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Effect of planting methods and levels of nitrogen on incidence of early shoot borer, *Chilo infuscatellus* Snellen in sugarcane

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Abstract

A field experiment was conducted at the farm of Regional Research Station, Uchani, Karnal, CCS Haryana Agricultural University, Hisar during 2017-2018 to evaluate the effect of planting methods and levels of nitrogen on the incidence of early shoot borer, *Chilo infuscatellus* Snellen in some sugarcane genotypes. Two planting methods *i.e.* paired row and conventional method with three doses of nitrogen, 150, 180 and 210 kg/ha were tested on three differently maturing sugarcane varieties CoH 160 (early maturing), CoH 167 (mid maturing) and CoH 150 (late maturing) to observe their effect on the incidence of early shoot borer in sugarcane. The incidence of early shoot borer was maximum (7.14, 12.03 and 5.37%) in CoH 160 and the minimum (3.45, 4.81 and 2.96%) in CoH 167 during April, May and June, 2017, respectively. Early shoot borer incidence was minimum (3.94, 6.65 and 2.85%) at 150 kg N/ha and maximum (6.29, 9.32 and 4.76%) at 210 kg N/ha during April, May and June, respectively. With the present findings, it can be concluded that with the increase in nitrogen dose there was increase in the incidence of above mentioned pest. Incidence of early shoot borer was not affected significantly with different planting methods.

Keywords: Planting methods, nitrogen, early shoot borer, incidence, sugarcane

Introduction

Sugarcane (*Saccharum officinarum* L.) is one of the most important commercial crops in India which has played a major role in Indian agricultural and industrial economy. It is cultivated under diverse agro-climatic conditions in India. It is a multiple source of food, fodder and cash need of the growers and readily available energy in human diet. About two thirds of the total sugarcane produced in India is consumed for making gur and khandsari and only one third of it goes to sugar factories (Anonymous, 2017) ^[1]. Besides sugar production, whole plant of sugarcane is used for different products as top for fodder, trash for fuel, molasses for ethanol and bagasse is used in paper and card board industry *etc.* It also provides raw material for manufacturing alcohol. Different pests appear during different seasons and they are called pre-monsoon, monsoon and post-monsoon pests. Among tissue borers, shoot borer, *Chilo infuscatellus* Snellen; top borer, *Scirpophaga nivella* Fabricius and stalk borer, *Chilo auricilius* Dudgeon are the major pests in subtropical region. These pests have been reported to inflict varying degree of losses in yield and sugar depending chiefly on factors like the variety under cultivation, stage of crop attacked, nitrogenous fertilizer and the environmental conditions. Shoot borer is a serious pest during summer months *i.e.*, pre-monsoon period. The pest multiplies rapidly in hot and dry weather (April to June). The larvae after hatching enter the young shoots and as a result of its feeding the central leaf whorl dries up and forms a dead heart. This borer has been found to cause mortality of mother shoots to the extent of 50 per cent and 6.4, 27.0 and 75.0 per cent of primary, secondary and tertiary tillers respectively (Gupta, 1959) ^[3]. Keeping in view the importance of the above pest, a trial was conducted to estimate the effect of planting methods and levels of nitrogen on incidence of early shoot borer in sugarcane.

Materials and methods

The experiment was conducted in laboratory and research area of Regional Research Station, Karnal, CCS HAU Hisar. Three varieties namely CoH 160, CoH 167 and CoH 150 which are early, mid and late maturing genotypes, respectively were selected and planted in first fortnight of March, 2017 with a plot size of 7 x 4.2 m and seed rate was 90 thousand two

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budded setts/ha with row to row distance of 70 cm (conventional planting) and 35-35-105 (paired row planting). The experiment was replicated thrice in a split plot design with a total of 18 treatments and a total number of 54 plots. Three doses of nitrogen at the rate of 150, 180 and 210 kg per hectare were applied. At the time of planting 1/3rd dose of nitrogen was applied in all the plots and remaining 2/3rd dose was applied at 2nd and 4th irrigation in the month of May and June, respectively. The incidence of shoot borer was recorded during the post-germination phase at 30 days interval up to 120 days (At 30, 60, 90 and 120 DAP). The observations on the total number of shoots and number of dead hearts due to the early shoot borer was recorded from two middle rows in each plot and the per cent incidence was calculated as per the following formula.

$$\% \text{ incidence} = \frac{\text{Total no. of dead heart}}{\text{Total no. of shoots}} \times 100$$

Table 1: Mean per cent incidence of early shoot borer in sugarcane varieties as influenced by planting methods and nitrogen levels from April to June, 2017

Treatment	Mean per cent incidence of Early Shoot Borer			
	April	May	June	July
Planting method				
Paired row	12.46 (5.10)	16.08 (8.10)	11.35(4.05)	-
Conventional	11.40 (4.50)	16.04 (8.04)	10.75(3.67)	-
S.E.(m) ±	0.72	0.48	0.19	-
C.D. @5%	N.S	N.S	N.S	-
Varieties				
CoH 160	15.16 (7.14)	20.22 (12.03)	13.25(5.37)	-
CoH167	9.54 (3.45)	12.48 (4.81)	9.75(2.96)	-
CoH 150	11.09 (3.82)	15.48 (7.36)	10.15(3.26)	-
S.E.(m) ±	0.88	0.58	0.24	-
C.D. @ 5%	2.78	1.85	0.76	-
Nitrogen levels				
150	10.88 (3.94)	14.52 (6.65)	9.45(2.85)	-
180	10.84 (4.17)	16.15 (8.23)	11.26(3.98)	-
210	14.07 (6.29)	17.51 (9.32)	12.45(4.76)	-
S.E.(m) ±	0.73	0.49	0.39	-
C.D. @5%	2.13	1.43	1.16	-

Figures in parentheses are angular transformed values

No incidence of early shoot borer was recorded during July, 2017

The interaction effects of early shoot borer with planting methods and variety (PxV) was found to be significant which has been shown in Table 2. The lowest per cent incidence of ESB was recorded in variety CoH 167 (3.03%) in conventional method of planting, while, it was highest in variety CoH 160 (7.58%) with paired row planting method. While, the interaction effects of early shoot borer with variety and nitrogen levels (VxN) was found to be non-significant, the interaction effects of early shoot borer with planting methods and N levels (PxN) was also found to be non-significant and has been shown in Table 2. The interaction effects of planting methods, varieties and different nitrogen levels (PxVxN) with early shoot borer was found non-significant.

Incidence of early shoot borer (ESB) during May, 2017 **Effect of varieties on Early Shoot Borer (ESB)**

The recorded mean per cent incidence of ESB in May, 2017 is presented in Table 1 Column 3. The mean per cent incidence of ESB was ranging from 4.81 to 12.03 in varieties CoH 160, CoH 167 and CoH 150. The maximum incidence (12.03%)

Results

Incidence of early shoot borer (ESB) during April, 2017

Effect of levels of nitrogen on early shoot borer (ESB)

Data on mean per cent incidence of early shoot borer are presented in Table 1. The mean per cent incidence of early shoot borer was influenced due to different levels of nitrogen fertilizer application. The highest ESB incidence (6.29%) was recorded at 210 kg N/ha while, the lowest incidence (3.94%) was recorded at 150 kg N/ha and it was statistically at par with 200 kg N/ha (6.33%).

Effect of planting methods on early shoot borer (ESB)

The incidence of ESB was found to be non-significant with different planting methods. The interaction effects of early shoot borer with planting methods and variety (PxV) was found to be significant which has been shown in Table 2. The lowest per cent incidence of ESB was recorded in variety CoH 167 (3.03%) in conventional method of planting, while, it was highest in variety CoH 160 (7.58%) with paired row planting method.

was recorded in variety CoH 160 while the minimum incidence (4.81%) was observed in variety CoH 167.

Effect of levels of Nitrogen on early shoot borer (ESB)

Mean per cent incidence of early shoot borer recorded during May, 2017 is presented in Table-1 Column 3 and the data shows that the mean per cent incidence of ESB was significantly the highest (9.32%) at 210 kg N/ha followed by (8.23%) at 180 kg N/ha, while, the lowest incidence (6.65%) was observed at 150 Kg N/ha.

Effect of planting methods on early shoot borer (ESB)

The incidence of ESB was found to be non-significant with different planting methods.

The interaction effects of ESB with planting methods and variety (PxV) was found to be non-significant and is presented in Table 3. The interaction effects of ESB with variety and nitrogen levels (VxN) was found to be differing significantly. Among the three nitrogen levels, significantly lowest (3.64%) incidence of ESB was recorded in variety CoH 150 at 150 kg N/ha, while, it was highest in CoH 160 (13.48%) at 210 kg N/ha. While, the interaction effects of

ESB with planting methods and nitrogen levels (PxN) was also found to be non-significant.

Incidence of early shoot borer (ESB) during June, 2017 Effect of varieties on early shoot borer (ESB)

The mean per cent incidence of shoot borer recorded in June, 2017 are presented in Table 1 Column 4. The mean per cent incidence of ESB ranged from 2.96 to 5.37 in variety CoH160, CoH 167 and CoH 150. The maximum incidence (5.37%) was observed in variety CoH 160 while the minimum

incidence (2.96%) was observed in variety CoH 167 and it was statistically at par with variety CoH 150 (3.26%).

Effect of levels of Nitrogen on Early Shoot Borer (ESB)

Mean per cent incidence of ESB recorded during May shows that the mean per cent incidence of early shoot borer was the highest (4.76%) at 210 kg N/ha while the minimum incidence (2.85%) was observed at 150 kg N/ha and it was statistically at par with that in 180 kg N/ha (3.98%).

Table 2: Mean per cent incidence of early shoot borer in sugarcane varieties as influenced by planting methods and nitrogen levels in the month of April during 2017-2018

Planting method x Variety				Variety x Nitrogen				Planting method x Nitrogen			
Planting Method	Variety			Variety	Nitrogen (kg/ha)			Planting Method	Nitrogen (kg/ha)		
	CoH 160	CoH 167	CoH 150		150	180	210		150	180	210
Paired row	15.65 (7.58)	10.50 (3.86)	11.22 (3.87)	CoH 160	13.16 (5.38)	14.40 (6.36)	17.90 (9.68)	Paired row	11.53 (4.32)	11.13 (4.12)	14.70 (6.86)
Conventional	14.66 (6.70)	8.58 (3.03)	10.96 (3.77)	CoH 167	8.73 (2.82)	7.99 (2.96)	11.90 (4.56)	Conventional	10.23 (3.75)	10.54 (4.02)	13.44 (5.72)
				CoH 150	10.75 (3.61)	10.12 (3.20)	12.40 (4.64)				
Mean	15.16 (7.14)	9.54 (3.45)	11.09 (3.82)	Mean	10.88 (3.94)	10.84 (4.17)	14.07 (6.29)	Mean	10.88 (3.94)	10.84 (4.17)	14.07 (6.29)

Figures in parentheses represent original values and those outside are angular transformed values

C.D. at 5% Planting method = N.S. Variety = 2.78 Nitrogen = 2.13 Planting method x Variety = 2.08 Variety x Nitrogen = N.S. Planting method x Nitrogen = N.S. Planting method x Variety x Nitrogen = N.S.

Table 3: Mean per cent incidence of early shoot borer in sugarcane varieties as influenced by planting methods and nitrogen levels in the month of May during 2017-2018

Planting method x Variety				Variety x Nitrogen				Planting method x Nitrogen			
Planting Method	Variety			Variety	Nitrogen (kg/ha)			Planting Method	Nitrogen (kg/ha)		
	CoH 160	CoH 167	CoH 150		150	180	210		150	180	210
Paired row	20.33 (12.18)	15.47 (7.34)	12.55 (4.85)	CoH 160	18.66 (10.26)	20.52 (12.37)	21.48 (13.48)	Paired row	14.69 (6.81)	15.34 (7.48)	18.20 (10.00)
Conventional	20.11 (11.88)	15.48 (7.38)	12.42 (4.77)	CoH 167	13.96 (6.06)	16.29 (8.19)	16.19 (7.83)	Conventional	14.35 (6.49)	16.96 (8.98)	16.83 (8.64)
				CoH 150	10.94 (3.64)	11.64 (4.14)	14.80 (6.65)				
Mean	20.22 (12.03)	15.48 (7.36)	12.48 (4.81)	Mean	14.52 (6.65)	16.15 (8.23)	17.51 (9.32)	Mean	14.52 (6.65)	16.15 (8.23)	17.51 (9.32)

Figures in parentheses represent original values and those outside are angular transformed values

C.D. at 5% Planting method = N.S. Variety = 1.85 Nitrogen = 1.43 Planting method x Variety = N.S.

Variety x Nitrogen = 1.62 Planting method x Nitrogen = N.S. Planting method x Variety x Nitrogen = N.S.

Effect of planting methods on early shoot borer (ESB)

The incidence of ESB was found to be non-significant with different planting methods. The interaction effects of ESB with planting methods and variety (PxV) was found to be non-significant and is presented in Table 4. Similarly, the interaction effects of variety and nitrogen levels (VxN) and

planting method and nitrogen (PxN) was found to be non-significant.

Incidence of early shoot borer (ESB) during July, 2017

No incidence of early shoot borer was recorded during July, 2017.

Table 4: Mean per cent incidence of early shoot borer in sugarcane varieties as influenced by planting methods and nitrogen levels in the month of June during 2017-2018

Planting method x Variety				Variety x Nitrogen				Planting method x Nitrogen			
Planting Method	Variety			Variety	Nitrogen (kg/ha)			Planting Method	Nitrogen (kg/ha)		
	CoH 160	CoH 167	CoH 150		150	180	210		150	180	210
Paired row	13.42 (5.45)	10.51 (3.42)	10.45 (3.45)	CoH 160	11.65 (4.22)	13.79 (5.75)	14.31 (6.16)	Paired row	9.60 (2.95)	11.80 (4.32)	12.95 (5.10)
Conventional	13.08 (5.30)	8.98 (2.49)	9.84 (3.07)	CoH 167	7.76 (1.82)	9.66 (2.87)	10.66 (3.50)	Conventional	9.28 (2.75)	10.71 (3.64)	11.94 (4.43)
				CoH 150	8.91 (2.50)	10.32 (3.32)	12.36 (4.63)				
Mean	13.25	9.75 (2.96)	10.15	Mean	9.44 (2.85)	11.26	12.44	Mean	9.44	11.26	12.44

	(5.37)		(3.26)			(3.98)	(4.76)		(2.85)	(3.98)	(4.76)
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Figures in parentheses represent original values and those outside are angular transformed values

C.D. at 5% Planting method = N.S. Variety = 0.76 Nitrogen = 1.16 Planting method x Variety = N.S.

Variety x Nitrogen = N.S. Planting method x Nitrogen = N.S. Planting method x Variety x Nitrogen = N.S.

Discursion

From the present study, it was observed that the shoot borer incidence in April, May and June, 2017 was highest (7.14, 12.03 and 5.37%, respectively) in CoH 160. Whereas, the lowest incidence (3.45, 4.81 and 2.96%) was observed in CoH 167 during April, May and June, respectively. The present investigation is in accordance with the findings of Pandey and Kumar (2014) who reported that the highest incidence (8.8%) of early shoot borer observed during May. The peak active period of *Chilo infuscatellus* was in the month of May in Andhra Pradesh as observed by Kumar *et al.* (2004)^[4, 5]. The present findings are also in accordance with the findings of Pandya *et al.* (1996)^[8] who observed that no incidence of *C. infuscatellus* was recorded during July, August, September and October. Variation in the incidence of *C. infuscatellus* in different varieties was recorded in the present investigation. It was observed that the behaviour of different varieties is different in case of shoot borer incidence. The present findings are in accordance with the observations Singh *et al.* (2002)^[10] who observed that among one hundred thirty one genotypes checked against early shoot borer, thirty genotypes were rated as tolerant, forty eight as moderately tolerant, fifty two as susceptible and one as highly susceptible. Rao (1962)^[9] also observed that genotypes resistant to *C. infuscatellus* had greater green leaf area and were more vigorous in growth as compared to susceptible genotypes. Results of present study showed that significantly the highest (6.29, 9.32 and 4.76%) incidence of *C. infuscatellus* was recorded at 210 kg N/ha in April, May and June, 2017 respectively. Whereas, the lowest (3.94, 6.65 and 2.85%) incidence of *C. infuscatellus* was observed at 150 kg N/ha in April, May and June, respectively. The present study is in accordance with the study of Mishra *et al.* (2004)^[5] who observed that higher N levels with lesser number of irrigation cause stimulative effect on multiplication of shoot borer in sugarcane ratoon crop. However, Avasthy and Varma (1979)^[2] and Pandey *et al.* (1994)^[6] observed the effect of nitrogen levels on incidence of *C. infuscatellus* and found non-significant which is in contrary to the present findings. This variation may be due to difference in ecological conditions prevailing in the area of study. There was no significant difference in the incidence of early shoot borer in different planting methods *i.e.* conventional and paired row planting method.

Conclusion

Field experiment for the effect of planting methods and levels of nitrogen on the incidence of early shoot borers in sugarcane was conducted at Regional Research Station, Uchani, Karnal, CCS Haryana Agricultural University, Hisar during 2017-18 crop season. Efforts have been made to find out the effect of different planting methods and levels of nitrogen on the incidence of early shoot borer, *Chilo infuscatellus* Snellen. The results concluded that the incidence of early shoot borer was highest in CoH 160 during April, May and June, 2017 (7.14, 12.03 and 5.37%) while it was the lowest (3.45, 4.81 and 2.96%) in CoH 167 during April, May and June, respectively. Among different levels of nitrogen, highest incidence (6.29, 9.32 and 4.76%) was at 210 kg N/ha during April, May and June, respectively while it was the lowest at

150 kg N/ha (3.94, 6.65 and 2.85%) during April, May and June, respectively. The incidence of shoot borer affected non-significantly among different planting methods.

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