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Awareness and knowledge of fall armyworm pest amongst maize growers in Dhule district

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Abstract
The Fall Armyworm (Spodoptera frugiperda), FAW has high capacity of biological and ecological adaptation. FAW can survive on more than 80 plant species, including maize. This paper attempts to explore the awareness and knowledge of recommended package of practices regarding FAW amongst the Maize growers of Shirpur, Sakri and Dhule Tehsils of Dhule district of Maharashtra in India. The findings of the study revealed that, majority of the respondents were educated, economically sound and uses mass media to good extent. Besides this there was a huge gap between expected and actual knowledge regarding the control measures used to control FAW of the maize growers. Therefore, State Agriculture Universities should give recent information about knowledge of FAW and imparts skill amongst farmers through trainings and method demonstration. Also State Agriculture Department should promotes and start Farmers Field School (FFS) regarding FAW on Maize.

Keywords: awareness, knowledge, fall armyworm, maize growers

Introduction
The Fall Armyworm (*Spodoptera frugip*erda) i.e. FAW, is an insect native to tropical and subtropical regions of the Americas. FAW larvae can feed on more than 80 plant species, including maize, rice, sorghum, millet, sugarcane, vegetable crops and cotton. FAW was first detected in Central and Western Africa in early 2016 [1]. In India the pest was reported in Karnataka, Part of AP, Telangana, MS & Gujrat during May, 2018. Under the Jurisdiction Mahatma Phule Krishi Vidyapeeth, Rahuri, the first occurrence was observed in Shirpur, Sakri and Dhule Tehsils of Dhule District of Maharashtra state. FAW's has high capacity of biological and ecological adaptation. Therefore, farmers particularly maize growers will need substantial support to sustainably manage this new pest using Integrated Pest Management (IPM). For the effective implementation of IPM in maize, maize growers must have awareness and knowledge regarding the Fall Armyworm. Hence, the present study entitled, 'Awareness and knowledge of fall armyworm pest amongst Maize growers in Dhule District' was undertaken.

The specific objectives of this research are; to study the socio-economic profile of Maize growers, to study the awareness about Fall Armyworm amongst the Maize growers, to assess the knowledge about Fall Armyworm amongst the Maize growers and to ascertain the constraints faced by Maize growers regarding the Fall Armyworm and suggestions made.

Materials and Methods
The study was conducted purposively in the Shirpur, Sakri and Dhule Tehsils of Dhule district on the basis of area sown under the maize crop. The list of villages having highest area under maize was obtained from the Agriculture Department to select the respondents. A total of 140 representative farmers were selected from nine villages from these three tahsils by using proportionate random sampling procedure. The data were collected through a specially developed interview schedule. Ex-Post Facto Design was used. The data were analyzed, tabulated and interpreted with suitable statistical parameters like frequency, percentage and mean [2].

Results and Discussion
I. Socio-economic characteristics of the respondent maize growers
The socio-economic characteristics of the respondent maize growers like age, education, occupation etc. were studied and grouped under the socio-economic characteristics are presented as Tables below.

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Table 1: Characteristic of the respondent maize growers

Sr. No.	Variables	Categories	No. of Respondents (N=140)	Percentage
1	Age	Young (Up to 35)	14	10.00
		Middle 36 to 50	67	47.86
		Old (51 & above)	59	42.14
2	Education	Illiterate	0	0.00
		Primary (Up to IV std)	6	4.29
		Secondary (V to X std.)	60	42.85
		Higher Secondary (IX &XII)	51	36.43
		Graduate and above	23	16.43
3	Occupation	Agriculture	60	42.85
		Agriculture + Dairying	74	52.86
		Agriculture + Service	06	04.29
4	Farming experience	Low (Up to 11 years)	30	21.43
		Medium (12 to 33 years)	92	65.71
		High (34 years and above)	18	12.86
5	Type of farming	Irrigated	94	67.14
		Partially irrigated	46	32.86
6	Land holding (ha)	Marginal (Up to1.00)	74	52.86
		Small (1.01 to 2.00)	37	26.43
		Semi Medium (2.01 to 3.00)	8	5.71
		Medium (3.01 to 4.00)	19	13.57
		Large (4.01 & above)	2	1.43
7	Area under Maize (ha.)	Up to 0.40	4	2.86
		0.41 to 1.00	46	32.86
		1.01 to 2.00	72	51.44
		Above 2.01	18	12.86
8	Annual income (Rs.)	Up to 125266	69	49.30
		125267 to 250532	24	17.15
		250533 to 375798	25	17.85
		375799 to 501064	9	6.40
		501065 and above	13	9.30
9	Source of information	Low (Up to 4)	22	15.72
		Medium (5 to 7)	82	58.57
		High (8 and above)	36	25.72

Age: From Table 1, it is observed that majority (47.86%) farmers belong to middle age category followed by, old (42.14%) and young age category (10.00%).

Education: It is observed from Table 1 that, all most all respondents were literate. About (16.43%) farmers were graduated and above, 36.43 per cent had completed education up to higher secondary, followed by, secondary level (42.85%) and very few were low educated i.e. up to primary level and nobody was illiterate. This literacy might have helped them in increasing awareness about the FAW using different information sources. The findings are in line with the findings of [3].

Occupation: It is revealed from Table 1 that, majority (52.86%) of the respondents had agriculture and dairying as subsidiary occupation with agriculture as their primary occupation, 42.85 per cent had only agriculture as primary occupation, and 4.29 per cent respondents were employed with some organization in addition to farming. The findings are in line with the findings of [4].

Farming experience: It was found that majority of maize growers (65.71%) had medium maize growing experience, followed by low and high maize growing experience i.e., 21.43 and 12.86 per cent, respectively. Thus it can be concluded that majority maize growers had medium (12 to 33 years) farming experience followed by, low (>11 years) and high farming experience (< 34 years).

Type of farming: From above table it is observed that majority (67.14%) of the respondents had irrigated type of farming, while 32.86 per cent of the respondents had partially irrigated type of farming.

Land holding: From above table it is observed that 52.86 percent had marginal land holding (Upto1.00 ha) followed by, 26.43 per cent had small land holding (1.01 to 2.00 ha), 13.57 per cent had medium land holding (3.01 to 4.00 ha), 5.71 per cent had semi medium (2.01 to 3.00 ha) and 1.43 per cent had Large land holding.

Area under Maize: From above table it is conferred that majority (51.44%) of farmers had 1.01 to 2.00 ha area under maize crop followed by, area upto 0.41ha to 1.00 ha (32.86 per cent). Few farmer i.e. 12.86 and 2.86 percent had area under maize above 2.01 ha and up to 0.40 ha, respectively.

Annual income: The minimum annual income recorded was Rs. 58,270/- and Maximum annual income recorded was Rs. 6,84,600 /- per annum. It can be observed from the data that 49.30 per cent of respondents had annual income Up to Rs. 125266, while 17.85 per cent of the respondents were having their total annual income up to Rs. 250533 to Rs. 375798/- per annum. About 17.15 per cent respondents recorded annual income between Rs. 125267 to Rs. 250532/-. More than 15.00 per cent respondents recorded annual income more than Rs. 375799 /-

Source of information: From the Table 1, it is observed that about 58.57 per cent of the respondents were using medium sources of information, whereas 25.72 and 15.72 per cent of them had used high source of information to medium and low extent, respectively. The findings are in line with the findings of [4]. The main source of information for Ethiopian farmers regarding the fall armyworm was extension agents and media [5].

II. Awareness regarding fall armyworm

The term awareness is operationalized as a result of information possessed by the respondent maize growers in respect of awareness regarding fall armyworm. For this thirteen questions were finalized with the help of Plant Protection Specialist of Krishi Vigyan Kendra, Dhule and available literature to access the awareness regarding fall armyworm and the same were posed to the respondent farmers at the time of interview.

The information regarding the awareness of the respondents about fall armyworm was collected, tabulated and analyzed. The results are presented in Table 2 and 3.

Table 2: Distribution of the respondents according to their overall awareness level

Sr. No.	Category (score)	No. of Respondents (N=140)	
		Number	Percentage
1.	Low (up to 2)	72	51.43
2.	Medium (3 to 7)	39	27.86
3.	High (8 and above)	29	20.71
	Total	140	100.00

From Table 2, it is observed that 51.43 per cent respondents had low awareness level, followed by 27.86 per cent respondents had medium awareness level and 20.71 per cent respondent maize growers had high awareness level of fall armyworm.

Thus, it is concluded that, large majority (79.29 per cent) of the respondents fall under low to medium awareness category.

Table 3: Awareness of the Maize growers regarding FAW

Sr. No.	Questions to test the awareness	No. of Respondents (N=140)			
		Yes		No	
		Freq.	%	Freq.	%
1.	Do you know about the origin of fall armyworm?	00	0.00	140	100.00
2.	If you know, then where is the origin of FAW ?	00	0.00	140	100.00
3.	Has ever been fall armyworm notice on Maize ?	32	22.86	108	77.14
4.	Do you know about the life cycle of FAW ?	32	22.86	108	77.14
5.	Which are the life stages /instars of FAW ?	32	22.86	108	77.14
6.	Where is dormant stage of FAW occurred?	4	2.86	136	97.14
7.	Do you able to identify the eggs of FAW ?	33	23.57	106	76.43
8.	What is the eggs laying capacity of FAW ?	20	14.29	120	85.71
9.	How many time FAW laid eggs in her life ?	20	14.29	120	85.71
10.	During which plant growth stage did you find the incidence of FAW?	130	92.86	10	7.14
11.	Which part of maize plant is most affected by FAW ?	137	97.86	03	2.14
12.	What is the feeding habit / hosts of FAW ?	56	40.00	84	60.00
13.	On which crops the incidence of FAW observed ?	45	32.14	95	67.86

From table 3, it is depicted that all most all (100%) maize growers didn't know the origin of fall armyworm, followed by unaware about dormant stage of FAW (97.14%), eggs laying capacity (85.71%), life cycle and life stages /instars of FAW (77.14%). But at the same time large majority of them are able to identify incidence of FAW. From this it is concluded that there is vast unawareness regarding the FAW amongst the maize growers.

While in Ethiopia and Kenya, majority of the farmers reported that they had observed the larvae of the fall armyworm on infested maize plant, while very few farmers observed eggs and adult stages of the insect [5].

III. Knowledge of recommended package of practices of the Maize growers

The term knowledge in the present study means factual information possessed by maize growers about FAW. To work out the knowledge level, knowledge parameters were finalized and the same were posed to the respondent farmers at the time of interview [2].

Table 4: Knowledge about recommended package of practices followed by maize growers to control Fall Armyworm

Sl. No.	Recommended Cultural Practices	No. of Respondents (N=140)	
		Freq.	%
A.	**Cultural Methods**		
1	Deep Ploughing before sowing in (April-May)	140	100.00
2	Crop rotation	139	99.29
3	Use of Trap crops	27	19.29
4	Intercropping in Maize (Redgram/ Black gram/Green gram)	61	43.57
B.	**Physical Methods**		
1	Use of Bird perch	100	71.43
2	Manual collection & destruction of eggs and larva	77	55.00

3	Use of pheromone traps	74	52.86
C.	**Biological Methods**		
1	Use of neem based insecticides	97	69.29
2	Use of bio-pesticides	121	86.43
3	Use of Tricho card	69	49.29
D.	**Chemical Methods**		
1	Use of appropriate chemical pesticides	110	78.57
2	Use of proper combination of pesticides	84	60.00
3	Use of correct quantity of pesticides	98	70.00

Regarding the knowledge about recommended package of practices followed by maize growers to control Fall Armyworm, Table 4 shows that; all most all (100%) respondent maize growers had knowledge about deep Ploughing before sowing in (April-May), followed by Crop rotation (99.29%), use of bio-pesticides (86.43%), use of appropriate chemical pesticides (78.57%) and use of bird perch (71.43%). Comparatively respondent having knowledge of trap crop (19.29%) and intercropping in Maize (Redgram/ Black gram/Green gram) were less (43.57%).

About 48.00 per cent Ethiopian and Kenyan farmers reported that they used chemical sprays to mitigate the fall armyworm damage [5].

IV. Constraints faced by maize growers in control of Fall Armyworm

Constraints act as a barrier in control of fall armyworm with this view in mind, the respondents were specially asked as to what constraints they have faced regarding fall armyworm.

The results with respect to the constraints faced by respondents in knowledge about fall armyworm are discussed in this section and presented in the table 5.

Table 5: Distribution of maize growers according to the constraints faced

Sr. No.	Constraints	No. of Respondents (N=140)		
		Number	Percentage	Rank
1	High cost of recommended pesticides	122	87.14	I
2	High labour charges	108	77.14	II
3	Not able to identify the damaging stages of FAW ?	105	75.00	III
4	Not able to identify the FAW ?	85	60.71	IV
5	Non-readable font of information sheets provided with pesticides	81	57.86	V
6	Unavailability of tricho cards in time and at local level	74	52.86	VI
7	Unavailability of pheromone trap in time and at local level	65	46.43	VII
8	Unable to use correct quantity of pesticides	63	45.00	VIII
9	Unable to use correct combination of pesticides	52	37.14	IX

From table 5 it is observed that large majority of the respondents (87.14%) reported that cost of recommended pesticides are too high, followed by High labour charges (77.14%), Not able to identify the damaging stages of FAW (75.00%), Not able to identify the FAW (60.71%), Non-readable font of information sheets provided with pesticides (57.86%), Unavailability of tricho cards in time and at local level (52.86%), Unavailability of pheromone trap in time and at local level (46.43%), Unable to use correct quantity of pesticides (45.00%) and Unable to use correct combination of pesticides (37.14%). The findings are in line with the findings of [6].

V. Suggestions of Maize growers for overcoming constraints

Considering the constraints faced by the maize growers regarding FAW, the respondent's suggestions are presented in table 6.

Table 6: Distribution of maize growers according to the suggestions

Sr. No.	Suggestions	Respondents (N=140)	
		Number	percentage
1	Pesticides should made available at subsidized rate	130	92.86
2	Training should be given by State Agricultural Universities and state agriculture department at village level	115	82.14
3	State Agriculture Department should provide critical input kits to control FAW	104	74.29
4	State Agricultural Universities should developed maize varieties which are resistant to FAW	85	60.71
5	State Agriculture Department should made available trichocards and insects traps at village level	48	34.29

From table 6, it is observed that large majority of the respondents (92.86%) suggested that pesticides should made available at subsidized rate followed by, training should be given by State Agricultural Universities and State Agriculture Department at village level (82.14%), State Agriculture Department should provide critical input kits to control FAW (74.29%), State Agricultural Universities should developed FAW resistant maize varieties (60.71%) and State Agriculture Department should made available trichocards and insects traps at village level (34.29%).

Conclusion

From the study on Awareness of Fall Armyworm pest amongst Maize growers it is concluded that, majority of the respondents were middle aged, educated, economically sound, uses mass media to good extent and majority faced constraints regarding training on FAW. Besides this there was a huge gap between expected and actual knowledge & awareness regarding the control measures used to control FAW of the maize growers. Therefore, State Agriculture Universities should give recent information about knowledge of FAW and imparts skill amongst farmers through trainings, method

demonstrations and good quality publications like leaflets, folders, bulletins etc. In addition to this State Agriculture Department should promotes and start Farmers Field School (FFS) regarding FAW on Maize.

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