Food and Agriculture Organization of the United Nations

SUPPORT THE NATIONAL CAPACITY TO ADDRESS FAW

June 2020

SDGs:	
Countries:	Mozambique
Project Codes:	TCP/MOZ/3701
FAO Contribution:	USD 287 000
Duration:	15 April 2018 – 31 March 2020
Contact Info:	FAO Office in Mozambique FAO-MZ@fao.org

Implementing Partners

Ministry of Agriculture and Food Security.

Beneficiaries

Extension agents and technicians from the Government and its partners; small-scale farmer groups.

Country Programming Framework

Output 1.2: Producers in agriculture and fisheries sectors have enhanced capacity to adopt sustainable production techniques for own consumption and improved market participation.

Output 1.3: Public sector institutions are supported to improve their capacity to design and implement better strategies and regulatory frameworks, and to provide public services related to plant and animal health, food safety and quality.

BACKGROUND

The majority of people in Mozambique live in rural areas and rely predominantly on agriculture for their livelihoods, with approximately 89 percent of households being involved in the agriculture, livestock, fisheries or forestry sectors. Agriculture and livestock provide the main source of income for roughly 55 percent of households, and the agriculture sector is made up primarily of smallholder subsistence farmers.

Extreme weather events, such as droughts, floods and cyclones, as well as outbreaks of transboundary pests and diseases, have started to occur much more frequently in Mozambique in recent years. These events and outbreaks have become much more intense, and they pose a significant threat to food security and livelihoods, particularly for those who are already living in poverty and do not have strategies in place to deal with shocks of this nature.

An outbreak of Fall Armyworm (FAW) during the 2016 – 2017 agricultural season plagued many countries in Southern Africa, including Mozambique. The FAW preferentially feeds on maize, which is the main staple crop in the country; therefore, it is a serious threat to food security and nutrition there.

The Ministry of Agriculture and Food Security (MASA) formed a technical working group comprising representatives from academia, NGOs, the private sector and the resource partner community to address the FAW outbreak. The working group was supported by FAO and other partners in the formulation of a national action plan to respond to the threat in the short, medium and long term.

To meet the short-term needs of the action plan, the MASA requested assistance from FAO in the form of a TCP project to strengthen national capacities to manage the FAW. The project design included the establishment of a monitoring and early warning system for FAW and other pests and diseases, capacity building activities on controlling FAW outbreaks for local institutions and communities, and the creation of a national coordination platform for the management of the FAW. The project targeted beneficiaries to receive awareness-raising materials on the management of this transboundary plant pest, as well as technical assistance and training on an Integrated Pest Management (IPM) approach to controlling the FAW.

IMPACT

The strengthening of national and local capacities to implement an IPM approach to controlling the FAW population in Mozambique is expected to build resilience and boost the livelihoods of small-scale farmers in the country.

ACHIEVEMENT OF RESULTS

The project greatly contributed to the strengthening of institutional capacities to collect data on FAW population dynamics and distribution using a mobile app called the FAW Monitoring and Early Warning System (FAMEWS). This data was made accessible to national agricultural authorities to enable decision-making and/or the definition of priorities based on scientific evidence for the management of FAW and for mitigating its impact on maize production. In addition, the data was also shared at national and international conferences, and it was disseminated through the media, along with other information on the FAW.

Thanks to the technicians trained under this project, farmers benefited from better assistance on FAW management and testing, and from the adoption of sustainable management approaches. This improved technical assistance for farmers is expected to lead to an increase in productivity, while reducing risks to human health and the environment.

The project and its efforts to control FAW received some media coverage in articles from *Agência Lusa* (https://bit.ly/3dUjJvf), *Portal do Governo* (https://bit.ly/366JzK2), *Diário de Notícias de Portugal* (https://bit.ly/3bNGTlS), and *Rádio Moçambique* (https://bit.ly/3fZv8fq).

All three of the project Outputs were achieved, and they contributed to the achievement of the project Outcome, which was to increase the resilience of livelihoods to climate change, threats and crises.

Output 1 focused on the establishment of a functioning monitoring and early warning system for FAW and other pests and diseases. To achieve this Output, training sessions on FAW monitoring and management and on the FAMEWS app were held for representatives of 73 plant clinics, 13 of which were women. Initial plans only included 10 plant clinics; however, by training more technicians, more farmers were able to receive technical assistance. All of the technicians that were trained provided assistance on FAW management to farmers at local level, and they were responsible for uploading data to the FAMEWS platform to contribute to FAW management at national level. This activity was supported by other projects, including the Plantwise project, funded by the Centre for Agriculture and Biosciences International (CABI).

To support the collection of data and their transmission to the FAMEWS platform, a total of 35 smartphones and tablets were procured and distributed to the technicians who benefited from the above-mentioned training. The data collected and disseminated through the FAMEWS platform was shared at national and international meetings, and in the media.

Further training on the use of the FAMEWS app was provided for 120 technicians from the Government, NGOs and other partners, and 35 of them received the smartphones/tablets that were procured under the previous activity. Eighteen of the participants in this training session were women. This activity was conducted in collaboration with project GCP/MOZ/126/USA, funded by the United States Agency for International Development (USAID).

To monitor the FAW population, a total of 450 pheromone traps were procured and distributed. Project GCP/MOZ/126/USA contributed to activity as well, through the provision of additional traps, lures and killing strips. The traps were installed in the field, so that FAW population changes could be monitored by the 120 technicians trained under this Output. At least two of these technicians, equipped with smartphones or tablets, conducted field scouting and trapping activities, and then transmitted the information and data they gathered to the appropriate national authorities (i.e. National Directorate for Plant Protection [DSV]) to support evidence-based decision-making and the setting of priorities at national level.

Training sessions on FAW monitoring (scouting and trapping) also took place for partner organizations, including NGOs, farmer associations and representatives from academia and the private sector. These sessions included training on the use of the FAMEWS app. There were 43 participants. Seven of them were women. Those who benefited from the training contributed to the strengthening of national capacity on FAW management by participating in monitoring and data collection activities. They also integrated FAW-related activities into their respective plans. These training sessions were also supported by GCP/MOZ/126/USA.

Demonstration plots were established, so that experiments could be carried out in order to validate several approaches for the sustainable management of FAW. Four experiments were performed. The first was an impact assessment of low-toxicity pesticides, the second examined the effectiveness of planting at certain times of the season to reduce FAW infestation levels, the third focused on the efficacy of botanical pesticides on FAW larvae, and the fourth was an assessment of the effectiveness of botanical pesticides in controlling FAW. These experiments were conducted under Letters of Agreement (LoAs) that were signed with the Faculty of Agronomy and Forest Engineering (FAEF) in the Maputo and Gaza provinces and the *Instituto Superior Politécnico de Manica* (ISPM) in the Manica province, as well as other partners, including the Land O'Lakes Resilient Agricultural Market Activities – Beira Corridor (RAMA – BC) project. Details of the findings of these experiments can be found in the LogFrame Matrix below.

Capacity building was also a focus of Output 2. The achievement of this Output began with the dissemination of information on the sustainable management of FAW. This information included the results of field monitoring and data collection activities, as well as strategies for sustainable management, which were promoted in the field by Government and partner extension officers. Pamphlets, leaflets, posters and manuals were prepared and shared via email and in WhatsApp groups. This information was also disseminated on TV, the radio, and social media, and in newspapers. The sharing of this information was continued under GCP/MOZ/126/USA. Farmers also received technical materials on the use of botanical pesticides.

A total of 120 technicians were trained on the integrated management of FAW. This training session included 25 master trainers from Farmer Field Schools (FFS) all over the country and 20 FAMEWS focal points. Twenty of the participants were trained as trainers, and they were expected to echo the training sessions in their respective provinces. As a result of the training, all of the participants were able to promote sustainable FAW management practices, including the identification of natural enemies and the use of bio and botanical pesticides that are locally available.

Two modules of this training were also dedicated to the handling of chemical pesticides. The goal of these modules was to reduce the risks to both human health and the environment that are associated with the use of these pesticides. Ultimately, it was decided that chemical pesticides should only be used as a last resort, and safety recommendations were formulated to support any farmers that might use them. A list of these recommendations can be found in the LogFrame Matrix below.

Owing to the fact that there are differences in the agro-ecological conditions of the areas of Mozambique where the project was implemented, it was thought to be possible that FAW occurrence in the country could have originated from different introductions of the pest, which meant that there could have been variations in populations or biotypes. For this reason, studies were conducted on the FAW found in different areas, and the samples that were collected were expected to be submitted to the Eduardo Mondlane University Biotechnology Laboratory for analysis and DNA sequencing. This activity was conducted under a LoA with the FAEF.

National research priorities were discussed with the DSV, the Agricultural Research Institute of Mozambique (IIAM), FAEF and FAO under this Output, and they were incorporated into the country's national action plan. This was part of a larger effort to formulate a national IPM strategy for controlling FAW. The IPM approach was discussed at training sessions with various stakeholders, including extension staff. It focused on prevention and avoidance strategies, the importance of planting dates, and the use of locally available resources for mitigating outbreaks of FAW.

The third and final Output focused on coordination mechanisms for managing FAW and other pests and diseases. Owing to the fact that FAW outbreaks occurred in areas that were affected by cyclones Idai and Kenneth, which had already caused food security issues, many organizations in the area were in need of information and training on FAW management in an attempt to prevent further crop loss. Partners involved in the agriculture sector were identified, and activities for stakeholders were mapped. A coordination meeting was held with FAO and partners from other Portuguese-speaking countries, including the Brazilian Agricultural Research Corporation (EMBRAPA), the *Istituto Nacional de Investigação Desenvolvimento Agrário* (INIDA) of Cabo Verde and the (DSPV) of Guinea Bissau. A meeting was held to discuss the implementation of biological control measures for FAW, and it was followed up with a training session on these measures.

Several coordination meetings were also held with the National FAW Task Force, the DSV, the IIAM, FAEF and FAO. Additional meetings were held with other partners, including the Land O'Lakes RAMA-BC project, which focuses on the effect of planting dates on FAW outbreaks, intercropping maize with legumes, and cost-sharing and synergies.

The Vulnerability Assessment Committee (VAC) of Mozambique integrated FAW control into their activities. This included the incorporation of FAW-related questions on the vulnerability assessments they carried out in the provinces of Manica and Sofala, which were affected by cyclone Idai. It also included the provision of awareness-raising materials and assistance related to FAW, as well as the training of Government officials and representatives from NGOs and farmer associations on FAW management in the areas affected by cyclone Idai, in partnership with a FAO emergency project.

This project fostered the development of several tools for FAW management. In addition to those mentioned above, this included the formulation of protocols on the use of biological control agents and other research protocols, as well as field monitoring practices and management tools. The project team was also invited to participate in testing new versions of the FAMEWS app, and they were asked to provide feedback to its developers based on this testing.

The final activity of this Output was the organization of an international seminar to discuss the sustainable management of the FAW, based on experiences and ongoing research in Brazil and Mozambique. Approximately 50 people attended. Participants included scientists from Brazil and Mozambique, as well as National Plant Protection Officers from Angola, Malawi, Mozambique, and Zimbabwe, national- and provincial-level public extension service providers, and representatives from the private sector and partner organizations. This seminar facilitated the development of research recommendations and messaging to support the work of extension agents and the FAMEWS system. Two technicians from Mozambique were invited to present at the seminar. One presented on the above-mentioned experiment performed on the efficacy of botanical pesticides, and the other presented on the use and application of the FAMEWS system. Both presentations were well received, and they were considered to be good examples of the innovations available to small-scale farmers to combat FAW infestations in the field.

Implementation of work plan

The project was implemented according to the activities that were planned, and the expected Outputs were successfully delivered. Three no-cost extensions were approved throughout the life of the project.

There was a delay in the implementation of the project, due to the occurrence of cyclones Idai and Kenneth. These natural disasters affected planting dates, which impacted the harvesting of crops. Therefore, this amendment is for activity completion due to delay on the LOA implementation.

The activities were implemented within the planned budget, which allowed for additional smartphones to be purchased.

The risks that were identified during project formulation were managed successfully by following the mitigation measures that were indicated in the Project Document. Any impact related to these risks was minimal.

Follow-up for government attention

The relevant authorities in the agriculture sector should promote and integrate the good practices demonstrated under this project into the IPM approach to FAW, including early planting and the use of botanical pesticides. These measures are appropriate for small-scale farmers due to their low cost, local availability and accessibility.

The FAW monitoring and management activities should be fully integrated into Government plans. A database for FAW information at country level should be developed, and the FAMEWS app should be adopted widely for continued use in the country.

It is recommended that the Government strengthen collaboration with different stakeholders to include information sharing among partners through seminars and/or workshops. The Government should also strengthen information dissemination and awareness raising through the media (e.g. TV and radio).

Finally, continuous training or capacity building should be provided for technicians, farmers and other stakeholders to address the gaps in the sustainable management of the FAW. In order to support all of these follow-up actions, the Government and its partners should continue efforts to mobilize resources.

Sustainability

1. Capacity development

At the time of this report, the national agricultural authorities (the DSV, the Directorate for Agriculture and Forestry [DINAS] and the Ministry of Agriculture and Rural Development [MADER]) had engaged with cooperation partners to prepare a national action plan and to mobilize resources for supporting medium- to long-term activities that aim to control the FAW.

To ensure the sustainability and continuity of the results achieved by the project after its end, capacity building activities were conducted for Government technicians. In addition, a FAW monitoring system, which included a national FAW management strategy, was developed. The project also led to the establishment of a National FAW Task Force.

Another achievement of the project was the creation of partnerships among different stakeholders (i.e. the Government, public, private and research institutions, NGOs, development agencies or resource partners, among others). All of the institutions involved in the project were guided by the same objectives. A framework based on joint planning and operation directed the management of activities to control FAW. The synergy created under this project is expected to ensure resource mobilization for the continuity of project activities and for the delivery of project outcomes to the main beneficiaries (small-scale farmers).

The signature of LoAs with public research institutions and extension services are expected to support the training of technicians at community level, thereby ensuring institutional sustainability and improving access to public initiatives, which could also contribute to the continuity of the activities carried out under this project after its closure.

During the project implementation period, research on the FAW was conducted thanks to partnerships and alliances with several national and international organizations, including public research and academic institutions, the private sector, NGOs, farmer associations, and other projects. At the time this report, these partnerships were playing an important role and contributing to FAW research and management. This is expected to ensure sustainability and to improve the impact of FAW management activities in the country.

2. Gender equality

The activities of this project were implemented according to its design, and all of the objectives and expected Outputs were achieved. The project met the needs of the targeted beneficiary groups (small-scale farmers) through better technical assistance from trained technicians, and through capacity building at the Government level.

Fifteen percent of the technicians trained were women that were selected at province and district level. Despite efforts that were made to increase the number of women participating in the training sessions, their overall representation was low. Further efforts are expected to be made to improve this ratio in the future.

3. Environmental sustainability

A significant number of the activities of this project focused on reducing risks to both human health and the environment. The promotion of the use of non-chemical methods for the control of FAW, i.e. locally available products, including botanical pesticides, is an environmentally sound approach.

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

While the HRBA was not a direct target of this project, its results are expected to support the livelihoods of small-scale farmers and to increase food supplies through a reduction in FAW infestation in maize crops.

5. Technological sustainability

The project validated and/or tested and demonstrated the effect of prevention and/or avoidance methods, planting dates, and using low-cost botanical pesticides that are low risk to human health and the environment, and are therefore appropriate for small-scale farmer groups.

Before the implementation of the project, there was little knowledge of the FAW among the majority of technicians in the country, and they could not adequately recognize the FAW and/or provide assistance to farmers, which led to failures in the identification and control of the pest. The activities of this project emphasized the strengthening of institutional capacities to effectively deal with FAW. The training sessions held for technicians from public and research institutions, the private sector, NGOs and farmer associations contributed to the development of local knowledge.

The project also contributed to the establishment of a national FAW monitoring system throughout the country and made it operational. The FAMEWS was also introduced in each of Mozambique's ten provinces, and it became a crucial part of the country's preparedness and rapid response capacity. Thanks to the trained technicians that were based at community level, farmers received better assistance in sustainably managing the FAW.

During the project implementation period, capacity building was one of the main objectives so that stakeholders would be able to continue the activities started by the project without additional technical assistance after its closure. The training of technicians from the Government, the private sector, NGOs and farmer associations is expected to ensure that technical assistance is provided to farmers and that FAW infestation levels are reduced.

6. Economic sustainability

The main beneficiaries were the small-scale farmers that produce the majority of maize in Mozambique. The project developed the national capacity to provide technical assistance to small-scale farmer groups, and it contributed to the development of low-cost, low-risk approaches to FAW management.

Documents and outreach products

Documents

- ❑ Assessment of the effectiveness of botanical extracts in the suppression of FAW population in Mozambique (under field conditions). L. Canhanga & B. Francisco. Maputo, 2020.
- ❑ Effect of botanical extracts (from Azadiratcha indica, Bixa orellana and Thevetia peruviana) on the mortality of FAW larvae (in the laboratory). D. Cugala, A. Changara & T. Agostinho. Maputo, 2019.
- ❑ Impact of selected low toxicity insecticides in the control of FAW. L. Canhanga & F. Matsinhe. Maputo, 2020.
- ❑ The Effect of planting dates on reducing the infestation levels of FAW, Spodoptera frugiperda, on Maize. D. Cugala, M. Mussume & T. Agostonho. Maputo, 2019.

Outreach Products

- ❑ *Ciclo de vida da lagarta do funil do milho* (Pamphlet). 2 pp.
- ❑ *Pesticidas Botânicos e Iniciativas Locais para o Controlo da Lagarta do Funil do Milho (LFM)* (Leaflet). D. Cugala, S. Mangana, C. Banze, M. Lobo, A. Vaz, A. Lazaro, A. Simbine, N. Madogolele, & M. Huo. 2019. 2 pp.
- ❑ *Principias métodos de controlo da lagarta de funil do milho Spodoptera frugiperda* (Poster). D. Cugala, S. Mangana A. Lázaro & A. Vaz. 2019.

LAGARTA DO FUNIL DE MILHO

Praga ameaça agricultura e segurança alimentar no país

Armadilhas sexuais eficazes na monitoria

Todos os distritos de Manica afectados

ACHIEVEMENT OF RESULTS - LOGICAL FRAMEWORK

Expected Impact	**Capacity of communities (and women in particular), government and civil society to build resilience and adapt to climate change is strengthened**		
Outcome	Increase the resilience of livelihoods to climate change, threats and crisis		
	Indicator	– Preparedness and response capacity services for FAW in place and operational at provincial level. – Number of households adopting IPM practices to control FAW.	
	Baseline	– 0 – 0	
	End Target	– 10 – 6 000	
	Comments and follow-up action to be taken	The country's preparedness for FAW was strengthened, with a total of 120 technicians being equipped with smartphones and trained in FAW identification, scouting and trapping protocols and the use of the FAMEWS mobile app. At the time of this report, these technicians were running the monitoring and early warning system for FAW in the targeted provinces. Apart from the establishment of the monitoring system at provincial level, capacities were also built on monitoring and early warning at central level, in the MADER (6) as well as in academia and/or research institutions (4). The trained technicians were engaged in training other technicians, as well as farmers, on FAW management options at the time of this report.	
Output 1	Established a functioning system for monitoring and early warning system of FAW and other pests and diseases		
	Indicators	Target	Achieved
	– Number of smartphones for data collection using the FAMEWS system. – Number of pheromone traps and lures for adult FAW monitoring.	A total of 30 smartphones and 450 traps.	Yes
Baseline	0		
Comments	Technicians from the Government, NGOs and farmer associations were trained on FAW monitoring and management, including the use of the FAMEWS app. A total of 120 technicians, including Government extension officers, plant clinic doctors, FFS masters and extension officers from NGOs and farmer associations were trained on FAW identification and sustainable management practices, in order to support and assist farmers on sustainable FAW management. Among these, 35 were equipped with smartphones and/or tablets for data collection through FAMEWS. In addition, a total of 450 traps were procured and distributed throughout the 10 provinces for FAW population monitoring. Data (from both scouting and trapping) were collected through field visits and FAMEWS, and they were shared with technicians and the central team through social networks and WhatsApp. The data were also presented at national and international meetings and/or conferences.		
Activity 1.1	Plant clinics, NGOs and other projects or initiatives will be integrated in the system for the monitoring of FAW		
	Achieved	Yes	
	Comments	A total of 73 plant doctors or plant clinics (one doctor per clinic) were trained in FAW monitoring and management, including the use of the FAMEWS app. The original goal for this activity was greatly exceeded, due to the fact that the total number of plant clinics integrated into the FAW national program (73) was higher than the initially targeted number of 10. The idea of training more plant doctors than originally planned was to have enough technicians involved in FAW activities, thereby increasing the number of farmers that received technical assistance and improving FAW management overall. The technicians were from the five provinces where plant clinics were established: Zambezia, with 15 plant doctors from the districts of Milange and Gurué; Manica, with 14 technicians from the districts of Manica, Vanduzi and Barué; Inhambane, with 16 plant doctors from the Inharrime, Morrumbene and Zavala districts; Nampula, with 16 plant doctors from the Ribaué and Malema districts; and Maputo, with 12 technicians from the Moamba district. All the technicians were part of the national extension service and were based in their respective districts and localities to better assist farmers. In terms of gender, out of the 73 locally selected participants, 13 were women, which corresponded to 17.8 percent of the total, i.e. the majority of participants were men. All the trained technicians were automatically integrated into FAW activities in the country. They were expected to provide information and data on FAW infestation and management and to assist and train farmers on FAW identification and management. They were also expected to transmit data on the FAMEWS platform. This activity was conducted in collaboration with other projects, such as Plantwise (CABI).	

Activity 1.2	Procurement of tablets for uploading information	
	Achieved	Yes
	Comments	A total of 35 smartphones and tablets were procured, acquired and distributed to the technicians trained on FAW monitoring, scouting and management in all 10 provinces of the country for data collection. The data were transmitted to the FAMEWS platform. Mozambique is one of the countries with the largest amount of data on the FAMEWS platform. Information on the presence of the pest as a result of field monitoring and data collected from the FAMEWS is disseminated through national and international meetings and/or conferences (October 2019, in Cape Verde) and through newspapers and radio to the major beneficiary groups (farmers and other stakeholders).
Activity 1.3	Training on the use of the mobile application	
	Achieved	Yes
	Comments	A total of 100 beneficiaries were targeted for training on the use of the FAMEWS app; however, 120 were reached, corresponding to 120 percent of the original target. Participants from the Government, NGOs and other partners were trained on the use of the app. Among these, 35 were equipped with the smartphones and/or tablets for data collection through FAMEWS. Among the trained technicians, 18 were women, which corresponded to 15 percent of the total. Data were collected through field visits and FAMEWS, and they were shared among technicians and the central team through social networks and WhatsApp. The data were also presented in national and international meetings and/or conferences. For purposes of synergy, the training of technicians was conducted in collaboration with the project GCP/MOZ/126/USA, funded by USAID.
Activity 1.4	Procurement and distribution of pheromone traps	
	Achieved	Yes
	Comments	A total of 450 traps were procured and distributed to each of the 10 provinces for FAW population monitoring (50 bucket traps, along with their respective lures and killing agent). Most of the traps were installed in the field, and the data collected from the traps was transmitted to both the FAMEWS platform, and to trap monitoring forms. FAW population changes were monitored and sent to the competent national authorities (i.e. the DSV). The data were being used for decision-making and the setting of priorities at the time of this report. As a result of this activity, the national capacity on FAW population changes was built, and a monitoring system was established in the country. Additional traps, lures and killing strips were provided by project GCP/MOZ/126/USA.
Activity 1.5	Maintenance and monitoring of FAW traps	
	Achieved	Yes
	Comments	A national functional system on FAW monitoring was established. The 120 trained technicians formed a team for FAW monitoring in the country. At the time of this report, at least two technicians equipped with smartphones were available and conducting FAW monitoring using the FAMEWS app in each of the 10 provinces. The monitoring system is based on both field scouting (to determine level of infestation and damage) and trapping (for FAW presence and early detection).
Activity 1.6	Promote the use of the FAMEWS as monitoring tool, risk assessment and early warning system for early detection and timely implementation of control methods, contributing to increased maize production and food security and its integration in VAC assessments	
	Achieved	
	Comments	
Activity 1.7	Training for partners on use and maintenance of traps	
	Achieved	
	Comments	

Activity 1.8	Train partners on scouting, data collection and transmission of data	
	Achieved	Yes
	Comments	Training sessions for 43 technicians from 20 NGOs, teaching and research institutions, farmer associations and the private sector were conducted on FAW monitoring and management, including the use of FAMEWS. Seven participants were female. The training of these technicians strengthened Government capacity to provide technical assistance to farmers on FAW monitoring and management in the areas where they are operating. The technicians became part of the national FAW monitoring system and are responsible for transmitting data through the FAMEWS platform and WhatsApp groups. At the time of this report, they were supporting Government extension staff on FAW monitoring and management in the country. They were also contributing to the training of other technicians and farmers in their areas of jurisdiction, therefore increasing the national capacity to effectively deal with FAW in the country. During the training sessions, it was decided that that the technicians would integrate FAW activities into their plans and share them with the FAW technical unit at FAO and MASA for possible advice and follow-up. This training was successfully conducted with the financial contribution of GCP/MOZ/126/USA, FAO emergency projects and various other partners operating in the areas affected by cyclone Idai in the Manica and Sofala provinces.
Activity 1.9	Conduct demonstration plots of FAW control	
	Achieved	Yes
	Comments	In Mozambique, the production of maize is threatened due to the occurrence of FAW (*Spodoptera frugiperda)*, which can reach an infestation rate of 100 percent and is associated with high losses of grain yield if control measures are not taken. Proven and validated strategies to prevent, avoid and/or effectively manage FAW in Mozambique are lacking. Therefore, efforts have been made to conduct experiments to validate several approaches for FAW management in the country. Experiment and demonstration plots on sustainable FAW management practices, including the use of locally available resources (i.e. plant extracts and dates) and selected low-toxicity synthetic insecticides were established in the central and southern regions of the country. The experiments and demonstrations were carried out under LOAs signed with the FAEF in the Maputo and Gaza provinces, the ISPM in the Manica province and other partners (i.e. the Land O'Lakes RAMA-BC project) between 2018 and 2020. The objectives of the experiments were: (i) to assess the efficacy of different management approaches on controlling the FAW population; (ii) to evaluate the impact of FAW on maize grain yield and yield losses; and (iii) to provide demonstration plots for farmers and other stakeholders on sustainable FAW management approaches. The following experiments were undertaken: 1. An impact assessment of the selected low-toxicity pesticides for the control of the population of FAW, *Spodoptera frugiperda,* and its impact on maize yield loss in Mozambique 2. The effect of planting dates to reduce the infestation levels of FAW, *Spodoptera frugiperda*, on maize 3. The efficacy of botanical pesticides on the mortality of fall armyworm (*Spodoptera frugiperda*) larvae (under laboratory conditions) 4. An assessment of the effectiveness of botanical pesticides in the control of the FAW (under field conditions) All field experiments were conducted either on-farm (under rainfed conditions) or at research stations (under irrigation conditions). The experiments were conducted in a randomized complete block design (RCBD), with four to five treatments and four replications. For all treatments (insecticides or botanical pesticides), the first application was done at early whorl stage, when 10 percent of the plants were infested. The infestation levels were evaluated throughout the maize growing period and at the end yield, and yield losses were assessed.

<table>
<tr><td rowspan="3">Activity 1.9</td><td colspan="2">Conduct demonstration plots of FAW control</td></tr>
<tr><td>Achieved</td><td>Yes</td></tr>
<tr><td>Comments</td><td>
<u>Summarized results of the experiments</u>
1. An impact assessment of the selected low-toxicity pesticides for the control of the population of FAW, Spodoptera frugiperda, and its impact on maize yield loss in Mozambique
Three low-toxicity insecticides were selected and tested for the control of FAW: Flubendiamide 220 ml/ha, Lufenuron 50 ml/l and Cyromazine 750 gr/Kg. There was also a control group with no insecticide application. Results showed that plant damage parameters (77.4 percent of infestation and 4.0 on the damage scale) in the control plots were significantly higher than in the insecticide-treated plots (15.9 percent and 16.5 percent for Flubendiamide and Lufenuron respectively). Significantly high yield losses were observed in the control compared to the insecticide-treated plots. This is clear evidence that, to some extent, all of the applied insecticides prevented maize grain yield losses. The highest yield loss of 44.3 percent was observed in the control when compared with Lufenuron, followed by Flubendiamide (40.4 percent). The lowest yield loss was observed when comparing Cyromazine with the control (21.0 percent). The results from the studies indicate that at least two of the three assessed insecticides provided a significant reduction in the Spodoptera frugiperda infestation and damage, and significantly prevented yield losses when compared with the control. The level of yield loss is a clear indication of the potential risk and threat that the pest represents to maize production. The correct use of selected insecticides can play an important role in the integrated management of FAW infestations and prevent maize yield loss, and therefore contribute to food and nutrition security in the country.

2. The effect of planting dates to reduce the infestation levels of FAW, Spodoptera frugiperda, on maize
The experimental conditions were as follows: 4 treatments (T1 – November planting, T2 – December planting, T3 – January planting and T4 – Control, with the application of Flubendiamide). Infestation levels were assessed on a sample of 50 plants at 20, 35, 50 and 65 days after plant emergence.
The results indicated lower levels of infestation of FAW larvae in the November planting (48.3 percent and a damage level of 1 [Davies and William scale]), causing less maize yield loss (8.9 percent) when compared with the synthetic insecticide application.
High levels of infestation were recorded for the January planting (95.9 percent, and an average damage level of 6), associated with maize yield losses of 57.1 percent when compared with the synthetic insecticide application. The results obtained for the November and early December planting dates showed no significant differences with the chemical control. Planting early in the beginning of the season (November and early December) significantly reduced the level of FAW infestation, and the yield was significantly higher compared to late planting (January). Therefore, farmers could opt to plant early in the main season and reduce FAW infestation levels, rather than using synthetic insecticides, which, in addition to presenting risks to human health and the environment, come with high costs and lead to similar results.

3. The efficacy of botanical pesticides on the mortality of fall armyworm (Spodoptera frugiperda) larvae (under laboratory conditions)
Four treatment groups were tested in the laboratory to measure the mortality rates of FAW larvae at different instars: Azadiratcha indica (100 gr/l), Bixa orellana (100 gr/l), Thevetia peruviana (100 gr/l), Beta-Cyfluthrin (positive control at 0.1 ml/l) and water (negative control). Results indicated that the botanical extracts caused FAW larvae mortality at all instars, with higher mortality rates in early instar larvae (first, second and third). For the fourth instar, both A. indica and B. orellana caused similar mortality rates as the chemical insecticide. They resulted in 100 percent and 95 percent mortality respectively. T. peruviana caused significantly lower mortality (38 percent). For the larvae of the fifth instar, only A. indica resulted in significantly higher mortality (97 percent), which was statistically similar to that of the synthetic insecticide (98 percent). B. orellana caused 50 percent mortality while T. peruviana caused the lowest (38 percent).
Extracts from A. indica caused similar mortality rates as the synthetic insecticide in all tested FAW larval instars. Although the later instars are less susceptible and more difficult to control, there are botanical pesticides that lead to significant mortality. Therefore, the results suggested that FAW can be effectively controlled by the proper application of botanical extracts with insecticidal properties.
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Activity 1.9	Conduct demonstration plots of FAW control	
	Achieved	Yes
	Comments	4. An assessment of the effectiveness of botanical pesticides in the control of the FAW (under field conditions) The objective of this experiment was to evaluate botanical pesticides that are low-risk, accessible and easily usable by smallholders in Mozambique, to determine which are the most effective in controlling FAW larvae and preventing yield losses under field conditions. The following were tested: *Canavalia ensiformis* (leaves), *Tephrosia purpura* (leaves), *Azadirachta indica* (leaves) and a synthetic insecticide (Flubendiamide). The results showed that all of the botanical extracts significantly reduced FAW infestation from the first application of pesticides to the fifth and last and that they prevented maize yield losses when compared with the positive control treatment (synthetic insecticide). For example, on plants treated with *A. indica*, the level of infestation varied from 82 percent to 16 percent at the end of the applications. There was no significant difference in yield among the plants treated with the various botanical pesticides, indicating that their effect is similar to the effect of synthetic insecticides on preventing yield losses due to FAW. For instance, there were zero yield losses when comparing *A. indica* leaves with the synthetic pesticide (Flubendiamide). In addition, other studies on the botanical pesticides tested, such as the leaves of *C. ensiformis* (dried seeds) and the leaves of *B. ollerana* provided similar results in terms of reducing FAW infestation levels and preventing yield losses. <u>Conclusions from the experiments</u> The results of the controlled experiments demonstrated the following conclusions, which are examples of successful innovations that are available to small-scale farmers for controlling the FAW population in the field and reducing the level of maize yield losses. (i) The botanical pesticides that were tested and validated, particularly extracts from *Azadiratcha indica*, *Bixa Orellana* and *Canavalia ensiformis* (dried seeds), performed similarly to or even better than the synthetic pesticides that farmers use to suppress FAW infestations. (ii) Most small-scale farmers preferred botanical pesticides to synthetic pesticides, due to the fact that they are low-risk, cost-effective, locally available and easily accessed and prepared by smallholder farmers. (iii) Early planting in the main season (November and early December) showed a significant impact on reducing FAW infestation and yield losses. (iv) There is a high potential for adapting planting dates, as this is a common practice among small-scale farmers in the country. (v) The level of yield losses (in almost all experiments) was high in the absence of any treatment. This is an indication of the threat that this pest poses to maize yields, which has possible implications for food security. Competent authorities should promote and integrate the good agricultural practices demonstrated here, such as planting early in the season and the use of botanical pesticides in IPM for FAW, as these are appropriate for small-scale farmers due to their low costs, local availability and easy accessibility.
Activity 1.10	Procurement of pesticides for trials and demonstrations	
	Achieved	Yes
	Comments	Low-toxicity synthetic insecticides were procured under two LOAs with FAEF and ISPM for the above-mentioned experiments, and for the creation of reference comparisons for the efficacy of botanical pesticides in controlling the FAW. A total of five litres of insecticides were acquired through the LOAs for exclusive use in the experiments. The selection of the insecticides was based on the criteria of toxicity defined by USAID, FAO and the World Health Organization (WHO). The following insecticides were procured: 1. Flubendiamide (stomach, contact and translaminar). 2. Cyromazine (interferes with the growth mechanisms within an insect, causing incomplete growth and failure to reach adult stage). 3. Lufenuron (insect growth regulator which inhibits chitin synthesis and thereby prevents Lepidoptera larvae from moulting). 4. Emamatin Benzoate (stomach, contact and translaminar). 5. Deltamethrin + Pirimiphos Methyl (stomach and contact).

Output 2	Increased capacity of institutions and communities to deal with FAW and other pests and diseases		
	Indicators	Target	Achieved
	Number of extension staff, plant protection technicians and other stakeholders trained in monitoring and sustainable FAW management.	At least 20 technicians trained on FAW monitoring and management.	Yes
Baseline	0		
Comments	A total of 120 technicians from the Government, NGOs and other partners were trained on FAW monitoring and management in order to effectively deal with the FAW problem the country. Only 100 technicians were originally targeted; however, this number was surpassed thanks to the involvement of other projects and partners that supported the training of technicians from the Government, NGOs in the Manica and Sofala provinces, farmer associations, FAO emergency programme and plant clinics. The trained technicians were participating in the national system of FAW monitoring and management and farmer assistance in the country at the time of this report. The project contributed greatly to the strengthening of the national capacity for FAW monitoring and management. Information on the presence of the pest and its impact, as well as sustainable management strategies were being disseminated by the Government and partner extension officers at the time of this report. Awareness-raising materials were prepared and being distributed as well.		
Activity 2.1	Dissemination of information for sustainable management of FAW		
	Achieved	Yes	
	Comments	At the time of this report, information regarding the presence of the FAW and its impact, along with results of field monitoring and data collected from the FAMEWS and sustainable management strategies were being disseminated by the Government and partner extension officers in their respective areas through direct technical assistance to farmers. Awareness-raising materials such as pamphlets, leaflets and posters were prepared and being distributed to technicians and other stakeholders via email and through WhatsApp groups. In addition, media such as TV, newspapers, radio and social media were also disseminating information to the major beneficiary groups (farmers and other stakeholders) (sms of links in annexes) at the time off this report. Dissemination of information and awareness raising continued through project GCP/MOZ /126/USA.	
Activity 2.2	Production and multiplication of FAW awareness materials		
	Achieved	Yes	
	Comments	As stated above, key messages were prepared and distributed via email and through WhatsApp groups. Training and awareness materials were prepared, including: (i) leaflets on the FAW life cycle, morphological characteristics for identification and damage caused to maize; (ii) preparation and use of botanical extracts for the control of FAW; (iii) main management strategies; and (iv) a poster summarizing the IPM strategies for FAW management. The project also supported the translation and printing of the FAO manual “Integrated management of the Fall Armyworm on maize - A guide for Farmer Field Schools in Africa”. A total of 100 copies were distributed in each of the 10 provinces of Mozambique. At the time of this report, the manual was being used by technicians to provide better technical assistance to farmers on FAW monitoring and management.	
Activity 2.3	Based on existing technical materials, support the preparation of a farmer training and communication materials for sustainable management of the FAW		
	Achieved	Yes	
	Comments	The materials mentioned in the previous activity were also being used by farmers at the time of this report. The pamphlet on the preparation and use of botanical pesticides against FAW were also disseminated among maize growers in the country. Information from the technicians indicated that farmers were using botanical pesticides to control the FAW (e.g. neem extracts and other locally available plants). This activity continued under the project GCP/MOZ/126/USA**.**	
Activity 2.4	Trainings on integrated management of FAW		
	Achieved	Yes	
	Comments	The original target of this training was 20 technicians; however, 120 technicians were trained in total, thanks to the support of other partners and projects. The technicians trained under this activity included 25 FFS master trainers from all over the country (24 percent of whom were woman), 20 FAMEWS focal points (two per each of the ten provinces) and 20 trainees who would become trainers for other technicians and farmers in their respective provinces (two per each of the ten provinces). All of the technicians that were trained were able to promote sustainable practices for FAW management, including the identification of natural enemies, biopesticides, botanical pesticides and other natural products that are locally available and can be recommended for use by smallholder farmers.	

<table>
<tr><td rowspan="3">Activity 2.5</td><td colspan="2">Training on chemical handling</td></tr>
<tr><td>Achieved</td><td>Yes</td></tr>
<tr><td>Comments</td><td>Two training modules were dedicated to the handling of chemical insecticides. The main objective of these modules was to reduce the risks to human health and the environment that are associated with the use of pesticides (handling, transportation, preparation and spraying) for the management of the FAW.
Data from FAMEWS (based on scouting) revealed that throughout the country, very few small-scale farmers were using synthetic insecticides. Field observations showed that there were a few cases of small-scale farmers using chemical control (most insecticides are pyrethroids, such as Cypermethrin and lambda cyhalothrin, and others) for the management of FAW. The majority were not applying any insecticides as a method of control (48.3 percent). Cases of failure in controlling the pest were also reported.
The pesticides are frequently applied without safety precautions (i.e. personal protective equipment). Very often, increased dosages are applied, and as a consequence, there is evidence of pesticide poisoning in farmers as a result of FAW control in the Maputo and Sofala provinces.
For these reasons, it is recommended that small-scale farmers do not use chemicals to control FAW. Using chemical pesticides should be considered as the last alternative if other strategies fail to control the pest. The objective of this is to reduce or minimize the use of chemical pesticides in the country.
During the training sessions, the facilitators and technicians discussed pesticide regulations in the country and the FAO Code of Conduct. They are summarized below.
a) Personal protective equipment is required when handling pesticides.
b) Pesticides are to be separated from other products (especially food products) when they are being transported, to prevent them from contaminating food products and passengers.
c) Pesticide labels must be read carefully with the help of a technician before they are used.
d) The risks that are associated with the use of empty pesticide containers for food, drinks and drinking water.
e) The need to avoid transferring pesticides from their original packaging to others.
f) The fact that pesticides should not be handled by children.
g) The importance of not spraying pesticides against the wind or in rainy conditions.
h) The importance of personal hygiene after preparing and/or spraying a pesticide.
i) The measures that need to be taken to ensure that pesticides are handled with care to prevent them from being absorbed by the skin.
j) When in storage, pesticide containers must be kept closed and away from children and unauthorized personnel.
k) Pesticide containers should be pressure washed three times before they are destroyed or disabled, in order to prevent them from being used as food or water containers.
l) Empty pesticide containers should be buried or burned.
m) Food that is contaminated by pesticides should also be buried or burned.
n) In the event that a person comes into contact with pesticides without the proper equipment, they must immediately wash their skin and clothes with an abundant amount of water.
o) In case of contamination by a pesticide that results in a loss of consciousness or fainting, artificial respiration should be considered, and a doctor should be consulted immediately. The pesticide label should be provided for the doctor so that the appropriate course of treatment can be prescribed.
In addition to the training sessions for risk reduction, the use of locally available pesticides that are low-cost and either non- or less toxic was emphasized, and awareness-raising materials for FAW management (e.g. a press release and a TV programme on a farmer who experienced pesticide poisoning) were disseminated. These measures were part of the IPM approach. The MADER developed a short list of pesticides that are recommended for controlling FAW, as they have low toxicity levels and are low risk for human health and the environment.
These training sessions may lead to increased public awareness on the risks associated with the use of pesticides and thus contribute to a greater awareness of these risks among farmers in rural areas.</td></tr>
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Activity 2.6	Support the identification, testing and validation of FAW management strategies identified locally by researchers and the extension groups	
	Achieved	Yes
	Comments	In order to mitigate the impact of FAW infestation on maize production, many small-scale farmers tested the use of locally available materials, such as plant extracts, and they reported some success in controlling the FAW with them. In some cases, the results were even better than when synthetic insecticides were used (e.g. there was a farmer from Nampula province who used leaves of *Bixa ollerana*, because chemical insecticides were not sufficient in controlling the pest). In addition to the botanical pesticides, farmers reported that planting early in the season reduced FAW infestation. Because these were field observations, it was considered necessary to conduct controlled experiments to validate the observations in order to provide farmers with scientifically proven, evidence-based approaches to mitigate the damage of FAW on maize production. Therefore, the following experiments were conducted for validation of the field observations (see details on the results under activity 1.8 of Output 1): 1. The effect of planting dates to reduce the infestation levels of FAW, *Spodoptera frugiperda*, on maize. 2. The efficacy of botanical pesticides on the mortality of fall armyworm (*Spodoptera frugiperda*) larvae (under laboratory conditions). 3. An assessment of the effectiveness of botanical pesticides in the control of the FAW (under field conditions). Owing to the local availability of these botanicals, and to the fact that planting early in the season is a common practice among small-scale farmers, the approaches were being promoted as part of the IPM programme conducted by the MADER through extension officers in rural areas.
Activity 2.7	On-farm research by universities	
	Achieved	Yes
	Comments	See a detailed description of the research conducted under activity 1.8 of Output 1.
Activity 2.8	Support in defining the long-term research agenda	
	Achieved	Yes
	Comments	National research priorities were discussed with DSV, IIAM, FAEF and FAO, and related activities were included in the national action plan. Some were conducted under this project (as part of an LoA with FAEF and ISPM) and project GCP/MOZ/126/USA, funded by USAID.
Activity 2.9	Support refining the national strategy for FAW	
	Achieved	Yes
	Comments	As stated above, the national FAW management strategy was discussed with various partners. The Government adopted IPM as the strategy for the FAW population in the country. The IPM approach was discussed during training sessions with extension staff, starting with prevention and avoidance, the importance of planting dates, the use of locally available resources (ash, plant extracts, biological control and biopesticides, among others). It was emphasized that chemical pesticides should be avoided by small-scale farmers and only considered as the last option if other strategies fail to control the pest.
Activity 2.??	Conduct studies of pest ecological adaptation for early warning	
	Achieved	Yes
	Comments	Due to the difference in agro-ecological conditions between lowland areas and high-altitude areas, and the distance that separates Lichinga (Niassa province) and Maputo (Maputo province), it is possible to suggest that FAW occurrence in the country may originate from introductions of the pest in different locations, and therefore, that there may be different populations or biotypes. Samples of FAW larvae were collected from different agro-ecological zones of the country (lowland areas associated with high temperatures, mid-to-high altitude areas and high-altitude areas where temperatures are low). At the time of this report, the samples were to be submitted to the Eduardo Mondlane University Biotechnology Laboratory for analysis using DNA sequencing, to determine differences in populations or biotypes. The result will clarify whether there are different populations and/or several introductions of FAW in the country, or if FAW spread through the country as a result of one introduction. This activity was being conducted under the LoA with the FAEF.

Output 3	Established a national coordination platform to deal with FAW and other pests and diseases		
	Indicators	Target	Achieved
	At least one coordinating platform (meeting) established	2	Yes
Baseline	0		
Comments	The project initiated the creation and establishment of coordination mechanisms for FAW training, monitoring and management among stakeholders internally (i.e. the National FAW Task Force and other FAO projects such as (GCP/MOZ/126/USA, GCP/MOZ/112/LDF, OSRO/MOZ/703/AUS, emergency projects, etc.), and at regional or international level with other Portuguese-speaking countries (Cabo Verde, Guinea Bissau and Brazil). Various WhatsApp groups were established for information and experience exchange among the group members. An international seminar on FAW was organized in Maputo for the sharing of experiences with national stakeholders and other countries. Additional international coordination meetings with EMBRAPA in Brazil, and organizations in Cabo Verde and Guinea Bissau were also organized (in Cabo Verde and Brazil).		
Activity 3.1	Identification of partners		
	Achieved	Yes	
	Comments	Information on potential partners working in agriculture and/or interested in FAW management were shared by technicians and the Provincial Directors of Agriculture and Food Security (DPASAs) via email and through WhatsApp groups. Several partners working on agricultural production and food security with an interest in management were identified throughout the country.	
Activity 3.2	Map activities of the stakeholders		
	Achieved	Yes	
	Comments	After the emergency period caused by cyclones Idai and Kenneth, there was an increase in partners looking for information and training on FAW management. More than 20 different partners, who were distributed throughout the country, were identified. These partners had collaborated with project activities and/or were working in the area of agricultural production and food security, and they were interested in FAW management, owing to the fact they provide technical assistance to small-scale farmers.	
Activity 3.3	Establish coordination with neighbouring countries on the options for biological control		
	Achieved	Yes	
	Comments	Coordination with other countries was established on FAW biological control with Portuguese-speaking countries such as Brazil (EMBRAPA), Cabo Verde (INIDA) and Guinea Bissau (DSPV), in collaboration with FAO Headquarters in Rome (Plant Protection Division). The first coordination meeting was held in Cabo Verde to discuss the implementation of biological control of FAW using egg parasitoids and biopesticides. As a follow-up to this meeting, a training course on the biological control of FAW (rearing, releasing and impact assessment) was organized by EMBRAPA (Brazil) in collaboration with FAO headquarters, and technicians from Mozambique (3), Cabo Verde (5) and Guinea Bissau (5) attended. As a result of the coordination meeting, the country engaged in the process of establishing insect colonies of FAW and Anagasta species as hosts of the egg parasitoids (*Trichogramma pretiosum*). The egg parasitoid is expected to be imported under activities of other projects. At the time of this report, Cabo Verde had already imported the egg parasitoids and field releases were ongoing. In addition, the group of four countries, in coordination with FAO Headquarters, were discussing a joint project on biological control.	
Activity 3.4	Disseminate good practices through demonstrations		
	Achieved	Yes	
	Comments	See a detailed description of the research and demonstration plots under activity 1.8 of Output 1	

Activity 3.5	Quarterly coordination meetings	
	Achieved	Yes
	Comments	Several coordination meetings with the National FAW Task Force, DSV, IIAM, FAEF and the FAO team were organized to discuss project activities, planning and responsibilities. Coordination meetings were also established with other partners, such as the Land O'Lakes RAMA – BC project, a USAID-funded project that conducts experiments on planting dates, intercropping maize with legumes, cost-sharing and synergies.
Activity 3.6	Integrate FAW assessment in the national VAC	
	Achieved	Yes
	Comments	The integration of measures to manage FAW into the activities of the VAC was based on: (i) the inclusion of FAW-related questions in the vulnerability survey conducted in the central provinces of Manica and Sofala in the areas affected by cyclone Idai; (ii) the provision and dissemination of FAW awareness-raising materials to the VAC team; (iii) assistance in assessing FAW infestation levels and the impact of infestation on maize production in areas affected by cyclone Idai; and (iv) training of Government officials, NGOs and farmer associations on FAW management in the areas affected by cyclone Idai, in partnership with a FAO emergency project.
Activity 3.7	Participate in the development of tools	
	Achieved	Yes
	Comments	The national technical project team was involved in discussions about and the development of protocols on the use of biological control agents against FAW, particularly the use of egg parasitoids (*Trichogramma pretiosum*). Field monitoring and management tools and research protocols were also developed. A small-scale FAW impact assessment in farmers' fields was conducted, and protocols for experiments to evaluate the effect of planting dates, botanical pesticides and selective insecticides were created. In addition, the project team was invited to participate in the test of new version of the FAMEWS app, and to report back to the FAMEWS developers.
Activity 3.8	Organization of workshops	
	Achieved	Yes
	Comments	The project supported the organization of an international seminar to discuss experiences from Brazil and Mozambique on the sustainable management of the FAW. The seminar also included discussions of ongoing research. The meeting was attended by about 50 people, including scientists from Brazil and Mozambique, National Plant Protection Officers from Mozambique, Angola, Malawi and Zimbabwe and representatives of public extension services at national and provincial level, the private sector and partner organizations. The main achievement of the seminar was the formulation of a set of recommendations for research and development, and the development of relevant messages to support the work of the extension agents and the establishment of the FAMEWS in the country. Two technicians from Mozambique (one from FAO and one from the Ministry of Agriculture) were invited, and they made two presentations: (1) The Efficacy of Botanical Pesticides on the Mortality of Fall armyworm (*Spodoptera frugiperda*) larvae; and (2) Use and application of FAW monitoring and Early Warning System (FAMEWS): Case study of use of FAMEWS in Mozambique. The presentations were considered as successful examples of the innovations available to smallholders in the field.

Partnerships and Outreach
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