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## EMERGENCY RESPONSE TO ENHANCE TECHNICAL CAPACITY FOR EARLY WARNING, MONITORING AND MANAGEMENT OF FALL ARMY WORM IN YEMEN

November 2021

SDGs:



Country:

Yemen

Project Code:

TCP/YEM/3701

FAO Contribution:

USD 500 000

Duration:

1 January 2019 – 30 June 2021

Contact Info:

FAO Representation in Yemen

FAO-YE@fao.org

### Implementing Partner

Ministry of Agriculture, Irrigation and Fisheries (MAIF).

### Beneficiaries

Farmers, extension workers, plant protection officers, and Non-governmental Organizations (NGOs).

### Country Programming Framework (CPF) Outputs

Pillar 1 of the Yemen Plan of Action 2018-2020: Emergency support to the most vulnerable rural and peri-urban households (across famine-risk districts).

FAO Strategic Objective 5 (SO5): Increase the resilience of livelihoods to threats and crises.

SO5 Outcome 5.2: Countries and regions deliver regular information and trigger timely actions against potential, known and emerging threats to agriculture, food and nutrition.

SO5 Outcome indicator 5.3. A: Countries apply prevention and impact mitigation measures that reduce risks for agriculture, food and nutrition.



### BACKGROUND

Fall armyworm (FAW) is a moth that is native to tropical and subtropical regions of the Americas, and has now spread globally. In its caterpillar stage it can cause significant damage to plants, unless there is natural control, good agronomic practices, or resistant varieties of plants in place. FAW prefers maize but can also feed on more than 80 other crops, including wheat, sorghum, millet, sugar cane, vegetable crops and cotton.

The first report of FAW in Yemen was confirmed in July 2018, in two governorates; and subsequently its presence was reported in all areas where maize was grown. A total of 70 percent of Yemeni households rely on agriculture and livestock for their livelihoods. The infestation was expected to have a devastating impact on agriculture production and food security, and to exacerbate the already dire food security situation in Yemen, as the pest feeds on the country's main staple food crops.

In this context, FAW had spread and infested maize and sorghum fields that were expected to produce 74 percent of the cereals in the country. Farmers, particularly smallholders with limited coping capacities, needed significant support to protect their livelihoods, through sustainable and integrated management of FAW in their cropping systems. Their lack of knowledge on managing the pest was one of the main reasons behind its spread in large geographical areas of the country. It was also necessary to enhance institutional capacity building for early detection and control of FAW, to ensure the monitoring and provision of critical extension services.

In addition, large amounts of chemical pesticides were used to control the pest, which was an inefficient method and caused chronic poisoning to the environment.

Against this background, the project aimed to reduce the infestation and spread of FAW by strengthening FAW monitoring and integrated management capacities at all levels; as well as to introduce biopesticides and other natural methods to combat the pest.

### IMPACT

The project interventions significantly reduced FAW infestation, and thereby contributed to protecting the livelihoods and food security of smallholders living in FAW-affected areas. In the words of one of the beneficiary women farmers, Haliyah: "Thanks to the support provided by FAO, the presence of these worms has already been reduced, and there is significant improvement in the plant hearts (buds) into which these insect pests directly eat. Now, no worries any more about my family food security because my crops are protected and safer".

The project also contributed to safeguarding the health of beneficiary farmers, their animals and the environment, by providing natural pesticides to control FAW and identifying several natural enemies to rear and release in the fields, as an alternative to chemical pesticides.

### ACHIEVEMENT OF RESULTS

The project successfully developed the capacity and raised awareness of main stakeholders in surveillance, monitoring and integrated management of FAW. Innovative technical solutions to FAW control were introduced to MAIF staff through various activities, comprising capacity building, the development of studies, and provision of inputs, enabling the MAIF to better assist farmers to prevent and manage FAW.

An operational FAW surveillance system (FAW Monitoring and Early Warning System [FAMEWS]) and management mechanisms were established in 22 governorates in the country.

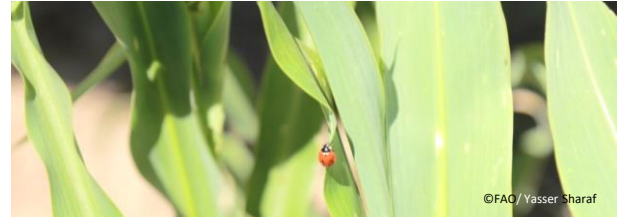
Capacity development was a core component of the project. A training workshop on monitoring and controlling FAW was led by FAO, successfully increasing awareness on FAW infestation in Yemen for a number of stakeholders (farmers, extension workers and plant protection officers) from several governorates. In addition, training workshops were organized for stakeholders in different regions on how to use FAMEWS application for collecting data from the field.

Survey reports were conducted in four governorates, Sana'a, Dhamar, Ibb and Al Mahwit, to identify potential biological agents for the control of FAW, and possible opportunities to rear and release the agents at field level. Inputs were provided for FAW control, including 4 800 pheromone traps and 7 400 litres of neem-based bio-pesticides, as an alternative to chemical pesticides, as well as smartphones with FAMEWS application; and methods were introduced to produce neem oil at community level. With regard to capacity building, training was provided for over 500 farmers on Farmer Field School (FFS), focusing on Integrated Pest Management (IPM)/FAW, enabling them to apply appropriate IPM approaches for management and control of the pest. In addition, 96 government technicians and six plant protection specialists were trained on the production of other fungal bio-pesticides. Two laboratories were also rehabilitated for biological rearing and releasing of natural enemies.

Materials were produced and disseminated, including 2 000 posters on FAW life cycle and management and 2 000 leaflets on FAW biology and management; the translation of the FAO-FAW FFS Guide from English into Arabic, which was distributed to government agriculture engineers and technicians; and communication materials on IPM and biocontrol of FAW, which were distributed to focal points in the MAIF agriculture offices.

## IMPLEMENTATION OF WORK PLAN AND BUDGET

Overall, project activities were implemented on time. However, some delays occurred, owing to administrative constraints, as well as to problems accessing some northern areas, as a result of security issues and COVID-19 restrictions. The activities were implemented within the planned budget. Three no-cost extensions were approved and implemented, in order to complete some of the remaining activities.



## FOLLOW-UP FOR GOVERNMENT ATTENTION

It is recommended that communication and cooperation continue to be strengthened between government agronomists and farmers, by facilitating meetings among these stakeholders.

It is advised that additional funds be mobilized to: i) address the presence of FAW in maize crops in other governorates in Yemen; and ii) provide government staff with further assistance, to address the management needs for FAW.

It is also recommended that neem preparation *in situ* as a biopesticide be considered as one of the best sustainable low-cost biopesticides.

## SUSTAINABILITY

### 1. Capacity development

The project successfully built the capacity of MAIF staff in the surveillance of FAW, and the Plant Protection Department in rearing and releasing FAW natural enemies. In addition, farmers who were trained through FFS will ensure sustainability through the dissemination of acquired knowledge and skills to fellow farmers in their community and surrounding areas.

The project work plan and management arrangement were designed to ensure participation by the Government, local authorities, crop, and other stakeholders from project inception and throughout implementation, in order to promote ownership and sustainability beyond the project.

In order to support the sustainability of the project outcome, the project initiated consultations with the MAIF for the development of a national strategy on FAW operations. In addition, the establishment of a task force was assisted within government agriculture offices in Sana'a and Aden, to support FAW surveillance and control; partnerships were created with the MAIF and local agricultural offices at governorate level; and Yemen became a member of the FAW global platform and started sharing information with other countries.

Additional resources were mobilized from the project to upscale the approach that was piloted. For example, the FAW management interventions (neem and pheromone traps) were included in the Enhanced Rural Resilience in Yemen (ERRY) II programme, funded by the European Union. The project also initiated discussions with the MAIF on the development of a national strategy on FAW control.

## 2. Gender equality

The project targeted women-headed households.

## 3. Environmental sustainability

The project contributed to protecting the environment by providing bio-pesticides to manage FAW, instead of chemical pesticides, and supporting the rearing and releasing of natural FAW enemies.

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

This cross-cutting area was not applicable to the project.

## 5. Technological sustainability

The project developed simple methods to rear and release the most important natural enemies to control FAW. In addition, neem oil was introduced to combat FAW, which is made from trees that are available at the community level.

The project contributed to the development of local knowledge, capacity and resources by training MAIF Desert Locust Monitoring and Control Centre (DLMCC) engineers and technicians in the use of inputs, good practices, personnel protective equipment (PPE), sprayers, natural enemies rearing and release, FAW management, and mobile application for the monitoring of FAW at field level.

## 6. Economic sustainability

The Plant Protection Department of the MAIF provided support at governorate level to provide neem oil and cover the costs of spraying.

In addition, the project supported the development of a production protocol for neem oil, and identified potential natural enemies to manage FAW. Both modalities are low cost and affordable to the beneficiaries.



## DOCUMENTS AND OUTREACH PRODUCTS

- ❑ **FAO.** 2018. Handbook: Integrated management of the Fall Armyworm on maize. A guide for Farmer Field Schools in Africa (2018) translated from English into Arabic. Sana'a, July 2019. 135 pp.
- ❑ **Minister of Agriculture, Irrigation and Fisheries.** 2019. 82 Fall Armyworm Survey Reports produced by 26 surveillance teams from northern governorates, 1 August-31 October 2019; and by 26 surveillance teams from southern governorates, 1 September–31 November 2019.
- ❑ **Minister of Agriculture, Irrigation and Fisheries.** 13 February 2019. Official letter from the Ministry of Agriculture, Irrigation and Fisheries on materials and tools in surveying and controlling Fall Armyworm (such as sprayers, pesticides). Sana'a.
- ❑ **FAO.** June 2019. Final report of the Field Survey of Fall Armyworm (FAW), *Spodoptera frugiperda* (Lepidoptera: Noctuidae) and natural enemies from selected cereal crops (maize and sorghum) in four pilot governorates.
- ❑ **Minister of Agriculture, Irrigation and Fisheries.** 13 June 2019. Official letter from the Ministry of Agriculture, Irrigation and Fisheries on materials and tools in surveying and controlling Fall Armyworm (such as sprayers, pesticides). Aden.
- ❑ **Minister of Agriculture, Irrigation and Fisheries.** 25 June 2019. Official letter from the Ministry of Agriculture, Irrigation and Fisheries on the implementation of the training course in surveying and controlling Fall Armyworm. Aden.
- ❑ **Minister of Agriculture, Irrigation and Fisheries.** 29 June 2019. Official letter from the Ministry of Agriculture, Irrigation and Fisheries on the implementation of the training course in surveying and controlling Fall Armyworm. Sana'a.
- ❑ **Minister of Agriculture, Irrigation and Fisheries.** 17 August 2019. Official letter from the Ministry of Agriculture, Irrigation and Fisheries on the disbursement of financial dues to the Fall Armyworm survey and control teams. Aden.
- ❑ **FAO. 1 December 2019–31 January 2020.** Two Pheromones Lure and Tunnels Traps Reports on Fall Armyworm, follow-up to the surveillance teams in south and north governorates, by focal point.
- ❑ **FAO.** December 2019. 2 000 posters on FAW life cycle and management and 2 000 leaflets on FAW Biology and Management. Sana'a and Aden.

## ACHIEVEMENT OF RESULTS - LOGICAL FRAMEWORK

<b>Expected Impact</b>	<b>Protected livelihoods and food security of smallholders in FAW-affected areas in Yemen</b>		
<b>Outcome</b>	Reduced infestation and spread of FAW by strengthening FAW monitoring and Integrated management capacities at all levels		
	<b>Indicator</b>	Number of governorates with operational FAW surveillance system (FAMEWS) and management mechanisms.	
	<b>Baseline</b>	0	
	<b>End Target</b>	22 affected governorates.	
	<b>Comments and follow-up action to be taken</b>	<ul style="list-style-type: none"> <li>- An operational FAW surveillance system (FAMEWS) and management mechanisms were established in 22 governorates.</li> <li>- A total area of 11 225 ha was surveyed (maize, sorghum, wheat).</li> <li>- A total area of 3 204 ha was controlled (maize, sorghum).</li> <li>- 18 345 farmers were reached.</li> </ul> <p>It is recommended that communication and cooperation continue to be strengthened between government agronomists and farmers, by facilitating meetings among these stakeholders. In addition, it is advised that additional funds be mobilized to address the presence of FAW in maize crops in other governorates.</p>	
<b>Output 1</b>	Increased awareness among all stakeholders (farmers/extension workers/plant protection officers/NGOs, etc.) on FAW infestation in Yemen		
	<b>Indicators</b>	<b>Target</b>	<b>Achieved</b>
	<ul style="list-style-type: none"> <li>- Number of inception workshop participants, disaggregated by gender.</li> <li>- Number of communication materials disseminated.</li> </ul>	<ul style="list-style-type: none"> <li>- 40 participants sensitized during inception workshops in two regions.</li> <li>- 800 communication materials produced and disseminated (including FAO FAW FFS guide in Arabic and on the danger of using pesticides).</li> </ul>	Yes
<b>Baseline</b>	0		
<b>Comments</b>	The project exceeded the expected targets.		
<b>Activity 1.1</b>	Identify project partners (farmers, extension workers, NGOs and stakeholders), focal points in each governorate and their role in completing project activities		
	<b>Achieved</b>	Yes	
	<b>Comments</b>	FAO carried out a training workshop on monitoring and controlling FAW in Aden and Sana'a. Awareness was increased among all stakeholders (farmers, extension workers, plant protection officers). 96 participants from several governorates took part in the training.	
<b>Activity 1.2</b>	Conduct an inception workshop to discuss the scope and objectives of the project, present the proposed work plan and designate the responsibilities of each stakeholder in Yemen		
	<b>Achieved</b>	Yes	
	<b>Comments</b>	The project carried out two inception workshops, one in the north and one in the south, which were attended by 44 participants (12 women) from 22 governorates, Aden, Lahj, Abyan, Al Hodeida, Hajah, Al Mahra, Shabwa, Al Jouf, Amran, Sana'a, Taiz, Al Mahwet, Dhamar, Ibb, Al Bhayda, Reyma, Hadaramout, Amanet Alasmiah, Sadda, Aldalie, Socotraand Mareb. During these workshops, project objectives and proposed work plans were discussed.	
<b>Activity 1.3</b>	Prepare, produce and disseminate communication materials (posters, leaflets, videos, etc.) followed by initiating awareness raising campaigns through local media coverage on the dangers/damages posed by the FAW		
	<b>Achieved</b>	Yes	
	<b>Comments</b>	The project produced and disseminated 2 000 posters on FAW life cycle and management, and 2 000 leaflets on FAW biology and management.	
<b>Activity 1.4</b>	Develop, print and disseminate FAO-FAW FFS Guide in Arabic		
	<b>Achieved</b>	Yes	
	<b>Comments</b>	The FAO handbook, "Integrated management of the Fall Armyworm on maize. A guide for Farmer Field Schools in Africa", was translated from English into Arabic, and 90 copies were printed and distributed to government agriculture engineers and technicians.	
<b>Activity 1.5</b>	Develop communication materials on the danger of using hazardous pesticides in management of FAW		
	<b>Achieved</b>	Yes	
	<b>Comments</b>	Communication materials on Integrated Pest Management (IPM) and biocontrol of FAW were distributed to focal points in the MAIF agriculture offices.	

Supporting the Ministry of Agriculture and Irrigation in setting up a national FAW network and an efficient monitoring and early warning plan in Yemen	
Indicators	Target
<p><b>Output 2</b></p> <ul style="list-style-type: none"> <li>- Number of (a) Pheromone traps/and refill kits, (b) litre bio-pesticides, spraying tools, PPE and other tools (PCs, smartphones; and internet connection devices) procured and delivered.</li> <li>- Number of people trained, disaggregated by gender.</li> <li>- Number of FFS established and operational.</li> </ul>	<ul style="list-style-type: none"> <li>- (a) 6 000 Pheromone traps/and refill kits; (b) 3 100 litres bio-pesticides, spraying tools, PPE, materials for biopesticides production and other tools (2 PCs); 200 smartphones; and 2 internet connection devices) procured and delivered.</li> <li>- (a) At least 80 members/stakeholders trained on FAMEWS, monitoring tools, and FAW sustainable management options.</li> <li>- (b) At least 30 FFS facilitators received ToT training.</li> <li>- (c) At least 500 farmers trained on FFSs focusing IPM/FAW.</li> <li>- 30 FFS implemented.</li> </ul>
<b>Baseline</b>	0
<b>Comments</b>	56 smartphones were distributed, instead of the envisaged target of 200. This was because only 56 officers were nominated by the agriculture offices. In addition, 10 FFS ToT were conducted, instead of the planned 30 FFS, owing to access issues related to COVID-19 restrictions.
<b>Activity 2.1</b>	Conduct national ToT for national focal points on FAW trapping/field scouting/how to use FAMEWS application for collecting data from the field/data validation and review and analysis of data generated and presented in the FAMEWS Global Platform
<b>Achieved</b>	Yes
<b>Comments</b>	10 FFS Training of Trainers (ToT) were conducted, instead of the planned 30 FFS, owing to access issues related to COVID-19 restrictions.
<b>Activity 2.2</b>	Procure and deliver of FAW Pheromone traps/and refill kits (lures and killing strips)
<b>Achieved</b>	Yes
<b>Comments</b>	4 800 pheromone traps were procured and delivered in 22 governorates, with three refill kits each (total 14 400).
<b>Activity 2.3</b>	Procure and deliver of bio-pesticides (Neem, Bt, etc.)/spraying tools and PPE
<b>Achieved</b>	Yes
<b>Comments</b>	A total of 7 400 litres of bio-pesticides (neem products) was procured and delivered in 22 governorates.
<b>Activity 2.4</b>	Procure and deliver smartphones, wireless routers, laptops
<b>Achieved</b>	Yes
<b>Comments</b>	56 smartphones with FAMEWS application were procured and delivered.
<b>Activity 2.5</b>	Conduct training workshops for all stakeholders at different regions on FAW trapping/field scouting/how to use FAMEWS application for collecting data from the field
<b>Achieved</b>	Yes
<b>Comments</b>	96 people were trained in FAMEWS.
<b>Activity 2.6</b>	Support field missions for collecting data from different governorates
<b>Achieved</b>	Yes
<b>Comments</b>	All data collected through FAMEWS was uploaded on the FAMEWS Global Platform.
<b>Activity 2.7</b>	Conduct ToT for FFS facilitators on how to implement and run FFSs in relation to FAW
<b>Achieved</b>	Yes
<b>Comments</b>	Ten FFS facilitators received ToT training.
<b>Activity 2.8</b>	Implement FFSs focusing IPM/FAW
<b>Achieved</b>	Yes
<b>Comments</b>	More than 500 farmers were trained on FFS, focusing on IPM/FAW.

Develop and implement actions for FAW management in Yemen			
Indicators	Target	Achieved	
<b>Output 3</b>	<ul style="list-style-type: none"> <li>- Survey report on identifying the potential biological agents and opportunities.</li> <li>- Number of individuals trained on the production of bio-pesticides, disaggregated by gender.</li> <li>- Reports on the evaluation of local FAW management options and the efficiency of bio-pesticides.</li> <li>- Ability to produce natural enemies evaluated.</li> <li>- Business models for low-cost production of bio-pesticides developed.</li> </ul>	<ul style="list-style-type: none"> <li>- Three months survey to identify the potential biological agents and opportunities conducted and report produced.</li> <li>- 40 individuals trained on the production of bio-pesticides.</li> <li>- Two evaluation reports on the local FAW management options and the efficiency of bio-pesticides produced.</li> <li>- One evaluation report on the ability to produce natural enemies.</li> <li>- At least two business models developed for low cost production of bio-pesticides.</li> </ul>	Yes
<b>Baseline</b>	0		
<b>Comments</b>	<p>All targets were achieved, except for the development of business models for low-cost production of bio-pesticides. This activity was replaced with the rehabilitation of two laboratories, in Sana'a and Hadramout respectively.</p> <p>It is recommended that neem preparation <i>in situ</i> as a biopesticide be considered as one of the best sustainable low-cost biopesticides.</p>		
<b>Activity 3.1</b>	<p>Conduct a survey to identify the potential biological agents for the control of FAW and possible opportunities to rear and release the agents to the field level</p> <p><b>Achieved</b> Yes</p> <p><b>Comments</b> Two national consultants conducted three-month survey reports in four governorates, Sana'a, Dhamar, Ibb and Al Mahwit, to identify potential biological agents for the control of FAW, and possible opportunities to rear and release the agents at field level; as well as to assess percentages of damage to maize and sorghum crops. A total of 29 districts was visited and 67 locations. One evaluation report on the ability to produce natural enemies was developed.</p>		
<b>Activity 3.2</b>	<p>Develop business models for low-cost production of bio-pesticides (small bio-factories) to reduce costs</p> <p><b>Achieved</b> Partially</p> <p><b>Comments</b> The initially planned activity of developing business models for low-cost production of bio-pesticides could not be implemented at field level, due to COVID-19 restrictions. Hence, this activity focused on the rehabilitation of two laboratories, in Sana'a and Hadramout respectively.</p>		
<b>Activity 3.3</b>	<p>Train on the production of other fungal bio-pesticides (<i>Beauveria bassiana</i> and <i>Metarhizium anisopliae</i>) at farm level</p> <p><b>Achieved</b> Yes</p> <p><b>Comments</b> 96 government technicians were trained on the production of other fungal bio-pesticides.</p>		
<b>Activity 3.4</b>	<p>Organize a study visit to Egypt to explore on natural enemy rearing in Yemen to improve the existing laboratory to produce <i>Trichogramma</i></p> <p><b>Achieved</b> Yes</p> <p><b>Comments</b> A study tour to Egypt was initially planned, to train six plant protection specialists (three from the north and three from the south) on the production of other fungal bio-pesticides (<i>Beauveria bassiana</i> and <i>Metarhizium anisopliae</i>) at farm level. However, owing to COVID-19 restrictions the training was carried out online.</p>		
<b>Activity 3.5</b>	<p>Evaluate the local FAW management options through FFS</p> <p><b>Achieved</b> No</p> <p><b>Comments</b> It was not possible to carry out this activity, owing to COVID-19 and security-related restrictions.</p>		
<b>Activity 3.6</b>	<p>Evaluate the efficiency of bio pesticides as FAW management option through FFS</p> <p><b>Achieved</b> Yes</p> <p><b>Comments</b> Two evaluation reports were produced on local FAW management options and the efficiency of bio-pesticides.</p>		

**Partnerships and Outreach**

For more information, please contact: [Reporting@fao.org](mailto:Reporting@fao.org)

**Food and Agriculture Organization of the United Nations**

Viale delle Terme di Caracalla

00153 Rome, Italy

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