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MANAGEMENT OF THE FALL ARMYWORM (*SPODOPTERA FRUIPERDA*) IN BOTSWANA

April 2022

SDGs:	
Country:	Botswana
Project Code:	TCP/BOT/3702
FAO Contribution:	USD 202 000
Duration:	1 February 2019 – 31 December 2021
Contact Info:	FAO Representation in Botswana FAO-BW@fao.org

Implementing Partners

Ministry of Agricultural Development and Food Security, Department of Crop Production and Division of Plant Protection.

Beneficiaries

Farmers and farmers' organizations; youth; women's groups; community leaders; and extension staff.

Country Programming Framework (CPF) Outputs

Priority Area 2 – Supporting increased agricultural production and productivity through environmentally friendly and climate smart practices.

Background

Government initiatives to improve food security in Botswana are often affected by transboundary pests and diseases, which hamper trade and agricultural production. The introduction of new pests in the country has historically proved to be challenging, as the management and eradication of these pests requires significant human and financial resources. Botswana has struggled with the invasion of the Oriental fruit fly (*Bactrocera dorsalis*), the Tomato leaf miner (*Tuta absoluta*), and most recently, with the Fall armyworm (FAW) (*Spodoptera frugiperda*).

When the FAW was first detected in Botswana in 2017, the government enacted a number of interventions, aiming to ensure sustainable food security. Public awareness-raising campaigns on the FAW were carried out, and training sessions were conducted. The government provided chemicals and technical support to the farming community and promoted Integrated Pest Management (IPM) approaches to move farmers from the persistent use of synthetic pesticides (most of which are highly hazardous and carcinogenic) to the use of biopesticides.

To support and advance these interventions, the design of this project included further technical assistance to government staff, farmers and other stakeholders in Botswana by continuing to build their capacities and supplying inputs for the detection, monitoring, control and management of FAW.

Impact

By building the capacities of farmers to sustainably manage FAW and thereby reduce its impact on food and income security, the project results are expected to contribute to SDGs 1 (No poverty) and 2 (Zero hunger).

Achievement of results

The project Outcome of national institutions having improved capacity for the effective management of FAW in Botswana was supported through the achievement of the project's four Outputs.

The status, host range and distribution of FAW was established under Output 1. Surveys were carried out in districts, and reports were received from farmers clearly indicating that the pest was present, with maize and sorghum being the preferred hosts.

Under Output 2, awareness on FAW was raised through the dissemination of materials and at a series of events that included a harvest day, a demonstration on the use of botanicals, a farm walk, a youth expo and a national agriculture show, as well as at training sessions for trainers, extension workers, farmers and the media. At the time of reporting, awareness was still being raised.

Under Output 3, a Training of Trainers (ToT) session was held to build the capacities of participants to replicate training and carry out demonstrations on a variety of topics for FAW management. The participants in the ToT were plant protection officers, researchers and academics, agronomists and horticultural officers who formed a core group that was tasked with guiding and assisting extension staff in disseminating accurate information. Training on monitoring and evaluating FAW infestation was also carried out. Eighteen training sessions were held for 419 farmers under this Output, increasing their knowledge of the biology, ecology, identification, signs of and damage caused by FAW, as well as how to scout, monitor and manage the pest.

Output 4 focused on the sustainable management of FAW in the project areas. Surveys and farm visits were carried out, and a variety of management techniques were observed. Farmers expressed satisfaction with the results that they saw.

Implementation of work plan and budget

Two no-cost extensions were requested and granted, and activities were implemented within the allotted budget. The project funds were released in a timely manner to enable implementation, which facilitated the achievement of most activities. At the beginning of the project, there was a delay in the hiring of consultants. As soon as that was carried out, implementation ran relatively smoothly.

Delays were also encountered in finding a supplier to provide inputs for Activity 4.1, under which pilot studies were to be carried out for FAW management techniques. Ultimately, this activity was not conducted under the project, but it is expected that the studies will be done during the next ploughing season. Activities 4.3 (Evaluate the use of biological control agents) and 4.4 (Conduct project validation workshop) were also not carried out. Activity 4.3 was not carried out because natural enemies were not found to have any measurable effects, and Activity 4.4 was postponed repeatedly because of the coronavirus disease 2019 (COVID-19) pandemic restrictions.

Some expendable equipment, including entomological kits, entomological mounting pins and a portable microscope were not procured.

As mentioned briefly above, the timeline of some activities was affected by the COVID-19 pandemic. One activity that remained pending at the end of the project was for the research team to determine which biocontrol agents should be used for FAW management. At the time of reporting, the Division of Plant Protection had decided to demonstrate the use of some biopesticides in selected districts to show the farming community the benefits of their use.

A major risk to implementation was a possible lack of skilled personnel to implement FAW control activities. To manage this risk, FAO engaged the Centre for Agriculture and Biosciences International (CABI) to conduct ToTs for 50 extension officers, who later replicated the training for 192 other extension officers. District staff and the community were then trained by these officers. After these training sessions, some farmers were able to manage FAW in their fields by adopting and implementing FAW control strategies; however, the adoption rate of the strategies was found to be low overall. Activities to strengthen Farmer Field Schools (FFSs) are planned to support the continued education of farmers on FAW management.

Another risk that was identified during formulation was the possibility that traps would be vandalized, as people tend to use the pheromone trap buckets as containers. This issue calls for continuous awareness raising to be carried out in the community to reinforce the importance of pheromone traps.

The risk of insufficient monitoring persists due to a shortage of transportation options for carrying out monitoring missions; however, extension officers are expected to continue monitoring where possible.

The advocacy for the use of biopesticides and other biological control methods as opposed to synthetic pesticides reduced the environmental and social risks that could have been posed by the project.

Follow-up for government attention

At the time of reporting, 103 traps that were set up around the country required monitoring. It is expected that extension staff and district plant protection officers will ensure that these traps are serviced every 4-6 weeks, that they are monitored regularly and that trap catches are submitted as necessary.

Activities to compile data for the national FAW database should be revisited.

The use of biopesticides should be encouraged through education for farmers.

The vandalization of pheromone traps should be discouraged through continuous awareness raising activities in the targeted communities.

Sustainability

1. Capacity development

The government of Botswana has a Plant Protection Act of 2007 that is currently in place to prevent the introduction and spread of pests, as well as to facilitate trade and enable the country to comply with its international obligations.

The impact of this project is expected to improve trade, which would subsequently improve food security at both household and national levels. Among other things, the project contributed to: (i) stronger policy coordination and public awareness; (ii) the facilitation of budget support with regard to agriculture and food security in Botswana; (iii) deeper trade integration in the agricultural and food sectors in Botswana; (iv) improved agriculture and food availability through the management of FAW; and (v) building capacity in pest control.

To ensure the sustainability of the project, the following activities are planned:

- continued sensitization of all key stakeholders (government, politicians and farmers) to ensure ownership;
- continued capacitation of staff and farmers to ensure adoption of information and implementation of FAW management options;
- continued collaboration and information-sharing with cooperating partners to share experiences and pave the way forward; and
- regular feedback to financiers and government to lobby for support.

The government is expected to continue providing funding for FAW monitoring and management. The farming community will be fully involved as the government had already identified some FFSs to benefit from demonstrations on the use of biopesticides. The FFSs are expected to further disseminate the acquired knowledge to other farmers.

Alliances were created with research institutions, academia and CABI, and it was evident that they are more than willing to collaborate beyond the duration of the project to help assist farmers in attaining food security.

There is a five-year national strategy for the Sustainable Management of Fall Armyworm in Botswana that CABI was engaged to work on. It contains clearly defined follow-up actions and supports the exit of the project. At the time of reporting, the strategy was yet to be completed and shared with relevant stakeholders.

2. Gender equality

The gender of participants for each of the training sessions and other events was tracked. The extension training was attended by 124 men (55 percent of attendees) and 100 women (44 percent). The farmer training sessions were attended by 241 men (57 percent) and 179 women (43 percent). The training sessions for enumerators saw the participation of 9 men (43 percent) and 12 women (57 percent). The training for members of the media was attended by 68 men (66 percent) and 35 women (34 percent).

Fifty-three men (55 percent) participated in the media tour, whereas 44 women (45 percent) participated. In other events, including the harvest day, demonstration on the use of botanicals, farm walk, youth expo, and national agriculture show, the attendees were recorded as 382 men (61 percent), and 242 women (39 percent).

Despite efforts to support the participation of women in the project activities, these numbers demonstrate that men and women did not benefit equitably. This could be attributed to the fact that men are more involved in the farming sector than women.

3. Environmental sustainability

The project performed well in capacitating stakeholders on environmentally friendly FAW management through the introduction of IPM, which supports the use of biopesticides over chemical ones. The use of commercial chemical pesticides alone poses health risks to people, builds up pesticide resistance, causes higher economic losses and kills potential indigenous natural enemies of the FAW and other pests. This can jeopardize complex ecological balances, foster the emergence of other pests, and compromise the sustainability of existing farming and food systems.

FAO has established a sustainable FAW management programme, which indicates the necessary steps to protect crops from the FAW. It has also developed a number of early-warning products that can be used to aid effective decision-making on the pest. These products include the Fall Armyworm Monitoring and Early Warning System (FAMEWS), FAWRisk-Map and KoBoCollect.

At the time of reporting, the Division of Plant Protection was installing the FAMEWS application on procured mobile phones to be used by officers at district level to collect data. Out of 100 procured phones, FAMEWS had been installed on 83.

4. Human Rights-based Approach (HRBA) – in particular Right to Food and Decent Work

Human rights were promoted by encouraging both men and women in the farming sector to benefit from the information provided on FAW, which aimed to help them increase their production by learning how to reduce crop damage.

Through the introduction and promotion of FAW management options, such as the use of biopesticides and natural enemies, interested youth ventured into the business of supplying, selling and applying these control options, as well as educating others on their use.

The legal framework of Botswana's Plant Protection Act ensures occupational health and safety with the use of pesticides.

5. Technological sustainability

The IPM approach is flexible, allowing farmers to select effective, affordable and simple management options that can bring about favourable results.

The project made significant contributions to the development of local knowledge, capacity, resources and good practices, because it provided farmers with the opportunity to conduct their own trials with botanicals like chillies, tobacco and wild plants, allowing them to personally observe their effects as biopesticides. Some farmers even tried the traditional go upa method (which has not been fully described to avoid compromising its efficiency). The farmers expressed satisfaction with the results obtained.

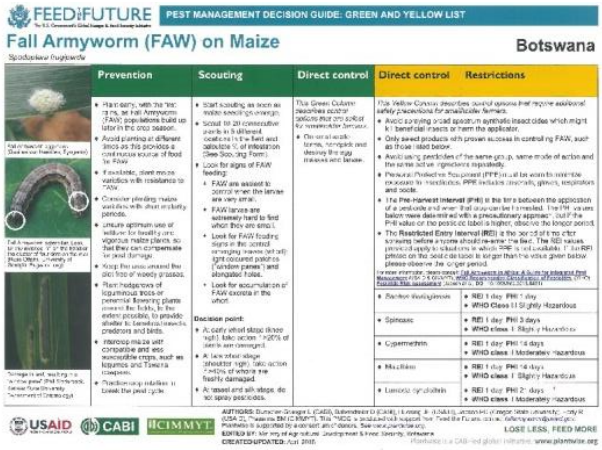
After the training sessions, most participants expressed that they felt comfortable in pursuing FAW-related interventions on their own, with the help of the awareness-raising materials that they were given. These interventions consisted of the morphological identification of the pest, egg crushing, the W pattern for scouting, and checking for and removing larva within the whorl of a plant.

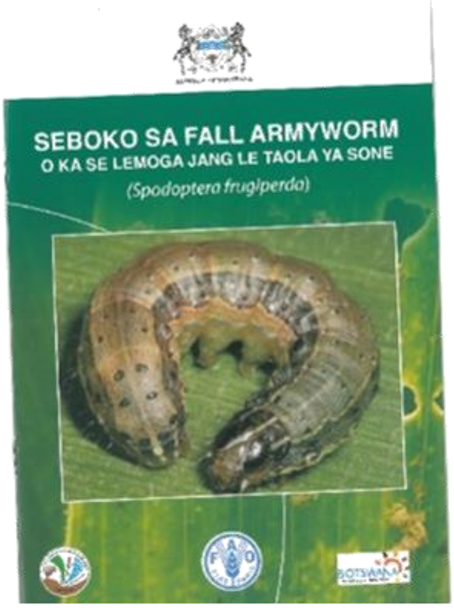
6. Economic sustainability

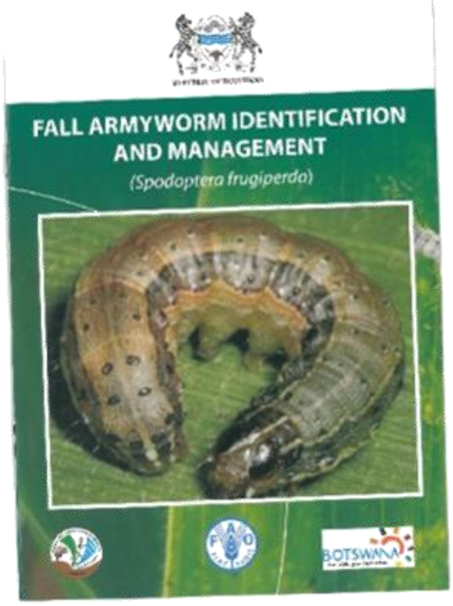
The inputs procured under the project, including traps for selected farms, seeds, fertilizers and biopesticides for demonstrations, were made available to farmers for use as needed.

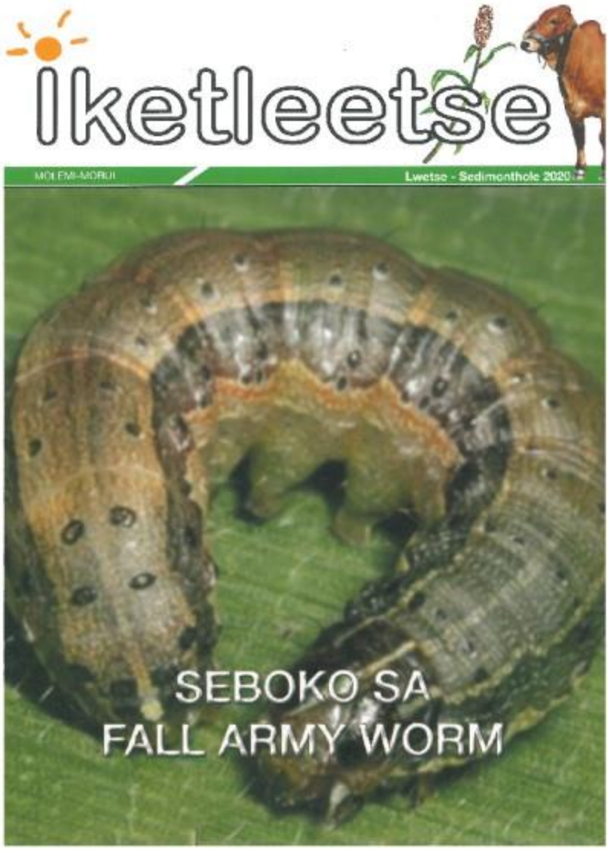
Documents and outreach products

- **Ministry of Agricultural Development and Food Security.** 2020. *Fall armyworm identification and management (spodoptera frugiperda)*. Gaborone, Ministry of Agricultural Development and Food Security.
- **Ministry of Agricultural Development and Food Security.** 2020. *Fall armyworm (FAW) on Maize Botswana*. Gaborone, Ministry of Agricultural Development and Food Security.
- **CABI and USAID.** 2020. *Fall armyworm Management* (poster). Edited by Ministry of Agricultural Development and Food Security. Gaborone, Ministry of Agricultural Development and Food Security.
- **Ministry of Agricultural Development and Food Security.** 2020. *Seboko sa fall armyworm. Gaborone*. Iketleetse magazine.
- **Ministry of Agricultural Development and Food Security.** 2020. *Seboko sa Fall Armyworm (FW) mo Mmiding*. Gaborone, Ministry of Agricultural Development and Food Security.
- **Ministry of Agricultural Development and Food Security.** 2020. *Seboko sa Fall Armyworm o ka se lemoga jang le taolo ya sone*. Gaborone, Ministry of Agricultural Development and Food Security.









ACHIEVEMENT OF RESULTS - LOGICAL FRAMEWORK

Expected Impact	**Livelihood opportunities and food security of rural communities in Botswana is improved**	
Outcome	National institutions have improved capacity for effective management of Fall Armyworm	
	Indicator	– Number of institutions capacitated in FAW management. – Number of districts with established database system and trained staff to monitor and evaluate FAW incidence. – National FAW Data base system established and operational with up-to-date information (incidence, occurrence etc.). – Number of staff from national institutions trained on FAW management.
	Baseline	– 0 – Districts have 30% capacity to monitor and evaluate FAW incidence. – 4 districts. – 40% of relevant Ministry of Agriculture technical staff.
	End Target	– 2 – 70% – 10 districts (100%). – 70% of relevant Ministry of Agriculture technical staff.
	Comments and follow-up action to be taken	Two institutions, Botswana International University of Science and Technology and Botswana University of Agriculture and Natural Resources (BUAN), benefited from capacity-development activities related to FAW management. Six districts were equipped with databases, and staff was trained to monitor and evaluate FAW incidence. A national database system was established and made operational because the FAMEWS application was not supported on available devices. A total of 192 extension staff were trained out of 290, which means that 66 percent of the staff was trained. In addition to the 192 extension staff, 87 media personnel were trained, and 50 participants attended a ToT session. Stakeholders from the Ministry of Agricultural Development and Food Security and others involved in FAW management were extremely willing to attend the sessions, and their level of engagement was high. Media personnel were targeted for training so that they could assist in mass outreach campaigns to provide the same information to people at the same time. The training also sought to support proper reporting on the FAW and its management across media channels. Trainees who attended the ToT session were capacitated to assist in extension training. This group included agronomists, horticulturalists, academics, plant protection officers and a research team. Again, their role was to guide and assist extension staff in disseminating accurate information. Extension staff were capacitated to assist in conveying information to other stakeholders, including the farming community. Because the media cannot do all the work of an extension agent, this group, after being capacitated, offered technical advice and support, teaching practical skills on management and answering farmers’ questions promptly.

Output 1	Status, host range and distribution of Fall Armyworm established in Botswana			
	Indicators		Target	Achieved
				Yes
Baseline				
Comments	This Output was achieved. The FAW was detected in January 2017, and almost all districts were infested. After intensive surveys were carried out, its presence was officially confirmed in seven out of ten districts, and it was declared as a new pest with the potential of causing massive damage if not managed and contained early. The preferred host appeared to be maize, although in areas where there was no maize, other cereals, like sorghum, were affected.			

Activity 1.1	Procurement	
	Achieved	Yes
	Comments	The following items to assist with surveillance were procured under the project: – 150 moth traps (buckets). – 375 x 4 (in a packet) trapping strips (*Spodoptera frugiperda* lures). – 654 2,2-dichlorovinyl dimethyl phosphate (DDVP) strips/pads. – 10 Global Positioning Systems (GPS). This equipment facilitated the detection of the pest in all project areas, as well as continued monitoring. It was observed that the transparent bottoms for the buckets need replacement after some time, as they wear off due to external weather conditions. At the time of reporting, there were 103 traps around the country that required monitoring. Extension staff and district plant protection officers are expected to ensure that traps are serviced every 4-6 weeks, monitored regularly and that trap catches are submitted for confirmation as necessary. The main limitation for these activities is a shortage of transport options for the timely monitoring of traps.
Activity 1.2	Conduct baseline survey	
	Achieved	Yes
	Comments	Surveys were conducted in all seven project areas (Kgatleng, Kweneng, South East, Central, Chobe, North East and Southern). It was observed that the extent of spread was high, as most of the farmers who had planted preferred hosts like maize and sorghum were affected, and infestation was severe.
Activity 1.3	Develop guidelines	
	Achieved	Yes
	Comments	Guidelines published by FAO were used.
Activity 1.4	Undertake trainings	
	Achieved	Yes
	Comments	All trap operators were capacitated on trap operation, intervals of service and reporting frequency. Servicing was to be done every 4-6 weeks, reporting weekly, and buckets replaced as and when needed.
Activity 1.5	Undertake trap monitoring visits	
	Achieved	Yes
	Comments	Specimens taken from trap monitoring visits were sent for confirmation at BUAN and the Department of Agricultural Research. The specimens were analysed using morphological identification, rather than molecular.
Activity 1.6	Establish Fall armyworm database	
	Achieved	No
	Comments	There has been no consistency in data collection due to a lack of transportation for trap monitoring and the arrival of COVID-19. Repeated lockdowns stalled momentum to carry the exercise out, though it was evident that the pest is all over the country, except in the Ghanzi district. At the time of reporting, there were plans to revisit the activity to develop an up-to-date database.

<table>
<tr><th rowspan="3">Output 2</th><th colspan="3">Awareness on FAW created in Botswana</th></tr>
<tr><th>Indicators</th><th>Target</th><th>Achieved</th></tr>
<tr><td></td><td></td><td>Yes</td></tr>
<tr><td>Baseline</td><td colspan="3"></td></tr>
<tr><td>Comments</td><td colspan="3">Awareness was raised through a number of channels, including radio, television and on-farm discussions to educate and sensitize the farming community about the FAW, a new pest, which they confused with damage caused by other caterpillars like Helicoverpa amigera and Chilo patellus. A number of awareness-raising materials were produced to help enhance communication about Spodoptera frugiperda:
– 3 000 FAW leaflets.
– 3 000 FAW booklets.
The above were also translated into Setswana and the same numbers were printed.
– 3 000 posters.
– 1 000 folders.
– 2 banners.
– 2 gazebos.
– 1 telescope.
– 150 t-shirts.
– 50 golf shirts.
– 150 hats.
All of the above were used during training sessions and farm visits to communicate and disseminate information about the FAW.</td></tr>
<tr><td rowspan="3">Activity 2.1</td><td colspan="3">Inception workshop</td></tr>
<tr><td>Achieved</td><td colspan="2">Yes</td></tr>
<tr><td>Comments</td><td colspan="2">The inception workshop was held on 11 April 2019 after a delay in the recruitment of consultants. The purpose of the inception workshop was to raise awareness of the project and explain the project objectives to stakeholders to ensure buy-in.</td></tr>
<tr><td rowspan="3">Activity 2.2</td><td colspan="3">Produce FAW materials</td></tr>
<tr><td>Achieved</td><td colspan="2">Yes</td></tr>
<tr><td>Comments</td><td colspan="2">The above-mentioned awareness-raising materials (3 000 posters, 1 000 folders, 2 banners 2 gazebos, 1 telescope, 150 t-shirts, 50 golf shirts, 150 hats) were produced.</td></tr>
<tr><td rowspan="3">Activity 2.3</td><td colspan="3">Distribute FAW materials</td></tr>
<tr><td>Achieved</td><td colspan="2">Yes</td></tr>
<tr><td>Comments</td><td colspan="2">Materials were distributed at all activities that attracted large crowds of people, which facilitated a rapid spread of messaging.</td></tr>
<tr><td rowspan="3">Activity 2.4</td><td colspan="3">Undertake awareness campaign</td></tr>
<tr><td>Achieved</td><td colspan="2">Yes</td></tr>
<tr><td>Comments</td><td colspan="2">Campaigns were carried out by putting up stalls during events to attract people to become educated on FAW. About 721 people were reached. The activities were:
– Mosisedi harvest day (3 May 2019);
– Satau demonstration on botanicals (23 February 2020);
– North East farm walk (6 June 2019);
– Mosetse youth expo (8 May 2019);
– National agricultural show (22-26 August 2019); and
– Media tour (28 May 2019 and 4-5 June 2019).</td></tr>
</table>

Output 3	Government Research and Extension Departments are capacitated to sustainably manage fall armyworm			
	Indicators		Target	Achieved
				Yes
Baseline				
Comments	Fifty people were trained as trainers, including plant protection officers, research staff, agronomists, horticultural officers and staff from academia. This core team was formed to replicate the training for district extension staff. The ToT was held from 12-16 December 2020, and it was deemed successful.			
Activity 3.1	Organize Training of Trainers for NPPOs and crop extension officers			
	Achieved	Yes		
	Comments	See above (plant protection and crop extension officers were part of the core team).		
Activity 3.2	Organize farmer training			
	Achieved	Yes		
	Comments	There were 18 farmer training sessions conducted, which reached a total of 419 beneficiaries. The objectives of the training were to teach farmers about the biology and ecology of FAW, as well as their identification, damage symptoms, signs in relation to other common caterpillars, monitoring and scouting techniques and management options. The expectation was that those who attended the training share information with others. Farmers were also taken on a field visit to see the actual situation in the field. Training sessions are expected to continue through farmers' committees and existing FFSs.		
Output 4	Fall armyworm sustainably managed in project areas			
	Indicators		Target	Achieved
				Yes
Baseline				
Comments	The sustainable management of FAW in the project areas is expected to continue through follow-up visits to fields to check the level of technology adoption and to provide technical support as needed.			
Activity 4.1	Pilot FAW research studies			
	Achieved	No		
	Comments	These studies were not implemented on time owing to delays in procurement of required inputs. It is expected that the pilot studies will be pursued after project closure.		
Activity 4.2	Implement area-wide fall armyworm control			
	Achieved	Yes		
	Comments	During surveys and farm visits, it was evident that farmers were testing different options to try and contain the pest. Some of the methods involved chemical control. The use of botanicals like fever berry and chillies was also observed, as well as the use of ash and sand, soap and *go upa* (a traditional method utilized by farmers, the procedure for which they refuse to disclose). For each method selected, farmers seemed to appreciate the results achieved. The problem with synthetic pesticides appeared to be resistance due to improper use and the poor selection of chemical classes, the stage at which they were applied, as well as the mode of action and severity of infestation at the time of application.		
Activity 4.3	Evaluate the use of biological agents			
	Achieved	No		
	Comments	The persistent use of chemical pesticides has been observed to hinder the release of natural enemies as a means of controlling the FAW, rendering them inefficient. The number of natural enemies was found to be so insignificant that the results were not visible. More education is required to encourage farmers to use biopesticides and other safer options, rather than synthetic ones.		
Activity 4.4	Project Validation workshop			
	Achieved	No		
	Comments	The lockdown and consequent disruptions resulted in the validation workshop being postponed a number of times.		

Partnerships and Outreach
For more information, please contact: Reporting@fao.org

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