholder communication and coordination strategy and networks						
1-3: Conduct project reviews and reporting						
1-4: Implement and manage funding platform.						
	#	Days	Travel	Accom.	Daily Rate	Total Project Cost
Manager/Coordinator of Action Plan		1000			600	600,000
Technical backstopping & administration (1/2 time)		500			450	225,000
IT support / programming / app development	5					50,000
Annual meeting of FAW Regional Action	5			20,000		100,000
Creation, maintenance and active updating of FAW IPM knowledge portal and databases	1				20000	20,000
Communications - newsletter, short-stories & farmer testimonials, day-to-day updating of FAW IPM knowledge portal, including Africa - Asia - Australia knowledge exchange	5			5,000		25,000
Travel & Accommodation		200			350	70,000
Funding Platform	20000				5	100000
TWIG	2	150			600	180000
Meeting Room	17					2,720
Communication platforms/survey subscriptions (e.g. SurveyMonkey/Zoom)	5				200	1,000
					Misc.	106,000
					Total	1,429,720

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Work Programme 2. Knowledge Generation & Policy Support						
2-1: Employ existing knowledge to pre-define IPM-compatible products and emerging 'Good Practices'						
2-2: Define priority needs for local registration / implementation						
2-3: Provide tailored policy support to national governments						
2-4: Build capability within the ASEAN research and policy community						
2-5: Facilitate communication to address Covid-19 disruption in seed/pesticide supply chains						
2-6: Map 'critical gaps' and capacity needs						
	#	Day	Travel	Acc.	Daily Rate	Total Project Cost
Develop pesticide use and risk management guidelines, as well as economic modelling (e.g. thresholds)		25			600	150000
Define priority needs for local registration, including emergency registration, product selection		60			600	36000
Multi-language policy briefs covering resistance management, IRM / IPM / integrated biodiversity management	10				2500	25000
Provide tailored IPM policy support to national governments		45			1000	45000
Develop efficient, simple-to-use, and targeted communications resources for policymakers		200			600	120000
ASEAN researcher workshops/exchange/webinar program	5	10000				50,000
Facilitate communication resources to account for Covid-19/other disruption in seed/pesticide supply chains		60			600	36,000
Map critical gaps and capacity needs across ASEAN to implement Action Plan		80			600	48,000
					Misc.	40,400
					Total	550,800

Work Programme 3 Farmer Learning and Support						
3-1: Integrate crowd-sourcing, FtF knowledge exchange and advisory tools						
3-2: Establish ToTs, digital FFS and farmer innovation hubs						
3-3: Develop efficient, simple-to-use, and targeted communications resources for farmers and extension service providers						
3-4: Promote multi-stakeholder learning alliances						
	#	days	Travel	Acc.	Daily Rate	Total Project Cost
Content development/design/translation knowledge materials - video clips, text messaging		90			500	45,000
Development & multi-lingual translation of farmer-to-farmer educational videos	3	15000				45,000
Web site establishment and maintenance						55,000
Webinar online subscriptions						25,000
Farmer Communication / innovation officer (1/2 time)	1	500				225,000
Accommodation & travel for farmer innovation hub unit	1	200		350		70,000
Establishment / operations / insurance support for local (multi-stakeholder) innovation hubs	5				25000	125,000
Extension tools and equipment, e.g., smart projectors, camera	40					48,000
Advisory Services on Communications	30				600	18,000
Preparation of Course materials, ToT sessions	20			2500		50,000
Delivery of Training courses (including farmer field schools), video-based + person-to-person + other multi-media	4	7		12000		336,000
Technology up-scaling through innovator network + farmer cooperatives	1					150,000
Testing of Effectiveness of Farmer communication / extension programs / digital FFS - 1 PhD	1	85000				85,000
					Misc.	86,560
					Total	1,168,560

ANNEX 3: Key International Research Organisations/ Initiatives Working on FAW

The following list includes key international research organisations and initiatives which have a specific focus on FAW. Descriptions are based CABI excellent summary of organisations involved in African FAW programmes, with additional updates of information from each organisations' website, where relevant. Additional organisations have been added. Government Aid and Development programmes have not been included, although are supporting significant work on FAW (e.g. USAID).



Founded in 2003 to address Africa's food security prospects through agricultural technology, the [African Agricultural Technology Foundation \(AATF\)](#) focuses on supporting smallholder farmers in Sub-Saharan Africa and providing them with practical technology solutions capable of addressing their farm productivity constraints and improving their livelihoods. The AATF recognises that frequent drought events and insect-pests including stemborers and fall armyworm are a major threat to food security in Africa. To address this threat, the Water Efficient Maize for Africa ([WEMA](#)) Project was created in 2008 to develop and deploy new drought-tolerant and insect-resistant (*climate-smart*) maize varieties using conventional plant breeding techniques enhanced with molecular markers and double haploids technologies, and genetic engineering or transgenic technology. The [TELA Maize Project](#) uses both drought-tolerant and insect-resistant transgenes or traits donated royalty-free to smallholder farmers, to develop white maize varieties under the trademark TELA®. An informative blog is regularly updated at the TELA Maize Project website.



[Access Agriculture](#) is a non-profit organisation that showcases agricultural training videos in local languages. Several [videos](#) have been made to give information on how to scout for FAW and manage the pest.



[CABI](#) improves people's lives worldwide, by applying relevant scientific expertise and practical tools, to solve challenges caused by invasive species such as fall armyworm. CABI is developing and scaling out an extensive and diverse range of innovative solutions to manage fall armyworm through prevention, early detection, eradication/containment and control. CABI has been closely involved with international and national responses to Fall Armyworm (FAW) since it first appeared in West Africa, primarily through two programmes: Action on Invasives (www.invasive-species.org) and Plantwise (www.plantwise.org). CABI has undertaken a range of activities:

- Collation of information and review of the evidence for policy and scientific decision making
- Supporting national response planning in Africa and Asia
- Contributing to international coordination and collaboration
- Planning mass extension and communication campaigns in support of national response plans, including the development of various communication materials and channels
- Surveying in Latin America for candidate biocontrol agents for introduction to Africa and Asia
- Research on natural enemies in invaded areas
- Field trials on biopesticides



The [Cereal Systems Initiative for South Asia \(CSISA\)](#) was established in 2009 to benefit more than 8 million farmers by the end of 2020. The project is led by the International Maize and Wheat Improvement Center (CIMMYT) and implemented jointly with the International Food Policy Research Institute (IFPRI) and the International Rice Research Institute (IRRI). CSISA has been increasingly active on FAW-related work in Bangladesh, India and Nepal since the arrival of the pest from 2018. Several excellent graphics (e.g. posters) have been developed.



[The International maize and wheat improvement centre \(CIMMYT\)](#) have developed the Fall Armyworm in Africa: A Guide for Integrated Pest Management, and are working on lowland tropical inbred lines with resistance to fall armyworm. CIMMYT also leads the Fall Armyworm R4D International Consortium, that brings together diverse institutions in public and private sectors worldwide to explore ways to synergistically work on short-, medium- and long-term solutions to tackle the challenge of fall armyworm in Africa. Also, CIMMYT provides many useful information resources to help stakeholders better understand how to manage FAW, as well as holding workshops to bring stakeholders together to develop future responses and share knowledge.

Fall Armyworm R4D International Consortium

Focusing on applied research, the consortium joins other global efforts and coordinates with international bodies working against this pest. The Fall Armyworm R4D International Consortium will be co-led by the International Maize and Wheat Improvement Center (CIMMYT) and the International Institute of Tropical Agriculture (IITA). The goal of the consortium was to establish an inclusive, science-based R4D initiative, by which evidence-based tools that are safe, effective, accessible and sustainable are developed/validated and deployed for FAW management by smallholder farmers across Africa.



[Farm Radio's](#) mission is to support African broadcasters to provide radio services that share knowledge with and amplify the voices of small-scale farmers, their families, and their communities. An example of a radio broadcast related to FAW can be found [here](#).



FAO has recently launched a [Global Action for FAW Control](#) as a response to the international threat that FAW is posing for food security and the livelihoods of millions of smallholder farmers. Amongst its many activities, it has also developed a [Fall Armyworm Monitoring and Early Warning System \(FAMEWS\)](#). The FAW Monitoring and Early Warning System (FAMEWS) mobile app is free, works offline and provides farmers with advice on how to manage FAW.



ICiPE mission is to help alleviate poverty, ensure food security and improve the overall health status of peoples of the tropics, by developing and extending management tools and strategies for harmful and useful arthropods, while preserving the natural resource base through research and capacity building. It focuses on developing an IPM strategy that is suited to the needs of the African smallholders, considering the agroecology, cropping systems and the diversity of natural enemies of fall armyworm in Africa. Many innovative initiatives have been implemented in this regard, including Push-pull technology (PPT), identification of several indigenous natural enemies for fall armyworm, including parasitoids *Cotesia icipe*, *Palexorista zonata*, *Charops ater* and *Coccygidium luteum*, as well as identification of Fungal isolates effective against early life stages of fall armyworm. ICiPE also engaged in the establishment of a Community–Based Fall Armyworm Monitoring, Forecasting, Early Warning (CBFAMFEW) and management strategy for fall armyworm. enable decision making for effective management of fall armyworm in sub-Saharan Africa.



The **International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)** is an international non-profit organization that undertakes scientific research for development. ICRISAT has specialized knowledge on the drylands, which covers 55 countries in Asia and sub-Saharan Africa In Niger, **ICRISAT**, with the national phytosanitary services, carried out a survey on the fall armyworm incidence using pheromone traps and observed FAW on maize, sorghum, rice, fonio (=Digitaria) and pearl millet. In 2018, ICRISAT-Niger in collaboration with Institut National de la Recherche Agronomique du Niger (INRAN), University of Maradi, and the Feed the Future Innovation Lab for Integrated Pest Management found two natural enemies of the fall armyworm, *Telenomus remus* and *Trichogramma*, which attack its eggs. ICRISAT has also been collaborating with Institut de l'Environnement et de Recherches Agricoles (INERA) in Burkina Faso to test synthetic pesticides and neem-based formulations against fall armyworm. ICRISAT also provides **training** and **workshops** for stakeholders on FAW.



The **International Institute of Tropical Agriculture (IITA)** is a non-profit institution that generates agricultural innovations to meet Africa's most pressing challenges of hunger, malnutrition, poverty, and natural resource degradation. In early 2016, FAW was first detected by IITA scientists on the African continent following initial caterpillar outbreaks on maize in Central and Western Africa. Amongst a diverse range of projects, IITA is assessing the efficacy of native parasitoids of fall armyworm, as well as various projects concerning the evaluation of biopesticides, and biorational and biocontrol strategies.



The **International Rice Research Institute (IRRI)** is the world's premier research organization dedicated to reducing poverty and hunger through rice science; improving the health and welfare of rice farmers and consumers; and protecting the rice-growing environment for future generations. IIR has an increasing interest in FAW. Resources and information are shared with stakeholders on how to manage the pest. IRRI

is also involved in specific FAW projects.



[The International Plant Protection Convention \(IPPC\)](#) is an intergovernmental treaty signed by over 180 countries, aiming to protect the world's plant resources from the spread and introduction of pests, and promoting safe trade. The IPPC fosters cooperation and knowledge sharing in preventing and managing the FAW among IPPC contracting parties. The IPPC also plays an important role in helping to prevent the spread of the Fall Armyworm - and minimize the risk of the movement of the pest, through commodities and means of transportation, in international trade. A specific set of IPPC International Standards for Phytosanitary Measures (ISPMs) can also help countries enforce suitable effective measures to prevent and regulate the pest. These include pest risk analysis, pest surveillance, requirements for the establishment of pest-free areas, phytosanitary inspection and different phytosanitary treatments.

The [Asia-Pacific Plant Protection Commission](#) is committed to protecting plant, human and animal health and the environment, facilitating trade, and protecting the sustainability of agriculture. The Commission provides a regional forum for cooperation and the full implementation of the Plant Protection Agreement for the Asia and Pacific region. It assists in the development of measures for plant protection, including regional standards for phytosanitary measures (RSPMs), promotion of integrated pest management and the Code of Conduct for Distribution and Use of Pesticides.



[Scientific Animations Without Borders \(SAWBO\)](#) is a university-based program which transforms extension information on relevant topics such as agriculture, disease and women's empowerment, into 2D, 2.5D and 3D animations, which are then voice overlaid into a diversity of languages from around the world. All SAWBO animations are made freely available to anyone wishing to use them for educational purposes. Animations can be downloaded from a diversity of SAWBO channels and used on computers, tablets, cell phones, TVs, and overhead projection systems. Several useful short [animated videos](#) on FAW have been made.

ANNEX 4: Members of the Expert Working Group

The following experts gave valuable contributions as part of an Expert Working Group, convened from 15 April to 3 May 2020. This Expert Working Group provided feedback on the development of a comprehensive list of activities necessary to successfully manage FAW across the ASEAN region. The additional assistance by Dr Kris Wyckhuys in helping to facilitate the Expert Working Group workshops and his technical assistance is gratefully acknowledged.

Name	Organisation
Ahmad Salahuddin	Access Agriculture
Bui Xuan Phong	Plant Protection Department, MARD, Vietnam
Cau Duong	Bayer
Gary Jahn, John Bowman, Joe Huesing	USAID
Hongqiang Feng	Institute of Plant Protection, Henan Academy of Agricultural Sciences
Jan Ketelaar	Independent Expert
Jedeliza Ferrater	East-West Seed, Philippines
Jennifer Lewis	International Biocontrol Manufacturers Association
Kenneth Wilson	University of Lancaster
Kongming Wu, Zhenying Wang	Chinese Academy of Agricultural Sciences (CAAS)
Kris Wyckhuys	Independent consultant
Melanie Bacou	WorldCover PBC
Mike Furlong	University of Queensland
Min Su	President, Shenzhen Bio-global Company
Ngo Tien Dung	Independent consultant
Nguyen Van Liem	Plant Protection Research Institute (PPRI) Vietnam
Ni Ni Htain	Plant Protection Division, Department of Agriculture, Myanmar
Nurindah Balittas	Indonesian Agency for Agricultural Research and Development (IAARD)
Pankaj Sharma, Elizabeth Hernandez	Corteva
Paul Jepson	Oregon State University
Pierre Martin, Florent Tivet	CIRAD
Prapit Wongtiem, Pruettichat Punyawattoe	DoA, Thailand
Prasanna Boddupalli	CIMMYT
Rebijith Kayattukandy Balan	Ministry of Primary Industries New Zealand
Rhett D. Harrison	World Agroforestry Centre
Rica Joy Flor	IRRI
Roger Day	CABI
Sadawud Koonmanee	CCP Crops
Sarina Macfadyen	ACIAR/CSIRO
Srinivas Parimi	CropLife Asia Representative
Steve Prager	International Center for Tropical Agriculture (CIAT)
Ted Turlings	Université de Neuchâtel
Tek Tay	CSIRO
Wei Zhang	International Food Policy Research Institute (IFPRI)
Xue-xin Chen	Zhejiang University
Y. Andi Trisyono	Universitas Gadjah Mada, Indonesia
Youichi Kobori	Japan International Research Center for Agricultural Sciences (JIRCAS)