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Impact of sowing periods on incidence of fall armyworm, *Spodoptera frugiperda* in maize

Tiku Gurjar, Dilipsinh Sisodiya and Atul Mohapatra

Abstract
The field experiment on the impact of sowing periods of maize on the incidence of fall armyworm in maize was carried out at Entomology farm during *rabi*, 2019-20 and 2020-21. Among the different sowing periods, the lowest larval incidence (3.20 larvae/10 plants), plant damage (45.49%) and cob damage (30.11%) were recorded when the crop was sown during 3rd week of November followed by 1st week of November during both years *i.e.*, 2019-20 and 2020-21. The highest larval incidence (6.09 larvae/10 plants), plant damage (75.62%) and cob damage (57.14%) were obtained in 1st week of October followed by 3rd week of October. Among six sowing periods, the highest grain (4624 kg/ha) and fodder (6579 kg/ha) yields of maize were produced during 3rd week of November and it was at par with 1st week of November. The lowest grain (2616 kg/ha) and fodder (4059 kg/ha) yields were recorded when maize was sown during the 1st week of October and it was at par with the 3rd week of October.

Keywords: Fall armyworm (FAW) and Standard meteorological week (SMW)

1. Introduction
Invasive alien species cause a serious threat to agriculture and cost billions of dollars in terms of reduced production and productivity. A recent study showed that about 1300 species of invasive insect pests and pathogens have been introduced into 124 countries (Paini *et al*., 2016) [18]. The Fall Armyworm is one of them an invasive pest of maize that is native to the United States of America (Anonymous, 2019a) [1]. It has not been detailed in any other portion of the world except the North, Central and South United States of America up to 2015. Then, it was reported in the African continent which caused serious damage to maize crops in January 2016 (Goergen *et al*., 2016) [11]. In India, it was reported in maize crops in different areas of Karnataka on 18th May 2018 (Sharanabasappa *et al*., 2018) [21]. The potential FAW has come to India and Indo-china by characteristic relocation from Africa with the help of the Somali Flight. After the first time report of FAW on maize in Karnataka, later it was reported from different parts of the country (Deole and Paul, 2018; Sisodiya *et al*., 2018; Meena *et al*., 2019; Dhar *et al*., 2019; Jitendra *et al*., 2019 and Kerketta *et al*., 2020) [9, 24, 16, 10, 14, 15].
FAW can be a cosmopolitan pest because it attacked more than 100 hosts (Wiseman *et al*., 1966) [26]. It brought about principal damage to economically important cultivated grasses such as rice, maize, sorghum, and sugarcane as well as horticultural crops like cabbage, beet, tomato, potato and onion other than cotton, pasture grasses, peanut, soybean, alfalfa and millets (Chapman *et al*., 2000) [6].
In general, the maize infestation by FAW ranged from 26.4 to 55.9 per cent and impacted yield of 11.57 per cent (Baudron *et al*., 2019) [5] but, it's the severity of damage varies from region to region. According to the initial reports, FAW had been attributed to 33-36 per cent corn yield losses in India (Jagdish *et al*., 2019 and Balla *et al.*, 2019]) [13, 4]. This pest becomes havoc in various states of India and it affected 1.4 lakh ha in Karnataka; 85,000 ha in Madhya Pradesh; 59,000 ha in Rajasthan; 2000 ha in Maharashtra; 1,747.9 hectares in Mizoram; 200 ha in Tamil Nadu and 137 ha in Andhra Pradesh (Anonymous, 2019b) [2].
Different strategies have to be involved for keeping the pest in check and stabilizing the productivity of the cropping system. Date of sowing is one of the crop habitat diversifications which help to minimize the incidence of insect-pests on maize crop so that its yield can be enhanced. It takes advantage of the absence of the pest or avoids susceptible stage of the crop. But, studies on relationship between different dates of sowing of crop which aid to find out the incidence of insect-pests which helps to forewarn the cultivators to resort to preventive measures against such pests in time (Singh, 1999) [23].

2. Materials and Methods

A field study on the impact of sowing periods of maize on the incidence of fall armyworm in maize was carried out at Entomology farm, B. A. College of Agriculture, Anand Agricultural University, Anand during *rabi*, 2019-20 and 2020-21. Maize variety GAYMH-3 was grown in the 4.8 x 6.0 m plot with 60 x 20 cm spacing according to treatments (D_1:1st week of October, D_2: 3rd week of October, D_3:1st week of November, D_4: 3rd week of November, D_5:1st week of December and D_6: 3rd week of December) and four replications with Randomized Block Design. The crop was raised with all standard agronomical practices except the application of insecticide.

For recording observations, Ten plants were randomly selected from each net plot. The number of the larvae and damaged and healthy plants were recorded at the weekly interval after the germination of the crop up to harvest of the crop while, damaged and healthy cobs per ten plants were recorded at the weekly intervals starting from cob formation up to harvest of the crop. Based on a healthy and damaged plants and cobs, per cent plants and cobs damage were calculated. The grain and dry fodder yield were recorded from each net plot area. The data were subjected to ANOVA after following square root and arc sine transformation.

3. Result and Discussion

3.1 Based on Larval Population

Periodical data presented in Appendix 1 to 3 indicated that the larval population initiated in all the treatments from the 3rd week after the sowing of maize. After that, it continued to increase and reached to peak in the 8th week after the sowing of maize. Then it continues to decrease from the 9th week (the tassel inside maize whorl) to the 15th week after sowing (the dough stage of maize) of maize. There were only differences in larval density of fall armyworm according to different periods of sowing of maize and the results for both the years (2019-20 & 2020-21) as well as pooled over years are shown in Appendix 1 to 3, respectively.

First Year (*Rabi*, 2019-20)

The data on the number of larvae per 10 plants are provided in Table 1. The six dates of sowing of maize were found significantly differing from each other. Data shows that a significantly the lowest larval population of fall armyworm was recorded from maize sown during 3rd week of November (3.04 larvae/10 plants) followed by 1st week of November (3.70 larvae/10 plants). The larval incidence recorded in maize sown during the 1st and 3rd week of December were 4.45 and 4.82 larvae per 10 plants, respectively, which were averaged across all sowing dates. The highest larval incidence was observed in maize sown during 1st week of October (5.92 larvae/10 plants) followed by 3rd week of October (5.52 larvae/10 plants).

Second year (*Rabi*, 2020-21)

The information regarding the number of larvae per 10 plants gathered periodically as well as pooled over periods are presented in Table 1. The pooled over periods data showed that significantly the lowest larval population of fall armyworm was recorded from maize sown during 3rd week of November (3.35 larvae/10 plants) followed by 1st week of November (3.92 larvae/10 plants). Maize sown during the 1st and 3rd week of December were observed with a larval incidence of 4.70 and 4.97 larvae per 10 plants, respectively, which were mediocre among all dates of sowing. The highest larval incidence was recorded from crop sown during 1st week of October (6.26 larvae/10 plants) followed by 3rd week of October (5.75 larvae/10 plants).

Pooled Over Years (*Rabi*, 2019-20 & 2020-21)

The pooled over years data are summarized in Table 1 indicated that significantly the lowest larval incidence of fall armyworm was observed in maize sown during 3rd week of November (3.20 larvae/10 plants) which was followed by the 1st week of November (3.81 larvae/10 plants). The larval population in 1st week of December (4.57 larvae/10 plants) and 3rd week of December (4.90 larvae/10 plants) was closely following. The highest larval population was recorded in the maize crop sown during 1st week of October (6.09 larvae/10 plants) followed by 3rd week of October (5.63 larvae/10 plants).

Davis *et al.* (1996) [8] recorded the maximum insect colony of FAW during the early planting period compared to late planting in the Tifton location. Cherry *et al.* (2013) [7] recorded the highest foliar damage done by FAW in the early sowing crop than in late sowing. Sisodiya *et al.* (2020) [25] recorded the lowest larval incidence of FAW (0.33 larva/ 10 plants) in timely sown sweet corn (3rd week of November) and the highest (1.35 larva/ 10 plants) in early sown sweet corn (1st week of October). These reports are less or more in agreement with the findings of the present investigation. However, in contrast to the above researchers, Perdiguero *et al.* (1967) [19] recorded the maximum larval population of FAW in the late sowing date (1.3 larvae/plant) than the optimum sowing date (0.5 larva/plant) in maize. Ayala *et al.* (2013) [3] found the highest mean density of larvae on late sowing (1.65 larvae/plant) than the optimal sowing (1.16 larvae/plant) in maize. Reddy (2020) [20] observed the lowest incidence of FAW larvae (0.54 larva/plant) from early sown maize (15th June) and the highest (1.10 larva/plant) from late sown maize (16th July). Shashank *et al.* (2022) [22] noted the lowest larval population (0.63 larvae/plant) in early sown maize (October 2nd fortnight) whereas; the highest mean larval population (1.78 larvae/plant) was recorded in late sown crop (December 1st fortnight).

3.2 Based on Plant Damage (%)

The per cent damaged plants caused by fall armyworm corresponded to the larval population of FAW. Periodical data indicates that it began in all the treatments from the 3rd week after the sowing of maize. Later, it kept rising until it peaked in the 8th week after the sowing of maize. Following that, plant infestation gradually declined up to the 15th week after the sowing of maize. Here only differences found in the intensity of per cent plants damage according to different dates of sowing of maize and its findings are shown in Appendix 4 to 6 for both years (2019-20 & 2020-21) along with the data pooled over years, respectively.

First Year (*Rabi*, 2019-20)

Data on damaged plants per 10 plants are compiled in Table 2. It is significantly different from each other on all six dates of sowing. The pooled over period's data indicated that the significantly lowest plant damage by FAW was observed from maize sown in the 3rd week of November (45.37%) followed by the 1st week of November (50.12%). The plant damage was moderate in maize sown during 1st week of December (60.07%) and 3rd week of December (64.12%). The

highest plant damage was noted when maize was sown during the 1st week of October (73.97%) followed by the 3rd week of October (70.41%).

Second Year (*Rabi*, 2020-21)
The pooled over period data on the percentage of plant damage per 10 plants are presented in Table 2. The results indicated that the plant damage by FAW was significantly lowest when maize was sown in the 3rd week of November (45.62%) which was followed by the 1st week of November (53.90%). Maize sown during the 1st and 3rd week of December had plant damage rates of 61.13 per cent and 64.45 per cent, respectively which were closely followed and found mediocre among all dates of sowing. The highest plant damage was recorded in the maize crop sown during 1st week of October (77.22%) followed by 3rd week of October (72.41%).

Pooled Over Years (*Rabi*, 2019-20 & 2020-21)
The pooled over year's data on the percentage of damage are presented in Table 2. The data indicated the significantly lowest plant damage was noted from the crop sown during the 3rd week of November (45.49%) followed by the 1st week of November (52.02%). The plant damage was moderate in maize sown during 1st week of December (60.60%) and 3rd week of December (64.29%). The highest plant damage was noted when maize was sown during the 1st week of October (75.62%) followed by the 3rd week of October (71.42%).
The result of the present finding is supported by the Sisodiya *et al*. (2020) [25] report which recorded the lowest plant damage (15.61%) caused by FAW in timely sown sweet corn (3rd week of November) and the highest (44.44%) in early sown sweet corn (1st week of October). However, in contrast to the present finding, Perdiguero *et al*. (1967) [19] recorded the maximum attack rate of FAW at the late sowing date (80.00%) than the optimum sowing date (37. 00%) in maize. Ayala *et al*. (2013) found the highest plant damage on late sowing (43%) than optimal sowing (26.5%) in maize. Reddy (2020) observed the lowest per cent plant damage (21.25%) caused by FAW from early sown maize (15th June) and the highest (36.54%) from late sown maize (16th July). Shashank *et al.* (2022) [22] observed the lowest plant damage (33.55%) in early sown maize (October 2nd fortnight) whereas the highest plant damage (61.51%) was recorded in late sown crop (December 1st fortnight).

3.3 Based on Cob Damage (%)
The periodical data revealed that the fall armyworm started causing damage to the cob from the 11th week after sowing (Silking or blister stage of corn) of maize. Then, it gradually increased until the 15th week after the sowing of maize. The findings regarding cob damage per ten plants for both years (2019-20 & 2020-21) as well as a pool over years are shown in Appendix 7 to 9, respectively.

First Year (*Rabi*, 2019-20)
The pooled over periods data on the percentage of cob damaged by fall armyworm per 10 plants are compiled in Table 3. The results showed that the significantly lowest cob damage was received from maize sown during 3rd week of November (29.18%) followed by 1st week of November (36.38%). The cob damage in maize sown during 1st week of December (42.14%) was mediocre and it was at par with the 3rd week of December (44.23%). The highest cob damage was noted when maize was sown during the first week of October (55.84%) and it was at par with the crop sown during the 3rd week of October (52.01%).

Second Year (*Rabi*, 2020-21)
The pooled periods data on the percentage of cob damage caused by fall armyworm per 10 plants are presented in Table 3. Data showed the significantly lowest cob damage was recorded in maize sown during 3rd week of November (31.04%) followed by 1st week of November (39.57%). The cob damage observed in maize sown during the 1st and 3rd week of December were 44.73 and 46.26 per cent, respectively, which were averaged across all sowing dates. The highest cob damage was found in maize sown during 1st week of October (58.43%) and it was at par with the 3rd week of October (53.64%).

Pooled Over Years (*Rabi*, 2019-20 & 2020-21)
The pooled over years data on cob damage caused by fall armyworm in maize are represented in Table 3. The data indicated that the cob damage by FAW was significantly lowest when maize was sown in the 3rd week of November (30.11%) followed by the 1st week of November (37.97%). The highest cob damage was noted when maize was sown during the 1st week of October (57.14%) followed by the 3rd week of October (52.83%) and the 3rd week of December (45.25%) and it was at par with the 1st week of December (43.44%).
Cherry *et al*. (2013) [7] recorded the maximum heading damage by FAW in the early sowing crop than the late sowing. Sisodiya *et al*. (2020) [25] recorded the lowest cob damage caused (15.44%) by FAW in timely sown sweet corn (3rd week of November) and the highest (49.01%) in early sown sweet corn (1st week of October). These reports are in close agreement with the findings of the present investigation. However, in contrast to the above, Mitchell (1978) [17] noted the lowest per cent cob damage (< 8%) in all plantings made before 12th April and the highest (12 to 60%) in late sown maize (April 2nd fortnight).

3.4 Base on Grain yield (kg/ha)
The data on maize grain yield for the years 2019-20 and 2020-21 are shown in Table 4. All treatments were discovered to differ significantly from one another.

First Year (*Rabi*, 2019-20)
The data (Table 4) indicated that the significantly the highest grain yield was recorded from maize sown during 3rd week of November (4715 kg/ha) and it was at par with 1st week of November (4266 kg/ha) followed by 1st week of December (3891 kg/ha). While lowest grain yield was noted when maize was sown during the 1st week of October (2698 kg/ha) which was at par with the 3rd week of October (3134 kg/ha) followed by the 3rd week of December (3544 kg/ha).

Second Year (*Rabi*, 2020-21)
The results (Table 4) revealed that the significantly highest grain yield was observed in the 3rd week of November (4533 kg/ha) which was at par with the 1st week of November (4067 kg/ha). Both these treatments were found at par and harvested significantly higher yields over the rest of the sowing periods. The lowest grain yield was recorded in the 1st week of October (2533 kg/ha) which was at par with the 3rd week of October (2978 kg/ha) followed by 3rd week of December

(3494 kg/ha) and 1st week of December (3719 kg/ha).

Pooled Over Years (*Rabi*, 2019-20 & 2020-21)

According to data (Table 4), the highest grain yield of maize was produced during 3rd week of November (4624 kg/ha) followed by 1st week of November (4167 kg/ha) and it was at par with 1st week of December (3805 kg/ha). The lowest grain yields were noted when maize was sown during the 1st week of October (2616 kg/ha) followed by the 3rd week of October (3056 kg/ha) and 3rd week of December (3519 kg/ha).

The present finding is supported by Sisodiya *et al.* (2020) [25] who harvested a highest grain yield from timely sown sweet corn (3rd week of November) and lowest from early sown sweet corn (1st week of October) whereas in contrast to present finding, Harrison (1984) found 6, 2, 63, 69 and 84 per cent infested plants and 0, 0, 20.9, 31.0, 38 per cent yield loss in a series of five plantings (25th May, 1st June, 9th June, 16th June and 23rd June) of corn, respectively. Shashank *et al.* (2022) [22] also obtained a highest grain yield in early sown maize (October 2nd fortnight) whereas; it recorded lowest in late sown crop (December 1st fortnight).

3.5 Base on dry fodder yield (kg/ha)

The data on maize dry fodder yield during 2019-20 and 2020-21 are given in Table 4. There were significant differences among the six sowing dates.

First Year (*Rabi*, 2019-20)

The highest dry fodder yield was recorded from maize sown during 3rd week of November (6791 kg/ha) and it was at par with 1st week of November (4167 kg/ha) followed by 1st week of December (5627 kg/ha). The lowest dry fodder yield found even though maize was sown during the 1st week of October (4218 kg/ha) and it was at par with the 3rd week of October (4593 kg/ha) and 3rd week of December (5440 kg/ha).

Second Year (*Rabi*, 2020-21)

The data (Table 4) indicated that the significantly highest dry fodder yield was noted from maize sown during 3rd week of November (6366 kg/ha) and it was at par with 1st week of November (5916 kg/ha). The lowest dry fodder yield was recorded when maize was sown during the 1st week of October (3899 kg/ha) which was at par with the 3rd week of October (4326 kg/ha) followed by 3rd week of December (4881 kg/ha) and it was at par with 1st week of December (5276 kg/ha).

Pooled Over Years (*Rabi*, 2019-20 & 2020-21)

Data (Table 4) showed the significantly highest dry fodder yield was obtained in the 3rd week of November (6579 kg/ha) which was at par with the 1st week of November (6092 kg/ha) followed by 1st week of December (5452 kg/ha) and 3rd week of December (5161 kg/ha). The lowest dry fodder yield was taken in the 1st week of October (4059 kg/ha) and it was at par with the 3rd week of October (4460 kg/ha).

Sisodiya *et al.* (2020) [25] obtained the highest fodder yield from timely sown sweet corn (3rd week of November) and the lowest from early sown sweet corn (1st week of October). The above report closely supports to the present finding.

According to the above results, it can be concluded that the early-sown maize crop (1st week of October) had the highest larval population, plant and cob damage as well as the lowest grain and fodder yield. While a timely sown maize crop (3rd week of November) had the lowest larval population, plant and cob damage along with the highest grain and fodder yield. The variation in the sowing periods noticed in the literature may be due to the variation in climatic conditions that prevailed in the respective study places, crop variety and ecological factors.

Table 1: Impact of sowing periods on incidence of *S. frugiperda* in maize

Tr. No.	Treatments	No. of larvae / 10 plants		
		2019-20	2020-21	Pooled
D_1	1st week of October	2.53 (5.92)	2.60 (6.26)	2.57 (6.09)
D_2	3rd week of October	2.45 (5.52)	2.50 (5.75)	2.48 (5.63)
D_3	1st week of November	2.05 (3.70)	2.10 (3.92)	2.08 (3.81)
D_4	3rd week of November	1.88 (3.04)	1.96 (3.35)	1.92 (3.20)
D_5	1st week of December	2.23 (4.45)	2.28 (4.70)	2.25 (4.57)
D_6	3rd week of December	2.31 (4.82)	2.34 (4.97)	2.32 (4.90)
S.Em.± (Date of sowing) D		0.03	0.03	0.02
(Period) P		0.04	0.04	0.03
(Year)Y		-	-	0.01
D x P		0.10	0.11	0.08
D x Y		-	-	0.03
P x Y		-	-	0.04
D x P x Y		-	-	0.11
C. D. at 5% D		0.08	0.08	0.06
P		0.12	0.12	0.09
Y		-	-	0.03
D x P		NS	NS	NS
D x Y		-	-	NS
P x Y		-	-	NS
D x P x Y		-	-	NS
C. V. (%)		9.34	9.59	9.47

Note: 1 Figures in parentheses are retransformed values and those outside are √(X+0.5) transformed values 2. NS = Non-significant

Table 2: Impact of sowing periods on plant damage by *S. frugiperda* in maize

Tr. No.	Treatments	Plant damage (%)		
		2019-20	2020-21	Pooled
D_1	1st week of October	59.32 (73.97)	61.50 (77.22)	60.41 (75.62)
D_2	3rd week of October	57.05 (70.41)	58.31 (72.41)	57.68 (71.42)
D_3	1st week of November	45.07 (50.12)	47.24 (53.90)	46.16 (52.02)
D_4	3rd week of November	42.34 (45.37)	42.49 (45.62)	42.41 (45.49)
D_5	1st week of December	50.81 (60.07)	51.43 (61.13)	51.12 (60.60)
D_6	3rd week of December	53.20 (64.12)	53.40 (64.45)	53.30 (64.29)
S.Em.± (Date of sowing) D		0.82	0.84	0.59
(Period) P		1.21	1.23	0.86
(Year)Y		-	-	0.34
D x P		2.97	3.02	2.12
D x Y		-	-	0.83
P x Y		-	-	1.22
D x P x Y		-	-	3.00
C. D. at 5% D		2.29	2.32	1.63
P		3.36	3.42	2.40
Y		-	-	0.94
D x P		NS	NS	NS
D x Y		-	-	NS
P x Y		-	-	NS
D x P x Y		-	-	NS
C. V. (%)		11.60	11.48	11.54

Note: 1 Figures in parentheses are retransformed values and those outside arc sine transformed values 2. NS = Non-significant

Table 3: Impact of sowing periods on cob damage by *S. frugiperda* in maize

Tr. No.	Treatments	Cob damage (%)		
		2019-20	2020-21	Pooled
D_1	1st week of October	48.35 (55.84)	49.85 (58.43)	49.10 (57.14)
D_2	3rd week of October	46.15 (52.01)	47.09 (53.64)	46.62 (52.83)
D_3	1st week of November	37.09 (36.38)	38.98 (39.57)	38.04 (37.97)
D_4	3rd week of November	32.69 (29.18)	33.86 (31.04)	33.28 (30.11)
D_5	1st week of December	40.48 (42.14)	41.98 (44.73)	41.23 (43.44)
D_6	3rd week of December	41.69 (44.23)	42.86 (46.26)	42.27 (45.25)
S.Em.± (Date of sowing) D		1.07	1.11	0.77
(Period) P		0.97	1.02	0.70
(Year)Y		-	-	0.44
D x P		2.38	2.50	1.72
D x Y		-	-	1.09
P x Y		-	-	1.00
D x P x Y		-	-	2.44
C. D. at 5% D		3.00	3.14	2.14
P		2.74	2.87	1.95
Y		-	-	1.23
D x P		NS	NS	NS
D x Y		-	-	NS
P x Y		-	-	NS
D x P x Y		-	-	NS
C. V. (%)		11.61	11.75	11.69

Note: 1 Figures in parentheses are retransformed values and those outside arc sine transformed Values 2. NS = Non-significant

Table 4: Impact of sowing periods on grain and fodder yield of maize

Tr. No.	Treatments	Grain yield (kg/ha)			Dry fodder yield (kg/ha)		
		2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
D_1	1st week of October	2698	2533	2616	4218	3899	4059
D_2	3rd week of October	3134	2978	3056	4593	4326	4460
D_3	1st week of November	4266	4067	4167	6267	5916	6092
D_4	3rd week of November	4715	4533	4624	6791	6366	6579
D_5	1st week of December	3891	3719	3805	5627	5276	5452
D_6	3rd week of December	3544	3494	3519	5440	4881	5161
S.Em.± (Date of sowing) D			209	153	330	325	224
Year (Y)			-	88	-	-	130
D x Y			-	216	-	-	317
C. D. at 5% D			629	366	994	979	537
Y			-	NS	-	-	NS
D x Y			-	NS	-	-	NS
C. V. (%)			11.75	11.92	12.01	12.71	11.99

4. Conclusion

Among the different sowing periods, the crop sown during 3rd week of November was proved effective by recording lowest larval incidence, plant damage as well as cob damage and thereby increases in the grain and fodder yield in managing the incidence of fall armyworm.

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Appendix 1: Impact of sowing periods on incidence of *S. frugiperda* in maize (2019-20)

Date of sowing	No. of larvae / 10 plants													
	3 WAS	**4 WAS**	**5 WAS**	**6 WAS**	**7 WAS**	**8 WAS**	**9 WAS**	**10 WAS**	**11 WAS**	**12 WAS**	**13 WAS**	**14 WAS**	**15 WAS**	**Pooled**
D_1	2.45 (5.49)	2.69 (6.73)	2.91 (7.99)	3.04 (8.73)	3.11 (9.19)	3.16 (9.47)	2.73 (6.95)	2.45 (5.49)	2.23 (4.49)	2.29 (4.74)	2.18 (4.24)	2.06 (3.74)	1.65 (2.23)	2.53 (5.92)
D_2	2.34 (4.98)	2.55 (5.98)	2.82 (7.46)	2.91 (7.94)	2.99 (8.47)	3.04 (8.72)	2.64 (6.45)	2.39 (5.22)	2.17 (4.21)	2.28 (4.72)	2.11 (3.97)	2.00 (3.48)	1.65 (2.23)	2.45 (5.52)
D_3	1.65 (2.23)	1.92 (3.20)	2.34 (4.98)	2.49 (5.72)	2.59 (6.21)	2.64 (6.45)	2.22 (4.44)	1.99 (3.46)	1.86 (2.96)	2.06 (3.74)	1.93 (3.24)	1.64 (2.18)	1.31 (1.23)	2.05 (3.70)
D_4	1.40 (1.47)	1.73 (2.48)	2.17 (4.19)	2.32 (4.91)	2.44 (5.45)	2.48 (5.66)	2.11 (3.97)	1.92 (3.20)	1.65 (2.23)	1.80 (2.73)	1.73 (2.48)	1.49 (1.73)	1.22 (1.00)	1.88 (3.04)
D_5	2.00 (3.48)	2.22 (4.44)	2.59 (6.21)	2.64 (6.45)	2.78 (7.21)	2.78 (7.23)	2.39 (5.22)	2.18 (4.24)	2.00 (3.48)	2.11 (3.94)	2.00 (3.48)	1.86 (2.96)	1.40 (1.47)	2.23 (4.45)
D_6	2.05 (3.71)	2.34 (4.98)	2.64 (6.45)	2.73 (6.97)	2.86 (7.69)	2.91 (7.96)	2.44 (5.45)	2.23 (4.49)	2.05 (3.71)	2.17 (4.19)	2.05 (3.71)	1.93 (3.24)	1.58 (2.00)	2.31 (4.82)
S.Em.± D	0.09	0.11	0.12	0.14	0.14	0.13	0.13	0.10	0.10	0.10	0.09	0.11	0.07	0.03
P	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04
D x P	-	-	-	-	-	-	-	-	-	-	-	-	-	0.10
C. D. at 5% D	0.28	0.35	0.37	0.41	0.42	0.40	0.40	0.30	0.31	0.30	0.27	0.32	0.23	0.08
P	-	-	-	-	-	-	-	-	-	-	-	-	-	0.12
D x P	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C. V. (%)	9.52	10.25	9.44	10.08	9.92	9.28	10.98	9.22	10.23	9.55	9.08	11.53	10.16	9.34

Note: 1. Figures in parentheses are retransformed values and those outside are $\sqrt{X + 0.5}$ transformed values
2. NS = Non-significant
3. Significant parameters: D (Date of sowing) and P (Period)

Where,				
	D_1: 1st week of October	D_3: 1st week of November	D_5: 1st week of December	WAS: Week After Sowing
	D_2: 3rd week of October	D_4: 3rd week of November	D_6: 3rd week of December	

Appendix 2: Impact of sowing periods on incidence of *S. frugiperda* in maize (2020-21)

Date of sowing	No. of larvae / 10 plants													
	3 WAS	**4 WAS**	**5 WAS**	**6 WAS**	**7 WAS**	**8 WAS**	**9 WAS**	**10 WAS**	**11 WAS**	**12 WAS**	**13 WAS**	**14 WAS**	**15 WAS**	**Pooled**
D_1	2.55 (5.98)	2.78 (7.23)	3.04 (8.73)	3.12 (9.22)	3.16 (9.47)	3.20 (9.73)	2.82 (7.46)	2.59 (6.22)	2.28 (4.72)	2.34 (4.95)	2.23 (4.49)	1.98 (3.42)	1.73 (2.48)	2.60 (6.26)
D_2	2.39 (5.22)	2.64 (6.45)	2.91 (7.99)	2.99 (8.47)	3.04 (8.73)	3.12 (9.23)	2.68 (6.71)	2.39 (5.22)	2.23 (4.47)	2.28 (4.72)	2.17 (4.19)	2.00 (3.48)	1.65 (2.23)	2.50 (5.75)
D_3	1.80 (2.73)	2.05 (3.71)	2.39 (5.20)	2.55 (5.98)	2.64 (6.45)	2.74 (6.98)	2.28 (4.72)	2.05 (3.71)	1.87 (3.00)	2.00 (3.48)	1.86 (2.96)	1.80 (2.73)	1.31 (1.23)	2.10 (3.92)
D_4	1.56 (1.95)	1.79 (2.70)	2.27 (4.65)	2.38 (5.16)	2.54 (5.94)	2.58 (6.16)	2.17 (4.21)	1.98 (3.42)	1.86 (2.96)	1.87 (3.00)	1.80 (2.73)	1.49 (1.73)	1.22 (1.00)	1.96 (3.35)
D_5	2.05 (3.71)	2.34 (4.98)	2.59 (6.22)	2.72 (6.92)	2.77 (7.17)	2.86 (7.66)	2.49 (5.70)	2.22 (4.44)	2.11 (3.94)	2.12 (4.00)	2.00 (3.48)	1.87 (3.00)	1.49 (1.73)	2.28 (4.70)
D_6	2.11 (3.97)	2.44 (5.45)	2.64 (6.45)	2.81 (7.42)	2.91 (7.95)	2.91 (7.95)	2.55 (5.98)	2.34 (4.98)	2.11 (3.97)	2.17 (4.19)	2.06 (3.74)	1.87 (3.00)	1.49 (1.73)	2.34 (4.97)
S. Em.± D	0.10	0.12	0.13	0.15	0.14	0.14	0.12	0.13	0.10	0.10	0.10	0.09	0.08	0.03
P	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04
D x P	-	-	-	-	-	-	-	-	-	-	-	-	-	0.11
C. D. at 5% D	0.30	0.37	0.39	0.46	0.41	0.41	0.37	0.40	0.30	0.30	0.30	0.28	0.25	0.08
P	-	-	-	-	-	-	-	-	-	-	-	-	-	0.12
D x P	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C. V. (%)	9.54	10.49	9.86	11.01	9.63	9.37	9.76	11.69	9.70	9.30	9.80	10.04	11.19	9.59

Note: 1. Figures in parentheses are retransformed values and those outside are $\sqrt{X + 0.5}$ transformed values
2. NS = Non-significant
3. Significant parameters: D (Date of sowing) and P (Period)

Where,	D_1: 1st week of October	D_3: 1st week of November	D_5: 1st week of December	WAS: Week After Sowing
	D_2: 3rd week of October	D_4: 3rd week of November	D_6: 3rd week of December	

Appendix 3: Impact of sowing periods on incidence of S. frugiperda in maize (Pooled over years, 2019-20 & 2020-21)

Date of sowing	No. of larvae / 10 plants													
	3 WAS	4 WAS	5 WAS	6 WAS	7 WAS	8 WAS	9 WAS	10 WAS	11 WAS	12 WAS	13 WAS	14 WAS	15 WAS	Pooled
D_1	2.50 (5.73)	2.73 (6.97)	2.98 (8.35)	3.08 (8.97)	3.14 (9.33)	3.18 (9.60)	2.78 (7.20)	2.52 (5.85)	2.26 (4.60)	2.31 (4.85)	2.21 (4.36)	2.02 (3.58)	1.69 (2.36)	2.57 (6.09)
D_2	2.37 (5.10)	2.59 (6.22)	2.87 (7.72)	2.95 (8.20)	3.02 (8.60)	3.08 (8.97)	2.66 (6.58)	2.39 (5.22)	2.20 (4.34)	2.28 (4.72)	2.14 (4.08)	2.00 (3.48)	1.65 (2.23)	2.48 (5.63)
D_3	1.73 (2.48)	1.99 (3.45)	2.36 (5.09)	2.52 (5.85)	2.61 (6.33)	2.69 (6.72)	2.25 (4.58)	2.02 (3.58)	1.87 (2.98)	2.03 (3.61)	1.90 (3.10)	1.72 (2.45)	1.31 (1.23)	2.08 (3.81)
D_4	1.48 (1.70)	1.76 (2.59)	2.22 (4.42)	2.35 (5.02)	2.49 (5.69)	2.53 (5.91)	2.14 (4.09)	1.95 (3.31)	1.76 (2.59)	1.83 (2.87)	1.76 (2.61)	1.49 (1.73)	1.22 (1.00)	1.92 (3.20)
D_5	2.02 (3.60)	2.28 (4.70)	2.59 (6.22)	2.68 (6.68)	2.77 (7.19)	2.82 (7.44)	2.44 (5.46)	2.20 (4.34)	2.05 (3.71)	2.11 (3.97)	2.00 (3.48)	1.87 (2.98)	1.45 (1.60)	2.25 (4.57)
D_6	2.08 (3.84)	2.39 (5.21)	2.64 (6.45)	2.77 (7.19)	2.88 (7.82)	2.91 (7.96)	2.49 (5.71)	2.29 (4.73)	2.08 (3.84)	2.17 (4.19)	2.06 (3.72)	1.90 (3.12)	1.54 (1.86)	2.32 (4.90)
S.Em.± D	0.06	0.08	0.08	0.09	0.09	0.09	0.08	0.08	0.07	0.07	0.06	0.07	0.05	0.02
P	0.04	0.05	0.05	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03
Y	-	-	-	-	-	-	-	-	-	-	-	-	-	0.01
D x P	0.10	0.12	0.13	0.14	0.14	0.13	0.13	0.12	0.10	0.10	0.09	0.10	0.08	0.08
D x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03
P x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	0.04
D x P x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	0.11
C. D. at 5% D	0.18	0.22	0.24	0.27	0.26	0.25	0.24	0.22	0.20	0.19	0.18	0.19	0.15	0.06
P	-	-	-	-	-	-	-	-	-	-	-	-	-	0.09
Y	-	-	-	-	-	-	-	-	-	-	-	-	-	0.03
D x P	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
D x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	NS
P x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	NS
D x P x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	NS
C. V. (%)	9.53	10.38	9.66	10.57	9.77	9.33	10.37	10.57	9.63	9.42	9.45	10.81	10.69	9.47

Note: 1. Figures in parentheses are retransformed values and those outside are $\sqrt{X+0.5}$ transformed values, Non-significant
2. Significant parameters: D (Date of sowing), P (Period) and Y (Year)

Where,			
D_1: 1st week of October	D_3: 1st week of November	D_5: 1st week of December	WAS: Week After Sowing
D_2: 3rd week of October	D_4: 3rd week of November	D_6: 3rd week of December	

Appendix 4: Impact of sowing periods on plant damage by *S. frugiperda* in maize (2019-20)

Date of sowing	Plant damage (%)													
	3 WAS	4 WAS	5 WAS	6 WAS	7 WAS	8 WAS	9 WAS	10 WAS	11 WAS	12 WAS	13 WAS	14 WAS	15 WAS	Pooled
D_1	31.55 (27.38)	45.00 (50.00)	53.78 (65.08)	63.81 (80.52)	69.53 (87.77)	78.75 (96.19)	69.53 (87.77)	70.45 (88.80)	63.81 (80.52)	58.45 (72.62)	58.61 (72.87)	55.44 (67.82)	52.49 (62.93)	59.32 (73.97)
D_2	29.89 (24.83)	43.56 (47.48)	52.27 (62.56)	60.11 (75.17)	67.50 (85.36)	74.14 (92.53)	68.41 (86.47)	65.47 (82.76)	61.77 (77.63)	56.95 (70.25)	55.28 (67.57)	54.00 (65.45)	52.27 (62.56)	57.05 (70.41)
D_3	18.43 (10.00)	31.55 (27.38)	42.12 (44.97)	47.95 (55.13)	50.83 (60.11)	55.28 (67.57)	52.27 (62.56)	50.89 (60.22)	49.39 (57.63)	49.33 (57.52)	47.88 (55.03)	45.00 (50.00)	45.00 (50.00)	45.07 (50.12)
D_4	15.86 (7.47)	27.86 (21.83)	37.66 (37.33)	43.49 (47.37)	49.39 (57.63)	53.84 (65.19)	49.39 (57.63)	47.88 (55.03)	47.88 (55.03)	46.51 (52.63)	45.00 (50.00)	43.56 (47.48)	42.12 (44.97)	42.34 (45.37)
D_5	22.50 (14.64)	36.22 (34.92)	47.95 (55.13)	53.78 (65.08)	60.64 (75.96)	62.14 (78.17)	60.11 (75.17)	56.95 (70.25)	55.44 (67.82)	53.78 (65.08)	50.83 (60.11)	50.83 (60.11)	49.39 (57.63)	50.81 (60.07)
D_6	24.53 (17.24)	37.73 (37.44)	47.88 (55.03)	56.95 (70.25)	63.81 (80.52)	67.50 (85.36)	62.14 (78.17)	60.11 (75.17)	58.61 (72.87)	55.28 (67.57)	54.00 (65.45)	52.27 (62.56)	50.83 (60.11)	53.20 (64.12)
S. Em.± D	2.63	2.59	2.57	3.10	3.20	4.06	4.09	3.81	2.82	2.67	2.88	2.83	2.42	0.82
P	-	-	-	-	-	-	-	-	-	-	-	-	-	1.21
D x P	-	-	-	-	-	-	-	-	-	-	-	-	-	2.97
C. D. at 5% D	7.92	7.80	7.75	9.35	9.64	12.23	12.32	11.47	8.51	8.04	8.67	8.53	7.28	2.29
P	-	-	-	-	-	-	-	-	-	-	-	-	-	3.36
D x P	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C. V. (%)	22.09	13.99	10.95	11.42	10.61	12.43	13.56	12.99	10.06	10.00	11.07	11.28	9.92	11.60

Note: 1. Figures in parentheses are retransformed values and those outside are arc sine transformed values
2. Non-significant
3. Significant parameters: D (Date of sowing) and P (Period)

Where,	D_1: 1st week of October	D_3: 1st week of November	D_5: 1st week of December	WAS: Week After Sowing
	D_2: 3rd week of October	D_4: 3rd week of November	D_6: 3rd week of December	

Appendix 5: Impact of sowing periods on plant damage by *S. frugiperda* in maize (2020-21)

Date of sowing	Plant damage (%)													
	3 WAS	**4 WAS**	**5 WAS**	**6 WAS**	**7 WAS**	**8 WAS**	**9 WAS**	**10 WAS**	**11 WAS**	**12 WAS**	**13 WAS**	**14 WAS**	**15 WAS**	**Pooled**
D_1	34.72 (32.43)	47.88 (55.03)	56.95 (70.25)	65.47 (82.76)	78.75 (96.19)	80.78 (97.43)	74.14 (92.53)	67.50 (85.36)	63.81 (80.52)	58.61 (72.87)	58.61 (72.87)	56.95 (70.25)	55.28 (67.57)	61.50 (77.22)
D_2	31.55 (27.38)	45.00 (50.00)	53.78 (65.08)	64.33 (81.24)	74.14 (92.53)	74.14 (92.53)	67.50 (85.36)	63.81 (80.52)	60.64 (75.96)	58.45 (72.62)	56.95 (70.25)	53.84 (65.19)	53.94 (65.34)	58.31 (72.41)
D_3	19.92 (11.61)	31.39 (27.13)	43.56 (47.48)	52.56 (63.04)	55.28 (67.57)	56.95 (70.25)	55.28 (67.57)	53.78 (65.08)	52.27 (62.56)	52.34 (62.67)	47.88 (55.03)	45.00 (50.00)	47.88 (55.03)	47.24 (53.90)
D_4	18.43 (10.00)	29.89 (24.83)	40.61 (42.37)	47.95 (55.13)	49.33 (57.52)	34.85 (32.65)	52.34 (62.67)	51.05 (60.48)	49.33 (57.52)	45.06 (50.11)	45.00 (50.00)	45.00 (50.00)	43.49 (47.37)	42.49 (45.62)
D_5	26.57 (20.00)	36.22 (34.92)	49.39 (57.63)	55.44 (67.82)	58.45 (72.62)	63.81 (80.52)	60.11 (75.17)	56.95 (70.25)	55.44 (67.82)	53.78 (65.08)	52.27 (62.56)	50.83 (60.11)	49.33 (57.52)	51.43 (61.13)
D_6	26.37 (20.00)	39.17 (39.89)	50.83 (60.11)	58.45 (72.62)	63.81 (80.52)	65.84 (83.25)	61.77 (77.63)	58.45 (72.62)	56.95 (70.25)	55.44 (67.82)	53.78 (65.08)	52.34 (62.67)	50.83 (60.11)	53.40 (64.45)
S.Em.± D	2.86	2.66	2.57	3.99	3.70	4.14	3.22	3.02	3.11	2.89	3.06	2.81	2.38	0.84
P	-	-	-	-	-	-	-	-	-	-	-	-	-	1.23
D x P	-	-	-	-	-	-	-	-	-	-	-	-	-	3.02
C. D. at 5% D	8.61	8.02	7.76	12.02	11.10	12.47	9.70	9.12	9.38	8.72	9.21	8.46	7.16	2.32
P	-	-	-	-	-	-	-	-	-	-	-	-	-	3.42
D x P	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
C. V. (%)	21.72	13.91	10.47	13.90	11.15	12.60	10.41	10.32	11.03	10.73	11.66	11.08	9.48	11.48

Note: 1. Figures in parentheses are retransformed values and those outside are arc sine transformed values
2. NS = Non-significant
3. Significant parameters: D (Date of sowing) and P (Period)

Where,				
	D_1: 1st week of October	D_3: 1st week of November	D_5: 1st week of December	WAS: Week After Sowing
	D_2: 3rd week of October	D_4: 3rd week of November	D_6: 3rd week of December	

Appendix 6: Impact of sowing periods on plant damage by *S. frugiperda* in maize (Pooled over years, 2019-20 & 2020-21)

Date of sowing	Plant damage (%)													
	3 WAS	**4 WAS**	**5 WAS**	**6 WAS**	**7 WAS**	**8 WAS**	**9 WAS**	**10 WAS**	**11 WAS**	**12 WAS**	**13 WAS**	**14 WAS**	**15 WAS**	**Pooled**
D_1	33.13 (29.88)	46.44 (52.52)	55.36 (67.69)	64.64 (81.65)	74.14 (92.53)	79.77 (96.84)	71.84 (90.28)	68.97 (87.13)	63.81 (80.52)	58.53 (72.74)	58.61 (72.87)	56.19 (69.04)	53.89 (65.27)	60.41 (75.62)
D_2	30.72 (26.09)	44.28 (48.74)	53.03 (63.83)	62.22 (78.28)	70.82 (89.21)	74.14 (92.53)	67.96 (85.92)	64.64 (81.65)	61.21 (76.80)	57.70 (71.44)	56.11 (68.92)	53.92 (65.32)	53.10 (63.96)	57.68 (71.42)
D_3	19.18 (10.79)	31.47 (27.26)	42.84 (46.23)	50.25 (59.11)	53.06 (63.88)	56.11 (68.92)	53.78 (65.08)	52.34 (62.67)	50.83 (60.11)	50.83 (60.11)	47.88 (55.03)	45.00 (50.00)	46.44 (52.52)	46.16 (52.02)
D_4	17.15 (8.69)	28.87 (23.31)	39.14 (39.84)	45.72 (51.26)	49.36 (57.58)	44.35 (48.86)	50.86 (60.16)	49.47 (57.77)	48.61 (56.28)	45.78 (51.37)	45.00 (50.00)	44.28 (48.74)	42.81 (46.17)	42.41 (45.49)
D_5	24.53 (17.24)	36.22 (34.92)	48.67 (56.38)	54.61 (66.46)	59.54 (74.31)	62.98 (79.35)	60.11 (75.17)	56.95 (70.25)	55.44 (67.82)	53.78 (65.08)	51.55 (61.34)	50.83 (60.11)	49.36 (57.58)	51.12 (60.60)
D_6	25.55 (18.60)	38.45 (38.66)	49.36 (57.58)	57.70 (71.44)	63.81 (80.52)	66.67 (84.32)	61.96 (77.90)	59.28 (73.91)	57.78 (71.57)	55.36 (67.69)	53.89 (65.27)	52.31 (62.61)	50.83 (60.11)	53.30 (64.29)
S.Em.± D	1.80	1.73	1.69	2.34	2.41	2.70	2.44	2.30	1.97	1.84	1.85	1.59	1.95	0.59
P	1.12	1.07	1.05	1.46	1.41	1.67	1.50	1.40	1.21	1.14	1.15	0.98	1.21	0.86
Y	-	-	-	-	-	-	-	-	-	-	-	-	-	0.34
D x P	2.74	2.62	2.57	3.57	3.46	4.10	3.68	3.44	2.97	2.78	2.82	2.39	2.96	2.12
D x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	0.83
P x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	1.22
D x P x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	3.00
C. D. At 5% D	5.19	4.98	4.86	6.77	6.94	7.76	7.03	6.61	5.66	5.30	5.32	4.56	5.60	1.63
P	-	-	-	-	-	-	-	-	-	-	-	-	-	2.40
Y	-	-	-	-	-	-	-	-	-	-	-	-	-	0.94
D x P	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
D x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	NS
P x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	NS
D x P x Y	-	-	-	-	-	-	-	-	-	-	-	-	-	NS
C. V. (%)	21.92	13.95	10.71	12.79	11.19	12.52	12.05	11.73	10.56	10.37	11.18	9.70	11.37	11.54

Note: 1. Figures in parentheses are retransformed values and those outside are arc sine transformed values, Non-significant
2. Significant parameters: D (Date of sowing), P (Period) and Y (Year)

Where,				
	D_1: 1st week of October	D_3: 1st week of November	D_5: 1st week of December	WAS: Week After Sowing
	D_2: 3rd week of October	D_4: 3rd week of November	D_6: 3rd week of December	

Appendix 7: Impact of sowing periods on cob damage by *S. frugiperda* in maize (2019-20)

Date of sowing	Cob damage (%)					
	11 WAS	12 WAS	13 WAS	14 WAS	15 WAS	Pooled
D_1	36.22 (34.92)	43.56 (47.48)	50.83 (60.11)	54.22 (65.81)	56.95 (70.25)	48.35 (55.84)
D_2	33.21 (30.00)	43.56 (47.48)	49.39 (57.63)	50.83 (60.11)	53.78 (65.08)	46.15 (52.01)
D_3	24.53 (17.24)	34.72 (32.43)	39.17 (39.89)	42.05 (44.87)	45.00 (50.00)	37.09 (36.38)
D_4	20.47 (12.23)	31.99 (27.13)	34.72 (32.43)	37.73 (37.44)	39.17 (39.89)	32.69 (29.18)
D_5	28.23 (22.37)	37.73 (37.44)	43.56 (47.48)	45.00 (50.00)	47.88 (55.03)	40.48 (42.14)
D_6	29.89 (24.83)	39.17 (39.89)	43.56 (47.48)	46.44 (52.52)	49.39 (57.63)	41.69 (44.23)
S.Em.± D	1.84	2.41	2.49	3.13	2.50	1.07
P	-	-	-	-	-	0.97
D x P	-	-	-	-	-	2.38
C. D. at 5% D	5.56	7.26	7.51	9.45	7.54	3.00
P	-	-	-	-	-	2.74
D x P	-	-	-	-	-	NS
C. V. (%)	12.83	12.56	11.44	13.61	10.28	11.61

Note: 1. Figures in parentheses are retransformed values and those outside are arc sine transformed values, 2. Non-significant

Where,				
	D_1: 1st week of October	D_3: 1st week of November	D_5: 1st week of December	WAS: Week After Sowing
	D_2: 3rd week of October	D_4: 3rd week of November	D_6: 3rd week of December	

Appendix 8: Impact of sowing periods on cob damage by *S. frugiperda* in maize (2020-21)

Date of sowing	Cob damage (%)					
	11 WAS	12 WAS	13 WAS	14 WAS	15 WAS	Pooled
D_1	36.22 (34.92)	47.88 (55.03)	50.83 (60.11)	54.22 (65.81)	60.11 (75.17)	49.85 (58.43)
D_2	34.72 (32.43)	45.00 (50.00)	47.95 (55.13)	50.83 (60.11)	56.95 (70.25)	47.09 (53.64)
D_3	26.57 (20.00)	37.66 (37.33)	42.12 (44.97)	43.56 (47.48)	45.00 (50.00)	38.98 (39.57)
D_4	22.13 (14.19)	29.73 (24.60)	37.66 (37.33)	39.17 (39.89)	40.61 (42.37)	33.86 (31.04)
D_5	29.89 (24.83)	39.17 (39.89)	43.56 (47.48)	47.88 (55.03)	49.39 (57.63)	41.98 (44.73)
D_6	29.89 (24.83)	40.67 (42.48)	45.00 (50.00)	47.88 (55.03)	50.83 (60.11)	42.86 (46.26)
S.Em.± (Date of sowing) D	2.10	2.58	2.58	2.85	2.73	1.11
(Period) P	-	-	-	-	-	1.02
D x P	-	-	-	-	-	2.50
C. D. at 5% D	6.34	7.78	7.76	8.59	8.22	3.14
P	-	-	-	-	-	2.87
D x P	-	-	-	-	-	NS
C. V. (%)	14.08	12.90	11.57	12.06	10.80	11.75

Note: 1. Figures in parentheses are retransformed values and those outside are arc sine transformed values, 2. NS = Non-significant

Where,				
	D_1: 1st week of October	D_3: 1st week of November	D_5: 1st week of December	WAS: Week After Sowing
	D_2: 3rd week of October	D_4: 3rd week of November	D_6: 3rd week of December	

Appendix 10: Impact of sowing periods on cob damage by *S. frugiperda* in maize (Pooled over years, 2019-20 & 2020-21)

Date of sowing	Cob damage (%)					
	11 WAS	12 WAS	13 WAS	14 WAS	15 WAS	Pooled
D_1	36.22 (34.92)	45.72 (51.26)	50.83 (60.11)	54.22 (65.81)	58.53 (72.74)	49.10 (57.14)
D_2	33.96 (31.21)	44.28 (48.74)	48.67 (56.38)	50.83 (60.11)	55.36 (67.69)	46.62 (52.83)
D_3	25.55 (18.60)	36.19 (34.86)	40.64 (42.42)	42.81 (46.17)	45.00 (50.00)	38.04 (37.97)
D_4	21.30 (13.19)	30.56 (25.85)	36.19 (34.86)	38.45 (38.66)	39.89 (41.13)	33.28 (30.11)
D_5	29.06 (23.59)	38.45 (38.66)	43.56 (47.48)	46.44 (52.52)	48.64 (56.33)	41.23 (43.44)
D_6	29.89 (24.83)	39.92(41.18)	44.28 (48.74)	47.16 (53.77)	50.11 (58.87)	42.27 (45.25)
S.Em.± (Date of sowing) D	1.31	1.68	1.69	1.97	1.73	0.77
(Period) P	0.81	1.02	1.03	1.22	1.07	0.70
(Year) Y	-	-	-	-	-	0.44
D x P	1.98	2.50	2.53	2.99	2.62	1.72
D x Y	-	-	-	-	-	1.09
P x Y	-	-	-	-	-	1.00
D x P x Y	-	-	-	-	-	2.44
C. D. at 5% D	3.75	4.82	4.86	5.66	4.96	2.14
P	-	-	-	-	-	1.95
Y	-	-	-	-	-	1.23
D x P	NS	NS	NS	NS	NS	NS
D x Y	-	-	-	-	-	NS
P x Y	-	-	-	-	-	NS
D x P x Y	-	-	-	-	-	NS
C. V. (%)	13.49	12.74	11.51	12.84	10.55	11.69

Note: 1. Figures in parentheses are retransformed values and those outside are arc sine transformed values, Non-significant

Where,				
	D_1: 1st week of October	D_3: 1st week of November	D_5: 1st week of December	WAS: Week After Sowing
	D_2: 3rd week of October	D_4: 3rd week of November	D_6: 3rd week of December	