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Effect of nitrogen and potash on top borer (*Scirpophaga excerptalis* walker) incidence in differently maturing varieties of sugarcane

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Abstract
A field experiment was conducted to evaluate the effect of nitrogen and potash levels on the incidence of sugarcane top borer under Haryana conditions at the farm of Regional Research Station CCS HAU Uchani, Karnal during 2015-16. The experiment was laid out in split-split plot design with three differently maturing varieties *viz*., Co 0238, CoH 119 and CoH 150 as main plot, three doses of nitrogen *viz*., 150, 200 and 250 kilogram per hectare (kg/ha) as sub plot and two doses of potash *viz*., 0 and 50 kg/ha as sub-sub plot. The mean per cent incidence (%) of top borer recorded in July, August and September, 2015 was highest (9.11, 11.78 and 13.56, respectively) in Co 0238 followed by CoH 150 (7.33, 10.00 and 12.44, respectively) while, lowest incidence was (6.22, 7.56 and 10.67, respectively) in CoH 119. With respect to nitrogen application, the maximum mean per cent incidence (9.11, 11.56 and 14.44, respectively) in July, August and September, 2015 of top borer was recorded at 250 kg N/ha and the minimum (5.78, 7.78 and 9.56, respectively) at 150 kg N/ha. Application of potassium significantly reduced the top borer infestation with mean per cent incidence lower at 50 kg K_2O/ha (6.52, 9.04 and 10.52, respectively) in July, August and September, 2015 compared to control i.e., no application of potassium (8.59, 10.52 and 13.93, respectively). Hence, there is need to optimize nutrient and their balanced application to reduce the topborer incidence in sugarcane. Nitrogen fertilizer (200 kg N/ha) combined with potassium application produced highest cane yield, number of millable canes and commercial cane sugar by reducing the top borer incidence.

Keywords: Incidence, nitrogen, potash, sugarcane, top borer, varieties

Introduction
Sugarcane is one of the important cash crops of India. As the sugarcane is long duration crop, it is attacked by several insect-pests at different stages of growth and resulting in losses about 25-30 per cent in cane yield and 15-20 per cent in sugar recovery (Dhaliwal *et al.*, 2004) [1]. Among various pests, moth borers possess more potential to cause damage to sugarcane cane from planting to harvest and affect the expansion of area under cane production in Haryana. Sugarcane top borer is one of the most destructive pests of sugarcane. In years of heavy multiplication, cane yield and quality of juice receive a great set back which ultimately influence the economy of the farmer and country at large. Top borer completes five generations in a year under Haryana conditions (Paul, 2007) [2]. The larvae of top borer enter through midrib and reach the central whorl subsequently damage the growing point and causes bunchy top in the cane. An estimated loss of 1.05 to 18.5 t/ha reported in cane yield and 1.9 to 2.9 units in sugar recovery (Mukunthan, 1986) [3]. Gupta and Singh (1997) [4] reported that the 3rd and 4th broods of sugarcane borers cause more than 25 per cent decrease in weight. Singh *et al.* (2004) [5] stated that the maximal loss in gur quality in terms of brix%, pol%, purity and color was observed in canes infested with third brood of top borer followed by fourth and fifth brood. Kalra and Prasad (1978) [6] observed nitrogen fertilization to be associated with the low incidence of top borer when it was synchronised with the third brood that enabled plant to escape from top borer attack. Similarly, Singh *et al.* (1979) [7] also advocated that higher doses of nitrogen before third brood moth emergence plugged the exit hole by quicker growth of plants and subsequently resulted in poor moth emergence. Malik (1982) [8] and Saikia *et al.* (1994) [9] observed that higher nitrogenous fertilizers increased top borer incidence. Gupta *et al.* (1992) [10] reported that application of potassium significantly reduced 3rd and 4th brood infestation of top borer and increased the yields of sugarcane.

Chaudhary and Yadav (1995) [11] reported that the presence of nitrogen in mid-ribs, growing points and leaf blades showed positive correlation with the incidence of top borer. However, the relationship between borer incidence and phosphorus and potassium contents in leaves found negative.

Hence there is need to study the sugarcane top borer dynamics under varied level and nature of nutrient for better understanding and adoption of measures for its control. Keeping in view of above aspects, the present study was conducted to estimate the effect of nitrogen and potash application on top borer infestation from Haryana.

Materials and Methods

The experiment was carried out at Laboratory and Research Area of Regional Research Station, Karnal, CCS HAU, Hisar during 2015-16. Three genotypes namely Co 0238, CoH 119 and CoH 150 which are early, mid and late maturing genotypes, respectively, were selected as the test genotypes. Genotypes were planted in 3rd week of March, 2015 with a plot size of 9 m x 4.5 m and seed rate was 90 thousand two budded sett/ha with row to row distance of 75 cm. The experiment was replicated thrice in a split-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, 200 and 250 kg per hectare (kg/ha) were applied. 1/3rd dose of nitrogen was applied in all the plots at the time of planting and remaining 2/3rd dose was applied at 2nd and 4th irrigation in the month of May and June, respectively. Application of Potash (K_2O) at the rate of 50 kg/ha was done as basal dose in half the number of plots and in other half, no potash was applied. Incidence of top borer was recorded during the 3rd and 4th broods (July, August and September). Meteorological data was also recorded during the study period from 1st week of July to 5th week of September, 2015 and is presented in Table 1 and Figure 1. Twenty five canes were selected randomly from two middle rows from each plot at each observation and per cent incidence was calculated as per the following formula:

$$\% \text{ incidence} = \frac{\text{Total no. of infected cane}}{25 \text{ (canes)}} \times 100$$

Data obtained was tabulated and subjected to statistical analysis as per requirement. Before the analysis of data, the data on top borer was converted into percentage. Angular transformation was applied for these parameters.

Results and Discussion

1. Incidence of Top borer (*S. excerptalis* Walker)

i. Varietal influence on incidence of top borer

The mean per cent incidence in different varieties was recorded in July, August and September, 2015 and is presented in Table 2. It was observed that top borer mean per cent incidence (%) was highest (9.11, 11.78 and 13.56) in Co 0238 followed by CoH 150 (7.33, 10.00 and 12.44), which is statistically at par with CoH 119 (6.22, 7.56 and 10.67) in July, August and September, respectively, in relation to each month. Different genotypes behaved differently with regard to top borer incidence. Maximum incidence of top borer was recorded in early maturing genotype, Co 0238 followed by late maturing genotype, CoH 150 and lowest in mid maturing genotype, CoH 119. The present findings are strongly supported by the findings of Gupta (1959a) [12] who stated that early maturing genotypes were more prone to top borer attack. Khaliq *et al.* (2005) [13] reported that Nitrogen, Potassium, Calcium, Magnesium and Ferrous content manifested positive and significant correlation with the top borer, *Scirpophaga nivella* Fabricus.

Table 1: Meteorological observations during the study period from 1st week of July to 5th week of September, 2015

Months/week	Standard weeks	Average Temperature		Average Relative Humidity		Sunshine Hours
		Minimum T (^{0}C)	Maximum T (^{0}C)	RH Morning (%)	RH Evening (%)	
July I	27	25.4	35.9	77	51	9.7
II	28	26.2	33.4	86	78	2.6
III	29	25.3	31.4	89	65	4.8
IV	30	25.8	33	88	75	5
V	31	24.9	32.7	83	65	8.1
August I	32	25.2	32	94	77	3.1
II	33	25.4	31.8	96	79	2.6
III	34	24.2	32.8	93	73	6.1
IV	35	25.2	33.8	91	66	10.1
September I	36	25.3	34.1	87	60	9.5
II	37	22.6	34	91	56	10.3
III	38	23.7	34.8	94	61	5.9
IV	39	22.2	32.1	93	65	7.3
V	40	19.2	32.7	93	51	9

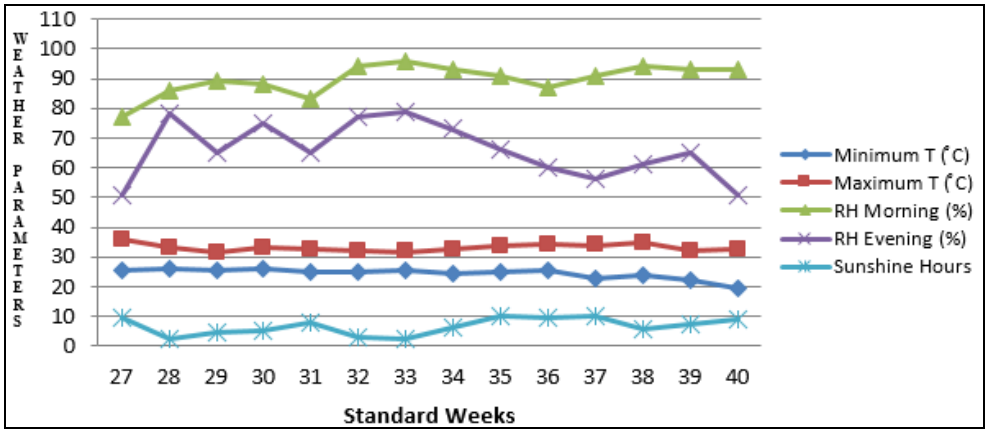

Fig 1: Various abiotic factors in Sugarcane field during observation of incidence of Top borer (*S. excerptalis* Walker)

Table 2: Mean per cent incidence of top borer in sugarcane varieties as influenced by nitrogen and potash levels

Treatment	Mean per cent incidence of Top Borer		
Varieties	**July**	**August**	**September**
Co 0238	17.43 (9.11)	19.93 (11.78)	21.44 (13.56)
CoH 119	14.25 (6.22)	15.70 (7.56)	18.86 (10.67)
CoH 150	15.43 (7.33)	18.25 (10.00)	20.42 (12.44)
S.E.(m) ±	0.50	0.80	0.44
C.D. @ 5%	1.96	3.11	1.72
Nitrogen levels			
150	13.71 (5.78)	15.95 (7.78)	17.77 (9.56)
200	15.98 (7.78)	18.25 (10.00)	20.72 (12.67)
250	17.43 (9.11)	19.69 (11.56)	22.24 (14.44)
S.E.(m) ±	0.48	0.57	0.51
CD at 5%	1.47	1.75	1.58
Potash levels			
0	16.84 (8.59)	18.66 (10.52)	21.82 (13.93)
50	14.57 (6.52)	17.26 (9.04)	18.66 (10.52)
S.E.(m) ±	0.36	0.32	0.30
CD at 5%	1.06	0.96	0.90

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

ii. Effect of Nitrogen and Potash fertilizer levels on top borer

The mean per cent top borer incidence was influenced significantly due to different levels of nitrogen fertilizer application. The maximum top borer incidence (%) was found (9.11, 11.56 and 14.44) at 250 kg N/ha which is at par with that at 200 kg N/ha (7.78, 10.00 and 12.67) while, the minimum top borer incidence (5.78, 7.78 and 9.56) was found at 150 kg N/ha for each month during July, August and September, respectively. This showed that with the increase in Nitrogen doses, there was an increase in top borer incidence and it might be associated with that the 3rd and 4th brood attach increases with increase in Nitrogen application. The present findings are strongly supported that higher nitrogenous fertilizers increase top borer incidence by Malik (1982) [8] and Saikia *et al.* (1994) [9]. Yadav (1985) [14] also reported a positive correlation between the incidence of top borer and nitrogen during 3rd and 4th brood attack of top borer in the mid-ribs of different genotypes.

Differences in top borer incidence with different potash levels were found to be significant. The mean per cent top borer incidence was significantly more (8.59, 10.52, 13.93) at 0 kg K_2O/ha as compared to that at 50 kg K_2O/ha (6.52, 9.04 and 10.52) during July, August and September, respectively, for each month. The present studies are in conformity with Yadav (1985) [14] who reported a negative correlation in phosphorus and potassium application with both 3rd and 4th brood attack of top borer. Gupta *et al.* (1992) [10] also reported that application of potassium significantly reduced 3rd and 4th brood infestation of top borer and increased the yields of sugarcane. Lower incidence of top borer with increased potassium is due to direct role of potassium by imparting resistance to disease and insect pest infestation. Nitrogen fertilizer (200 kg N/ha) combined with potassium application produced highest cane yield, number of millable canes and commercial cane sugar (Table 3). The interaction effects of varieties and nitrogen (V×N), varieties and potash (V×K), nitrogen and potash levels (N×K), and varieties, nitrogen and potash levels (V×N×K) with top borer incidence were found non-significant in July and August (Table 4 and 5). While for September all interactions are non-significant, except interaction effects of nitrogen and potash levels (N×K), were found to be significant, and are presented in Table 6. Lowest top borer incidence (7.11%) was recorded at 150 kg N/ha in potash treated plots, wherein highest incidence (15.56%) observed at 250 kg N/ha in control plots.

Table 3: Mean number of millable canes of sugarcane varieties as influenced by nitrogen and potassium application

Treatment	Mean number of millable canes ('000 canes/ha)	Mean CCS (%)	Mean cane yield (ton/ha)
	Varieties		
Co 0238	88.17	10.77	74.19
CoH 119	96.11	12.19	83.86
CoH 150	89.70	10.94	75.85
SE(m) ±	1.47	0.13	0.60
CD at 5%	5.76	0.51	2.33
	Nitrogen levels		
150	87.24	11.00	74.90
200	96.87	11.78	83.03
250	89.87	11.13	75.96
SE(m) ±	0.96	0.16	0.58
CD at 5%	2.97	0.48	1.78
	Potash levels		
0	89.97	11.07	76.36
50	92.68	11.54	79.57
SE(m) ±	0.50	0.09	0.50
CD at 5%	1.47	0.27	1.49

Table 4: Mean per cent incidence of top borer in sugarcane varieties as influenced by nitrogen and potash levels in the month of July during 2015-2016

Variety × Nitrogen				Nitrogen × Potash				Variety × Potash		
Nitrogen (kg/ha)	Variety			Potash (kg/ha)	Nitrogen (kg/ha)			Variety	Potash (kg/ha)	
	Co 0238	CoH 119	CoH 150		150	200	250		0	50
150	15.61 (7.33)	13.16 (5.33)	12.35 (4.67)	0	14.79 (6.67)	17.16 (8.89)	18.55 (10.22)	Co 0238	18.55 (10.22)	16.31 (8.00)
200	17.70 (9.33)	13.98 (6.00)	16.25 (6.00)	50	12.62 (4.89)	14.79 (6.67)	16.31 (8.00)	CoH 119	15.34 (7.11)	13.16 (5.33)
250	18.98 (10.67)	15.61 (7.33)	17.70 (9.33)					CoH 150	16.62 (8.44)	14.25 (6.22)
Mean	17.43 (9.11)	14.25 (6.22)	15.43 (7.33)	Mean	13.71 (5.78)	15.98 (7.78)	17.43 (9.11)	Mean	16.84 (8.59)	14.57 (6.52)

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

C.D. at 5% Variety = 1.38 Nitrogen = 1.38 Potash = 1.13
Variety × Nitrogen = N.S. Nitrogen × Potash = N.S. Variety × Potash = N.S.
Variety × Nitrogen × Potash = N.S.

Table 5: Mean per cent incidence of top borer in sugarcane varieties as influenced by nitrogen and potash levels in the month of August during 2015-2016

Variety × Nitrogen				Nitrogen × Potash				Variety × Potash		
Nitrogen (kg/ha)	Variety			Potash (kg/ha)	Nitrogen (kg/ha)			Variety	Potash (kg/ha)	
	Co 0238	CoH 119	CoH 150		150	200	250		0	50
150	18.25 (10.00)	13.98 (6.00)	15.61 (7.33)	0	16.13 (8.00)	19.35 (11.11)	20.51 (12.44)	Co 0238	20.88 (12.89)	18.98 (10.67)
200	20.17 (12.00)	16.25 (8.00)	18.34 (10.00)	50	15.76 (7.56)	17.16 (8.88)	18.86 (10.67)	CoH 119	16.73 (8.44)	14.68 (6.67)
250	21.36 (13.33)	16.89 (8.67)	20.81 (12.67)					CoH 150	18.38 (10.22)	18.13 (9.78)
Mean	19.23 (11.78)	15.70 (7.56)	18.25 (10.00)	Mean	15.95 (7.78)	18.25 (10.00)	19.69 (11.56)	Mean	18.66 (10.52)	17.26 (9.04)

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

C.D. at 5% Variety = 3.11 Nitrogen = 1.75 Potash = 0.96
Variety × Nitrogen = N.S. Nitrogen × Potash = N.S. Variety × Potash = N.S.
Variety × Nitrogen × Potash = N.S.

Table 6: Mean per cent incidence of top borer in sugarcane varieties as influenced by nitrogen and potash levels in the month of September during 2015-2016

Variety × Nitrogen				Nitrogen × Potash				Variety × Potash		
Nitrogen (kg/ha)	Variety			Potash (kg/ha)	Nitrogen (kg/ha)			Variety	Potash (kg/ha)	
	Co 0238	CoH 119	CoH 150		150	200	250		0	50
150	18.89 (10.67)	17.53 (9.33)	16.89 (8.67)	0	20.20 (12.00)	22.10 (14.22)	23.17 (15.56)	Co 0238	22.80 (15.11)	20.08 (12.00)
200	21.91 (14.00)	18.89 (10.67)	21.36 (13.33)	50	15.34 (7.11)	19.35 (11.11)	21.30 (13.33)	CoH 119	21.00 (12.89)	16.73 (8.44)
250	23.52 (16.00)	20.17 (12.00)	23.02 (15.33)					CoH 150	21.67 (13.78)	19.17 (11.11)
Mean	21.42 (13.56)	18.86 (10.67)	20.42 (12.44)	Mean	17.77 (9.56)	20.72 (12.67)	22.24 (14.44)	Mean	21.82 (13.93)	18.66 (10.52)

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

C.D. at 5% Variety = 1.72 Nitrogen = 1.58 Potash = 0.90
Variety × Nitrogen = N.S. Nitrogen × Potash = 1.55 Variety × Potash = N.S.
Variety × Nitrogen × Potash = N.S.

Conclusion

Field experiment for the effect of nitrogen and potash on the incidence of top borer, *Scirpophaga excerptalis* Walker in sugarcane genotypes with different maturity group revealed that the early maturing genotype Co 0238 was most susceptible to top borer with maximum mean per cent incidence followed by late maturing genotype CoH 150 and mid maturing genotype CoH 119 was most resistant to top

borer with minimum mean per cent incidence. Whereas, regarding fertilizer application the highest per cent incidence of top borer was at 250 kg N/ha and lowest incidence was recorded at 150 kg N/ha. Potassium application significantly reduced the top borer incidence in sugarcane by imparting resistance to top borer, while Nitrogen makes the plant susceptible. Thus, at optimum level of N, i.e. 200 kg N/ha, yield was found to be maximum. Hence, balanced fertilisation with selection of appropriate maturity group genotype in sugarcane can be recognised as valuable preventive measures to reduce infestation of top borer in sugarcane.

References

1. Dhaliwal GS, Arora A, Dhawan AK. Crop losses due to insect pests in Indian Agriculture: An update. Indian Journal of Ecology. 2004; 31:1-7.
2. Paul AVN. Pests of Sugarcane. In: Insect pests and their management, 2007, 12.
3. Mukunthan N. The top borer, *Scirpophaga excerptalis* Wlk. In: Sugarcane Entomology in India (Ed. David H, Easwaramoorthy S, Jayanthi R) Sugarcane Breeding Institute, Coimbatore, 1986, 93-119.
4. Gupta MK, Singh SN. Qualitative losses in sugarcane by plassey borer and top borer damage. Indian Sugar. 1997; 47:275-277.
5. Singh M, Verma SK, Lal K, Singh SB. Effect of top borer (*Scirpophaga excerptalis* Wlk.) infestation on quality of Jaggery. Sugar Tech. 2004; 6(3):191-192.
6. Kalra AN, Prasad M. Infructuous attack of sugarcane top borer. Indian Sugar Crops Journal. 1978; 5:37-39.
7. Singh OP, Yadav SR, Prakash O, Tiwari RK. Management of top borer, *Tryporyza nivella* F. of Sugarcane. Rajasthan Journal of Pesticides. 1979; 6:17-22.
8. Malik VS. Evaluation of some important crop management practices for the integrated control of shoot borer (*Chilo infuscatellus* Snell.) and top borer, (*Tryporyza nivella* F.) of sugarcane. Ph.D. Thesis, Haryana Agricultural University, Hisar, 1982, 160.
9. Saikia DK, Dutta SK, Dutta BC. Infestation of top borer and plassey borer in sugarcane as influenced by levels of nitrogenous fertilizers. Journal of Applied Biology. 1994; 4(1-2):44-48.
10. Gupta SC, Yazdani SS, Hameed SF, Agarwal ML. Effect of potash application on incidence of *Scirpophaga excerptalis* Wlk. in sugarcane. Journal of insect Science. 1992; 5(1):97-98.
11. Chaudhary JP, Yadav SR. Effect of nitrogen, phosphorous, potash and sulphur present in mid-ribs growing points and leaf blades of sugarcane genotypes on the incidence of top borer, *Scirpophaga excerptalis* Wlk. Indian Sugar. 1995; 45(9):671-682.
12. Gupta BD. Insect pest of sugarcane in India-III. The top borer, *Scirpophaga nivella* Fabr. Indian Sugar. 1959a; 9(3):127-149.
13. Khaliq A, Ashfaq M, Akram W, Kyoung CJ, Lee JL. Effect of plant factors, sugar contents, and control methods on the top borer (*Scirpophaga nivella* F.) infestation in selected varieties of sugarcane. Entomological Research. 2005; 35(3):153-160.
14. Yadav SR. Screening of sugarcane genotypes for infestation by top borer, *Tryporyza nivella* and characterization for susceptibility. Ph.D. Thesis, Haryana Agricultural University, Hisar, India, 1985.