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Survey and Surveillance of Fall Armyworm in Maize in Purnea District of Bihar

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ABSTRACT

Maize (Zea mays L.) is a very important cereal crop of the world. In India, maize stands at third after wheat and rice both in acreage and production obtained. In Bihar, it holds a very special place among the farmers. In recent times maize crop is affected by both abiotic and biotic factors. Apart from diseases it is getting a major threat from a new insect pest called as fall armyworm (Spodoptera frugiperda Smith) Noctuidae: Lepidopteras. To study the extent of occurrence of Fall Armyworm besides the impact of different weather parameters on the occurrence of Fall Army Worm in Maize in Kosi Region of Bihar, a study has been undertaken at Bhola Paswan Shastri Agricultural College, Purnea. Under this project, block wise survey of farmers was done on both Kharif and Rabi season of maize. The nine different blocks of Purnea district, namely Kasba, Jalalgarh, Dhamdaha, B. Kothi, Bhawanipur, Dagrua, Amour, Purnea East and Rupauli were surveyed under the study. Survey data reveals that among the nine different blocks, maximum incidence of Fall Armyworm has been reported in Bhawanipur block (15%) followed by Jalalgarh, and B. Kothi (both reported 14% incidence) in Rabi. In Kharif also, the maximum incidence of FAW has been reported in Bhawanipur block (13%) followed by Dagurwa, whereas the minimum 5% of incidence of FAW in both the seasons during all the years of study has been reported from Kasba block. The study reveals that the average percent of damage to the maize crop due to the infestation of Fall Armyworm was in the range of (20 to 36 %) at farmer's field in Purnea and adjoining districts, resulting in the reduction of yield. Data showed that the larval population and percent damage has slowed down in the Rabi season, especially during the month of December and January, (15 Dec to 15 Jan) because of low temperature otherwise the temperature, humidity may be within the range of suitability for lifecycle of the pest.

Keywords: Survey, Surveillance, Fall Armyworm, Maize

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INTRODUCTION

Maize (Zea mays L.) is a globally significant cereal crop. It ranks among the top three essential food crops that provide major food energy sources for humans (Awika, 2011). Besides being a crucial cereal for human consumption, maize serves as animal feed and is a vital component in various industries such as starch production, food processing, and bioethanol, due to its adaptability (KPMG et al., 2014). In different regions of India, maize is referred to as Makka, Makai, Chhali, Bhutta, Cholum, Mokochana, and Khaukiri (Rathore, 2002). In the Indian context, maize is the third most produced crop after wheat and rice, both in terms of area cultivated and total output. The crop contributes approximately 10 percent to the overall food grain production in the nation. In the context of India, maize covers an area of 0.87 million hectares (M ha), yielding a production of 2.22 million tonnes (MT) and demonstrating a productivity rate of 2556 kg per hectare. Specifically in Uttar Pradesh, maize is cultivated over an area of 0.74 M ha, resulting in a production of 1.24 MT and a productivity level of 1671 kg per hectare (Anonymous, 2018). Across India, maize is cultivated in several states including Karnataka, Madhya Pradesh, Uttar Pradesh, Bihar, Andhra Pradesh, West Bengal, and Tamil Nadu. In Bihar, maize holds significant importance for farmers. The primary growing season for maize is the kharif season; however, the

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contribution of Rabi maize is greater in comparison to Kharif maize. To enhance farmers' incomes in Bihar, maize can be regarded as a crucial crop due to its applications in different sectors and its richness in carbohydrates, proteins, and vitamins. The inability to achieve high yields in maize is largely attributed to the presence of numerous insect pests. Over 150 insect species inflict damage on the crop from planting through to harvest time. The practice of continuous maize cultivation during the 'kharif', 'rabi', and 'spring' seasons has resulted in various pest issues for the maize crop. Additionally, the introduction of the invasive pest known as fall armyworm (FAW), Spodoptera frugiperda, poses a significant threat and is a prevalent pest in its native region of America (Sah et al., 2019). The fall armyworm, S. frugiperda, is a widespread pest affecting maize globally. In Brazil, the expense associated with managing the fall armyworm in corn exceeds 600 million dollars each year. As reported by the UK Aid and CABI, the Fall Armyworm (FAW) could lead to corn yield loss ranging from 8.3 to 20.6 MT annually across 12 African nations if no management strategies are implemented. The estimated financial loss from these crop reductions is between US$2,481 million and US$6,187 million (Shylesha et al., 2018). In 2018, this highly destructive pest made its way into India. Preliminary reports indicate that yield losses in India attributed to this pest are between 33-36% (Jagdish et al., 2019; Aruna et al., 2019). This pest has created significant problems in various Indian states. Given the pest's potential for causing economic harm to maize, it is vital to conduct studies on the monitoring and assessment of the FAW pest in Purnea district of Bihar.

MATERIALS AND METHODS

Surveys were conducted in the different blocks of Purnea District, under the experiment. The block wise survey of farmers was done in both Kharif and Rabi season of maize during the period of study. The nine different blocks of Purnea district, namely Kasba, Jalalgarh, Dhamdaha, B. Kothi, Bhawanipur, Dagrua, Amour, Purnea East and Rupauli were surveyed under the study. From each block five randomly selected fields were observed at fortnightly interval to record infestation of fall armyworm in maize. In each field, twenty plants were randomly selected and observations on the number of plants damaged due to infestation of fall armyworm out of twenty plants as well as number of larvae per plant were recorded. Apart from this the farmers were asked to complete the questionnaire which was based on their knowledge about FAW, damage of crop, pest incidences and the management for controlling it.

Further, this data was used for calculation of mean larval population per plant as well as percent pest infestation by using the following formulae, Incidence of larvae per plant (nos.) = (No. of larvae) / (Total no. of plants observed) Per cent infestation = (No. of plants damaged) / (Total no. of plants observed) x 100

The data was collected from fortnightly survey was subjected for correlation coefficient and against meteorological data of study period. Later on observation of fall army worm and their management used in farmers' fields has been recorded.

RESULTS AND DISCUSSION

The survey was conducted at fortnightly interval in nine different blocks of Purnea district, namely Kasba, Jalalgarh, Dhamdaha, B. Kothi, Bhawanipur, Dagrua, Amour, Purnea East and Rupauli during kharif and rabi of 2019-2021. The larval load and per cent infestation of fall armyworm were recorded during the roving survey (Fig. 1).

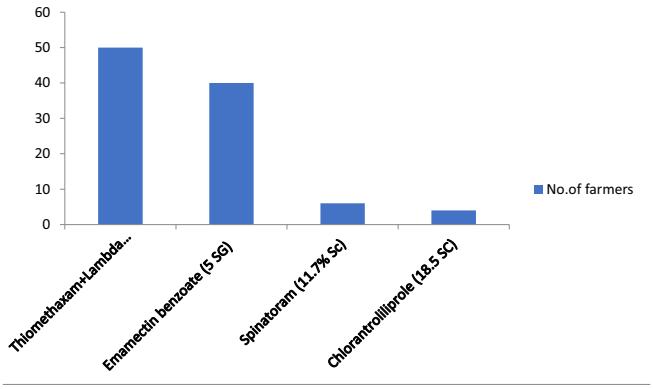

Fig.1: Graphical representation of chemical used by farmers during the survey of fall army in maize

During the course of survey, the per cent infestation in different blocks ranged between 6 to 15 percent of fall army worm incidence. The damage percentage of leaves were also observed in different blocks on different 20 randomly selected plants the damage leaf percentage range from 9 to 28 percent. The larvae per plant were also observed during the survey of different blocks of Purnea district.

Table1: Status of fall armyworm in Purnea district of Bihar during Kharif and Rabi 2020-21

Name of the Block	Percent Incidence of FAW	Damage leaves percentage per 20 plants per plot	Mean larvae Per 20 Plants per plot
kasba	6%	9	7.23
Jalagarh	14%	18	10.30
Dhamdaha	12%	17	11.31
B.kothi	14%	22	13.31
Bhawanipur	15%	26	14.33
Dagurwa	9%	14	10.29
Amour	10%	17	12.33
Purnea East	8%	15	11.32
Rupauli	12%	28	15.35

Table 1 revealed that highest mean number of larvae was observed in Rupauli block of Purnea (15.33) and least mean number of larvae was observed in Kasba block of Purnea district (7.33). The larval load was ranged in between 7.23 to 15.33 among all nine different blocks of Purnea district. The effect of climatic factors on fall armyworm incidence was documented by Waddill et al. (1981). They reported that "heavy rainfall was found lethal to the pest as rain drops accumulates in whorls which creates suffocation to larvae". Kumar et al. (2020) also reported that rainfall was having a significant negative correlation with the incidence of fall armyworm during kharif season in Perambalur district.

Table2: Incidence of fall army worm at Purnea district recorded at fortnight interval along with weather parameters

Period	No. of larvae/10 plants	% damage per 10 plants	Max temp	Min temp	Rainfall	Humidity
16 July to 31 July	9.75	33.50	31.35	26.23	323.40	62.69
1 August to 15 August	14.25	28.50	33.21	27.32	249.90	59.90
16 August to 31 August	27.25	25.25	31.86	26.71	74.90	59.03
1 September to 15 September	28.50	28.75	31.82	26.27	263.00	54.97
16 September to 30 September	25.50	20.25	30.19	25.43	331.90	52.27
1 October to 15 October	28.50	25.5	33.08	25.71	90.30	50.03
16 October to 31 October	31.25	28.75	32.61	23.18	0.00	52.31
1 November to 15 November	23.25	25.5	30.78	16.83	0.00	48.93

Irrespective of the talukas, the late sown maize crop (last week of July) suffered more as compared to the early sown (last week of May) or timely sown crop (first week of June) (Table 2). Mallapur et al. (2010) who stated that the infestation of fall armyworm in northern Karnataka was ranged between 6 to 100 per cent. Painkra et al. (2019) reported that infestation of fall armyworm was ranged between 35 to 70 per cent.

Table3: Data collected from farmers regarding their management of fall army worm in Maize

Chemicals Used	No. of farmers
Thiomethaxam+Lambda Cyhalothrin (12.6 % +9.5 %)	50
Emamectin benzoate (5 SG)	40
Spinetoram (11.7% Sc)	6
Chlorantraniliprole (18.5 SC)	4

Results in table 3 revealed that majority of farmers (50%) were using Thiomethaxam+Lambda cyhalothrin (12.6 % +9.5 %) followed by Emamectin benzoate (5 SG) (40%) and least used chemical by the farmers was Chlorantroliliprole (18.5 SC) (4%).

CONCLUSION

The average per cent damage to the crop was in the range of (20 to 33 %) at farmer's field in Purnea and adjoining districts. Data showed that the larval population and per cent damage has slowed down in the month of November, especially from 1st Nov to 15th Nov. because of low temperature and or otherwise the temperature, humidity may be within the range of suitability for their lifecycle. In survey, farmer responded that all these four insecticides are quite effective for controlling FAW. Among all these insecticdes Thiomethaxam+Lambda cyhalothrin (12.6 % +9.5 %) was easily and cheaply available in the market compared to other insecticides. However farmer also reported that the first two chemicals are very effective at early stages of FAW larvae while Spinetoram and Chlorantraniliprole were effective in the later stage of the crop.

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