



## **Ministry of Agriculture and Natural Resources**

### **Fall Armyworm Management Strategy and Action Plan for Ethiopia**

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## Abbreviations and acronyms

AAW	African Armyworm
ATVET	Agriculture vocational technical educational training center
CABI	Center for agriculture and bioscience international
CIMMYT	International-Maize-and-Wheat-Improvement-Center
CSA	Central statistics agency
DLCOEA	Desert locust control organization for Eastern Africa
EIAR	Ethiopian Institute of Agricultural Research
FAO	Food and Agriculture Organization
FAW	Fall armyworm
ICIPE	International center for insect physiology and ecology
IPPC	International plant protection convention
ISD	Institute of sustainable development
ISPM	International standards on phytosanitary measures
MoANR	Ministry of agriculture and natural resources
MLND	Maize lethal necrosis disease
NARC	National agricultural research council
NARS	National agricultural research system
NGO	Non-governmental organization
NPV	Nuclear polyhedrosis virus
PAN	Pesticide action nexus
PHC	Plant health clinics
PHRD	Plant health regulatory directorate
PMSS	Pest management support service
RBoANR	Regional bureau of agriculture and natural resources
SG 2000	Sasakawa global 2000
SMS	Short message system
SNNPR	Southern nations and nationalities and peoples region
SWOT	Strengths, weaknesses, opportunities and threats
ToT	Training of trainers
USAID	United States Agency for International Development

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## Fall Armyworm Management Strategy and Action Plan

### Background

Agriculture is Ethiopia's most important sector, crucial for the country's economic development and the livelihoods of nearly 85% of its people. Because of this it has been given the highest emphasis as the engine for national economic development. Based on this the government of Ethiopia has been implementing five years "growth and transformation program" to boost agricultural productivity in the country and has completed the first phase and entered the second one.

Success in surplus production of food and industrial crops could be only achieved with the proper implementation of good agricultural practices and pest management from seed-to-seed needs to be given due weight. Many regular, migratory and sporadic pests have been threatening crop production in Ethiopia. The fall armyworm (FAW), *Spodoptera frugiperda* (Smith) is a recently introduced invasive pest, which is reported to feed on more than 100 species of plants, but the most affected ones are maize, sorghum and rice.

Although it is an introduced crop, maize is now the highest productive and widely grown staple crop in Ethiopia. The crop has gained strategic importance in the agricultural sector owing to its meaningful contribution to income generation, employment, nutrition, and food security in the country. Besides, it has a huge potential as an export commodity for value-added food or non-food products. It is grown in almost all agro-ecological zones. It grows under a wide range of environmental conditions between 500 to 2400 meters above sea level. Maize is Ethiopia's leading cereal in terms of production, with 7.15 million tons grain produced by 9.55 million farmers on 2.11 million hectares of land (CSA, 2015/16 *meher* season). Maize is mainly grown in the four big regions of the country: Oromia, Amhara, SNNP, and Tigray and Oromia and Amhara, which contributed to almost 80% of the maize produced in 2012 (CSA, 2011/2012). Over half of all Ethiopian farmers grow maize, mostly for subsistence, with 75 % of all maize produced being consumed by the farming household.

Maize production in Ethiopia has been challenged by different factors including shortage of high yielding, pest resistant and quality varieties, poor implementation of good agronomic practices, drought, flooding, soil nutrient deficiency, damages by weed competition, insect pest and diseases causing pathogens. The major insect pests of maize in the field include the migratory African armyworm, *S. exempta* (Walker) and the regular pests mainly the three stalk borer species (*Chilo partellus*, *Busseola fusca* and *Sesamia calamistis*), aphids (*Rhopalosiphum maidis* and *R. padi*), and termites that have been affecting the crop at pre-harvest and the maize and rice weevils (*Sitophilus zeamais* and *S. oryzae*), flour beetles (*Tribolium* spp.) and grain moth, *Sitotroga cerealella* in postharvest conditions and also the recently introduced larger grain borer, *Prostephanus truncates* (Horn) is in the southern outskirts of the country bordering Kenya. The addition to this list is the fall armyworm (FAW) *Spodoptera frugiperda* (Smith), which has come on top of the maize lethal necrosis disease (MLND).

The fall armyworm is an introduced invasive, which is reported to feed on more than 100 species of plants, but the most affected ones are maize, sorghum and rice. The FAW is a tropical insect species that is native

to the Western Hemisphere, where it is distributed from Brazil northward, throughout Central America and North America. It migrates between the tropical and temperate environments and forms armyworm in fall hence it is called fall armyworm.

There is some evidence that two strains of the FAW exist, based primarily on their host plant preference. One strain feeds principally on maize, but also on sorghum, cotton and a few other hosts if they are found growing near the primary hosts. The other strain feeds principally on rice, Bermudagrass, and Johnson grass. It was reported to feed on about 100 different species but considered as a major pest of maize, rice, and forage grasses.

FAW larvae cause damage by consuming foliage. Young larvae initially consume leaf tissue from one side, leaving the opposite epidermal layer intact. The second and the third instar larvae begin to make holes in leaves, and eat from the edge of the leaves inward. Feeding in the leaf whorl of maize often produces a characteristic row of perforations in the leaves. Larval densities are usually reduced to one or two per plant when larvae feed in close proximity to one another, due to their cannibalistic behavior. Older larvae cause extensive defoliation, often leaving only the ribs and stalks of maize plants, or a ragged, torn appearance. Although fall armyworm generally feeds on foliage, but during heavy infestations, larvae will also feed on maize ears.



Plate 1 Fall armyworm damage symptoms on vegetative and male reproductive parts of maize (Photo by Zebdewos, Mar 2017).



Plate 2 Fall armyworm damage symptoms on growing maize cob (Photo by Zebdewos, Mar 2017).

The fall armyworm has been confined to the new world for far too long despite occasional interceptions by European quarantine services in recent years. FAW was first detected in Central and Western Africa in early 2016 (Benin, Nigeria, Sao Tome and Principe, and Togo) and in late 2016, in Southern Africa. In 2017 it has been detected in the whole of mainland Southern Africa (except Lesotho and the Island States), in Cameroon, Ghana, Niger and Ethiopia, Kenya, Uganda, Burundi, Rwanda, and it is expected to go further north. For the time being, its modality of introduction and its spread to Africa and adjustments of its bioecology are still speculative (FAO, June 2017). The pest is labeled as a new invasive species in Africa where every country reported outbreaks. The presence of at least two distinct haplotypes within samples collected on maize in Nigeria and São Tomé suggested multiple introductions into the African continent (Goergen et al, 2016).

The pest is known to cause extensive crop losses of up to 73 percent depending on existing conditions and is difficult to control FAW larvae with a single type of pesticide, especially when it has reached an advanced larval development stage (IPPC, Feb 28, 2017). Warm, humid and heavy rainfalls favor the multiplication of the FAW. It was estimated to cause annually loss worth of \$300 to \$500 million worth maize in the USA and ca. 600 million in Brazil. The rate of spread of FAW is reported to spread 483km/generation and weather front are thought to be primary tool for its long distance.

The presence of this pest was first detected in South Western Ethiopia in March 2017. A team of experts from Mizan Plant Health Clinic who for the first time intercepted the insect. Currently it has been reported in 411 woredas from across the country. Totally 22.23% (**600,296**) of the total maize planted to date (irrigation, belg and meher) has been infested with FAW. Using the available resources and human capacity out of this area, it was possible to spray only on 38.75% with insecticides. The cultural control of FAW by handpicking and killing accounted for 53.50% of the total FAW infested area to date. The area where it was not possible to take control measure on about 8% (46522.94) of the total infested area, which

is about eightfold of the total area planted in Rwanda every year. Such a country wide intervention within a short period took place because of the significant engagement and participation of farmers in using cultural control measures, mainly handpicking and killing. Farmers' engagement was the due to efforts made to increase awareness on the invasiveness of the FAW and its possible impact on maize and other cereals production. Despite the increased efforts to contain the spread and damage of FAW, reinvasion has occurred in most of the places it was observed earlier. . As a result, there is a fear that the population of the insect may be high enough to cause serious damage during tasseling and cob setting periods (Annex I)

In the western hemisphere the insect has been causing economic damage mainly on maize since the beginning of the 19<sup>th</sup> century and control actions include the use of to reduce economic damage using physical methods, pesticides and resistant host plants. The trench method was originally developed to control marching fall armyworm and has been effective ever since it was introduced; pesticides including carbaryl, malathion, synthetic pyrethroids and chlorpyrifos have been in use for many years; host plant resistance mainly use of *Bt* maize has been a more recent practice.

In Africa because of its very recent introduction insecticides have been widely used to control the FAW. Likewise, in Ethiopia the use of synthetic insecticides and handpicking have been promoted to address the FAW problem. The insect has been researched in Americas for a very long period and there are models for monitoring and prediction, sex pheromone lures, resistant maize varieties (conventional and *Bt* maize varieties). Different insecticides biological control agents (egg parasitoids, NPV and entomopathogenic nematodes) identified, evaluated and recommended.

## **Situation Analyses**

### **FAW pest history in Ethiopia**

Regarding the fall armyworm situation in Ethiopia, it was a team of experts from Mizan Plant Health Clinic who first intercepted the insect in March 2017 in Yeki woreda, Sheka zone in SNNPR and communicated it to the Ministry of Agriculture and Natural Resources (MoANR). In response, the MoANR sent a group of high level experts who confirmed the presence of the fall armyworm in SNNPR in two woredas and nine kebeles in Bench-Maji, in two woredas and two kebeles in Keffa and in one woreda and one kebele in Sheka. The damage in some farms visited in Bench-Maji reached 100% but through intervention using insecticides (Malathion and Chlorpyrifos) the crops have recovered. Since its first report, the insect has been spreading to new areas in SNNPR, Gambella and Oromiya regions. The most recent report showed that the insect has reached Amhara, Benishangul Gumz and Tigray regions.

### **Efforts made to address the FAW**

Prior to its emergence in Ethiopia and following its arrival, the MoANR, regional BoANR and other partner institutions have have been making multifaceted efforts to curtail the damage by FAW where a number of preparatory activities and control measures were taken. Some of the accomplished tasks were review of, global information sources on the FAW, establishing technical committee, developing different awareness creation materials, organized training of trainers program for federal and regional stakeholders that was

extended to within regions, woredas and kebeles; producing emergency action plan, which included training provision, wider awareness creation using different communication media, distribution of technical leaflets and posters in different local languages, mobilization of resources (finance, vehicles and insecticides); human and material resources were galvanized from different national and non-governmental institutions including regional BoANR, EIAR, Hawassa University, DLCOEA, FAO, CIMMYT, SG2000, ICIPE, USAID, and CABI. Additional undertaken tasks are nationwide coordinated survey and exchange of FAW current distribution, damage and management; formulation of research agendas by EIAR and FAW policy areas; involvement of graduate students to research on the biology and ecology and management of the FAW; fast track testing of management options including insecticides, sex pheromone traps, botanicals and cultural methods are being underway.

#### SWOT analyses on FAW management

<b>Strength</b>	<b>Weakness</b>
Presence of decentralized and functional government structure for the sector	Inefficient application of phytosanitary system
Presence of mass awareness mechanism	Weak sharing of knowledge and skill acquired in ToTs on the biology, ecology and management of the FAW
Availability of pest information exchange mechanism	Absence of published national and quarantine pest checklist
Technical backstopping capacity in the MoANR to address the FAW at Federal level	Weak surveillance, survey and monitoring of pests due to lack of well-equipped, facilitated and staffed National and Plant Health Clinics (PHC)
Rapid response and prompt allotment of resources from the MoANR	Failure to fully implement the Pest Management Support Service Strategy
Capability for pest identification and development of management methods	Absence of proactive and responsive plant pest management system
The expansion of agricultural research and higher learning institutions who can address the FAW	Shortage of qualified and trained research staff and up-to-date plant protection facilities
	Weakness to perform early detection and take rapid action
	Limited funding for research and development interventions on FAW
	Weak curriculum to address emerging pest problems including the FAW and lack of feedback about the graduates from employing institutions
	Weak enforcement of the mechanisms of safe and effective use of pesticides
	Absence of specific FAW management technologies which comply to Ethiopian conditions
<b>Opportunities</b>	<b>Threats</b>
Presence of successful experience in community based AAW management	Insecticide price hike
Presence of collaborating local, regional and	Availability of maize crop through continuous planting

international institutions	using irrigation, Belg, Meher and residual moisture
Federal and regional governments commitment to address emerging pests	Under valuing of the plant protection profession in job evaluation and grading process
Availability of companies that can deliver pesticides and other management tools	Presence of diversified plants, weather and agro-ecologies suitable for the FAW
	Emergence of other pest problems which compete for resources
	Competing demands for government's resources
	Recurrent droughts

### Strength

**Presence of functional government structure for the sector** The MoANR has a structure from Federal through regions to zones, woredas and kebeles. Plant protection experts are present all the way to woreda level whereas at kebele level there is one development agent committed to work on crops including pest management, agronomy and inputs distribution. Besides, there are 16 plant health clinics that are accountable to the different national regions and coordinate pest management activities. This organizational setup is suitable to deliver pest related information, knowledge and skill. However, it is important to note that there are vacant places and human and material capacity limitations at the different levels, which have been constraining the PMSS.

**Presence of mass awareness mechanism** whenever there are emergency pest problems due to mainly introduction of new pests the MoANR has well established awareness creation mechanism in which leaflets, posters, public media, schools, market places and social gatherings are used to communicate the occurrence of new pests. The communication materials are prepared and distributed in different local languages to facilitate information diffusion.

**Availability of pest information exchange mechanism** Standardized FAW information collection, processing and communication formats were first developed by the MoANR and delivered to national regions who in turn communicated all the zones, woredas and kebeles. Besides telephone, e-mail and written reports are used to provide updates on FAW current situation. The updates are centrally processed twice a week, weekly shared with the MoANR and regional BoANR command posts and feedbacks are given to all concerned.

**Technical backstopping capacity in the MoANR to address the FAW at Federal level** At the Federal level there is national technical committee composed of experts from different institutions, the ministry provided ToT by pulling together available human capacity from different institutions, technical experts participated in different international, regional and national workshop organized to address FAW. Shared accessed information sources including on the biology, ecology, and management of the insect. Continuous technical backstopping under field condition is being provided by Federal Plant Protection Directorate staff to the national regions.

**Prompt allotment of resources from the MoANR** Soon after the problem was reported the MoANR availed resources: pesticides, sprayers, vehicles and finance to facilitate the surveillance, survey, monitoring and control of the FAW. The following stakeholders including EIAR, RBoAR, Universities, NARC, FAO, DLCOEA, CIMMYT, SG200, ICIPE and USAID contributed in different ways for the same cause. EIAR allocated fund for training of experts and researchers from federal, regional and higher learning institutions and also for evaluation of different bio-pesticides, insecticides and varietal screening.

**Capability for pest identification and development of management methods** Species identity confirmation was made by national capacity from the MoANR and EIAR. The National Agricultural Research System and higher learning institutions have the capacity to address the FAW situation. In line with this pesticides are being screened to identify effective ones, FAW sex pheromone blends are being evaluated to pick the most attractive pheromone blend for use to monitor and if possible mass trap the FAW, maize varieties screening, and survey on natural enemies.

**Expansion of agricultural research and higher learning institutions who can address the FAW** There are agricultural research centers and teaching institutions across the country that are very well positioned to address the FAW problem and other economic pests affecting maize and other crops in the country. Most of the young staff in research centers, universities with agricultural faculties and ATVETs can be recruited and conduct research on different aspects of the FAW.

## **Weaknesses**

### **Inefficient application of phytosanitary system**

The phytosanitary system put in place has not been properly implemented both within Ethiopia and in the continent at large hence countries have not been made aware of the introduction of the FAW in the continent before it occurred at an outbreak level. As a consequence it was not possible to contain and mount eradication program on the pest. The absence of published national and quarantine pest checklists have curtailed the activities in phytosanitary.

### **Weak sharing of knowledge and skill on FAW**

Although series of trainings were provided by the MoANR, the BoANR and other stakeholders on FAW biology, ecology and management, the coverage was seriously limited and has not covered all the maize and sorghum growing areas from across the country. Besides, trainings are poorly planned, the duration of the trainings was often short and the contents were inadequate.

### **Weak surveillance, survey and monitoring of pests**

The occurrence and status of pests need to be determined through regular survey and surveillance. However, this activity was limited in Ethiopia due to inadequate capacity of the plant health clinics and absence of national pest diagnostics laboratories. Weakness to carry out early detection and take rapid response. FAW management requires early detection and taking prompt action, which can be achieved with efficient monitoring and surveillance system. This is one of the most critical shortfalls of the Ethiopian pest management support system.

### **Failure to fully implement pest management support service strategy**

The pest management support service strategy was communicated through consultation workshops and the published document was widely circulated. However, the strategy has not been fully implemented. Instead the national regions remained with having weak structures for plant protection; consequently the staff number and composition remained inadequate to respond to the FAW crisis.

### **Shortage of qualified and trained research staff and modern plant protection laboratory facilities**

There is shortage of qualified plant protection professionals in NARS (Research, Universities,) and extension. Moreover, the career structure has not been appealing enough to attract and retain qualified and competent staff for longer period. Plant protection requires up to date pest diagnostics and rearing/culturing facilities, which are lacking in Ethiopian research institutions. Modern facilities such as molecular detection tools, double haploid techniques for resistance breeding do not exist.

### **Limited funding for research and development interventions**

In response to the FAW crisis the MoANR and EIAR appropriated limited resources to carry out surveys, conduct trainings and take management actions. Since the insect is expected to remain a threat and the limited knowledge available on its different aspects under Ethiopian condition, substantial funding is required for research and development. However, the funds allotted have been too small.

### **Weak curriculum to address the problems of emerging pest**

University curricula are not proactive to entertain new pests and direct students to carry out research on such pests. This has been happening because of absence of periodic curriculum review, updated teaching materials, weak link with research and extension and also shortage of qualified and experienced instructors.

### **Poor emphases on safe and effective use of pesticides**

Ethiopia has the law and guidelines on pesticides registration and control. Nevertheless, the enforcement mechanism for safe use and handling of pesticides is under emphasized. The knowhow of pesticides handlers including professionals working in plant protection has been limited; in addition the technical skill on handling application equipment and maintenance has been low. Moreover, there is very short supply and use of personnel protective equipment.

### **Absence of specific FAW management technologies which comply with Ethiopian conditions**

The insect is a very recent introduction to Ethiopia and the African continent. Because of this the actions being taken to control this invasive insect were not systematically chosen due to lack of technologies to choose from and apply.

### **Opportunities**

#### **Presence of successful experience in community based African Armyworm (AAW) management**

The MoANR in collaboration with the DLCOEA have been implementing community based approach to carry out surveillance, survey and monitoring of the AAW. Because of this communities have acquired

sufficient knowledge on biology, monitoring and forecasting of AAW, which resulted in making early detection and taking rapid response in places.

### **Presence of collaborating local, regional and international partner institutions**

There are different local, regional and international organizations that have been working in the country supporting pest management related initiatives. These include NGOs (PAN Ethiopia, ISD, Crop Life Ethiopia), DLCOEA, FAO, CIMMYT, ICIPE and SG200. The presence of these organizations gives opportunities in getting expert support, pest management information, transit technologies and other resources to help better address emerging pest problems in collaboration with government institutions.

### **Federal and regional governments' commitment to address emerging pests**

As has been witnessed since the start of FAW outbreak government has been providing all out support to minimize FAW infestation and damage mainly on maize. Similarly the government has successfully responded to significantly reduce damage by recently introduced invasive pests such as the tomato fruitworm, *Tuta absoluta*.

### **Availability of companies that can deliver pesticides and other management tools**

The Adami Tulu Pesticide Formulation Plant, the only one in the country, has been the major supplier of the insecticides used to control FAW. It is expected to produce and supply effective insecticides recommended by the research system. There are many pesticide companies, agents and dealers who can supply pesticides to respond to pest emergency problems.

## **Threats**

### **Pesticide price discrepancy and escalation**

As an emergency response to the FAW outbreak pesticides, which were registered for use against already existing pests in the country are being used. But the price of such chemicals was variable. So far there are no locally evaluated and registered insecticides, which are effective, affordable and safe. Efforts are being made to locally screen and register pesticides in a fast track. Accordingly the insecticides chlorantraniprole, flubendiamide and imidacloprid + chloronicotinyl are under evaluation and may be found effective against the FAW, but their prices could be prohibitive in routine control on maize and sorghum. Moreover, prices of such pesticides may escalate due to uncompetitive marketing practices as was witnessed in the control of *Tuta absoluta* whereby the insecticides cost twofold from their prices at the beginning of the crisis.

### **Continuous planting of maize using irrigation, Belg, Meher and residual moisture**

The production of maize during belg, meher seasons and in residue moisture in more than 2.3 million hectares of land, the staggered planting dates used depending on onset of rainfall and expansion of small-to-large scale irrigated maize are feared to be conducive for the continuous reproduction and spread of the FAW. This may complicate the management of the FAW.

### **Under valuing of the plant protection profession**

The job evaluation and grading process put the maximum grade at 14 for plant protection experts. This is felt as far below the grade to which the experts should have been assigned considering the complexity of the work they do, level of responsibility they shoulder, high job related risks they face and critical decision they make in the use of pesticides and other related inputs. This threat is more pronounced in the plant health clinics jobs, which play a pivotal role in the plant protection activities to enhance production and productivity. This will exasperate the already existing attrition of qualified plant protection staff to better paying positions and related institutions.

### **Diversified plants and conducive environment and ecologies**

The country has diverse ecosystems stretching between below sea level to alpine heights. Because of this and the polyphagous habit of the insect the likelihood that the insect will get wide range of host plants that may favor year round reproduction is very high.

### **Competing demands for government's resources**

The challenges facing agriculture and the rural community is diverse and changing. These different needs and challenges would inevitably put pressure on government resources, and may compromise the resources allocated for FAW management.

### **Recurrent droughts**

Droughts and other natural disasters may result in shift of attention and resource commitment by the government and other partners.

### **Emergence of other pest problems which compete for resources**

The maize lethal necrosis and the larger grain borer are serious threats and their importance was overlooked because of the fall armyworm. Other pests that may come after the FAW may also sway the attention away from its management.

### **Critical strategic issues identified**

1. Limited policy support on technical coordination and organizational setup, enforcement of defined legal provisions,
2. Inadequate surveillance, survey and monitoring
3. Insufficient human, material, facility and financial resources
4. Lack of well-structured communication network for knowledge sharing among all stakeholders
5. Absence of locally generated FAW management technologies

## **Fall Armyworm Management Strategy and Action Plan**

### **Approaches/methodology used in developing the strategy**

Team of experts identified by the MoANR and assigned to serve as technical committee members to address the FAW problem were pulled together from the MoANR, EIAR, Hawassa University, DLCOEA,

FAO and ICIPE. The CIMMYT and SG2000 did not make it due to lack of plant protection expert and other critical assignments, respectively. The other team members traveled to Bishoftu and worked on the development of the strategy. Different information sources and the PMSS strategy were used during the formulation of this strategy. The team developed a framework and agreed on the content of the framework proceeded in putting together the strategy draft by working in a round table by discussing each and every component put in an agreed framework. The different components are described below.

### **Mission of the Plant Health Regulatory Directorate**

Provide pest management support services that could significantly and sustainably reduce losses due to pests and ensure increased crop productivity and produces and products quality for domestic and export markets.

### **Vision of the Plant Health Regulatory Directorate**

Create proactive and sustainable pest management support service system that promotes the growth and transformation of Ethiopian crop production, utilization and marketing in the 21<sup>st</sup> century.

### **Values**

- ◆ Workforce integrity and professionalism
- ◆ Commitment to conventions and rules pertinent to plant protection
- ◆ Devotion to promotion of safety first pest management technologies
- ◆ Competence and dynamism in PMSS system
- ◆ Promote public and public-private partnership in pest management

### **Strategic goal**

To implement safe, environmentally friendly, cost effective and socially acceptable fall armyworm management support services that contributes to sustainably increase maize production and productivity and thereby enhancing the marketing, distribution and proper utilization of safe food.

### **Objectives of the FAW strategy:**

- To create a mechanism to have a common understanding and sharing of responsibility among stakeholders in the country,
- To develop priority areas of interventions in Research, Extension, Education and Training
- To develop a system to coordinate efforts of different stakeholders
- To identify the required resources for the FAW management,

### **Strategic options /strategic directions**

- I. **Enhance policy support on technical coordination, organizational setup and enforcement of defined legal provisions in pest management**
  - Straighten out the technical coordination to better respond to emergency pest problems,
  - Institutionalize technical linkage of plant protection offices among the MoANR, RBoANR, and NARS,
  - Review and improve the job evaluation and grading for plant protection professions,

- Fully implement the pest management support service strategy,
- Finalize and publicize the different plant protection, quarantine and pesticide related legislations and directives.

## **II. Improve surveillance, survey and monitoring of the FAW**

- Implement the set of surveillance and survey standards (ISPM 6),
- Develop, periodically review and implement survey and monitoring protocols,
- Mobilize resources, put in place survey and monitoring tools and carry out surveillance, survey and monitoring,
- Establish community based FAW forecasting, monitoring and early warning system,
- Strengthen information exchange with neighboring countries.

## **III. Increase human, material, facility and financial resources**

- Build the human resource technical capacity,
- Strengthen plant health clinics and quarantine posts,
- Establish and upgrade national pest diagnostics laboratories,
- Strengthen linkages of FAW management efforts across the country
- Secure finance/fund.

## **IV. Put in place well-structured communication network for knowledge sharing among all stakeholders**

- Develop/adapt IT based pest survey data management,
- Establish National Web Based Platform,
- Develop and strengthen centralized training and awareness creation system,
- Strengthen Communication Networks between NGOs, MoANRs, BoANRs, Research institutions, Higher learning institutions, Regional and international partners,
- Develop various information dissemination and awareness raising and training materials

## **V. Locally generate and promote FAW management technologies**

- Understand the biology and ecology FAW in Ethiopian context,
- Identify effective, safe, available and cost effective insecticides,
- Develop non-chemical methods of FAW management,
- Develop varieties for FAW resistance
- Identify strains of FAW present in Ethiopia,
- Avoid duplication of efforts
- Promote effective FAW management technologies

## **Expected outputs of the strategic options**

- Policy support on technical coordination, organizational setup and enforcement of defined legal provisions in pest management enhanced,
- Surveillance, survey and monitoring of the FAW improved,
- Human, material, facility and financial resources increased,
- Well-structured communication network for knowledge sharing among all stakeholders put in place,
- FAW management technologies locally generated and promoted.

Table Strategic issues, actions and list of detailed activities identified the responsible organizations

Strategic issues	Strategic actions	Detailed activities	Responsible body
<b>Enhance policy support on technical coordination, organizational setup and enforcement of defined legal provisions</b>	<ul style="list-style-type: none"> <li>• Straighten out the technical coordination to better respond to emergency pest problems,</li> </ul>	<ul style="list-style-type: none"> <li>• Develop directives/ guideline on how to coordinate from MoANR to kebele levels</li> </ul>	MoANR and RBoANR
	<ul style="list-style-type: none"> <li>• Institutionalize technical linkage of plant protection offices among the MoANR, RBoANR, and NARS,</li> </ul>	<ul style="list-style-type: none"> <li>• Support establishment of consultation platform,</li> </ul>	MoANR and RBoANR
	<ul style="list-style-type: none"> <li>• Support the placement of plant protection profession in JEG</li> </ul>	<ul style="list-style-type: none"> <li>• Review and improve the job evaluation and grading for plant protection professions,</li> </ul>	MoANR, RBoANR and Ministry of Civil Service and human Resource Dev.
	<ul style="list-style-type: none"> <li>• Promote national pest management support service</li> </ul>	<ul style="list-style-type: none"> <li>• Fully implement the pest management support service strategy,</li> </ul>	MoANR, RBoANR and NARS
	<ul style="list-style-type: none"> <li>• Support preparation and enactment of plant protection related legislations</li> </ul>	<ul style="list-style-type: none"> <li>• Finalize and publicize the different plant protection, quarantine and pesticide related legislations and directives.</li> </ul>	MoANR, RBoANR and NARS
<b>Improve surveillance, survey and monitoring of the FAW</b>	<ul style="list-style-type: none"> <li>• Implement the set of surveillance and survey standards (ISPM 6),</li> </ul>	<ul style="list-style-type: none"> <li>• Provide training on ISPM 6,</li> <li>• Conduct surveillance based on ISPM 6,</li> <li>• Report and act on intercepted pests,</li> <li>• Take rapid response</li> </ul>	MoANR, RBoANR and NARS
	<ul style="list-style-type: none"> <li>• Develop, periodically review and implement survey and monitoring protocols,</li> </ul>	<ul style="list-style-type: none"> <li>• Finalize the drafted protocol,</li> <li>• Promote the protocol,</li> <li>• Carry out surveillance, survey and monitoring</li> <li>• Periodically review the protocol</li> </ul>	MoANR, RBoANR and NARS
	<ul style="list-style-type: none"> <li>• Regularly allocate adequate budget</li> </ul>	<ul style="list-style-type: none"> <li>• Regularly plan and secure finance,</li> <li>• Procure and prepare cost effective survey and monitoring tools and distribute</li> </ul>	MoANR, RBoANR and NARS
	<ul style="list-style-type: none"> <li>• Establish community based FAW forecasting, monitoring and early warning system,</li> </ul>	<ul style="list-style-type: none"> <li>• Identify representative districts and kebeles,</li> <li>• Select farmers and pastoralists and provide training,</li> <li>• Supply and install monitoring tools,</li> <li>• Provide standard format for collecting</li> </ul>	DLCOEA, MoANR, RBoANR and NARS

Strategic issues	Strategic actions	Detailed activities	Responsible body
		data and reporting, <ul style="list-style-type: none"> <li>• Provide technical backstopping</li> </ul>	
	<ul style="list-style-type: none"> <li>• Strengthen information exchange with neighboring countries.</li> </ul>	<ul style="list-style-type: none"> <li>• Create linkage among countries,</li> <li>• Regularly share FAW data and research activities through DLCOEA, FAO, ICIPE, CABI and CIMMYT</li> </ul>	MoANR and NARS
<b>Increase human, material, facility and financial resources</b>	<ul style="list-style-type: none"> <li>• Build the human resource technical capacity,</li> </ul>	<ul style="list-style-type: none"> <li>• Recruit more plant protection experts,</li> <li>• Provide short cycle and on job trainings for existing staff (locally and abroad),</li> <li>• Arrange long term training at MSC and PhD levels,</li> <li>• Organize experience sharing and exchange visits</li> </ul>	MoANR, RBoANR and NARS
	<ul style="list-style-type: none"> <li>• Strengthen plant health clinics and quarantine posts,</li> </ul>	<ul style="list-style-type: none"> <li>• Equip with current lab facilities,</li> <li>• Supply sufficient office supplies and facilities,</li> <li>• Provide field vehicles and tools,</li> <li>• Fulfill the human resource gap</li> </ul>	MoANR, RBoANR and NARS
	<ul style="list-style-type: none"> <li>• Establish and upgrade national pest diagnostics laboratories,</li> </ul>	<ul style="list-style-type: none"> <li>• Fulfill the gaps in the existing national labs in NARS,</li> <li>• Put up well-equipped insectary,</li> <li>• Expedite the construction of the planned labs</li> </ul>	MoANR and NARS
	<ul style="list-style-type: none"> <li>• Secure finance/fund.</li> </ul>	<ul style="list-style-type: none"> <li>• Allocate adequate budget, improve the procurement process and fasten budget release,</li> <li>• Solicit external funding</li> </ul>	MoANR, RBoANR and NARS
<b>Put in place well-structured communication network for knowledge sharing among all stakeholders</b>	<ul style="list-style-type: none"> <li>• Develop IT based pest data management and use</li> </ul>	<ul style="list-style-type: none"> <li>• Introduce SMS for pest information gathering,</li> <li>• Develop pest data collection, storage and retrieval system</li> <li>• Digitize existing and future pest data,</li> <li>• Analyze and provide feedback</li> </ul>	MoANR
	<ul style="list-style-type: none"> <li>• Establish National Web Based Platform,</li> </ul>	<ul style="list-style-type: none"> <li>• Design and develop website dedicated to plant protection,</li> <li>• Link the website to the MoANR homepage,</li> </ul>	MoANR

Strategic issues	Strategic actions	Detailed activities	Responsible body
		<ul style="list-style-type: none"> <li>Regularly update the contents</li> </ul>	
	<ul style="list-style-type: none"> <li>Develop and strengthen centralized training and awareness creation system,</li> </ul>	<ul style="list-style-type: none"> <li>Develop standardized training manual,</li> <li>Plan ToTs at national level,</li> <li>Plan similar trainings at regional level</li> <li>Cascade the training to woredas and kebele,</li> <li>Set a mechanism to evaluate and monitor trainings provided at different levels</li> <li>Preparation and distribution of publicity materials</li> <li>Organize awareness creation forums</li> </ul>	MoANR
	<ul style="list-style-type: none"> <li>Strengthen Communication Networks between NGOs, MoANRs, RBoANRs, Research institutions, Higher learning institutions, Regional and international partners.</li> </ul>	<ul style="list-style-type: none"> <li>Generate data base on stakeholders and collaborators,</li> <li>Organize consultation platform,</li> <li>Plan and conduct workshops, review meetings, seminars,</li> <li>Utilize the web based platform for information sharing</li> </ul>	MoANR
	<ul style="list-style-type: none"> <li>Strengthen linkages of FAW management efforts across the country</li> </ul>	<ul style="list-style-type: none"> <li>Coordinate and exchange FAW related information nationally</li> <li>Continually produce FAW distribution map and circulate across the country</li> </ul>	MoANR
<ul style="list-style-type: none"> <li>Coordinate and exchange FAW related information in national regions</li> </ul>		BoARNR	
<ul style="list-style-type: none"> <li>Organize and exchange season/year round data on FAW status</li> </ul>		Maize growing woredas	
<b>Locally generate FAW management technologies</b>	<ul style="list-style-type: none"> <li>Understand the biology and ecology FAW in Ethiopian context,</li> </ul>	<ul style="list-style-type: none"> <li>Generate information on the biology (field and lab) of the FAW,</li> <li>Generate information on the ecology (population dynamic, seasonal abundance, host plant range, survival and migration)</li> </ul>	NARC, EIAR, RARIs, HLI
	<ul style="list-style-type: none"> <li>Identify effective, safe, available and cost effective insecticides,</li> </ul>	<ul style="list-style-type: none"> <li>Generate data on pesticides registered elsewhere on FAW,</li> <li>Evaluate the efficacy of new and locally available insecticides,</li> <li>Evaluate dossiers of insecticides and register</li> </ul>	NARC, EIAR, RARIs, HLI

Strategic issues	Strategic actions	Detailed activities	Responsible body
		<ul style="list-style-type: none"> <li>• Study insecticide resistance in FAW populations</li> <li>• Develop and popularize guideline on insecticide resistance management</li> </ul>	
	<ul style="list-style-type: none"> <li>• Develop non-chemical methods of FAW management,</li> </ul>	<ul style="list-style-type: none"> <li>• Evaluate and identify effective biopesticides,</li> <li>• Assess and identify indigenous natural enemies,</li> <li>• Identify effective cultural practices effective on FAW,</li> <li>• Evaluate locally available and effective botanicals</li> <li>• Explore on classical biological control of FAW,</li> <li>• Develop IPM approach for FAW control</li> </ul>	NARC, EIAR, RARIs, HLI
	<ul style="list-style-type: none"> <li>• Develop varieties for FAW resistance</li> </ul>	<ul style="list-style-type: none"> <li>• Introduction and evaluation of germplasm from exotic sources for FAW under natural and artificial infestations</li> <li>• Screening of locally developed genotypes for FAW resistance under natural and artificial infestations</li> </ul>	NARC, EIAR, RARIs, HLI
	<ul style="list-style-type: none"> <li>• Identify strains of FAW present in Ethiopia,</li> </ul>	<ul style="list-style-type: none"> <li>• Conduct haplotypes analyses on FAW collected from different corners of the country,</li> <li>• Produce FAW strains distribution map</li> </ul>	NARC, EIAR, RARIs, HLI
	<ul style="list-style-type: none"> <li>• Environmental impact assessment of pesticide</li> </ul>	<ul style="list-style-type: none"> <li>• Provide training on pesticide safety,</li> <li>• Assess the impact of insecticides applied to control FAW on the environment</li> </ul>	NARC, EIAR, RARIs, HLI
	<ul style="list-style-type: none"> <li>• Technically coordinate research</li> </ul>	<ul style="list-style-type: none"> <li>• Prevent duplication of efforts through technical coordination and strengthening the review mechanism</li> </ul>	NARC, EIAR, RARIs, HLI, MoANR and RBOANR
	<ul style="list-style-type: none"> <li>• Technology promotion</li> </ul>	<ul style="list-style-type: none"> <li>• Pre-extension demonstration of technologies,</li> <li>• Organize experience sharing events,</li> <li>• Provide training on generated FAW management technologies</li> </ul>	NARC, EIAR, RARIs, HLI, MoANR and RBOANR

Table Budget estimate by strategic action and list of identified activities

Strategic actions	Detailed activities	Implementation period	Estimated budget ETB	Responsible body
Straighten out the technical coordination to better respond to emergency pest problems,	<ul style="list-style-type: none"> <li>Develop directives/ guideline on how to coordinate from MoANR to kebele levels</li> </ul>	2017/18	820,000.00	MoANR and RBoANR
Institutionalize technical linkage of plant protection offices among the MoANR, RBoANR, and NARS,	<ul style="list-style-type: none"> <li>Support establishment of consultation platform</li> </ul>	2017/18	1,750,000.00	MoANR and RBoANR
Support the placement of plant protection profession in JEG	<ul style="list-style-type: none"> <li>Review and improve the job evaluation and grading for plant protection professions,</li> </ul>	2017/18	310,000.00	MoANR, RBoANR and Ministry of Civil Service & human Resource Dev.
Promote national pest management support service	<ul style="list-style-type: none"> <li>Fully implement the pest management support service strategy,</li> </ul>	2017/18	1,000,000.00	MoANR, RBoANR and NARS
Support preparation and enactment of plant protection related legislations	<ul style="list-style-type: none"> <li>Finalize and publicize the different plant protection, quarantine and pesticide related legislations and directives.</li> </ul>	2017-2018	500,000.00	MoANR, RBoANR and NARS
Implement the set of surveillance and survey standards (ISPM 6),	<ul style="list-style-type: none"> <li>Provide training on ISPM 6,</li> </ul>	2017/18	460,000.00	MoANR, RBoANR and NARS
	<ul style="list-style-type: none"> <li>Conduct surveillance using ISPM 6, report and take rapid response on intercepted pests</li> </ul>	2017-2021	4,000,000.00	
Develop, periodically review and implement survey and monitoring protocols,	<ul style="list-style-type: none"> <li>Finalize the drafted protocol,</li> </ul>	2017/18	150,000.00	MoANR, RBoANR and NARS
	<ul style="list-style-type: none"> <li>Promote the protocol,</li> </ul>	2017-2021	270,000.00	
	<ul style="list-style-type: none"> <li>Carry out surveillance, survey and monitoring</li> </ul>	2017-2021	15,000,000.00	
	<ul style="list-style-type: none"> <li>Periodically review the protocol</li> </ul>	2017-2021	100,000.00	
Regularly allocate financial resources	<ul style="list-style-type: none"> <li>Regularly plan and secure finance,</li> </ul>	2017-2021	50,000.00	MoANR, RBoANR and NARS
	<ul style="list-style-type: none"> <li>Procure and prepare cost effective survey and monitoring tools and distribute</li> </ul>	2017-2021	30,000,000.00	
	<ul style="list-style-type: none"> <li>Procure and secure safe and effective insecticide, sprayers and PPE</li> </ul>	2017/18	118,000,000.00	MoANR, RBoANR
Establish community based FAW forecasting and monitoring,	<ul style="list-style-type: none"> <li>Identify representative districts and kebeles, arrange ToT, select farmers and pastoralists and provide training,</li> </ul>	2017-2021	1,900,000.00	MoANR, RBoANR DLCOEA, and NARS
	<ul style="list-style-type: none"> <li>Supply and install monitoring tools,</li> </ul>	2017- 2021	1,500,000.00	

Strategic actions	Detailed activities	Implementation period	Estimated budget ETB	Responsible body
	<ul style="list-style-type: none"> <li>Provide standard format for collecting data and reporting,</li> </ul>	2017- 2021	100,000.00	
	<ul style="list-style-type: none"> <li>Provide technical backstopping</li> </ul>	2017- 2021	1,700,000.00	
Strengthen information exchange with neighboring countries.	<ul style="list-style-type: none"> <li>Create linkage among countries,</li> </ul>	2017/18	150,000.00	MoANR and NARS
	<ul style="list-style-type: none"> <li>Regularly share FAW data and research activities through DLCOEA, FAO, ICIPE, CABI and CIMMYT</li> </ul>	2017/18	150,000.00	
Build the human resource technical capacity,	<ul style="list-style-type: none"> <li>Recruit more plant protection experts in development and research (Recruitment based on needs in research and development to fill gaps in woredas, plant health clinics &amp; the research centers)</li> </ul>	2017- 2018	00.00	MoANR, RBoANR NARS, and NGOs (One MSc =500,000.00) (One PhD= 1,500,000.00)
	<ul style="list-style-type: none"> <li>Provide short cycle and on job trainings for existing staff</li> </ul>	2018- 2021	3,400,000.00	
	<ul style="list-style-type: none"> <li>Arrange long term training for 15 MSc and 5 PhD students,</li> </ul>	2018- 2021	15,000,000.00	
	<ul style="list-style-type: none"> <li>Organize experience sharing and exchange visits for the technical team</li> </ul>	2017/18	4,800,000.00	
Strengthen plant health clinics and quarantine posts,	<ul style="list-style-type: none"> <li>Equip with current lab facilities,</li> </ul>	2018	44,600,000.00	MoANR, RBoANR NARS and NGOs
	<ul style="list-style-type: none"> <li>Supply office equipment and facilities,</li> </ul>	2017-2021	1,500,000.00	
	<ul style="list-style-type: none"> <li>Provide field vehicles and tools,</li> </ul>	2018-2020	56,000,000.00	
Establish and upgrade national pest diagnostics laboratories,	<ul style="list-style-type: none"> <li>Fulfill the gaps in the existing national labs in NARS,</li> </ul>	2018-2019	420,000.00	MoANR and NARS
	<ul style="list-style-type: none"> <li>Put up well-equipped insectary,</li> </ul>	2018-2019	5,000,000.00	
	<ul style="list-style-type: none"> <li>Expedite the construction of the planned labs</li> </ul>	2018-2019	90,000,000.00	
Secure finance/fund.	<ul style="list-style-type: none"> <li>Allocate adequate budget, improve the procurement process and fasten budget release,</li> </ul>	2017-2021	150,000.00	MoFEC, MoANR, RBoANR, NARS, NGOs
	<ul style="list-style-type: none"> <li>Solicit external funding</li> </ul>	2017/18	200,000.00	
Develop IT based pest data management and use	<ul style="list-style-type: none"> <li>Introduce SMS for pest information gathering (Consider farmers to buy the phones)</li> </ul>	2017-2021	4,200,000.00	MoANR
	<ul style="list-style-type: none"> <li>Develop pest data collection, storage and retrieval system</li> </ul>	2017-2018	500,000.00	
	<ul style="list-style-type: none"> <li>Digitize existing and future pest data,</li> </ul>	2017-2018	2,000,000.00	

Strategic actions	Detailed activities	Implementation period	Estimated budget ETB	Responsible body
	<ul style="list-style-type: none"> <li>Analyze and provide feedback</li> </ul>	2017-2021	100,000.00	
Establish National Web Based Platform,	<ul style="list-style-type: none"> <li>Design and develop website dedicated to plant protection,</li> </ul>	2017/18	2,500,000.00	MoANR
	<ul style="list-style-type: none"> <li>Link the website to the MoANR homepage,</li> </ul>	2017/18	400,000.00	
	<ul style="list-style-type: none"> <li>Regularly update the contents</li> </ul>	2017-2021	200,000.00	
Develop and strengthen centralized training and awareness creation system,	<ul style="list-style-type: none"> <li>Develop standardized training manual,</li> </ul>	2017/18	80,000.00	MoANR
	<ul style="list-style-type: none"> <li>Plan ToTs at national level,</li> </ul>	2017-2021	5,000,000.00	
	<ul style="list-style-type: none"> <li>Plan similar trainings at regional level</li> </ul>	2017-2021	10,000,000.00	
	<ul style="list-style-type: none"> <li>Cascade the training to woredas and kebele,</li> </ul>	2017-2021	2,000,000.00	
	<ul style="list-style-type: none"> <li>Set a mechanism to evaluate and monitor trainings provided at different levels</li> </ul>	2017-2021	200,000.00	
	<ul style="list-style-type: none"> <li>Preparation and distribution of publicity materials</li> </ul>	2017-2021	100,000.00	
	<ul style="list-style-type: none"> <li>Organize awareness creation forums</li> </ul>	2017-2021	15,000,000.00	
Strengthen linkages of FAW management efforts across the country	<ul style="list-style-type: none"> <li>Coordinate and exchange FAW related information nationally, MoANR through the PPD</li> </ul>	2017-2021	9,460,000.00	MoANR
	<ul style="list-style-type: none"> <li>Continually produce FAW distribution map and circulate across the country, MoANR through the PPD</li> </ul>	2017-2021		
	<ul style="list-style-type: none"> <li>Coordinate and exchange FAW related information in national regions BoARNR</li> </ul>	2017-2021	18,920,000.00	BoANR
	<ul style="list-style-type: none"> <li>Organize and exchange season/year round data on FAW status, Maize growing woredas</li> </ul>	2017-2021	4,932,000.00	BoANR
Strengthen Communication Networks between NGOs, MoANRs, RBoANRs, Research institutions, Higher learning institutions, Regional and international partners.	<ul style="list-style-type: none"> <li>Generate data base on stakeholders and collaborators,</li> </ul>	2017/18	10,000.00	
	<ul style="list-style-type: none"> <li>Organize consultation platform, plan and conduct workshops, review meetings, seminars,</li> </ul>	2017-2021	2,150,000.00	
	<ul style="list-style-type: none"> <li>Utilize the web based platform for information sharing</li> </ul>	2017-2021	300,000.00	
Understand the biology and ecology of FAW in Ethiopian context,	<ul style="list-style-type: none"> <li>Generate information on the biology (field and lab) of the FAW (NARS)</li> </ul>	2017-2021	2,000,000.00	NARC, EIAR, RARIs, HLI
	<ul style="list-style-type: none"> <li>Generate information on the ecology (population dynamic, seasonal abundance, host plant range, survival and migration (NARS)</li> </ul>	2017-2021	15,000,000.00	
Identify effective, safe, available and cost effective insecticides,	<ul style="list-style-type: none"> <li>Generate local data on pesticides registered elsewhere on FAW,</li> </ul>	2017-2021	12,000,000.00	NARC, EIAR, RARIs, HLI
	<ul style="list-style-type: none"> <li>Evaluate dossiers of insecticides and registers,</li> </ul>	2017-2021		

Strategic actions	Detailed activities	Implementation period	Estimated budget ETB	Responsible body
	<ul style="list-style-type: none"> <li>Carry out efficacy trial on new and locally available insecticides,</li> <li>Study insecticide resistance in FAW populations</li> <li>Develop and popularize guideline on insecticide resistance management</li> </ul>	2017-2021		
Develop non-chemical methods of FAW management,	• Evaluate and identify effective bio-pesticides,	2017-2021	20,000,000.00	NARC, EIAR, RARIs, HLI
	• Assess and identify indigenous natural enemies,	2017-2021		
	• Identify effective cultural practices on FAW,	2017-2021		
	• Evaluate locally available and effective botanicals	2017-2021		
	• Explore on classical biological control of FAW,	2017-2021		
	• Develop IPM approach for FAW control	2017-2021		
Develop varieties for FAW resistance	• Introduction and evaluation of germplasms from exotic sources for FAW under natural and artificial infestation	2017-2021	20,000,000.00	NARC, EIAR, RARIs, HLI
	• Screening of locally developed genotypes for FAW resistance under natural and artificial infestation	2017-2021		
Identify strains of FAW present in Ethiopia,	• Conduct haplotypes analyses on FAW collected from different corners of the country	2017/18	750,000.00	NARC, EIAR, RARIs, HLI
	• Produce FAW strains distribution map	2017/18		
Environmental impact assessment of pesticide	• Provide training on pesticide safety,	2017-2021	400,000.00	MoANRs, NARC, EIAR, RARIs, HLI
	• Assess the impact of insecticides applied to control FAW on the environment	2017-2021	2,500,000.00	
Technically coordinate research	• Prevent duplication of efforts through technical coordination and strengthening the review mechanism	2017-2021	300,000.00	NARC, EIAR, RARIs, HLI, MoANR and RBOANR
Technology promotion	• Pre-extension demonstration of technologies,	2018-2021	4,500,000.00	NARC, EIAR, RARIs, HLI, MoANR and RBOANR
	• Organize experience sharing events,	2018-2021	16,750,000.00	
	• Provide training on generated FAW management technologies	2018-2021	9,908,400.00	
	<b>Grand Total</b>		<b>581,140,400</b>	<b>24,214,183.33 USD</b>

## **Implementation of the strategy**

The strategy for FAW was needed because of the seriousness of the problem and its potential to become the number one pest mainly on maize and sorghum. Moreover, because of the pest can attack many crops besides maize and sorghum, and the country being heavily dependent mainly on cereals, a separate strategy was found necessary. Besides, its content is very well aligned with the pest management support service strategy of the country and serves as a template for emerging pest problems.

## **Roles and Responsibilities of Stakeholders**

### **Federal Plant Health Regulatory Directorate, Plant Protection Directorate**

1. Support in creating the policy and regulatory environment for the implementation of the FAW management strategy,
2. Technically coordinate at the national level all activities related to the management of the FAW,
3. Nationally coordinate FAW surveillance, survey and monitoring and run information exchange across the country,
4. Provide all rounded support to Plant Health Clinics and the national regions, zones, woredas and kebeles on FAW,
5. Organize trainings, implement capacity building initiatives and experience sharing events on FAW to higher level plant protection experts;
6. Regulate nationally pesticide registration, distribution, safe handling and application on the FAW,
7. Produce FAW information communication materials and distribute them across the country
8. Establish national FAW data base and administer the system;
9. Represent the country in all forums being organized on FAW related issues.
10. Work with partners in soliciting funding to carry out FAW management

### **Regional Bureaus of Agriculture and Regulatory bodies (Plant protection and Quarantine)**

1. Support in creating the policy and regulatory environment for the implementation of the FAW management strategy in the national regional states,
2. Technically coordinate in the national region all activities related to the management of the FAW,
3. Regionally coordinate FAW surveillance, survey and monitoring and run information exchange across the region,
4. Run the PHCs which are instrumental in identifying economic pests (regular and migratory) and quarantine pest species in the national regions, zones, woredas and kebeles to effectively manage the FAW,
5. Organize trainings, implement capacity building initiatives and experience sharing events on FAW,
6. Enforce in the national region pesticide distribution, safe handling and application with focus on the FAW,
7. Produce FAW information communication materials and distribute them across the national region,
8. Establish regional FAW data base and administer the system;
9. Represent the national region in all forums being organized on FAW related issues.
10. Assign adequate plant protection staff in a region.

11. Communicate, exchange data and information, and liaise for support with the Federal Plant Health Regulatory Directorate and Zonal/woreda Plant Health Regulatory Bodies

#### **Zonal/Woreda Agriculture Development offices, Plant protection unit**

1. Support in creating the policy and regulatory environment for the implementation of the FAW management strategy in the zone/woreda,
2. Technically coordinate in the zone/woreda all activities related to the management of the FAW,
3. In the zone/woreda coordinate FAW surveillance, survey and monitoring and run information exchange,
4. Run the PHCs which are instrumental in pest diagnostics in the zones/woredas to effectively manage the FAW,
5. Organize trainings, implement capacity building initiatives and experience sharing events on FAW,
6. Enforce in the zone/woreda pesticide distribution, safe handling and application with focus on the FAW,
7. Produce FAW information communication materials and distribute them in the zone/woreda,
8. Establish zone/woreda level FAW data base and administer the system;
9. Represent the zone/woreda in all forums being organized on FAW related issues.
10. Assign adequate plant protection staff in the zone/woreda,
11. Communicate, exchange data and information, and liaise for support with the Regional Plant Health Regulatory Bodies and Kebele Plant Health Regulatory Bodies

#### **Kebele Agriculture Development office**

1. Enforce pest related national laws, regulations and guidelines and provide feedbacks regularly,
2. Provide technical support to farmers on FAW management,
3. Carry out FAW surveillance, survey and monitoring on regular bases, and contribute to pest information exchange in the country;
4. Utilize the services of PHCs, for FAW identification and management in the kebeles;
5. Organize regular trainings and experience sharing events to contact farmers in the kebeles,
6. Enforce national regulations on pesticide management in the kebele,
7. Distribute FAW information communication materials to farmers,
8. Provide FAW related information regularly to the national pest data base,
9. Represent the kebele in all forums being organized on plant protection related issues
10. Communicate, exchange data and information, and liaise for support with the Zonal/Woreda Plant Health Regulatory Bodies

#### **National Agricultural Research System**

1. In consultation with the PHRD gather data on the FAW problems and address the problem at national, regional, zonal, woreda and kebele levels,
2. Develop research topics on the FAW problems,
3. Adapt and/or generate and transfer technical information, knowledge and skills on the management of FAW,

4. Take part in the provision of technical trainings and experience sharing events,
5. Proactively participate in FAW information exchange network,
6. Contribute to the strength of the national FAW data base,
7. Take part in all forums being organized on FAW related issues.

### **Higher Learning Institutions**

1. Conduct national needs assessment for plant protection experts,
2. Review the curricula to address emerging pests,
3. Proactively work to attract competent students to join agricultural and plant protection related fields of study,
4. Produce competent plant protection professionals who can address the FAW and other economic pests,
5. Carry out research on topics related with the FAW,
6. Adapt and/or generate and transfer technical information, knowledge and skills on the management of FAW,
7. Take part in the provision of technical trainings and experience sharing events related to the FAW,
8. Proactively participate in the FAW information exchange network,
9. Contribute to the strength of the national FAW data base,
10. Take part in all forums being organized on plant protection related issues.

### **Other Responsible Institutions**

Besides the institutions described above, which are fully mandated by the Federal government to serve as primary stakeholders to address pest problems, there are both governmental and nongovernmental institutions that can provide support in the management of the FAW. This includes the Ministry of Environment, Forestry and Climate Change, Ministry of Health, Ministry of Water Resources from government institutions and NGOs. However, it is incumbent on PHRD and the national committee to clearly plan the roles and involvement of these institutions.

### **Implementation arrangement and coordination**

The FAW strategy will be implemented following the usual routes within the MoANR and its linkages with the national regions. But considering the sense of urgency attached to the management of the FAW, the technical coordination which the Plant Health Regulatory Directorate General, Plant Protection Directorate has been handling needs to be expanded to involve non formal coordination, too. There is a need for understanding between the federal and regional institutions that some conditions may entail to short circuit the formal long hierarchy to reach affected areas. For example, by the MoANR may be prompted to give direct and fast support to zones and woredas at times of emergency.

Table Risk Matrix in FAW management: Risks, impact, probability of occurrence and mitigation measures

<b>Risk</b>	<b>Impact</b>	<b>Probability</b>	<b>Mitigation</b>
Failed to provide policy support on technical coordination, organizational setup, and enforcement of defined legal provisions	Ineffective FAW management resulting in increased economic damage by FAW	Very high	Proactively provide the required policy support for better response to FAW emergency
Inability to carry out surveillance survey and monitoring on the FAW	Poor national information on the spread and damage by the FAW, misuse of meager resources	Very high	Provide financial, material, facility support to carry out FAW survey and monitoring as deemed necessary
The needed human, material facility and financial resources are not secured	Significant economic damage on the most strategic food security crop, maize will be recorded	Very high	<ul style="list-style-type: none"> <li>i. Allocate enough fund from government sources,</li> <li>ii. Proactively communicate the problem</li> <li>iii. Develop competitive project proposals and secure funding,</li> </ul>
Failure to put in place communication network for knowledge sharing among all stakeholders	Misidentification of the FAW and wrong recommendations provided to farmers resulting in failure to effectively control the FAW, misuse of meager resources	Very high	<ul style="list-style-type: none"> <li>i. Produce standard training manual on the FAW,</li> <li>ii. Organize trainings at different levels,</li> <li>iii. Create wider public awareness using different publicity materials and venues,</li> <li>iv. Establish hotline for technical support provision</li> </ul>

<p>Absence of locally generated FAW management technologies</p>	<p>The FAW will continue to cause significant economic damage on major cereal crops grown in the country</p>	<p>Very high</p>	<ul style="list-style-type: none"> <li>i. Study the biology and ecology of the insect under Ethiopian condition,</li> <li>ii. Identify safe, effective, available and affordable synthetic insecticides,</li> <li>iii. Identify effective cultural control practices for the management of the FAW,</li> <li>iv. Investigate on different bio pesticides that can effectively control the FAW,</li> <li>v. Investigate on the possibility of introducing effective and highly specific natural enemy of the FAW from its center of origin,</li> <li>vi. Develop IPM method for sustainable management of the FAW</li> </ul>
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