

FIGHTING BACK AGAINST FALL ARMYWORM (FAW) IN BANGLADESH



Semi-Annual Report October 2020 - March 2021

Report and Activity Details

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Acronyms

AIRN	Agriculture Inputs Retailers' Network
AIS	Agricultural Information Services
BADC	Bangladesh Agriculture Development Corporation
BARI	Bangladesh Agriculture Research Institute
BRR	Bangladesh Rice Research Institute
BWMRI	Bangladesh Wheat and Maize Research Institute
CIMMYT	International Maize and Wheat Improvement Center
CSISA	Cereal Systems Initiative for South Asia
DAE	Department of Agricultural Extension
FAW	fall armyworm
IAL	Ispahani Agro Limited
IPM	integrated pest management
LSP	local service provider
MEL	monitoring, evaluation and learning
Mt	metric tons
MoU	memorandum of understanding
SAAO	Sub Assistant Agricultural Officer
SBL	Syngenta Bangladesh Limited
SEM	structural equation model
TOT	training of trainers
USAID	United States Agency for International Development



Above: Future master trainers learning about management of Fall Armyworm through Fighting FAW supported residential training events held during the reporting period.

Executive Summary

Fall Armyworm (FAW) is an invasive Lepidopteran crop pest native to the Americas, that has migrated to Africa and then to Asia, and has been in the process of colonizing Bangladesh since late 2018. FAW feeds on more than 80 species of plants, but maize (*Zea mays*) is its preferred host. The arrival of FAW in Bangladesh caused considerable concern – particularly within the Ministry of Agriculture – as maize has grown to be the country’s second most widely grown cereal crop of significant economic importance to farmers, exceeded only by rice. For farmers in Bangladesh, maize means money. The vast majority of maize is sold on the market, often earning farmers in excess of \$1,000 per hectare. Bangladesh is also near self-sufficiency in maize production, and aims to cease maize imports in before 2030.

Now found throughout Bangladesh and much of Asia, farmers’ response has typically been to apply pesticides to control the highly apparent signs of damage caused by FAW’s feeding. This is particularly problematic if highly toxic insecticides are indiscriminately used. In response, and supported by the University of Michigan and USAID/Bangladesh, the Fighting FAW Activity cooperates with national research and extension partners, in addition to the private sector, to mitigate impact of the pest on farmers’ income, food security and health. This semi-Annual report provides updates on Fighting FAW activities from October of 2020 to March of 2021. Some key activities and achievements include the following:

- To date, the Fighting FAW activity has already achieved its training targets to support DAE to scale-out trainings for at least 33,000 people. To date, 187,000 farmers and people have been reached with FAW IPM information as a result of cascade trainings and one-to-one interactions between DAE and farmers that were catalyzed and encouraged by the Activity.
- During the reporting period, the Fighting FAW Activity has provided consistent support to two Bangladesh national companies, Ispahani Agro-Limited (IAL) and Syngenta Bangladesh Ltd. through 50-50% cost share partnership agreements, with the ultimate aim of raising awareness to build a market of biological pesticides against FAW. At the time of writing, IAL has sold 67 liters of Fawligen (a biological pesticide that was registered for commercial use with the assistance of the Activity in 2020, and which is produced by the US based AgBiTech company and distributed by IAL) in the last two months in Bangladesh, which have been used by over 4,000 farmers as a safe, biological alternative to dangerous synthetic insecticides.
- In an effort to boost women’s standing in agricultural extension, as well as to provide a conduit for women extension agents to reach women headed households and farmers with advice on FAW IPM, the Activity implemented a series of women’s only trainings on FAW in collaboration with BWMRI from 22 November to 01 December 2020 in Chuadanga and Dinajpur, respectively, representing key regions for maize growth in southern and northern Bangladesh. To this end, 107 women DAE officials participated in hands-on in-person trainings on FAW while maintaining social distance and with COVID-19 restrictions in place. These trainings mark what is hoped to be a watershed moment in empowering women extension agents in Bangladesh. Subsequent monitoring and evaluation efforts indicated that these women leaders in agricultural extension shared what they learned with 2,530 other staff within the DAE through both formal trainings in their working offices and also informal engagements. The survey also suggested that this

modality resulted in approximately 17,000 farmers receiving additional IPM advice for FAW, with 23 percent of these farmers themselves being women or women headed households.

- In late 2020, an additional video on biological control of FAW for farmers in Bangladesh completed in partnership with CABI, which is also active in FAW response in South Asia. The video on biological control of FAW can be found [here](#). Since production, the video has been widely used by the Department of Agricultural Extension (DAE) in trainings. Importantly, the biological video was also further adapted by CABI and is now being used in Vietnam and in Thailand having been translated in the [Vietnamese](#) and [Thai](#) languages.
- Twelve batches of refresher virtual training were successfully completed for Cadre Officers of DAE and frontline extension agents from 27 October 2020 to 19 November 2020. The virtual trainings were completed in preparation for the 2020-21 winter *rabi* maize season. A total of 736 participants in 12 batches attended the training programs from 25 of Bangladesh's major maize growing districts.
- Manual observations of FAW populations from traps like those maintained by DAE can be time consuming and difficult. Although the Activity has had considerable success in mobilizing national FAW monitoring, in the long-run, less time and cost intensive methods will be needed. To this end, three solar-powered, self-cleaning and auto-count traps made by the company Trapview have been set inside three maize fields in Chuadanga, Bogura and Dinajpur for testing.
- Research on intergrated pest management of FAW is ongoing in partnership with the Bangladesh Agricultural Research Institute, Bangladesh Wheat and Maize Research Institute, and the Bangladesh Rice Research Institute. Focus areas include screening studies to evaluate the effectiveness of new pest control materials, FAW severity, incidence and management surveys to inform mitigation efforts studies to characterize natural enemies of FAW in Bangladesh, research on agroecological management of FAW, and screenhouse experiments examining the risks to rice from FAW attack.



Above: Women DAE staff learn how to scout fields for FAW damage in November of 2020.

Introduction



Above: Despite challenges posed by COVID-19 in the reporting period, the Fighting Fall Armyworm Activity was active in training trainers in the form of Sub-Assistant Agricultural Officers (SAAOs) from the Department of Agricultural Extension to scout fields and advise farmers on how to take action to manage FAW with integrated pest management techniques, as shown in this photo from March 2021 in Dinajpur.

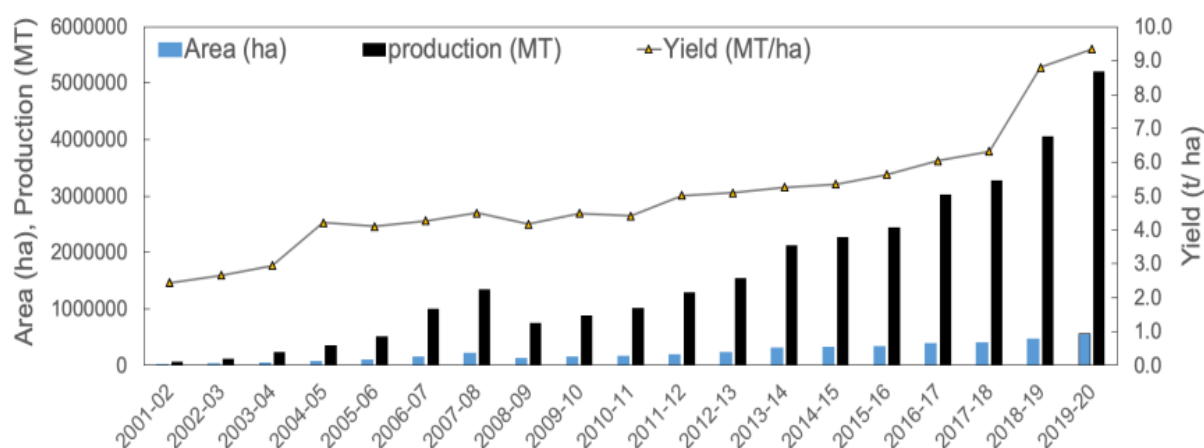
Fall Armyworm (FAW), an invasive Lepidopteran crop pest native to the Americas, migrated to Africa in 2016. FAW feeds on more than 80 species of plants, but maize (*Zea mays*) is its preferred host. Although the species causes limited damage to maize in the Americas – a condition that is likely the consequence of its long-term presence there and strong degree of biological control and availability of cultivars with plant resistance – migration of FAW from North America has been unprecedented and concerning. Over the course of the next two years, FAW spread more than 45 countries across Africa and destroyed more than 13.5 million tons of maize worth \$3 billion in Sub-Saharan Africa¹. As a migratory species with a large dispersal range, FAW again migrated and was found in India in 2018. Shortly after, FAW was identified in Bangladesh by the Bangladesh Agricultural Research Institute (BARI) for the first time in late 2018 following migration from southern India.

The arrival of FAW in Bangladesh is a significant concern, as maize has grown to be the country's second most widely grown cereal crop of significant economic importance to farmers, exceeded only by rice. For farmers in Bangladesh, maize means money. The vast

¹ Abrahams, P., Bateman, M., Beale, T., Clottey, V., Cock, M., Colmenarez, Y., Corniani, N., Day, R., Early, R., Godwin, J., Gomez, J., Gonzalez Moreno, P., Murphy, S.T., Oppong-Mensah, B., Phiri, N., Pratt, C., Richards, G., Silvestri, S., Witt, A. 2017. Fall Armyworm: Impacts and Implications for Africa Evidence Note (2). UK AID and CAB International. London, UK.

majority of maize is sold on the market, often earning farmers in excess of \$1,000 per hectare. Bangladesh is also near self-sufficiency in maize production.

Currently, about 74% of the maize required in Bangladesh – predominantly by the expanding poultry feed industry – is grown domestically. The remaining 26% is imported, at an annual cost of up to \$0.4 billion per year equivalent. For these reasons, and due to the significant interest expressed by the Ministry of Agriculture in achieving self-sufficiency in maize, the incursion of FAW into Bangladesh has been a significant concern.



Above: The rapid growth of maize area and yield in Bangladesh (data courtesy of the Bangladesh Bureau of Statistics). The arrival of FAW presents significant concern for the Ministry of Agriculture, which aims to achieve self-sufficiency in maize production in the near future.

Urgent action is therefore needed to address this threat using integrated pest management (IPM) strategies that can be sustainably implemented by resource-constrained farmers growing maize to generate much-needed income. The USAID/Bangladesh and Michigan State University supported Fighting FAW Activity, tackles these issues by generating evidence and developing educational strategies to facilitate FAW IPM training for the public and private sector, while also addressing institutional issues needed for efficient FAW response. The Activity commenced efforts in late 2019 and will continue to support the response to FAW in Bangladesh through September 2021.

Activity Objective Summary

The Fighting FAW Activity is comprised of six interrelated objectives structured as follows:

- Objective 1.** Develop educational materials to aid in reaching audiences with information to improve understanding and management of FAW
- Objective 2.** Assist the Department of Agricultural Extension in deploying awareness raising and training campaigns
- Objective 3.** Institutional change to improve crop protection and integrated pest management
- Objective 4.** Prepare the private sector for appropriate FAW response
- Objective 5.** Support standing multi-threat pest emergency task force
- Objective 6.** Generate data and evidence to guide integrated FAW management

Progress on each of these objectives relative to the project work plan are detailed in the below sections of the report

Progress towards Objectives and Sub-Objectives

Objective 1. Develop educational materials to aid in reaching audiences with information to improve understanding and management of FAW

Objective 1.1 Educational material development workshop

Objective 1.1 activities was completed in previous work cycles of the Fighting FAW Activity and are detailed in the 2019-20 Annual report, available [here](#). In addition to completed work, the Activity is also developing additional materials including (a) a Bangla language fact sheet describing new evidence and providing advice to farmers from research conducted by the Bangladesh Agricultural Research Institute (BARI), Bangladesh Rice Research Institute (BRRI) and the Bangladesh Wheat and Maize Research Institute (BWMRI) as part of this Activity's Sixth Objective (detailed later in this report). In addition, a short paper aimed at extension officers and NGOs that are working directly with farmers on agroecological options FAW pest management will be completed. These will be further detailed in the 2020-21 Annual report submitted in October of 2021.

Objective 1.2 Production of Bangla language educational videos

In response to the invasion of FAW, maize farmers in Bangladesh have tended to resort to the use of insecticides – for the first time in the case of many farmers growing maize – although many of the insecticides are available are ineffective against FAW. They also kill natural enemies of FAW, such as pests and predators, that can assist farmers through biological control. The excess use of chemical pesticides can also have a negative impact on public health.

On the other hand, the biological control and integrated pest management (IPM) methods can be cost effective, environmentally friendly, and comparatively safer for public health as they seek to reduce the indiscriminate use of insecticides. In addition, several companies are commercially formulating different biological pest management products; these are now available in the market on an affordable basis. However, farmers must be sensitized on the importance and benefits of these approaches. Entertaining videos are one of many important methods that can be used to achieve this goal.

Prior to the current semi-annual reporting period, and in accordance with the overall project work schedule, the Activity already developed and released an educational video and one drama on FAW identification, monitoring and management in Bangladesh in mid 2020. The 23 minutes video also includes biological information on FAW, including its identification, life cycle, scouting and key management techniques. This video can be found here: <https://youtu.be/zkGmoOXHGzM>. In addition, a 12-minute Bangla language video on “Best practices to manage Fall Armyworm” provides information on how farmers can use monitoring and scouting procedures and IPM methods to respond to FAW. The 12-minute is available here: <https://youtu.be/iBECvAwbnqI>. Both of these videos have been used in trainings and aired on national and district-level television programs (detailed in subsequent sections of the report).



Above: Screenshot of the educational video, *Jamal conquered his dream through Maize farming*, that provides and entertaining look at how farmers can manage Fall Armyworm in cost-effective ways using IPM. The video is available [here](https://youtu.be/zkGmoOXHGzM).

During the reporting period, an additional video on biological control of FAW for farmers in Bangladesh completed in partnership with CABI, which is also active in FAW response in South Asia. Production of this video was above and beyond the Activity’s original work plan that stipulated the production of two videos. The new video was added as it was an

opportunity to collaborate with CABI and produce additional and relevant training information on a subject identified by members of the Bangladesh Fall Armyworm Task Force as important for farmer education.

The development of the video on biological control was cooperatively developed by the Activity, CABI, and with direct input from the BARI on script and storyboard development. Following completion of initial draft content, plans for the video were vetted at a meeting on FAW held on 22 September 2020 held at the Bangladesh Agricultural Research Council (BARC) auditorium in Dhaka, during which the National FAW Task Force approved of video production. The video was subsequently completed in November 2020. The video can be found [here](#). Since production, the video has been widely used by the Department of Agricultural Extension (DAE) in trainings that are detailed in this report, as well as by other stakeholders.



Above: Screenshot of the [Biological control of Fall Armyworm](#) video produced by the Fighting FAW Activity and CABI, released in November 2020.

Each of these videos are now available on the Government of Bangladesh Agricultural Information Service portal (available [here](#)). Importantly, the biological video was also further adapted by CABI and is now being used in Vietnam and in Thailand, with the use of additional video material and adaptation of scripts to [Vietnamese](#) and [Thai](#) languages. More detailed information on the use of these videos in extension and training programs will be provided in the 2020-21 Annual Report submitted in October 2021.

Objective 2. Assist the Department of Agricultural Extension in deploying awareness raising and training campaigns

Objective 2.1 Deploy FAW Master Trainer of Trainers for Department of Agricultural Extension



Above: Fighting FAW staff lead scout fields to assess FAW population and crop damage during the reporting period.

Due to concerns with COVID-19 risks and prohibitions on field work imposed by CIMMYT on all offices and country operations globally, in-person refresher trainings of DAE staff – which were planned as part of the Activity’s 2020 work plan – were not possible prior to the advent of the maize cropping season in October. As such, the Activity took the decision to shift to use of Zoom for virtual refresher trainings. This was the first time that many SAAOs had engaged in an online training in Bangladesh. A series of twelve detailed trainings were provided to different batches of DAE staff, with emphasis placed on correct FAW identification, monitoring, scouting and IPM. The sections below describe preparation and execution of these trainings.

Training program and video-based presentation development

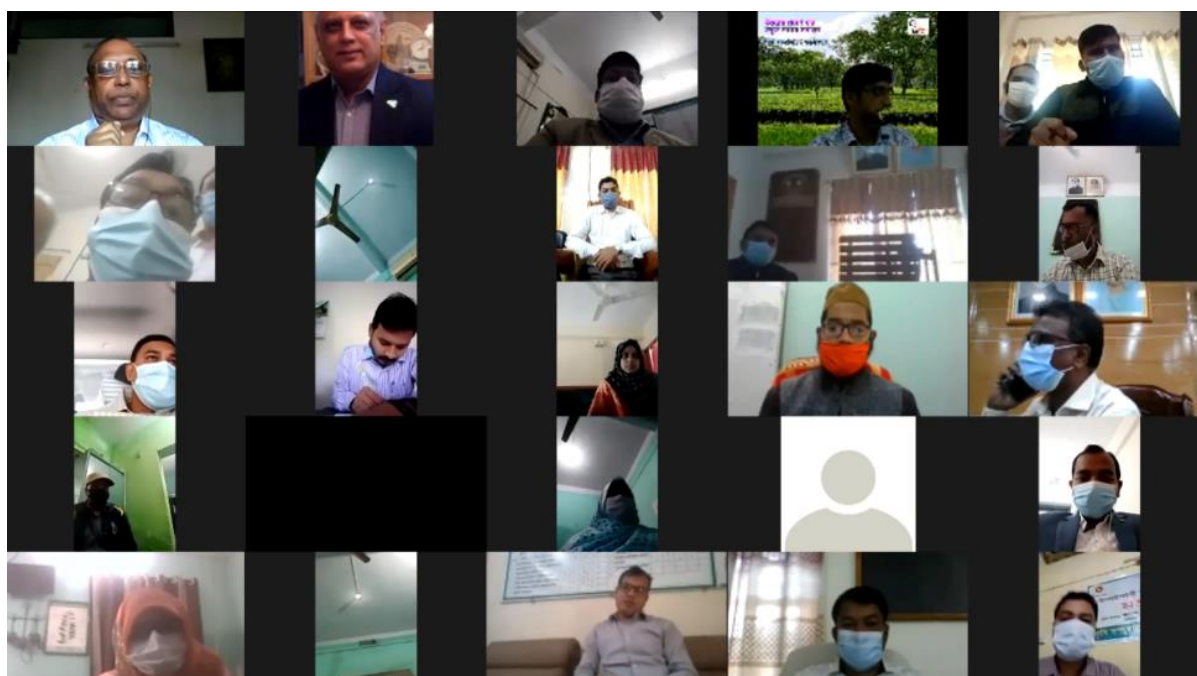
With the guidance from Dr. Dan McGrath, Emeritus Professor, Oregon State University and Fighting FAW Activity consultant, and the active participation of project staff, 13 video-based training presentations in Bangla providing FAW technical content were developed during September – October of 2020. The duration of each video was 10–15 minutes. These video-based presentations, which are available here, followed the topics below.

Titles and short descriptions of the videos		
SN	Title	Short description
1.	Bangla FAW Training Video 1: Introduction, Identification & Monitoring of Fall Armyworm	Background ways of identification and monitoring system of FAW in Bangladesh was described in this video. Total duration 10 min 32 sec.
2.	Bangla FAW Training Video 2: Risk of Crop Loss by Fall Armyworm	Risk of different stages of maize crop by FAW infestation was described. Total duration 13 min 23 sec
3.	Bangla FAW Training Video 3: Seedling Scout of Fall Armyworm	Scouting procedures of FAW at the seedling stages of maize crops was discussed in this video. Total duration 12 min 46 sec.
4.	Bangla FAW Training Video 4: Cob Scout of Fall Armyworm Part 1	Scouting procedures of FAW during cob stage especially just after tassel opening was described. Total duration 3 min 20 sec.
5.	Bangla FAW Training Video 5: Cob Scout of Fall Armyworm Part 2	Scouting procedures of FAW during cob stage especially after tassel stage was described. Total duration 7 min.
6.	Bangla FAW Training Video 6: Fall Armyworm Monitoring and Data Recording Instructions	In this video, FAW monitoring and scouting data entry procedures in tabs according to “Bangladesh FAW Monitoring Apps” was described. Total duration 10 min 21 sec.
7.	Bangla FAW Training Video 7: Fall Armyworm Cultural and Biological Management	Cultural and biological options for FAW management was described in this video presentation. Total duration 13 min 11 sec.
8.	Bangla FAW Training Video 8: Biological keys & Fall Armyworm Management	In this video the biology of FAW and its relationship with its sustainable management was discussed. Total duration 10 min 44 sec.
9.	Bangla FAW Training Video 9: Moth Count and Fall Armyworm Outbreak Part 1	In this video the relationship between FAW population fluctuation data recording in pheromone traps and prediction of its outbreak was discussed. Total duration 9 Min 32 Sec.
10.	Bangla FAW Training Video 10: Moth Count and Fall Armyworm Outbreak Part 2	In this video the relationship between FAW population fluctuation data recording in pheromone traps and prediction of its outbreak was discussed. Total duration 8 Min 50 Sec.
11.	Bangla FAW Training Video 11: Insecticide Choices for Fall Armyworm Management Part 1	In this video choices of insecticides for FAW management were described. Total duration 13 Min 5 Sec.
12.	Bangla FAW Training Video 12: Insecticide Choices for Fall Armyworm Management Part 2	In this video choices of insecticides for FAW management were described. Total duration 8 Min 44 Sec.
13.	Bangla FAW Training Video 13: Fall Armyworm Agro-ecological Management	Agro-ecological management of FAW was described in this video presentation. Total duration 10 Min.

Virtual refresher for FAW master trainers from the Department of Agricultural Extension

Twelve batches of refresher virtual training were successfully completed for Cadre Officers of FDAE and frontline extension agents, and for SAAOs of DAE from 27 October 2020 to 19 November 2020. The virtual trainings were completed in preparation for the 2020-21 winter rabi maize season. A total of 736 (477 Cadre Officers and 259 SAAOs) participants in 12 batches attended the training programs from 25 of Bangladesh's major maize growing districts.

During each training, a brief inaugural session was held. Participants were updated on the objectives of the Fighting FAW Activity and the intention of the training. After this, virtual trainings were officially inaugurated by Dr. Md. Abdul Mueed, Director General at the time of training for DAE. The Zoom trainings made use of the above mentioned videos and sought to assure that master trainers had been refreshed on the requisite level of information to guide other staff within DAE.



Above: Screenshot of participants in the Virtual refresher training for FAW master trainers of Department of Agricultural Extension for the Rabi Maize Crops 2020–21

The trainings, however, were not without challenges. Many SAAOs in particular experienced connectivity challenges and had trouble following attentively in a this online learning format. They are considerably more accustomed to in-person trainings, which made the Zoom integrations challenging. Similarly, it is difficult to gauge the degree to which participants are actively learning and developing competencies in an online format. For these reasons, exempting periods of serious lock-down, the Activity appealed to CIMMYT for approval to do in-person trainings with full assurances of social distancing. This was granted, and additional trainings that took place in late 2020 and early 2021 were shifted to in-person formats, albeit with low numbers of participants in each batch to assure safety through social distancing. These trainings, which began with speculated women's only training sessions, are described below.

In person FAW master trainer training for female officers of Department of Agricultural Extension for winter maize

In Bangladesh, women can be leaders in IPM for FAW. However, women are poorly represented in many agricultural extension activities. They also face challenges learning in mixed gender settings in which men – who are more culturally recognized as authorities in agriculture – can tend to dominate. In response, and in an effort to boost women's standing in agricultural extension, as well as to provide a conduit for women extension agents to reach women headed households and farmers with advice on FAW IPM, the Activity implemented a series of women's only trainings on FAW in collaboration with BWMRI from 22 November to 01 December 2020 in Chuadanga and Dinajpur, respectively, representing key regions for maize growth in southern and northern Bangladesh. Trainings in both locations were co-facilitated with CSISA.

To this end, 107 women DAE officials participated in hands-on in-person trainings on FAW while maintaining social distance and with COVID-19 restrictions in place. The training focused specifically on women staff within DAE to empower them to advise farmers and women in particular on how to make smart pest management decisions that lower the risk of pesticide exposure and poisoning in Bangladesh. The main objectives of this trainings were to (a) increase awareness and understanding of FAW IPM to train others, (b) empowerment of women within DAE, (c) increase women's participation on agricultural and pest management decision making, and (d) develop women leaders with increased expertise and agency to work more effectively within DAE.



Above: One of four batches of DAE women IPM Fall Armyworm leaders trained in November 2020 in Chauadanga and Dinajpur.

Training programs were residential and arranged over two days. At both locations the first batch comprised of the field level Cadre Officers and the second batch of SAAOs. On both days, the first half of the training program comprised of call room teaching on the identification, monitoring, scouting and different management options of FAW. In the second half, the participants went to a pre-selected maize field which had a considerable amount of FAW infestation in order to gain practical experience in scouting, identification, and pest management advising to farmers.



Above: Women leaders in Integrated Pest Management (IPM) of Fall Armyworm in the Department of Agricultural Extension scout fields for pests, record data on pest populations, and provide recommendations for IPM during intensive trainings in November through December of 2020.

At the end of the training program all the trainees were provided with training aids. These included video presentations, power point presentations, colored training manuals and materials to be used for the training they will now impart to the farmers, female farmers, farmers' family members and fellow officials. They were also informed that CIMMYT will launch a survey program later to establish the number of female farmers, family members, and extension workers who were trained during Rabi 2020–21 and Kharif 2021 seasons.

This was the first time DAE arranged a training program exclusively for women field level officers, and it is important as it provided a space for women to gather, share their knowledge, to learn, support, and empower each other to extend IPM to farmers. At first, participants were reluctant to join the training program due to COVID-19 risks and also because they had no prior experience participating in this type of women only training program. Yet after assurances of COVID-19 safety and provisions for women to bring their children and have childcare if necessary, DAE's staff enthusiastically embraced the trainings.



Above: Trainees learn how to install pheromone traps for monitoring FAW in Dinajpur.

A sharp increase of knowledge in participants was documented through training pre- and post-test results. Average pretest score was less than 40%, whereas the average post test score increased to more than 95%. By the end of the training batches, participants appealed to Senior DAE leadership to arrange more women's focused trainings in the near future because the number of female frontline officers in DAE are increasing and now comprise more than 30% of DAE's total staff numbers.

Two months after trainings were completed, the Activity implemented a phone survey of trainees which pointed to significant impact at scale from this effort. These women leaders in agricultural extension shared what they learned with 2,530 other staff within the DAE through both formal trainings in their working offices and also informal engagements. The survey also suggested that this modality resulted in nearly 17,000 farmers receiving additional IPM advice for FAW, with 23 percent of these farmers themselves being women or women headed households. As a result of this effort, farmers have been able to respond to FAW attack in their fields with rational approaches that seek to limit the use of pesticides only when and where absolutely needed. In addition, of the 98 trained women DAE leaders, 62 percent now regularly scout farmers' fields for FAW before advising farmers on IPM. This is crucial, as the data they collect can be quickly analyzed to make evidence-based pest management decisions,

rather than farmers simply resorting to ‘spray first, think later’ approaches to farming. Importantly, of the 98 women leaders in FAW IPM, ninety percent also advised farmers on how to avoid spraying entirely and make use of natural predatory and parasitoid insects to fight back against FAW. These trainings mark what is hoped to be a watershed moment in empowering women extension agents in Bangladesh.

In-person FAW master trainings for national research scientists and cadre officers from the Department of Agricultural Extension for the summer Kharif 2021 maize season

In addition to the above-mentioned zoom and women’s only trainings, during the reporting period, the Activity implemented a comprehensive in-person training program for 246 (202 men and 44 women) officials from DAE, BRRI, BARI, and BWMRI (the latter three with previously un-trained scientists participating) in eight batches. The objective of the training program was to inform the participants about the dangers of FAW and to build the capacity of DAE, BARI, BWMRI, and BRRI on information, methods, and approaches to monitor FAW and control the pest through IPM methods appropriate for the comparatively rainy *kharif* maize season. Trainings were held at BRAC and at BWMRI’s facilities in Dinajpur – where a standing maize crop could be used for in-field, hands-on trainings – during 6–25 March 2021.

The duration of each batch was two days, with trainings intended as training of trainers, and strong commitment from DAE to cascade trainings to other DAE staff in summer maize ground areas. The inauguration ceremony of the first batch of the training program was held on 6 March 2021. Mrs. Wahida Akter, Additional Secretary, Ministry of Agriculture (MoA), Government of Bangladesh was present as Chief guest, Dr. Shaikh Mohammad Bokhtiar, Executive Chairman, BARC was present as a special guest, along with other senior officials from DAE and BWMRI. Several other high officials also inaugurated other batches of that training program, including the Senior Secretary, MOA, Additional Secretary, MOA, Director General, Department of Agricultural Extension, Director General, BWMRI Director, Agricultural Information Services, MOA, Director, Plant Protection Wing, DAE, Director, Planning, Training and Technology Transfer, BWMRI, Director, Administration and Finance, BWMRI, Additional Director, DAE, Dinajpur region, Deputy Director, DAE, Dinajpur.

There was a significant level of increase of knowledge of the trainees during these two days’ hands on field-oriented training program, which was reflected in the result of pre- and post-test scores. In the training the average pretest score was 69.44% and post-test 99.84%, so an average improvement of 31.36% on a range of core competencies in FAW management were recorded. Although the *kharif* maize season has yet to begin at the time of writing this semi-Annual report, the trained officials will work as master trainers to train fellow scientists, extension officials and the farmers.



Above: Left to right: Mrs. Wahida Akter, Additional Secretary, Ministry of Agriculture inaugurating FAW trainings for the summer kharif maize season. Participants from DAE learning about FAW trapping and monitoring using pheromone traps.

Objective 2.2 Assist DAE in organizing training roll-out on large scale basis

The Fighting FAW activity has already achieved its Objective for 2.2, which was to support DAE to scale-out trainings for at least 33,000 people. To date, 187,00 farmers people have been reached with FAW IPM information as a result of cascade trainings and one-to-one interactions between DAE and farmers that were catalyzed and encouraged by the Activity.

Objective 2.3 Media campaign to raise farmers' awareness on FAW IPM

Television campaigns

Restrictions brought by COVID-19 prohibited the Activity from implementing large-scale public video shows and informal trainings as they had been conducted in 2019. An alternative dissemination modality was therefore found for increasing public and farmers' awareness on FAW IPM. This came in the form of collaboration with dish-line television operators in major maize growing districts, who after discussion and agreement with the Activity, agreed to broadcast the FAW videos described in Objective 1. Television cable operators of the following networks broadcast the FAW videos from 4:15 to 5:15 PM and 5:45 to 6:10 PM. Across Rangpur Division, the videos were shown from 14 January to 14 February 2021 and in Khulna Division, videos were broadcast twice during October 2020 and 9 January to 9 February 2021. The local dish TV operators were:

Table 1. Television networks airing Fall Armyworm learning videos during the reporting period.

Cable network name	Division	Districts covered	Number of sub-districts covered
AMC Digital	Rangpur	Dinajpur	9
Prime Cable	Rangpur	Rangpur	2
		Nilphamari	2
TCN Digital	Rangpur	Thakurgaon	6
Chuanga Vai Cable	Khulna	Chuadanga	4
Kotchadpur Vai Cable Network	Khulna	Jhenaidah	1
Kashipara Cable Operator		Meherpur	3

FAW Infographics and one pager leaflets up-dated distribution status

During the reporting period, the Fighting FAW Activity worked to continue to distribute [Fall Armyworm infographics](#) in Bangla to a range of partners for subsequent distribution to farmers and agricultural input retailers. From October 20 to March 21, 38,060 additional FAW infographics were distributed through to retailers, women DAE staff, and to SAAOs. This brings the total number of leaflets distributed by the Activity to 436,060 to date. The table below provides information on the distribution of these infographics by key partners.

Objective 3. Institutional change to improve crop protection and integrated pest management

Objective 3.1a FAW monitoring in maize

From December 2019 onward, monitoring of fall armyworm in Bangladesh remains ongoing through the [Bangladesh Fall Armyworm Monitor](#) in collaboration with DAE. During Rabi Season 2020–21, FAW monitoring data recordings are ongoing from maize fields across 259 unions of 199 sub districts of 25 districts. The roll out of monitoring in the 2020-21 season, however, was significantly slowed due to the COVID-19 crisis, and likely was affected by the modality employed by the Activity of re-training DAE staff on monitoring, as described in Section 2.1 of this report. Although staff did complete the refresher training, internet connectivity issues and also the slow deployment of traps and pheromone in the winter season meant that it took well into January for the majority of DAE staff to begin monitoring. The slow implementation may also have been due to leadership changes within the extension department that affected the speed of activities. As of February – March, most of the sub-districts and unions required for effective monitoring were reporting data each Monday, and that condition remains ongoing at the time of writing. The Annual report submitted in October of this year will provide details on pest incidence and severity levels following efforts to appropriately manage and clean data. This is particularly important as the datasets presented on the FAW monitor report means of the number of traps per union, then unions per sub-district, then sub-district per district, and then districts as a whole, and finally at a national level. Because of the delay in reporting in of monitoring data, this means there are more observations in the end than the start of the season. As a result, weighted averages will likely have to be employed to better describe the population and damage levels observed at higher levels of aggregation. The methods used to do this and resulting data will be described in October.

These points aside, it is nonetheless clear that the level of FAW infestation in Bangladesh has been more severe in the 2020-21 winter season than the previous 2019-20 season. This is likely due to generally higher temperatures in a number of locations, and the lack of late season rainfall that has been experienced to date. Late season heavy rainfall events can help to physically knock FAW larvae off plants or drown them inside maize whorls; as such, the lack of rainfall experienced this season compared to the previous season is notable and may

have affected what appears to be more significant rates of attack experienced so far. More details on these observations will again be clarified in the October Annual Report.

Objective 3.1b FAW monitoring in non-maize crops

As maize is not only the host plant of FAW and it can attack more than 82 crops, monitoring of FAW infestations is also on-going in another four crops, cabbage, tomato, tobacco and rice. Non-maize monitoring is being done by the scientists and scientific staff of BARI and BRRI at different locations throughout Bangladesh. To assure FAW monitoring systems on non-maize crops, the Activity carried out preparation during October-November 2020. Steps taken included the development of a protocol system, and training on FAW monitoring systems for non-maize crops, the setting up of pheromone traps and weekly data collections, field scouting and data entry in the digital monitoring [Bangladesh Fall Armyworm Monitor](#) app.

As an in-person training program was not possible due to the COVID-19 pandemic, virtual training programs were arranged for the BARI and BRRI Scientific Officers and Scientific Assistants, and those who were involved in the FAW monitoring of non-maize crops. Two virtual training programs were arranged, one on 2 December 2020 and another refresher course on 3 January 2021. A total of eight BARI and six BRRI officials attended both training programs. In the training program along with the monitoring and scouting system of FAW, field data collections and data entry systems were shown and explained through videos showcasing question and answer sessions.

During this Rabi 2020–21, the monitoring system and data collection is ongoing at Rangpur, Bogura, Barishal and Jamalpur by the BARI scientists and scientific assistants on three crops, those being cabbage, tomato and tobacco. A monitoring system and data collection was started at BRRI HQ, Gazipur, BRRI Regional Station Barishal, BRRI Regional Station Rangpur. Finally observations were made in farmers' fields in Chuadanga by the BRRI scientists and scientific assistants on *boro* rice.

So far, the highest plant damage observed in the winter 2020-21 *rabi* season was recorded in tobacco with an approximate incidence rate of around 18% across dates observed (last year it was around 11%), followed by infestation in tomato (4.34%; last year it was around 2%) and cabbage (1.29%, last year it was also around 1%). No attack was observed yet in winter season *boro* rice. Note however that the number of observations for these crops is comparatively lower than in maize, and that observations are made by entomologists rather than trained extension staff. For this reason, rates reported here may be higher than those seen in maize by the end of the season – indicative of a potential sampling artifact – though this will be confirmed or rejected following examination of all data as presented in the October Annual Report.

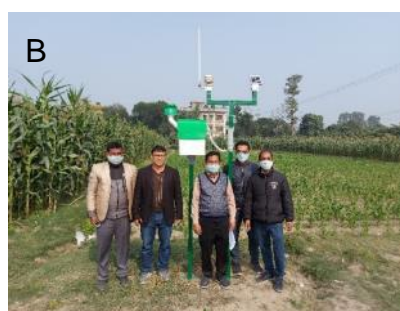
Objective 3.1c Automated FAW monitoring with solar powered traps

Manual observations of FAW populations from traps like those maintained by DAE can be time consuming and difficult. Although the Activity has had considerable success in mobilizing national FAW monitoring, in the long-run, less time and cost intensive methods will be needed. To this end, three solar-powered, self-cleaning and auto-count traps made by the company Trapview have been set inside three maize fields in Chuadanga, Bogura and Dinajpur for testing. Data collection process from on-going maize crops has already commenced. These traps consists of a solar panel and a battery, several HD cameras, a modem, GPS, optional self-cleaning mechanism and other advanced electronics that collect data, take pictures, and send them to the cloud-based IT platform.



Above: Trap view automatic FAW population monitor in Dinajpur.

The traps come with associated software that provides high resolution images taken from the trap and includes machine-learning aided automatic FAW population counts from the photos taken within the device. This is accomplished all without intervention by monitoring staff. The Activity is testing the use of these traps and software for automated pest counts and to judge of the traps can be used to trigger alarms on pest status. The Chuadanga and Bogura devices were in farmer's field and the last one was in Dinajpur research station's farm. In all devices, FAW lures used to monitor FAW only. All the devices are fully functional now and each of them are generating pest photos everyday along with the weekly pest accumulation report received by email.



Above: (A) BARI scientists learning about the installation process of the device in Bogura. (B) BWMRI Entomologists and Activity colleagues after Trapview installation training in Dinajpur (C) DAE representative and farmer were presented during installation of the device in Chuadanga.

The Activity has involved and trained the national agricultural research system staff from BWMRI and BARI on the monitoring devices. Training session was conducted in two sections; the first involved hands on training mainly focused trap features including an introduction, the installation process, maintenance and finally trouble shooting. The second training section was fully based on Trapview web application and online monitoring process. The second session of the training was organized through a Zoom call on 17 February, 2021.

Among Activity partners, these traps are so far quite popular as a digital monitoring device, capable of producing accurate data, among Activity partners. The Activity hopes that following verification of the data that BARI, BRRI, BWMRI, DAE will lead to monitoring FAW as well as other invasive pests with this device more accurately and efficiently. This week's report shows that the accumulated pest pressure was very high in Dinajpur and it captured 19 adult FAW in a week which indicated very high risk insect pressure for the particular location. So immediate control measures were advised taken after proper field scouting. But in the other two locations; Chuadanga and Bogura, the accumulated weekly pest pressure was low and the number of insects were 0–1 in both locations. So presently there is no need for any control measure intervention in those areas.

Objective 3.2 Raise awareness among DAE's plant protection wing to improve registration processes for new pest management technologies

Rapid registration of two effective and comparatively low-toxicity products, including the biopesticide *Spodoptera frugiperda* nucleopolyhedrovirus ([Fawligen, SFNPV, produced by the Texas-based AgBiTech](#) and sold locally by Ispahani Agro Limited, IAL) and Cyantraniliprole ([Fortenza, a seed treatment produced by Syngenta](#)) were achieved through intervention of this Activity an accelerated pace to control FAW since last June 2020 as reported in the previous [Annual Report](#). Several other biological products against FAW are in the trial phase at BARI and are being tested with support from the Activity. These are described in Objective 6.1.

Objective 4. Prepare the private sector for appropriate FAW response

Objective 4.1 Workshop to awareness and understanding of the biology and ecology of FAW especially about the low toxic new generation pesticides

This activity has been delayed due to the COVID-19 crisis but is anticipated to be held in the next six months, after which it will be reported on in the Annual report submitted in October of 2021.

Objective 4.1 Support to companies to develop viable business plans and activities to commercialize bio- and low-toxicity pesticides against FAW

The Fighting FAW Activity has provided consistent support to two Bangladesh national companies, IAL and Syngenta Bangladesh Ltd. through 50-50% cost share partnership agreements, with the ultimate aim of raising awareness to build a market of biological

pesticides against FAW. Especially pesticides such as SfNPV or Fawligen (imported from AgBiTech, USA, commercialized by IAL) and the seed treating agent against FAW, Cyantraniliprole (Fortenza, and commercialized by Syngenta). Importantly, efforts to assure effective advertising of Fawligen were also assisted by the Activity's partnership with the Rice and Diversified Crops Activity, which also co-financed advertising campaigns.

The Fighting FAW Activity is waiting on sales data from Syngenta, which markets Cyantraniliprole. Ispahani Agro-Limited, conversely, which markets Fawligen in collaboration with the US based firm AgBiTech and has provided detailed information on sales of this product during registration, as described in the box below.



Above: Product advertisements for Fawligen, sold by Ispahani Agro Limited.

US-Bangladesh business partnerships save farmers' health and control invasive pests with a biologically based alternative to chemical insecticides

Fall Armyworm (FAW) is an invasive agricultural pest that invaded Bangladesh in 2019 and has a preference for ravaging maize. FAW damage can be jaw-dropping; fields attacked by this pest can have significantly damaged leaves and cobs that are shocking when looked at. The highly apparent nature of these pest damage symptoms usually cause farmers to act without considerable thinking, by rapidly resorting to the spraying of highly toxic and expensive chemical pesticides out of panic. This puts both farmers' and environmental health at risk. In response, the Fighting FAW Activity partnered with the US based agricultural biotechnology company AgBiTech that produces high-quality biological insecticides that reduce the need for dangerous chemical sprays. Biologically based insecticides can be both affordable and safe to use, in addition to being targeted for the control of specific pests like FAW. The Activity linked AgBiTech to the Bangladeshi company Ispahani Agro Limited (IAL) as a local distributor, and by collaborating closely with the Bangladesh Agricultural Research Institute and the Department of Agricultural extension, was able to get Fawligen, a biologically based and safe-to-use alternative to synthetic pesticides for FAW registered for commercial use in just eight months – record time for Bangladesh. Only minute doses of Fawligen are required to control FAW with Fawligen, which offers significant economies of scale. At the time of writing, IAL has sold 67 liters of Fawligen in the last two months in Bangladesh, which have been used by over 4,000 farmers as a safe, biological alternative to dangerous synthetic insecticides. “These results are really encouraging, and we are looking to boost our partnership with Bangladesh and expand the volume of sales in the coming seasons” commented Shachi Gurumayum, Head of South Asia for AgBiTech.

Other highlights of the Fighting FAW's collaboration with the private sector

The section below provides brief updates on some of the major activities undertaken in the reporting period with IAL and Syngenta Bangladesh Ltd. Major outcomes of these activities will be described in the October Annual report.

Advertising media on Fawligen: With assistance from the Activity, IAL produced a video was on Fall Armyworm with a short introduction of the invasive pest, infestation symptoms, identification techniques and information on biopesticides like Fawligen for FAW control. The video is available at IAL's [YouTube Channel](#). The same video was used for television advertising from 20 November 2020 forward.

Crop consultants and spray service providers: In Bangladesh, most pesticides are applied by service providers hired by farmers to treat their fields. In order to raise awareness of the importance of scouting and advising on spray or no-spray decisions, as well as to popularize Fawligen, IAL conducted a detailed training for 504 spray service providers who are now capable of acting as crop consultants to farmers advising on FAW identification, scouting and bio-rational based integrated management. These spray service providers have also been linked with Fawligen demonstration plots implemented by IAL's IPM Championship program and educational and marketing campaigns. Outcomes from the IAL-led spray service provider program targeting maize farmers and FAW will be described in the October Annual report.



Above: Training for the spray service providers as part of the Activity's support to Ispahani Agro-Limited.

Fawligen educational and marketing campaign for Fawligen and bio-control agents:

IAL deployed intensive Fawligen marketing campaigns across FAW hotspot areas in Chuadanga, Jashore, Rangpur, Dinajpur, Bogura and Manikganj the winter 2020–21 rabi crop season. In a single location per district, at least ten lead farmers were selected, and all the bio-rational based pest management tools were supplied by IAL. Importantly, this also involved pre-season booking of bio-control agents in the form of FAW parasitoid insects that can be released into a field to control FAW. This was achieved in collaboration with DAE officials and DAE IPM club members and IAL agricultural input retailers. A total of 81 farmers have been enlisted in pre-booking of biocontrol agents in the six districts.

The same farmers also agreed to implement large scale demonstrations of Fawligen and train at least ten other lead farmers in scouting and monitoring of FAW. In addition, IAL distributed a total of 30,000 leaflets, and 5,000 posters on Fawligen have been to farmers, input dealers, and DAE officials. The impact of these activities, which are still ongoing at the time of writing, will be described in the October Annual report. The impact of these activities, which are still ongoing at the time of writing, will be described in the October Annual report.

Agricultural input dealer trainings and lead farmer awareness raising: To avoid mass gatherings in large in-person trainings that could increase COVID-10 risks, IAL conducted a campaign of door-to-door counseling of their registered agricultural input dealers to educate and raise awareness on Fawligen and its proper use. So far, all 180 dealers have been reached.



Above: Demonstration and advertising campaigns led by Ispahani Agro Limited with Activity support.



Above: Door-to-door agricultural input retailer counseling conducted by Ispahani Agro Limited on FAW with Activity support

In addition, 40 lead farmers and 140 retailers were trained in open-air awareness raising events with assured social distancing across Chuadanga, Jashore, Rangpur, Dinajpur, Bogura and Manikganj. IAL provided the promotional materials as well as product commission to popularize the product in his community. The overall outcomes of these activities, which are still ongoing, will be described in the October Annual report.

Roadshows to raise demand for Fawligen: To create increased demand for Fawligen, IAL hired six vehicles and decorated them with banners, posters and the products targeting FAW biological control products, with emphasis on Fawligen. During the month of January and February of 2021, the vehicles traveled throughout Chuadanga, Jashore, Rangpur, Dinajpur, Bogura and Manikganj districts. Learning materials (leaflets/booklets) were distributed to farmers and others who stopped to learn more about FAW and biological control products.



Above: Roadshows to create increased demand for Fawligen

Training of trainers and farmers by Syngenta Bangladesh Ltd.: From December 2020 to February 2021, Syngenta Bangladesh Ltd. provided product awareness training to popularize Fortenza as a seed treating agent protecting maize against FAW for 537 channel and sales staff across Dhaka, Comilla, Bogura, Jashore, Rajshahi, Rangpur, Kushtia and Dinajpur. Syngenta Bangladesh Ltd. also organized demand creation events focused on marketing of Fortenza across seen districts from December 2020 to February 2021.

Syngenta Bangladesh Ltd demonstrations and marketing campaigns on Fortenza in maize: During the reporting period, Syngenta Bangladesh Ltd. established 53 Fortenza demonstrations in maize fields in Manikganj, Comilla, Bogura, Mymensingh, Jamalpur, Kushtia, Chuadanga, Rangpur and Dinajpur. In addition, A total of 4,200 maize growers participated in Bogura, Jashore, Rajshahi, Kushtia, Chuadanga, Rangpur and Dinajpur districts. In addition, Syngenta Bangladesh Ltd. organized rural video shows in the same districts, reaching 3,600 participants. Measures to assure social distancing and use of personal protective equipment were implemented in these events. Syngenta Bangladesh Ltd. also arranged 50 vehicles that were used to conduct mobile advertising campaigns and distribution of leaflets and advertisements on Fortenza in the districts of Manikganj, Comilla, Bogura, Mymensingh, Jamalpur, Kushtia, Chuadanga, Rangpur and Dinajpur. The results of these coordinated activities will be detailed in the October Annual report for the full 2020-21 period of the Fighting FAW Activity.

Training of agricultural input dealers on integrated pest management by AIRN: The Activity also partnered with the Agricultural Retailer's Input Network (AIRN), an NGO that conducts trainers across a federation of agricultural input dealers, to conducted 37 batches of FAW IPM trainings for 764 agricultural input retailers from 10 districts and 33 sub districts. Trainings were carried out to update input dealer's knowledge on FAW, particularly to raise awareness on the commercial availability and use of Fortenza and Fawligen in management of FAW. Trainings focused on the life cycle of FAW, the impact on crops and FAW management principles. These activities too place across Dinajpur, Bogura, Rangpur, Nilphamari,

Thakurgaon, Meherpur Jheneidah, Chuadanga, Manikganj and Lalmonirhat districts. The training sessions were held from 22 November–10 December 2020. Due to COVID-19, all trainees were given masks and hand sanitizer and scanned for elevated body temperature before being admitted to trainings. Social distance was also maintained.

A total of 764 participants attended the day long training events, during which AIRN distributed 3,0560 FAW infographics among the retailers. What did agricultural input dealers learn in these trainings? Pre-test results from the training sessions indicated a 31.71% correct answer score to a battery of questions asked. Conversely, following the trainings, knowledge levels increased to 93.94% correct results among the participants.



Above: Body temperature tests conducted to assure COVID-19 safety during Agro-Input Retailers' Network (AIRN) trainings on FAW.



Above: An outdoor, COVID19 safe training session led by staff from AIRN

Objective 5. Support standing multi-threat pest emergency taskforce

Objective 5.1 Institutionalize FAW task force model to tackle emerging and emergency threats

In response to the anticipated invasion of FAW, the Ministry of Agriculture in Bangladesh took pro-active steps with guidance from USAID and CIMMYT in June of 2018 to form a task force to guide management of FAW. The specific goals of the Task Force are to provide a forum for sharing information on the FAW threat in Bangladesh, and to take decisions and guide efforts to mitigate risks to smallholder farmers throughout the country. Since that time, the Task Force has met every few months, and the Fighting FAW activity has participated as a core member of the Task force.

During the reporting period, the Fighting FAW activity continued with the regular provision of back-stopping and assistance of the task force in technical matters, sharing of insights from FAW management in other countries, and assistance in clarifying roles, responsibilities, processes implemented by the Task Force. To this end, the ninth meeting of the FAW Taskforce was held on November 26, 2020, at the BARC conference room in Dhaka. The Activity provided financial support that assured the meeting's implementation and covered travel costs for participants from outside Dhaka.

Lastly, the Fighting FAW Activity's original work plan also provided resources to bring key Task Force members will participate in an international study tour to Africa to learn how other countries are working to mitigate the threat of FAW. These activities were however suspended due to the COVID-19 crisis, with funds for travel re-allocated to the trainings described in Objective 2. Beyond this general support provided to the Task Force, although the Task Force has still not extended its membership to the private sector, the Activity worked as a conduit by facilitating facilitate information sharing between private sector and the Task Force. This has been achieved by regularly updating members of the Task Force on the outcomes of activities in Objective 4.

Objective 5.2 Within the Ministry of Agriculture, work on institutional recognition and support of the FAW Task Force

Despite the formation of the FAW Task Force, information on decisions taken and future plans developed by the task force may not always reach the Secretarial or Minister level within the Ministry of Agriculture. While Task Force meeting notes are regularly shared with high-level Ministry Officials, they may not be fully understood or adequately discussed. For this reason the Fighting FAW activity has worked towards informing the Ministry of key outcomes from Task Force meetings and activities associated with the project.



Above: Bangladesh's Honorable Minister of Agriculture Dr. Muhammad Abdur Razzaque and the Secretary of Agriculture Md. Mesbahul Islam inspecting packets of Fawligen, a commercially available biopesticide produced by the US firm AgBiTech and marketed by Ispahani Agro Limited in Bangladesh that was brought to the market with USAID's assistance, on March 15, 2021.

During the reporting period, this was accomplished through a zoom debriefing held with the Minister of Agriculture, Dr. Dr Abdur Razzak, on November 13, 2020, and during a visit to the Bangladesh Wheat and Maize Research Institute on 15 March of 2021. The first session in

November served as a general debriefing and update. The March 2021 meeting permitted more in-depth discussion and a visit by Dr. Razzak to an informational stand where he was shown information on FAW management and briefed on activity progress. During this visit he was accompanied by Md. Mesbahul Islam, Secretary of Agriculture, and the Director Generals of BWMRI, Dr. Israil Hossain, the Department of Agricultural Extension, Md. Assadullah, the Bangladesh Rice Research Institute, Md Abu Bakr Siddique, and the Bangladesh Agricultural Research Institute, Md. Nazirul Islam. Also accompanying on the visit was the Chairman of the Bangladesh Agricultural Research Corporation, Amitavh Sarker.

These visitors had an opportunity to learn about USAID supported FAW activities during a visit to an exhibition stall maintained by CIMMYT where they were able to examine FAW larvae up close, assess FAW damage to maize plants, learn about how the Fighting FAW activity supports BWMRI to improve the laboratory rearing of FAW for research on how to better manage the pest, in addition to learning about the biopesticide Fawligen marketed by Ispahani Agro Limited in Bangladesh through a business agreement with the US based firm AgBiTech. The Fighting FAW project helped both of these companies navigate the complicated pesticide registration process in Bangladesh, facilitating near-record time registration and commercialization of this biopesticide in 2020.

In addition to the above, ongoing trainings of Department of Extension (DAE) staff led by the Activity were inaugurated in a separate session presided by the Md. Mesbahul Islam, Secretary of Agriculture, and the Director General of DAE, Md. Assadullah.



Above: (left) Bangladesh's Secretary of Agriculture, Md. Mesbahul Islam, inaugurates the Fighting FAW Activity trainings of DAE staff, who learn about integrated pest management in residential trainings on March 15th in Dinajpur. (Right) Director General of the Department of Agricultural Extension, Md. Assadullah, addresses trainees in integrated pest management trainings on FAW organized by the Activity on March 15th in Dinajpur.

In addition to the efforts described above, the Activity also worked during the reporting period to assist pest management efforts in public and agricultural policy at large. In an innovation that was beyond the work plan of the Fighting FAW project, in late 2020, the Activity partnered with the inter-governmental South Asian Association for Regional Cooperation (SAARC) Agriculture Center, CABI and the Food and Agriculture Organization (FAO) to convene [a two-day consultation meeting](#) among key experts and policy makers from Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Delegates from

each country presented and discussed the FAW situation in their respective nations, before receiving feedback from CABI and from the Activity from the perspective of Bangladesh.

The workshop also enabled significant cross-learning and idea sharing among the partners on the call. Importantly, initial insights from a white paper under development by the Activity

Standing regional and national task forces initialized to pre-empt invasive species



- FAW will not be the last invasive species the region must contend with
- Task forces take time and money to set up, and rarely last
- The time required to set up task forces also reduces the speed of a country's ability to respond effectively to new pest threats
- A standing expert panel / committee on invasive species response is needed (regionally and at national levels)
- Offers opportunity for collaborative learning, pre-emptive planning, early response, use of best practices
- Requires strong governmental backing and a modest budget
- Potentially significant economic and policy benefits

Above: Slide from the presentation to South Asian Association for Regional Cooperation (SAARC) regional consultation meeting on Fall Armyworm on January 28th, 2021 in which the importance of maintaining standing tasks forces to respond to invasive species was discussed.

that provides justifications for, and suggests models to sustain standing multi-invasive species threat task forces in each country of South Asia, but with emphasis on Bangladesh, were highlighted in the penultimate presentation provided by Timothy J. Krupnik on behalf of the Fighting FAW activity. This suggestion was well received, as a describe below, was onboarded by SAARC members as a

primary policy suggestion.

As a result of this workshop, and because of the Activity's strong input and advising during invited presentations and discussions, SAARC, which is a key influencer in regional agricultural policy, provided major recommendations to the governments of Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka to fight back against FAW. These recommendations, which mirror many of the emphasized areas and outcomes of Fighting FAW Activity, are as follows:

- Support the evolution of national FAW task forces into standing cross-sectorial invasive pest species committees capable of developing strategies and action plans for SAARC Member States.
- Strengthen surveillance, research and monitoring of FAW on maize and potential non-maize host crops while developing biologically intensive integrated pest management IPM) programs against FAW.
- Establish mechanisms to communicate uniform FAW management recommendations through appropriate disseminating channels in rural areas of SAARC Member States.
- Popularize appropriate seed treatment against FAW and make available approved seed treating agents to farmers.

- Bilateral and/or multilateral MOUs among SAARC Member States should be developed for exchange of information, capacity building and biocontrol agents in line with the Nagoya protocol on ABS.
- Stable FAW tolerant genotypes should be identified and exchanged in collaboration with International organizations developing cultivars with native genetic tolerance or resistance.
- Build local capacities in SAARC Member States for extension personnel and maize / non-maize growers in partnership with local and International organizations.
- Develop appropriate, demand-driven and common digital tools for monitoring, advisory, and forecasting of FAW.
- Develop mass production protocols for biopesticides and the multiplication of bioagents at the community level and above.
- Natural enemies of FAW from similar agroecological zones may be collected and catalogued for the sharing of information on potential for FAW control among SAARC Member States.
- SAC is recommended to act as coordinator for monitoring and collaborative research and to facilitate the exchange of information across Member States in technical partnership with National and International organizations.
- FAW response networks should be strengthened among the SAARC Member States through FAW projects, institutions, and nominated nodal persons from each SAARC Member State to share data on the status of FAW and appropriate IPM technologies, which may also be linked to the SAC web portal.
- The harmonization of registration of biopesticides across Member States and SAC coordinates through consultation meetings of members of respective pesticide registration committees is recommended.



Above: Screen shot of the South Asian Association for Regional Cooperation (SAARC) regional consultation meeting on Fall Armyworm on January 28th, 2021

As a consequence of the Fighting FAW Activity's direct efforts to organize and provide key input to the SAARC consultation, this set of policy advisories has been delivered to the respective Ministers of Agriculture in Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, and are anticipated to influence the future direction of governmental investments in integrated pest management initiatives to control FAW and other invasive species.

5.3 Assist the task force in influencing pest control product registration

Activity 5.3 focuses on supporting the Task Force to influence attitudes within the Ministry of Agriculture regarding the need for modified policies for registration in case of emergencies. Activities have consequently focused on increasing Task Force members' understanding of seed treatment, biological insecticides, and viral products in particular, with additional information on chemical control made available upon request. Significant positive outcomes have come from this work, with the fast-track registration of biological pesticides and seed treating agents registered in 2020 and described thoroughly in Objective 4 of this report and in the previous Annual Report.

During the reporting period, the Activity continued to focus on this work by drafting a white paper that will be released in the next six months that addresses ways and provides suggestions for how DAE's Plant Protection Wing can streamline registration processes for low-toxicity pesticides in the case of pest invasion. After vetting by government officials in the next six months, this document will be included in the next Annual report.

Objective 5.4 Establish task force approved information portal on FAW linked to governmental website(s)

In support of all previous project Objectives (1-5), Activity 5.4 is working to establish an informational portal with information on FAW IPM to be linked to DAE's website. During the last six months, the content of the information portal has been finalized and the development of the web-portal has been nearly finished. Once the bi-lingual portal development is finished and approved by the DAE, the contents will be uploaded and will be shared publicly.

Meanwhile, embedding the portal in the BWMRI website was discussed with the Director-General, who is also the member-secretary of the task force, and he has agreed to host the portal and it will be housed on the BWMRI website. For embedding the portal to the DAE website, communications with the Director Plant Protection Wing have been formalized so that when the portal gets approved by the FAW Taskforce, which is anticipated before August of 2021, it can be rapidly uploaded and housed on the DAE website. The facilitation process of embedding the portal was discussed with Mr. Md. Manik Sarker, Assistant Programmer (ICT Management), Planning, Project Implementation & ICT Wing.



Above: Draft header for the Fall Armyworm management information portal to be housed on the DAE and BWMRI websites.

Objective 6. Generate data and evidence to guide integrated FAW management

Objective 6.1 Screening studies to evaluate the effectiveness of new pest control materials

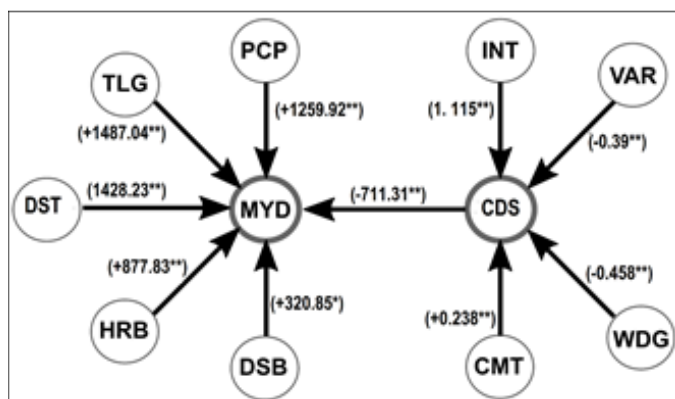
Because FAW was, at the time of its incursion, a newly invaded pest for Bangladesh, there were no effective low toxicity pesticide products available that were not broad spectrum chemicals. However, with the direct involvement Activity, two relatively safe and effective pesticides, including Fawligen and Fortenza were registered on an accelerated basis in less than eight months, whereas usually it takes more than two years to do this. The reasons why up to two years are normally needed is because of regulations stipulating the need for multi-location, multi-year field trials of new products. Both Fawligen and Fortenza could be accelerated to registration by implementing multiple trials within the same season, in different locations across Bangladesh, and working closely with BARI to assure presentation of the trial results to the FAW Task Force and DAE as soon as possible after data were available. With additional advocacy on the part of the Activity, rapid registration was achieved.

Additional efforts are however needed for other products, especially effective, low toxic pesticides, especially bio-pesticides. To this end, and with the support from the Activity through a research sub-grant, BARI is conducting multi-location trials of five more biological pesticides for efficacy including *Celastrus angulatus* 1% EW ('Bio-Chamak'), *Bacillus thuringiensis* var. *Kurstaki* ('Bio-fighter'), *Bacillus thuringiensis* var. *Kurstaki* ('Bio-killer'), Nimbicidine 0.03% (Neem *Azadiractin*), Methoxyfenozide (Zylo 24SC, Maxzide 24SC) and insect growth regulators. Following the 2021 winter season trial completions, results will be submitted to the Pesticide Technical Advisory Committee (PTAC) for consideration for accelerated registration, although additional trials may be required in the case of any uncertain or unclear results.

Objective 6.2 FAW severity, incidence and management surveys to inform mitigation efforts

In the 2019–20 Rabi season, 545 farmers out of 777 farmers with FAW pheromone traps located in their fields participated in a severity, incidence and management survey. The survey covered aspects such as awareness of farmers on FAW (ability to identify the worm) and management techniques employed (pesticides, handpicking, etc.) used by farmers, as well as how they reacted to the presence of FAW on their fields (what crop stage and what kinds of pesticides are sprayed, time of insecticide spray, number of spray rounds) in addition to their general agronomic practices (varieties used, tillage regime, fertilizer rates, herbicide use, application intercrops, planting dates and so-on that may affect FAW severity. Additionally, a matching sample of 498 farmers who did not have FAW traps in their field were surveyed as a control and contrast group, which provides an aggregate sample of 1,043 maize farmers.

During the reporting period, the Activity worked to refine initial analyses of FAW damage using data generated in 2019–20 season. This was achieved using structural equation models. In the previous Annual report, structural equations considering different types of maize crop damage from fall armyworm i.e. small fresh window panes (SFV), infested whorl damage (IWV) and damage to cobs at reproductive stages were presented. The updated structural equation model (SEM) shown below however uses a novel combined damage score which is an equally



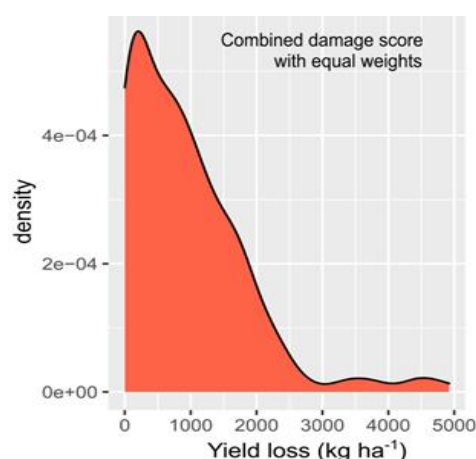
Above: Updated structural equation model describing FAW damage to maize in the 2020-21 season. Abbreviations are described in the text.

weighted score of the damage types. The SEM model consists of two equations with maize yield and combined damage score as dependent variables. Conversely, the independent variables considered were farm size (FRM), the previous crop (PCP), variety of maize used (VAR), tillage type (TLG), manure applied (CDG), weeding frequency (MWD), herbicides application (HRB), rounds pesticides application (PST), spraying decision (immediate spraying vs. scouting before spraying; DSB), pesticide spraying time (SPT), number of hand picking times (HPT), time of sowing (LS), weather events (WDG), and FAW moth count in reported by the pheromone trap (CMT). A combined damage score (CDG) was an additional predictor for mean yield (MYD) within the SEM. The following figure shows the significant variables (** and * indicating 95% and 90% levels of statistical significance) in the SEM model and the coefficients (INT shows the intercept).

The refined SEM results show the yield reduction due to Fall armyworm infestation, which was otherwise masked by very high yields reported in the season that resulted from favorable growing weather conditions. The reported moth counts in pheromone traps significantly predicted the combined damage score reported in the field showing the efficacy of the monitoring program. The updated SEM model reveals a mean yield loss of 0.93 tons per hectare due to FAW damage to leaves, whorls, and cobs) in the 2019–20 winter season. The new round of surveys in 2021–22 will validate the damage estimates.

Importantly, the spraying behavior of farmers i.e. scouting and proper spraying of pesticide, appears

weighted score of the damage types. The SEM model consists of two equations with maize yield and combined damage score as dependent variables. Conversely, the independent variables considered were farm size (FRM), the previous crop (PCP), variety of maize used (VAR), tillage type (TLG), manure applied (CDG), weeding frequency (MWD), herbicides application (HRB), rounds pesticides application (PST), spraying decision (immediate spraying vs. scouting before



Above: Updated structural equation model results describing FAW damage to maize in the 2020-21 season and discounting for the effects of favorable weather. These results indicate that in the absence of favorable growing conditions, yield loss to FAW can be severe.

to offsets the yield damage by 0.3 tons per ha. This points to the importance of effective training on FAW management. Heavy rainfall events also significantly reduced the FAW damage levels, in accordance with the literature on this topic. currently investigated.

In the 2020–21 winter *rabi* crop season, 678 farmers have had their fields monitored by DAE at least once in the season. Severity, incidence and management survey are also now being planned and will soon commence for at least for 500 farmers in addition to 500 non-monitored control farmers during April-May 2021. Because of COVID-19 restrictions, field level data collection through face-face interviews will be avoided and data will be collected through telephonic surveys (the same approach was used in the first round of the survey, also to avoid COVID-19 risks). For the collection of phone numbers and contact information of farmers (monitored and control), an additional survey module among extension agents in charge of the FAW pheromone traps will be deployed. In addition to spraying practices, agronomic measures and weather and varieties, the role of landscape diversity on controlling FAW will also be considered.

Objective 6.3 Studies to characterize natural enemies of FAW in Bangladesh

The Activity has awarded BARI a sub-grant to investigate the parasitoid complex of FAW in non-sprayed maize fields as well as in non-maize crops including tomato and cabbage in Bangladesh. This study is on-going during the winter 2020–21 *rabi* season at BARI research station in Gazipur. Eggs, larvae of FAW are being collected from the non-chemical pesticide sprayed crops and reared to identify parasitoids, alongside trapping and quantification of predators. Results from this work will be presented in the 2020-21 Annual Report.

Objective 6.4 Studies on the agroecological management of FAW

This is a new activity that has been added to Objective 6 and is part of a global effort to examine the effectiveness of agroecological methods of FAW control in a range of countries in Asia (most notably India, Bangladesh, Nepal, Myanmar and Vietnam), and a number of countries in Africa. In order to assess the potential for intercropping to reduce FAW damage, the study has been initiated at BWMRI with additional technical guidance and support of the Activity. The trial has been implemented in three locations including Dinajpur, Rajshahi and Gazipur.



Above: Dr. Md. Mostafizur Rahman Shah pf BWMRI staff providing interviews on the maize intercropping and FAW control experiment supported by the Fighting FAW activity to members of the media in Dinajpur on March 15th, 2021. Note the cowpea understory planted below the maize.

There are four treatments, as follows:

- Monoculture maize with 60 cm row to row
- Monoculture maize with 90 cm row to row
- Maize + Cowpea intercrop with 60 cm row to row
- Maize + Cowpea intercrop with 90 cm row to row

The study has been set following randomized block design with four replicates. The study is on-going during the winter 2020-21 maize growing season.

Objective 6.5 Digestibility of rice to assess risk damage to an alternative host

Like Objective 6.4, Objective 6.5 is an additional activity that was added to the Fighting FAW work plan in response to requests from the Bangladesh FAW Task Force to study the risks to rice – the country's staple crops – from FAW attack. To this end, and with support from the Activity, BRRI has set up a study the ability for the maize strain of FAW found in Bangladesh to digest and reproduce on a diet of different rice cultivars (both high yielding and local). This experiment is ongoing at the BRRI greenhouse and laboratory in Gazipur, with the following two objectives: (a) Quantify the impact of rice varieties on the development of FAW

and ability of FAW to reproduce when consuming only rice. (b) Examine the variable responses in FAW digestibility and reproductive rates across a range of rice cultivars.

Sixteen rice varieties, including BRRI dhan 28, BRRI dhan 29, BRRI dhan 33, BRRI dhan 48, BRRI dhan 49, BRRI dhan 50, BRRI dhan 58, BRRI dhan 67, BRRI dhan 75, BRRI dhan 87, BRRI dhan 88, BRRI dhan 89, BRRI dhan 9, Sadamota, Kalijira and BINA dhan 10 were collected from the Genetic Resources and Seed division and Grain Quality and Nutrition division of BRRI. Seeds of these varieties were sown in pots and trays on 25 December 2020 in screenhouses and on 16 January 2021. Larvae of FAW were collected from maize fields at Alamdanga, in Chuadanga district. They were transported to Gazipur and reared in BRRI's entomology laboratory. Both maize plants and an artificial diet provided as feed. Larvae then progressed to adults. The adult moths were subsequently allowed to lay eggs on maize leaves. Several adult moths were also allowed to oviposit on brown paper in a plastic jar. With these actions, BRRI has been able to develop stock cultures of FAW that are now maintained in the lab. After seed germination and growth to 30 days, ten 1st instar larvae were released into rice plant pot. Released larvae were confined by mylar film cages in each pot. This study is now ongoing and detailed results on the ability of FAW to subsist and reproduce on a diet of rice plants will be provided in the 2020-21 Annual report.



Above: (Left) Potted rice seedlings infested with 10 instar larvae of FAW were covered by mylar mesh. (Right) Rice seedlings ready for FAW larvae addition in a tray. One hundred 2nd instar larvae of FAW were released in each tray

Challenges encountered in the reporting period and future contingencies

The primary challenge encountered in the reporting period was COVID-19. As described in this report, in order to reduce the risks of infection at Fighting FAW events or in field activities, work in Objectives 2.1, 2.3, 3.1, 4, and 5 were significantly impacted with details of modifications and alternative work modalities presented within this report. At the time of writing, a second wave of COVID-19 is affecting Bangladesh, forcing lockdowns at a national level. Even before lockdown occurred, however, CIMMYT significantly curtailed field activities and closed offices in anticipation of increased risk to staff and partners. In addition, international travel and field trips have been suspended until further notice out of an abundance of caution. The length of the second wave and its implications on Fighting FAW activities are at this time unclear and difficult to predict; however, learning from experience in 2020, the Activity will work to implement the project to its fullest extent given the constraints imposed by the pandemic.

Annex I: Media on Fighting FAW activities in the reporting period

National print media			
S N	Newspaper	Date	Link
1.	Dhaka Tribune	November 23, 2020	https://dhakatribune.com/bangladesh/agriculture/2020/11/23/fall-armyworm-poses-threat-to-farmers-income-livelihoods/
2	Channel I	March 28, 2021	https://cimmyt-my.sharepoint.com/:v/g/personal/a_kurishi_cimmyt_org/EUd1eitFjglHvpaoleBCT74BVWdgABer5r8Y4l8kVWmlaGQ?e=JdB8Tp
3.	Mathabhanga.com	November 25, 2020	https://bit.ly/3fz5jD7
4.	Meherpur Protidin	March 22, 2021	https://bit.ly/2JbfuSf
5.	Sarakhon (Online portal)	23 Nov '20	https://cutt.ly/7cE1VEs
6.	Daily Jagodesh24 (Online News Portal)	23 Nov '20	http://jagodesh24.com/archives/49498
7.	Daily Meherpur Protidin (Regional newspaper)	24 Nov '20	https://cutt.ly/JcEMRsI
8.	Daily MuhurtoTv.com (National-Online)	25 Nov'20	https://cutt.ly/OcRi7Ac
9.	Channel 24 National TV Channel	02 Dec'20	https://youtu.be/sDha1PsknqU

Annex II: Staff Involved in Fighting FAW Project

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Annex III: Project Subcontractors and Key Partners

Partner	Partnership objective	Leveraging opportunity	Status of partnership
Government of Bangladesh			
Bangladesh Agricultural Research Institute (BARI)	<p>i. Monitoring of FAW in non-maize crops, viz. cabbage, tomato and tobacco.</p> <p>ii. Develop bio-rational based IPM technologies for cost-effective and sustainable FAW management.</p>	With a network of regional research stations and strong input into the development of extension materials, approaches and policies, and being integrated in the Ministry of Agriculture, BARI provides leveraging opportunities to mainstream sustainable intensification innovations into the Government of Bangladesh's National Agriculture Research and Extension System.	In June'20, the activity signed a subgrant with BARI. Crops for monitoring for FAW population fluctuation started after protocol development and training to related BARI scientific personnels. Field survey for FAW natural enemies as well as multi-location trials are on-going on the bio-rational based management of the pest. All the field works will be completed within project period, which will followed by report preparation and submission. This subgrant will continue till mid of May'21.
Bangladesh Wheat and Maize Research Institute (BWMRI)	Develop agro-ecological management tactics against FAW as well as to strengthen FAW mass rearing facilities.	With a network of regional research stations and strong inputs into the development of extension materials, approaches and policies, and being integrated in the Ministry of Agriculture, BWMRI provides leveraging opportunities to mainstream sustainable intensification innovations into the Government of Bangladesh's National Agriculture Research and Extension System.	The Wheat Research Centre (WRC), a former component of BARI, was transformed into BWMRI in mid-2018. In June'20, the activity has signed a subgrant with BWMRI on agro-ecological approaches to FAW management, focusing on soil management and intercropping. This field level multi-locations trials works are on-going now and will be completed within project period, which will followed by report preparation and submission. This contrat will continue till end of May 2021.

Partner	Partnership objective	Leveraging opportunity	Status of partnership
Bangladesh Rice Research Institute (BIRRI)	i. Monitoring of FAW in rice crop. ii. Laboratory studies on the Development and feeding performance of FAW on two rice varieties	With a network of regional research stations and strong inputs into the development of extension materials, approaches and policies, and being integrated in the Ministry of Agriculture, BIRRI also provides leveraging opportunities to mainstream sustainable intensification innovations in the Government of Bangladesh's National Agriculture Research System.	The activity signed a sub-grant in October 2020 to monitoring of FAW in rice and research on "Development and feeding behavior of FAW on two rice variety in laboratory". Both the laboratory and field monitoring works are on-going and will be completed with the project tenure. This will continue till mid of June 2021
Department of Agricultural Extension (DAE)	Assist the Department of Agricultural Extension (DAE) in deploying awareness raising and training campaigns	The DAE has over 13,000 field extension agents located across Bangladesh. The Department collaborated with the activity working on sensitization of DAE agents to FAW management practices and approaches provides large opportunities for reaching and raising the awareness of farmers, with sustainability through messaging after the end of FAW activity.	The Activity continues to collaborate with DAE informally and synergistically. To ensure FAW monitoring and management, the activity is providing training to frontline DAE staff.
Bangladesh private sector			
Ispahani Agro Limited (IAL)	Assist IAL, the pioneer & leading bio-pesticides company of the country to develop and commercialize the cost-effective bio-pesticide based management solution of FAW	There are 10+ activities (ToT for sales team, video development and screening, promotional material development and disbursement, crop consultant program, IPM championship program, educational and marketing campaign, dealers, retailers and farmers training, advertisements such as those put out by road shows) included in the agreement, aimed at rapid commercialization of the product.	The 1:1 matched fund agreement with this company started on August 2020 and will continue till June 2021. The field level promotional works are on-going now and all of them will be completed within the project tenure followed by report preparation and submission.

Partner	Partnership objective	Leveraging opportunity	Status of partnership
Syngenta Bangladesh Limited (SBL)	Assist SBL, the leading pesticides company of the country to promote and commercialize recently registered seed treating agent against FAW for cost-effective management solution of FAW	There are several activities specially to provide technical support to Syngenta by training their channel line dealers and village-level sales and commission agents on different aspects of FAW. Also, video development and showing, promotional material development and disbursement, dealers, retailers and farmers training etc. included in the agreement that aim for a rapid commercialization of that product.	The 1:1 matched fund agreement with this company began on October 2020 and will continue till June 2021. The field level promotional works are on-going now and all of them will be completed within the project tenure followed by report preparation and submission.
NGOs			
Agricultural Advisory Society (AAS) (project subcontractor)	Increasing awareness among maize growing farmers through video show and distributing learning materials.	The Activity worked with AAS in Phase II and CSISA-Bangladesh to reach 110,000 farmers with village training video screenings accompanied by question-and-answer sessions to raise awareness among farmers on scale-appropriate machinery and associated crop management practices. During CSISA III, AAS is working to promote better bet agronomy practices including healthy rice seedlings, early wheat sowing and fighting the fall armyworm.	AAS works under project sub-grants to conduct village-level video shows and on training farmers on FAW mnagement issues. In the previous reporting year, AAS organized a total 1,080 video shows in 921 villages where 1,32,358 farmer audiences watched those shows. Under this sub-grant, AAS has shown video on awareness on fall army worm. This partnership completed in 2020.
Agro-Input Retailers Network (AIRN) (project subcontractor)	Increase awareness and educating agro-inputs dealers through training program in maize growing zone.	AIRN was awarded sub-grants in project year 2019 for equipping the input dealers to fight the threat of fall armyworm.	Partnering with the project, AIRN trained 764 agro-input retailers from 10 districts on fall army worm, its life cycle, impacts and management to retailers of Dinajpur, Bogra, Rangpur, Nilphamari, Thakurgao, Meherpur Jhenaidah, Chuadanga, Manikganj and Lalmonirhat districts. The training sessions were held from 22 November- 10 December'20 under subgrant contract. This partnership completed in 2020.



Maize and wheat science for improved livelihoods

Vision

CIMMYT contributes to the development of a world with healthier and more prosperous people — free from the threat of global food crises and with more resilient agri-food systems.

Strategic goals

CIMMYT's strategic plan provides the direction to deliver on our mission and contribute strongly to the wider development agenda. Key strategic goals:

- Increasing research impact
- Accelerating genetic gains through novel diversity and tools
- Developing and improving access to stress-tolerant varieties
- Sustainable intensification for improved livelihoods
- Enhancing nutrition and processing quality

It also marks a shift in our focus from commodity-based research to an integrated approach centering on agri-food systems – a change that we believe is critical for working more effectively to strengthen food security, reduce poverty and enhance human nutrition.

Beyond CIMMYT's "core research," this strategic plan assigns higher priority to:

- Reducing malnutrition
- Empowering female farmers
- Sharing knowledge with partners and farmers



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