

## Pan-India Technology Transfer Program for Awareness and Management of an Invasive Pest, Fall Army Worm of Maize, *Spodopterafrugiperda*

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### ABSTRACT

The fall armyworm (FAW), an invasive pest, first detected on maize crop in the Indian state of Karnataka in May, 2018, spread like a wild fire covering practically the entire maize growing area of the country. Being an unfamiliar pest with potential to cause significant losses, the South Asia Biotechnology Centre (SABC) devised an outreach strategy called SAFFAL (Safeguarding Agriculture and Farmers against Fall Armyworm) facilitating an involvement of troika stakeholders viz., farmers, academics and the Government, at local level. Based upon the available literature worldwide, this strategy involved dissemination of knowledge on pest diagnostics, biology and management tactics where maize is extensively grown through information and communication technology. The Central Government provided policy support by facilitating approval of insecticides on contingency basis and guiding management strategy. The SABC's outreach strategy involved print as well as digital media, and also direct personal contacts with stakeholders in group meetings. This resulted in cascading information directly and indirectly to more than 300,000 farmers, 700+ academics and Government Agricultural Departments in almost all states. As a spin-off, other institutions also carried out their own extension activities for the FAW management. Thus, this extension strategy successfully addressed the farmer's informational needs, impacting positively, as the farmers' fear of the FAW weaned and their confidence to manage the pest arose. The maize farmers fine-tuned the strategy at local level wherever needed. These efforts resulted in limiting pest damage, developing and implementing pest management strategies, and provided stewardship to ensure seamless dissemination of pest-specific knowledge.

**Keywords:** Awareness, SAFFAL, Fall Army Worm, Training

### INTRODUCTION

Maize is a staple crop in India grown annually on about 9.0-9.5 million hectares with production ranging 24 to 28 million tons and is used for various purposes like poultry feed (47%), cattle feed (13%), industrial starch (14%), food and processed products (20%), and rest 6 per cent for bio-fuel, brewery, seed and export contributing more by its value addition to the Indian economy (FICCI-PWC 2018). Maize is mainly cultivated by ~15 million farmers annually during monsoon, winter seasons and to some extent during summer season. About 71 per cent of maize production comes from monsoon rainy season and rest from winter season. The cumulative growth rate in maize productivity is quite impressive at 3.6 per cent as against growth rate in area at 2.6 per cent since independence. With introduction of single cross hybrid in last two decades, there is a huge potential for increasing productivity and diversification of crop for various uses (Dass *et al.* 2009; 2012; Kumar *et al.* 2013). However, productivity of about 2.6 metric

tons/hectare fares poorly, less than one-fourth of the USA, and less than one-half of the world average. One of the constraints of poor productivity is losses caused by insect pests and diseases which vary from 5-15% on an average (Dhillon *et al.* 2014; Pradyumn Kumar *et al.* 2018). Further to this is an incidence of an invasive fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae) that was found for the first time in May 2018. Being unfamiliar with it and having caused significant damage in the months to come as it spread in many states, the FAW became a matter of great concern both for farm scientists as well as farmers.

*The Pandemic of Fall Armyworm (FAW):* The FAW is an economically important pest of maize native to Americas but has spread to African Continent in 2016 (Goergen *et al.* 2016). Subsequently, it devastated the corn cultivation in many African countries within a year, as it spread to as many as 30 countries of Africa (FAO 2018). The incursion of FAW as an invasive pest in Asia was reported on maize for the first time from

Shivamogga and Davangere districts of state of Karnataka in May 2018 (Sharanabasappa *et al.* 2018a), later from its other districts (Ganiger *et al.* 2018) and almost all maize growing states (Firake *et al.* 2019; Rakshit *et al.* 2019). Within short span, the FAW has spread into China, Bangladesh, Indonesia, Japan, Republic of Laos, Malaysia, Myanmar, Sri Lanka, Thailand and Vietnam (CABI 2020). It is recently reported from Nepal (Dhoj 2019) and Pakistan (Gilal *et al.* 2020), Australia (DPIRD 2020) and in Republic of Korea (IPPC 2020). The FAW is a highly polyphagous pest and is known to feed on 353 host plants (Montezano *et al.* 2018). Although the FAW that invaded India belongs to 'corn strain' it was found feeding on sugarcane, sorghum, millets and also on ginger in North Eastern States (Srikanth *et al.* 2018; Chormule *et al.* 2019; Firake and Behere 2020). As a result, area declined from 9.2 million hectares in 2018 to 8.19 million hectares in 2019, with likely reduction in production and increase in maize prices in late 2018 and early 2019 cascading adversely poultry and cattle products (Kulkarni 2019; Jha 2020). It also negatively impacted the consumers, particularly in the Southern States which led the Government of India to import 130,000 tons of maize in 2018. The FAW infestation also distressed small and marginal farmers as increase in cost of production, reduced productivity and income posed a formidable threat. Following detection of the FAW, research work was initiated on various aspects of biology, population dynamics and management (Sharanabasappa *et al.* 2018b; 2020; Rakshit *et al.* 2019). However, a massive technology dissemination programme based on the available information on the pest was urgently needed for creating awareness amongst the maize farmers to build up confidence. The non-Governmental organization, South Asia Biotechnology Centre (SABC) conceptualized the project entitled "Safeguarding Agriculture & Farmers against Fall Armyworm", acronym SAFFAL, that resounded to mean 'success' in the national language and later became synonymous with the farmers. This paper reports the success of the extension strategy, results and prospects.

## METHODOLOGY

As suggested by Toepfer *et al.* (2020), communication, information sharing and advisory services are extremely useful for area-wide management of the fall armyworm. And hence, extension strategy involved conceptualization, development of framework, implementation, assessment and stewardship of outreach programme across maize growing states of India.

**Conceptualization:** The FAW management was conceptualized as it was found to be an emerging key pest. The FAW outbreaks on maize have been recorded in USA and have caused damage worth millions of dollars (Sparks 1979). Yield loss of maize at mid-whorl to late whorl stage due to the FAW is reported to be high as these are very vulnerable stages. While developed countries have large farms and technology to manage the pest, the developing countries in Africa and Asia face substantial losses in view of small and subsistence farming (Hruska 2019). Therefore, extension framework was based upon the logical approaches to the problem identification and its impact understanding, formulation of approach, extension tactics and implementation (Fig. 1). Networking with experts from various international and national institutions and non-governmental organizations and farmer groups specified under collaborators helped to gain insights in to emerging problem and its possible solution.

**Development of Framework:** It is quite well known that for effective management, institutional framework has become a need. The FAW having been identified as a key pest and its management of utmost importance became a focus of attention, with available knowledge under the supervision of the SABC. The institutional framework involved the private partner, FMC Corporation, Mumbai, the State Departments of Agriculture (SDA), the State Agricultural Universities (SAU) and ICAR institutions like Indian Agricultural Research Institute, New Delhi; Indian Institute of Maize Research (IIMR), Ludhiana; the All India Coordinated Research Project on Maize (AICRP on maize), Ludhiana; National Bureau of Agricultural

Insect Resources, Bangalore; allied sector like Farm Science Centers; vernacularly called *Krishi Vigyan Kendra (KVK)*, Farmer Producer Organizations (FPO), Agricultural Technology Management Agency (ATMA), Diploma in Agricultural Extension Services for input dealers (DAESI) and allied institutions like National Institute of Agricultural Extension Management (MANAGE), and International Wheat and Maize Improvement Center (CIMMYT), Mexico and International Crop Research Institute for Semi-Arid tropics (ICRISAT), Hyderabad, hereafter referred to as collaborating institutions or collaborators. The SABC, New Delhi and FMC Corporation, Mumbai signed an MoU in February 2019 to work together in this outreach project to be funded by the latter. Funding of the project was based up on the ex-gratis grants by FMC Corporation for various extension activities including limited management kits.

The first meeting of the farmers was organized on the 8<sup>th</sup> June 2019. Later more than 15 such meetings involving academics and farmers were organized including interactive mode of discussion (Table 1). FAW management involved identification of knowledge gaps to be relevant to the local needs, policy matters related to use of approved insecticides and the extension strategy. The Government of India on its part approved the insecticides based upon their use elsewhere and limited knowledge on their efficacy under the Insecticide Act 1968 and over the years 2018-2020, this use of insecticides and other tactics has been revised as per needs (DPPQS 2019) (Table 2).

#### **Implementation of extension tactics:**

Extension tactics used were quite varied involving multiple media like print, personal contacts, internet use and mass farmer meetings. These tactics are detailed herein.

1. *The FAW training and educational meetings:* Meetings and rallies were organized with more than 150 farmers for specific duration of about 5-7 hours for education on the FAW. These served to dispel doubts that farmers had and give the requisite information. These also served to discuss the results of experiments conducted more particularly in the

concerned states with the help of our collaborators. Table 1 gives details of dates, number of farmers and the collaborators for these meetings. These rallies and face-to face meetings with the farmers, extension workers, Rural Agricultural Work Experience (RAWE) students and DEASI retailers were well advertised through local media and conducted in local languages in all maize growing states in intensive crop areas. Fifteen mega educational rallies were carried out between June 8, 2019 till November 14, 2019. Around 7050 farmers and key stakeholders physically attended the FAW awareness meetings. As many as 308,000 maize farmers were reached indirectly through these meetings.

2. *Field Visits and Monitoring:* During the course of meetings, limited field visits were made possible with the help of local hosts to know the extent of damage to the crop and pest complex. The FAW damage ranged widely and so was incidence of larvae as often maize crop was sown in limited area and wide apart in the area. These visits also served to educate the farmers about monitoring and decision-making intervention for control tactics, and conservation of the natural enemies. Monitoring of the FAW adults was also suggested using pheromone lures, as some farmers were keen to use this technology. Consequently, not only SDAs adopted and popularized pheromone-based control measures but also increased utility of pheromone for monitoring of the pest and promoted integrated pest management (IPM)-based measures by farmers across India. As many as 2700 pheromone traps/lures were distributed to the farmers and other extension functionaries in the farmers' meetings.

3. *Mobilizing extension system:* Following notification of the FAW incidence in Karnataka in 2018 and its consecutive spread to neighbouring states of Telangana, Andhra Pradesh, and Tamil Nadu, SABC spread awareness to mobilize extension system within each state. The SDAs too carried out workshops to train extension functionaries with the help of SAUs. The Project SAFFAL on its part established collaboration with 40 public sector

institutions including other collaborators. More than 315 maize breeders, entomologists & senior officials of SAUs, KVKs, AICRP Maize and ICAR-ATMA participated as resources people for the FAW programme. Institutional networking enabled the seamless relaying of approved package of practices (POPs) for implementation of the FAW control programmes across India.

4. *The FAW Alert & Advisory*: In order to disseminate approved control measures of the FAW by the Ministry of Agriculture and Farmers' Welfare, a website ([www.fallarmyworm.org.in](http://www.fallarmyworm.org.in)) was made to gather and create a repository of alerts and advisories on the FAW issued by different institutions of Central and State governments. The project SAFFAL created a knowledge bank and facilitated access and exchange of right information in different languages to farmers and key stakeholders in India. In the due course, the project SAFFAL spotted anomalies in POPs issued by 13 SAUs, KVKs and Dept of Agri in different languages and rectified it for effective management of the FAW.

5. *Maize Expert network*: A maize expert network was created to bridge the gap between maize experts and farmers located in different states of India. The maize expert network consists of data set of maize experts including breeders, entomologists, pathologists and agronomists from AICRP on Maize and other academic institutions like SAUs, KVKs and SDAs. The interactive India map with coordinates of experts from different maize growing states helped to facilitate an exchange of information on the FAW. Farmers availed this facility to communicate with maize experts in vernacular, and sought an expert advice to tackle the FAW at very early stage of infestation. Thus, the maize expert network became a source of knowledge for farmers in India.

### **Extension tools/materials developed**

1. *Educational Posters and toy models*: Educational posters on morphology, life cycle of the pest, damaging symptoms at various crop growth stages and IPM practices to be adopted were so designed in eight vernacular languages viz., Kannada, Marathi,

Tamil, Telugu, Gujarati, Bengali, Hindi and also in English that the farmers could understand the identification of pest stages, and overall life cycle (Fig.2). Simultaneously, soft toys were designed so that farmers are able to identify larvae of the FAW on the basis of major markings on its body (Fig.3).

2. *Dedicated Web Portal*: An exclusive user and farmers' friendly website on the FAW ([www.fallarmyworm.org.in](http://www.fallarmyworm.org.in)) was launched by the Union Minister of State for Agriculture and Farmers' Welfare Parshottam Rupala on the 1<sup>st</sup> August 2019 to create a multiplier effect in information dissemination and help in successful curbing of the FAW in India through knowledge empowerment. Focused on the welfare of maize farmers and other extension functionaries, the website on the FAW contained data on management strategies, alert and advisories issued by various organizations. Other features included SAFFAL FAW help centre, research resources, and information from international and national institutions. The website also featured an interactive map showing the FAW experts' network along with the details on maize experts for advice and guidance to control the FAW all over India.

3. *Inventory of Research Resources*: The catalogue of hundreds of research articles from both open access as well as other research journals were created in order to analyse, collate and disseminate research information on the FAW to key stakeholders. The catalogue was meant to enhance scientific understanding, promote localized research, mobilize stakeholders' engagement and implement evidence-based and IPM-led control measures for effective management of the FAW in India.

4. *Prints-newspapers, magazines*: Media-based approaches included training and interaction with journalists of local newspapers in different states. This helped in publication of POPs in vernacular print media and give wide publicity following media briefing during outreach programmes so that the local news coverage reached the large section of farmers who could not participate in the direct interactions. Project SAFFAL organized record

training and interaction with 65 journalists in major maize growing States. As a result, by early 2020, the print as well as online media published around 78 articles in key newspapers in major maize growing areas, which helped in indirectly reaching out to 308,000 smallholder maize farmers.

5. *Social media engagement*: Smart phone penetration in rural India has helped project SAFFAL to increase reach to farming community and amplify right messages about monitoring, surveillance and implementation of control measures of the FAW. Not only the FAW help centre on the SAFFAL website helped farmers to access posters on life cycle, identification and control measures in their own language but also the enrolment on WhatsApp group connected them with experts on real time basis. Posting of key messages, alert and advisory and training programmes on social media channels such as Facebook, twitter, You Tube and LinkedIn contributed enormously in increasing relaying of information with key stakeholders. The website-based FAW help centre achieved a record of page views and downloads of posters in different languages. The cumulative viewers of Project SAFFAL FAW articles on social media surpassed half a million view by end of March 2020. Posting of messages on different WhatsApp groups relevant to FAW amplified the key messages and increased reach of the project SAFFAL across agricultural value chain.

## RESULTS AND DISCUSSION

*The FAW Training and Face to Face Contacts*: As detailed in Table 1, massive personal contacts with farmers and extension workers were organized in different states in collaborations with SAUs, KVKs, Department of Agriculture (DOA) of respective State and AICRP on Maize. Through this direct contact, the project established collaborations with all these Institutions so they could organize the rallies of maize farmers in their areas. This experience was shared in the meetings with Central Tibet Relief Committee, The Tibet Fund and USAID India on September 18, 2019 in New Delhi, at International Plant Protection Congress November 10-14, 2019 at Hyderabad and at Asia Pacific Seed

Association November 26, 2019 at Kuala Lumpur in Malaysia. In all 315 maize breeders, entomologists and 460 extension specialists including the KVK staff, 45 senior Government officials of the states, 460 RAWE students and 512 Retailers being associated with the MANAGE's DAESI programmes were mobilized for the training of farmers. Through these State rallies more than 8000 farmers were personally trained in diagnosis of the pest, damage symptoms and IPM practices to be used for management. Wide local publicity to these programmes helped reach nearly 3,08,000 farmers according to media impressions based on news articles (Table 3). A sample of the local media coverage depicting critical crop stages along with management tactics is shown in Fig.4. At each rally, four FAW posters prepared on life cycle, crop stages to be scouted, IPM triangle and campaign tips were distributed to farmer leaders to be multiplied by extension workers for pasting them in rural local Government offices called *Panchayats* where farmers gather daily preferably during their lean period of activity. In all 16000 such posters; 1000 in English, 4000 in Hindi, 2000 each in Gujarati, Marathi, Bengali, Telugu, Tamil, and Kannada were handed over to farmers of different states (Table 4). Simultaneously, more than 1000 soft toys of the FAW larva were given for each village for quick identification. The opportunity of face to face interaction was also utilized to demonstrate the utility of personal protective equipments/safety kits while spraying pesticides for control of the pest. Five farmers from each state were selected for handing over 400 such safety kits.

*Media-based Extension*: After launching the website it was estimated that 6584 page views per month since August 2019 have taken and on an average 1300 posters per month were downloaded by the users. Since the start of the project on March 6, 2019, the SAFFAL posted 30 articles each on Facebook, Twitter and LinkedIn and uploaded FAW video on YouTube channels. Cumulative viewers of articles on social media were; 1,84,024 on LinkedIn, 66,028 on Facebook and 14,201 on Twitter (Table 3). Daily update of project SAFFAL was posted on six WhatsApp groups to spread key messages about the FAW situations in India. Project SAFFAL is now part

of the FAW officials WhatsApp Groups promoting IPM based control measures in many States. Similar information and communication technology-based extension campaign was successfully implemented in the FAW management in Uganda (Tambo *et al.* 2019). The project maintained a regular communication with officials of Government of India, SAUs, KVKs, ICAR institutions and all maize growing States. While conducting the direct interactions with the farmers at 15 rallies in different maize growing states, 65 local journalists were involved who contributed more than 78 articles both online and print on the utility of the project SAFFAL indirectly reaching out to large number of farmers who were not part of personal interactions.

Frequent reviews of the technical programmes were undertaken to assess the overall implementation of the project and improve scope of work. These internal and external reviews contributed in mid-term correction in extension methodology, stocktaking status of the FAW and to get field level feedback on the implementation of project SAFFAL. In the hindsight, this programme also created an awareness for recognizing importance of natural enemies and their role along with judicious use of insecticides for the FAW management (Shylesha *et al.* 2018; Firake and Behere 2020; Firake *et al.* 2020; Varshney *et al.* 2020).

The SAFFAL project was needed for mass awareness amongst all the stakeholders of maize. It achieved the desired effect as the collaborators, and even the input dealers and poultry feed businessmen all got activated and they came together for the common cause of management of FAW. The SAFFAL created the enabling framework that triggered extension activities specific to the FAW management. Many independent reviews of

the project have been published as success stories (Kulkarni and Vora 2019; APSA, 2020; Biovoice, 2020: Rural Marketing, 2020). Alien species like FAW can pose a serious threat to food security as the farmers and extension workers hardly know about its biology and management. It is in this background that communication strategy was found to be of importance to raise the awareness of FAW detection and area-wide management (Toepfer *et al.* 2019). Tambo *et al.* (2019) also demonstrated the utility of IT-based communication for successful management of FAW in Uganda. In India where a good network of extension services exists, it was logical to involve it with farmers fast enough to achieve desired results. Although maize area had declined in 2019 to 8.19 million hectares from 9.2 million hectares in 2018, a year of FAW invasion; production increase of 2.05 million tons in 2019 over that of 2018 showed resilience of the Indian farming system largely due to increased awareness of the FAW. Stewardship of extension programme by stakeholders helped a lot to ward off fears of alien pest. The Project SAFFAL, it is believed, will be trend setter for the management of any invasive pest species in future in India.

#### ACKNOWLEDGMENT

Authors are grateful to FMC Corporation, Mumbai for generous funding for this project.

**Disclaimer:** Project SAFFAL, although financially supported by FMC Corporation, Mumbai, does not endorse their products by overtly or covertly. **Compliance with ethical standards:** Conflict of interest. The authors declare that they do not have conflict of interest related to this study.

*Paper received on 25.08.20*

*Accepted on 30.08.20*

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**Table 1**  
**A list of the FAW Training programmes in India during June to November 2019**

No.	Location	Date	No. of Participants	Partner Institution(s) and locations
1	Shivamogga (Karnataka)	Jun-08	250+	UAHS, Shivamogga & DOA, Govt of Karnataka
2	Davangere (Karnataka)	Jun-29	120+	Taralababu KVK, Davangere, DOA & UAHS, Shivamogga
3	Dharwad (Karnataka)	Jul-03	550+	UAS Dharwad KVK & DOA
4	Haveri (Karnataka)	Jul-04	110+	ICAR-KVK Hanumanamatti, DOA & UAS, Dharwad
5	Aurangabad (Maharashtra)	Jun-26	350+	VNMKU, Parbhani DAO & KVK Aurangabad
6	Buldana (Maharashtra)	Aug-25	500+	DR PDKV, Akola, AICRP, Maize, DAO & KVK Buldana
7	Chindwara (Madhya Pradesh)	Jul-10	400+	JNKVV, Jabalpur, DAO+ATMA, KVK, Chindwara and ARS, Chindwara
8	Chittorgarh (Rajasthan)	28-Jul	150+	MPUA & T Udaipur, AICRR, Maize & DAO Rajasthan
9	Kanker (Chhattisgarh)	31-Jul	1000+	IGKVV, Raipur, AICRP -Maize DAO, Chhattisgarh & KVK, Kanker
10	Khed Brahma (Gujarat)	6-Aug	800+	SDAU, Dantiwada, KVK, Khed Brahma & DAO Gujarat
11	Coimbatore (Tamil Nadu)	21-Aug	250+	TNAU, Coimbatore & DAO, Tamil Nadu
12	Samastipur (Bihar)	17-Sep	400+	DRR PCAU, Pusa & DAO, Bihar
13	Malda (West Bengal)	28-Sep	1200+	ICAR-CISH, Regional Station, Malda & KVK, Malda

CISH Central Institute of Sub-tropical Horticulture, DAO District Agricultural Office, DOA Department of Agriculture, DR PDKV DR Punjabrao Deshmukh Krishi Vidyapeeth, DR RPCAU, DR Rajendra Prasad Central Agricultural University, IGKVV Indira Gandhi Krishi Vishwa Vidyapeeth, JNKVV Jawaharlal Nehru Krishi Vishwa Vidyalaya, KVK Krishi Vigyan Kendra (Farm Science Centres), MPUA & T Maharana Pratap University of Agriculture and Technology, SDAU Sardarkrishinagar Dantiwada Agricultural University, TNAU Tamil Nadu Agricultural University,

**Table 2**  
**Approved pesticides for the FAW management in India**

Insecticide	Dose (g ai/ha)	Application Rate	Mode of Application	Remarks
Chlorantraniliprole 9.3% + Lambdacyhalothrin 4.6% ZC	35 (23.42 + 11.58) g.a.i/ha	100 ml/acre (0.5 ml/litre of water)	Approved for foliar spray	
Chlorantraniliprole 18.5% SC	40 g.a.i/ha	80 ml/acre (0.4 ml/litre of water)	Approved for foliar spray	
Emamectin benzoate 5 % SG	20 g a.i./ha	160 gm/acre (0.8 gm/litre of water)	Approved for foliar spray	
Spinetoram 11.7% w/w SC	30 g.a.i/ha	100 ml/acre (0.5 ml/litre of water)	Approved for foliar spray	
Cyantraniliprole 19.8% + Thiamethoxam 19.8% FS	2.38 g.a.i/kg seed (1.19+1.19)	6 ml/kg seed	Approved for Seed Treatment	
Emamectin benzoate 5% + Lufenuron 40% WG	80 g.a.i/ha	70 ml/acre (0.35ml/litre of water)	Approved for foliar spray	Subject to MRL fixation on Maize by FSSAI
Thiodicarb 75% WP	750 g.a.i/ha	400 ml/acre (2 ml/litre of water)	Approved for foliar spray	Subject to MRL fixation on Maize by FSSAI
Novaluron 5.25% + Emamectin benzoate 0.9% w/w SC	78.75+13.5 g.a.i/ha	600 ml/acre (3 ml/litre of water)	Approved for foliar spray	Subject to MRL fixation on Maize by FSSAI
Biopesticides				
<i>Metarhiziumanisopliae</i> , <i>Metarhiziumrileyi</i> ( <i>Nomuraearileyi</i> ) <i>Beauveria bassiana</i>		1 × 10 <sup>8</sup> CFU/g @ 5 g/litre whorl application (Repeat after 10 days if required)		
<i>Bacillus thuringiensis</i> var. <i>kurstaki</i>		@ 2 g/l (or) 400 g/acre		
NPV				

**Table 3**  
**Digital/Social Media Impact**

Activity	Analytics
Website	Visitors per month:1875 Poster Download/ month:1350 Page Revives /month :6584
Website Article	News: 220 Research:90 FAW Expert Opinion: 82 Alerts and Advisory
Facebook LinkedIn Twitter	No. of views of Articles:66,028 :1,84,024 :14,207
Indirect Reach to farmers including the Extension Workers: 3,08,000	

**Table 4**  
*Material Distribution for duplication during rallies*

No.	Item	Number(s)
1	FAW 4 type Poster in 8 languages	8000+
2	FAW soft toys	1000+
3	Pheromone Traps and lures to farmers	1000+
4	Field Demonstration Shown	15
5	PPE/ Safety Kits	400+

**Figure 1**  
*Institutional extension framework for FAW management*

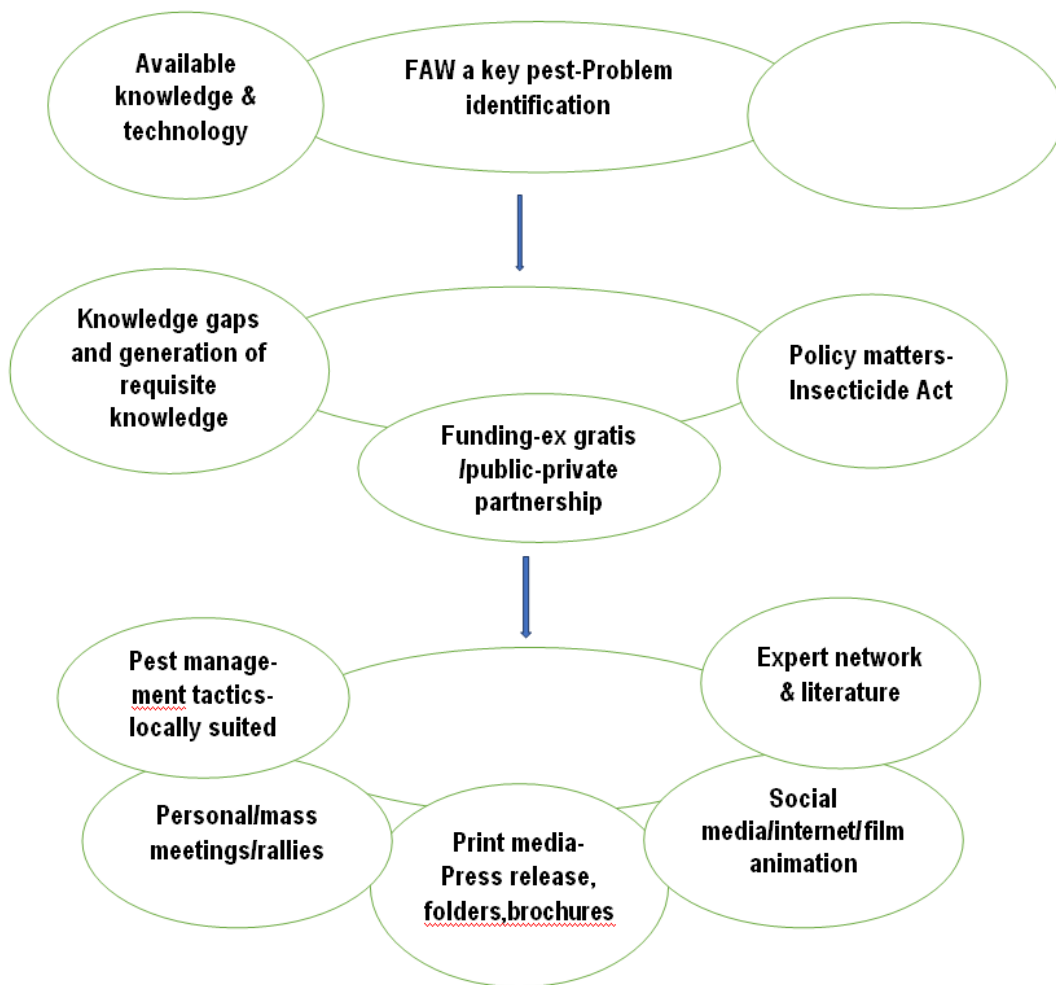


Figure 2  
Poster showing Fall Armyworm Life Cycle

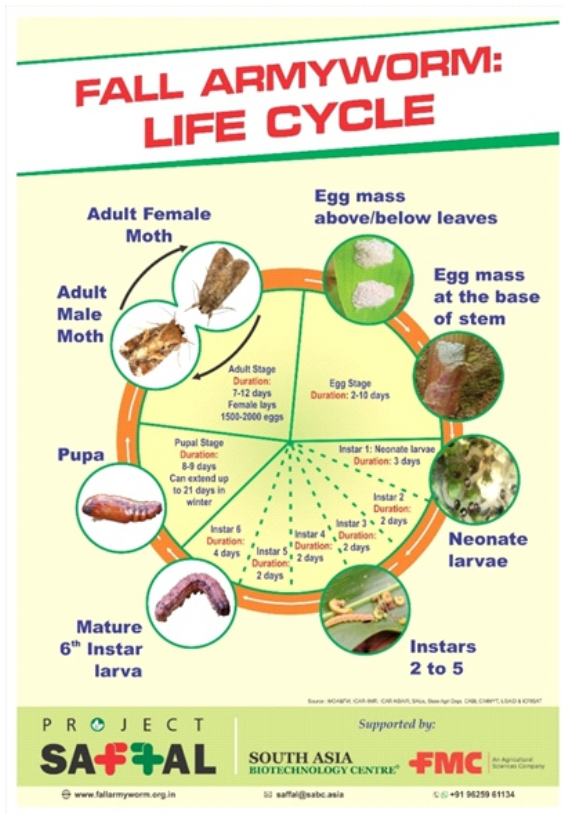
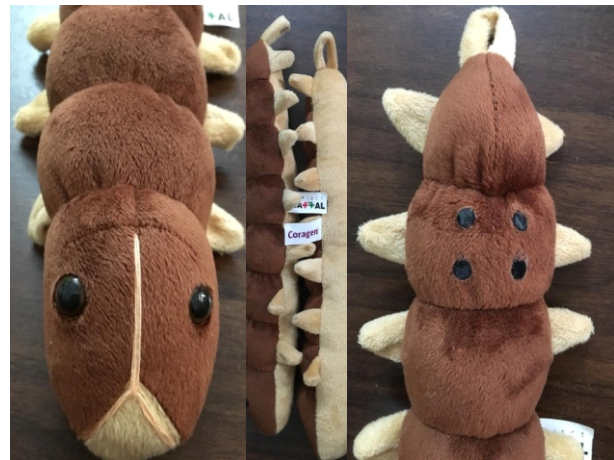


Figure 3  
Fall Armyworm Soft Toycreated under SAFFAL project



Left, front side-head showing inverted Y and right, end side showing four black dots on the eight abdominal segment for identification of FAW larva

Figure 4  
FAW Poster published in Karnataka's Local newspaper VijayVani, 8 July 2020 depicting crop stages and their importance for FAW management

**ಸೈನಿಕ ಹುಳು (ಫಾಲ್ ಆರ್ಮಿವರ್ಮ್) ಕುರಿತು ರೈತರಿಗೆ ಸಲಹೆಗಳು**

**ಮೊದಲನೇ ಕ್ರಮ** 1 ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸಿ

**ಎರಡನೇ ಕ್ರಮ** 2 ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸಿ

**ಮೂರನೇ ಕ್ರಮ** 3 ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸಿ

**ವಿವರಣೆ:**

- ಮೊದಲನೇ ಕ್ರಮ:** ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸಿ. ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು, ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು, ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.
- ಎರಡನೇ ಕ್ರಮ:** ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸಿ. ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು, ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು, ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.
- ಮೂರನೇ ಕ್ರಮ:** ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸಿ. ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು, ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು, ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.

**ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು:**

- ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.
- ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.
- ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.

**ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು:**

- ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.
- ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.
- ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.

**ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು:**

- ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.
- ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.
- ಸೂಕ್ತವಾದ ಕೃಷಿ ವಿಧಾನಗಳನ್ನು ಅಳವಡಿಸುವುದು.

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