

ANNUAL RESEARCH REPORT OF SUGARCANE ENTOMOLOGY
MAIN SUGARCANE RESEARCH STATION, NAVSARI AGRICULTURAL UNIVERSITY
NAVSARI (YEAR: 2016-17)

1. Project no. E.4.1:

- 1. Title** : **Evaluation of zonal varieties/ genotypes for their reaction against major insect pests**
 - 2. Objective** : To grade the entries in the Zonal Varietal Trials for their behavior towards damage by key pests in the area.
 - 3. Year of start** : 2015-16
 - 4. Location** : Main Sugarcane Research Station, Navsari.
 - 5. No. of replications** : Three
 - 6. Plot size** : 6.00 X1.00 M
 - 7. Date of planting** : 19.01.2016
 - 8. Varieties** : IVT/AVT
 - 9. Signature of the scientist in charge of the experiment :**
 - 10. Name and designation** : S. N. Gajjar, Assistant Research Scientist
- Methodology:** □

The IVT/AVT/other sugarcane genotypes were planted separately at Main Sugarcane Research Station, Navsari Agricultural University, Navsari. The experimental plot was kept unsprayed throughout the period of observation for insect pest attacking on sugarcane crop. Observations on pests were recorded in the experimental trial as per details given below.

Observations were recorded:

1. Early shoot borer, *Chilo infuscatellus*(S.)

Observations were recorded in post-germination phase at 30 days interval up to 120 days (At 30, 60, 90 and 120 DAP). The observation on the total number of shoots and number of dead hearts due to the early shoot borer was recorded. Calculated the per cent incidence as per the following formula:

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

The Cumulative incidence of up to 120 DAP was calculated. Number of bored plants/ha was also recorded. The data were worked out on per cent basis and were statistically analyzed.

2. Top borer: -

Scirpophaga excerptalis (Wlk): Per cent incidence was recorded on 5th month, 7th month and at harvest (i.e. 12th months.). The observations were recorded, for the total number of canes and total numbers of infested canes. The data were worked out on per cent basis and were statistically analyzed.

3. Stalk borer: *Diatraea saccharalis* (Fabricius) 4. Internode borer: *Chilo sacchariphagous indicus* (Kapur) and 5. Root borer: *Emmalocera depresella* (Swinhoe)

Minimum 25 canes were selected randomly from each plot and total number of internodes and internodes affected due to internode borer in each cane was counted at harvest. Calculated the per cent incidence on cane basis, per cent intensity on nodal basis (By considering total number of nodes on observed cane was recorded to compute infestation index). Infestation index was worked out, whereas only per cent incidence was observed for root borer on external visible symptoms up to 6 month. The data were worked out on per cent basis and were statistically analyzed.

6. Scale insects, *Melanaspis glomerata* (Green): and 7. Mealy bugs: *Saccharicoccus sacchari* (Cockerell): At harvest 25 canes were selected randomly from each plots and affected internode due to scale insect and mealy bugs. Per cent incidence and intensity were calculated for both the pests. The data were statistically analyzed.

8. Pyrilla: *pyrilla perpusilla*

The population of nymph and adult were recorded from a unit of 10 canes (20 leaves). Average population of nymphs and adults per leaf was noted. Observations on egg mass and cocoons of ecto-parasite, *Epiricania melanoleuca* were recorded. Observations were recorded at an interval of every fortnight and peak incidence of pyrilla and its ecto-parasitoid was also recorded.

9. Whitefly:

Aleurolobus barodensis (M): Population of nymph and puparia were recorded from a unit of 10 canes (20 leaves) from proximal, middle and distal region. Average population per 2.5 sq. cm was reported.

Project E.4.1.1 IVT (E) trial:**Table -4.1.1.1 Screening of sugarcane varieties against ESB in IVT (E) trial at Main Sugarcane Research Station, Navsari (2016-17).**

Sr. No.	Genotype	% Incidence of Early Shoot Borer							Cumulative incidence %	No. of bored plants/ha
		30 DAP	60 DAP		90 DAP		120 DAP			
1	Co 13002	0.00	2.20	(8.53)	3.81	(11.26)	2.08	(8.29)	2.74	13333
2	Co 13003	0.00	2.20	(8.53)	3.45	(10.70)	0.91	(5.47)	1.53	8333
3	Co 13004	0.00	8.57	(17.02)	6.56	(14.84)	0.88	(5.38)	5.29	30000
4	CoN 13071	0.00	2.20	(8.53)	4.50	(12.25)	1.03	(5.82)	1.97	10000
5	CoN 13072	0.00	2.20	(8.53)	5.45	(13.51)	0.86	(5.32)	2.06	11667
6	CoSnk 13101	0.00	2.75	(9.55)	2.38	(8.88)	0.84	(5.26)	1.98	11667
7	CoSnk 13102	0.00	2.20	(8.53)	12.96	(21.10)	0.97	(5.65)	4.97	25000
8	MS 13081	0.00	2.20	(8.53)	3.97	(11.49)	0.93	(5.53)	1.79	10000
9	Co 85004	0.00	15.45	(23.15)	15.24	(22.98)	3.96	(11.48)	7.01	36667
10	Co 94008	0.00	16.34	(23.84)	15.73	(23.37)	4.76	(12.60)	10.39	40000
11	Co C 671	0.00	8.99	(17.45)	11.93	(20.20)	3.64	(11.00)	8.12	41667
	S.Em.+(T)	-	0.29		0.31		0.33		-	-
	C. D @ 5%	-	0.90		1.01		NS		-	-
	C. V. %	-	12.30		11.32		9.94		-	-

Figures in the parenthesis are arcsine transformed values and those outside are original values

Early shoot borer, *Chilo infuscatellus* (S.):

The data on per cent incidence of ESB showed that the differences due to various genotypes in respect of cumulative per cent infestation were significant at 60 and 90 DAP, whereas it found non-significant at 120DAP, The cumulative per cent infestation of early shoot borer ranged from 1.53 to 10.39 per cent. The least cumulative per cent incidence was observed in Co 13003(1.53 %) followed by MS 13081 (1.79 %), while maximum incidence was observed in standard check Co 94008 (10.39%).

Table -4.1.1.2 Screening of sugarcane varieties against Top borer in IVT (E) trial at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	% Incidence of Top Borer						Root Borer % incidence	
		5 th month		7 th month		At harvest			
1	Co 13002	3.09	(10.12)	3.13	(10.19)	3.09	(10.13)	16.00	(23.58)
2	Co 13003	3.77	(11.20)	3.74	(11.15)	2.73	(9.51)	8.00	(16.43)
3	Co 13004	2.65	(9.37)	1.77	(7.65)	2.63	(9.34)	8.00	(16.43)
4	CoN 13071	1.83	(7.77)	1.92	(7.96)	1.87	(7.86)	8.00	(16.43)
5	CoN 13072	3.88	(11.36)	3.96	(11.48)	2.88	(9.78)	16.00	(23.58)
6	CoSnk 13101	4.27	(11.93)	3.45	(10.70)	2.54	(9.17)	8.00	(16.43)
7	CoSnk 13102	2.91	(9.82)	2.94	(9.87)	2.88	(9.78)	16.00	(23.58)
8	MS 13081	7.44	(15.83)	4.35	(12.04)	5.08	(13.03)	20.00	(26.57)
9	Co 85004	6.19	(14.41)	2.78	(9.60)	5.45	(13.51)	16.00	(23.58)
10	Co 94008	7.89	(16.31)	7.59	(15.99)	7.69	(16.10)	20.00	(26.57)
11	Co C 671	10.86	(19.24)	10.94	(19.31)	10.80	(19.19)	16.00	(23.58)
	S.Em.+(T)	0.81		0.56		0.65		0.98	
	C. D @ 5%	2.44		1.71		1.97		2.95	
	C. V. %	11.72		10.68		11.38		11.62	

Figures in the parenthesis are arcsine transformed values and those outside are original values

Top borer: - *Scirpophaga excerptalis* (Wlk):

From the table 4.1.1.2, data revealed that the differences in respect of per cent incidence of top borer due to various genotypes at 5th month, 7th month and at harvest were found significant among all tested genotypes.

Per cent of top borer incidence at 5th month ranged from 1.83 to 10.86 per cent. The least incidence was observed in CoN13071 (1.83 %), while maximum incidence was observed in CoC671(10.86) followed by Co 94008 (7.89 %) and MS 13081(7.44 %), respectively.

Whereas, Data on the per cent incidence of top borer at harvest reflect that incidence was ranged from 1.87 to 10.80 per cent. The least incidence was observed in CoN 13071(1.87 %) while, maximum incidence was observed in CoC 671 (10.80 %). All tested genotypes were found to be with less susceptible reaction against top borer

Root borer: *Emmalocera depresella* (Swinhoe)

From the table, it is seen that the differences in respect to per cent incidence in various genotypes were found significant. Per cent incidence of root borer was ranged from 8.00 to 20.00 per cent. The least per cent incidence of root borer was observed in Co 13003, Co 13004, CoN 13071 and CoSnk 13101 (8.00%), while maximum incidence was observed in Co 94008 and MS 13081(20.00%).

Table -4.1.1.3 Screening of sugarcane varieties against Scales and Mealy bugs in IVT- E trial at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	Scale insects				Mealy bugs			
		% incidence		% intensity		% incidence		% intensity	
1	Co 13002	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
2	Co 13003	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
3	Co 13004	0.00	(0.00)	0.00	(0.00)	13.33	(21.41)	5.83	(13.97)
4	CoN 13071	0.00	(0.00)	0.00	(0.00)	6.67	(14.97)	1.68	(7.45)
5	CoN 13072	0.00	(0.00)	0.00	(0.00)	6.67	(14.97)	1.60	(7.27)
6	CoSnk 13101	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
7	CoSnk 13102	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
8	MS 13081	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
9	Co 85004	13.33	(21.41)	4.24	(11.88)	20.00	(26.57)	12.71	(20.89)
10	Co 94008	6.67	(14.97)	2.48	(9.06)	4.00	(11.54)	2.09	(8.31)
11	CoC 671	14.67	(22.52)	4.46	(12.19)	20.00	(26.57)	4.46	(12.19)
	S.Em.± (T)	0.98		0.58		0.87		1.14	
	C. D @ 5%	2.95		1.75		2.62		3.44	
	C. V. %	11.38		12.60		10.34		13.27	

Figures in the parenthesis are arcsine transformed values and those outside are original values

Scale insects, *Melanaspis glomerata* (Green)

The data are presented in table 4.1.1.3 revealed that the differences due to various genotypes in respect of per cent incidence of scale insect were found significant. It was ranged from 0.00 to 14.67 per cent. No incidence (0.00 %) was observed in all the tested genotypes except checks, maximum incidence was observed in CoC671 (14.67%).

Same trend was observed in data on per cent intensity of scale insects and it was found to be ranged from 2.48 to 4.46 per cent. The maximum intensity was observed in CoC 671(4.46 %).

Mealy bugs: *Saccharicoccus sacchari* (Cockerell)

Data shows differences due to various genotypes in respect of per cent incidence of mealy bugs were significant. Data on per cent incidence was ranged from 4.00 to 20.00 per cent. Maximum incidence was observed in checks CoC 671 and Co 85004 (20.00 %).

Same trend was observed in data on per cent intensity. It was found to be ranged from 1.60 to 12.71 per cent. Maximum intensity was observed in Co 85004 (12.71%).

E.4.1.2 AVT (E) I Plant trial:**Table -4.1.2.1 Screening of sugarcane varieties against ESB in AVT (E) I plant trial at Main Sugarcane Research Station, Navsari (2016-17).**

Sr. No.	Genotype	% Incidence of Early Shoot Borer								Cumulative % incidence	No. of bored plants/ha
		30 DAP		60 DAP		90 DAP		120 DAP			
1	Co 11001	0.00	15.27	(23.00)	15.83	(23.45)	14.75	(22.59)	15.28	95000	
2	Co 11004	0.00	7.83	(16.25)	9.17	(17.63)	1.67	(7.42)	6.10	35000	
3	CoM 11081	0.00	1.56	(7.18)	0.83	(5.22)	1.53	(7.10)	1.32	8333	
4	CoM 11082	0.00	4.21	(11.84)	5.50	(13.57)	1.85	(7.82)	3.85	20000	
5	CoM 11084	0.00	15.63	(23.28)	15.11	(22.87)	15.97	(23.55)	15.54	100000	
6	Co 85004	0.00	10.89	(19.27)	9.80	(18.25)	7.00	(15.34)	9.24	46667	
7	Co 94008	0.00	15.22	(22.96)	15.31	(23.03)	15.84	(23.45)	15.46	75000	
8	CoC 671	0.00	15.56	(23.23)	15.83	(23.45)	14.43	(22.33)	15.36	71667	
	S.Em±(T)	-	0.92		0.83		1.17		-	-	
	C. D @ 5%	-	2.77		2.51		3.62		-	-	
	C. V. %	-	10.16		12.50		13.47		-	-	

Figures in the parenthesis are arcsine transformed values and those outside are original values

Early shoot borer, *Chilo infuscatellus* (S.):

The data on per cent incidence, cumulative per cent incidence and number of bored plant per ha. showed that differences due to various genotypes in respect of cumulative per cent infestation of early shoot borer at 60 DAP, 90 DAP and 120 DAP were found significant. Based on the cumulative per cent incidence the least incidence was observed in CoM 11081(1.32 %) while, maximum incidence was observed in CoM 11084 (15.54 %).

Table -4.1.2.2 Screening of sugarcane varieties against Top borer and Root borer in AVT (E) I P trial at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	% Incidence of Top Borer						Root Borer % incidence	
		5 th month		7 th month		At harvest			
1	Co 11001	2.68	(9.42)	2.65	(9.37)	2.40	(8.91)	8.00	(16.43)
2	Co 11004	2.94	(9.87)	3.00	(9.97)	2.83	(9.68)	20.00	(26.57)
3	CoM 11081	1.79	(7.69)	3.54	(10.84)	1.63	(7.34)	12.00	(20.27)
4	CoM 11082	1.94	(8.01)	3.92	(11.42)	3.09	(10.12)	8.00	(16.43)
5	CoM 11084	2.29	(8.70)	2.33	(8.78)	1.63	(7.34)	12.00	(20.27)
6	Co 85004	4.46	(12.19)	5.77	(13.90)	5.77	(13.90)	16.00	(23.58)
7	Co 94008	5.38	(13.41)	8.06	(16.49)	7.45	(15.84)	20.00	(26.57)
8	CoC 671	10.56	(18.96)	11.41	(19.74)	10.33	(18.75)	16.00	(23.58)
	S.Em±(T)	0.73		0.39		0.52		0.86	
	C. D @ 5%	2.21		1.18		1.64		2.59	
	C. V. %	9.34		10.15		9.68		11.83	

Figures in the parenthesis are arcsine transformed values and those outside are original values

Top borer: - *Scirpophaga excerptalis* (Wlk):

From the data it can be concluded that the per cent infestation of top borer at 5th month, 7th month and at harvest was found significant. Based on the per cent incidence of top borer at harvest

the least per cent incidence was observed in CoM 11081 and CoM 11084 (1.63 %) while maximum incidence was observed in CoC671(10.33%).

Root borer: *Emmaloceradepresella* (Swinhoe)

From the table, it is seen that the differences in respect to per cent incidence in various genotypes were found significant. Per cent incidence of root borer was ranged from 8.00 to 20.0 per cent. The least per cent incidence of root borer was observed in Co 11001 and CoM 11082 (8.0%), while maximum incidence was observed in Co 11004 and Co 94008 (20.0%).

Table -4.1.2.3 Screening of sugarcane varieties against Scales and Mealy bugs in AVT (E) I P trial at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	Scale insects				Mealy bugs			
		% incidence		% intensity		% incidence		% intensity	
1	Co 11001	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
2	Co 11004	20.00	(0.00)	4.55	(12.32)	13.33	(21.41)	10.91	(19.29)
3	CoM 11081	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
4	CoM 11082	0.00	(0.00)	0.00	(0.00)	22.67	(28.43)	7.87	(16.29)
5	CoM 11084	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)	0.00	(0.00)
6	Co 85004	13.33	(21.41)	4.24	(11.88)	20.00	(26.57)	12.71	(20.89)
7	Co 94008	6.67	(14.97)	2.48	(9.06)	4.00	(11.54)	2.09	(8.31)
8	CoC 671	14.67	(22.52)	4.46	(12.19)	4.00	(11.54)	1.79	(7.69)
	S.Em.+(T)	0.64		0.79		1.31		0.95	
	C. D @ 5%	1.93		2.38		3.94		2.86	
	C. V. %	10.95		14.82		12.68		15.68	

Figures in the parenthesis are arcsine transformed values and those outside are original values

Scale insects, *Melanaspis glomerata* (Green)

The data from the table indicated differences due to various genotypes in respect of per cent incidence of scale insects were significant. Data on per cent incidence was ranged from 0.00 to 20.0 per cent. No incidence was observed amongst tested genotypes except Co 11004 recorded maximum (20.00).

The data also showed that the differences due to various genotypes in respect of per cent intensity of scale insect were found significant. Per cent intensity was ranged from 0.00 to 4.55 per cent. Maximum scale insect per cent intensity was observed in Co 11004 (4.55 %).

Mealy bugs: *Saccharicoccus sacchari* (Cockerell)

Data from the table indicated differences due to various genotypes in respect of per cent incidence of mealy bugs were significant. Per cent incidence of mealy bugs ranged from 4.00 to 22.67 per cent. Maximum per cent incidence was observed in CoM 11082 (22.67).

From the data it is seen that the differences due to various genotypes in respect of per cent intensity of mealy bugs were significant. Per cent intensity of mealy bugs, ranged from 1.79 to 12.71 per cent. Least per cent intensity was observed in CoC 671(1.79%) and maximum per cent intensity was observed in Co 85004(12.71) followed by Co 11004(10.91%) respectively.

Project E.4.1.3 AVT (E) II Plant trial:**Table -4.1.3.1 Screening of sugarcane varieties against ESB in AVT (E) II P trial at Main Sugarcane Research Station, Navsari (2016-17).**

Sr. No.	Genotype	% Incidence of Early Shoot Borer							Cumulative % incidence	No. of bored plants/ha
		30 DAP	60 DAP		90 DAP		120 DAP			
1	Co 10004	0.00	16.67	(24.09)	15.91	(23.51)	13.19	(21.29)	15.06	60000
2	Co 10005	0.00	6.56	(14.84)	9.71	(18.15)	1.00	(5.74)	5.68	25000
3	Co 10006	0.00	2.08	(8.30)	4.30	(11.97)	1.00	(5.74)	2.49	10000
4	Co 10024	0.00	0.90	(5.45)	7.29	(15.67)	0.81	(5.15)	2.72	15000
5	Co 10026	0.00	7.45	(15.84)	3.23	(10.35)	0.90	(5.45)	3.65	20000
6	Co 10027	0.00	1.03	(5.83)	3.85	(11.31)	2.38	(8.88)	2.55	15000
7	CoT 10366	0.00	1.30	(6.54)	2.75	(9.55)	1.05	(5.89)	1.78	8333
8	CoT 10367	0.00	0.00	(0.00)	2.25	(8.62)	3.57	(10.89)	1.98	8333
9	Co 85004	0.00	5.26	(13.26)	9.18	(17.64)	0.96	(5.63)	5.05	25000
10	Co 94008	0.00	16.35	(23.85)	15.24	(22.98)	15.15	(22.91)	15.58	80000
11	CoC 671	0.00	15.53	(23.21)	15.89	(23.49)	15.60	(23.26)	15.67	83333
	S.Em±(T)	-	0.81		0.69		0.73		-	-
	C. D @ 5%	-	2.44		2.17		2.21		-	-
	C. V. %	-	11.26		13.01		10.60		-	-

Figures in the parenthesis are arcsine transformed values and those outside are original values

Early shoot borer, *Chilo infuscatellus* (S.):

From the data in table 4.1.3.1., the differences due to various genotypes in respect of cumulative per cent infestation of early shoot borer at 60 DAP, 90 DAP and 120 DAP were found significant. Based on the cumulative per cent incidence of early shoot borer the least incidence was observed in CoT 10366 (1.78 %) while, maximum incidence was observed in Check CoC 671 (15.67 %) followed by Co 94008 (15.58 %) and Co 10004 (15.06 %).

Table -4.1.3.2 Screening of sugarcane varieties against top borer and root borer in AVT (E) II P trial at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	% Incidence of Top Borer						Root Borer % incidence	
		5 th month		7 th month		At harvest			
1	Co 10004	6.10	(14.30)	3.66	(11.03)	2.67	(9.40)	8.00	(16.43)
2	Co 10005	4.55	(12.32)	4.44	(12.16)	2.22	(8.57)	8.00	(16.43)
3	Co 10006	2.47	(9.04)	3.49	(10.77)	4.05	(11.61)	16.00	(23.58)
4	Co 10024	3.39	(10.61)	3.51	(10.80)	2.36	(8.84)	8.00	(16.43)
5	Co 10026	2.73	(9.51)	2.83	(9.68)	2.80	(9.63)	12.00	(20.27)
6	Co 10027	4.07	(11.64)	2.56	(9.21)	1.96	(8.05)	16.00	(23.58)
7	CoT 10366	2.25	(8.63)	2.27	(8.67)	4.44	(12.16)	20.00	(26.57)
8	CoT 10367	5.49	(13.55)	4.35	(12.04)	4.26	(11.91)	12.00	(20.27)
9	Co 85004	4.46	(12.19)	5.77	(13.90)	5.77	(13.90)	16.00	(23.58)
10	Co 94008	5.38	(13.41)	8.06	(16.49)	7.45	(15.84)	20.00	(26.57)
11	CoC 671	10.56	(18.96)	11.41	(19.74)	10.33	(18.75)	16.00	(23.58)
	S.Em.± (T)	0.69		0.71		0.54		0.37	
	C. D @ 5%	2.11		2.15		1.63		1.13	
	C. V. %	12.54		13.42		11.15		10.25	

Figures in the parenthesis are arcsine transformed values and those outside are original values

Top borer: - *Scirpophaga excerptalis* (Wlk):

From the data it can be concluded that the per cent incident of top borer at 5th month, 7th month and also at harvest was significant. Based on the per cent incidence of top borer at harvest least per cent incidence was observed in Co 10027 (1.96 %) while maximum incidence was observed in CoC 671 (10.33 %).

Root borer: *Emmalocera depressella* (Swinhoe)

From the data differences in respect to per cent incidence in various genotypes were found significant. Per cent incidence of root borer was ranged from 8.00 to 20.00 per cent. The lowest per cent incidence of root borer was observed in Co 10004, Co 10005 and Co 10024 (8.00 %).

Table -4.1.3.3 Screening of sugarcane varieties against Scales and Mealy bugs in AVT (E) II P trial at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	Scale insects				Mealy bugs			
		% incidence		% intensity		% incidence		% intensity	
1	Co 10004	6.67	14.97	0.87	5.35	4.00	(11.54)	0.87	(5.35)
2	Co 10005	5.33	13.35	0.82	5.20	5.33	(13.35)	8.00	(16.43)
3	Co 10006	4.00	11.54	0.80	5.13	2.67	(9.40)	0.90	(5.44)
4	Co 10024	6.67	14.97	0.82	5.20	2.67	(9.40)	0.89	(5.41)
5	Co 10026	6.67	14.97	0.80	5.13	0.00	(0.00)	0.00	(0.00)
6	Co 10027	2.67	9.40	0.80	5.13	0.00	(0.00)	0.00	(0.00)
7	CoT 10366	1.33	6.62	0.80	5.13	0.00	(0.00)	0.00	(0.00)
8	CoT 10367	2.67	9.40	0.80	5.13	0.00	(0.00)	0.00	(0.00)
9	Co 85004	13.33	21.41	4.24	11.88	20.00	(26.57)	12.71	(20.89)
10	Co 94008	6.67	14.97	2.48	9.06	4.00	(11.54)	2.09	(8.31)
11	CoC 671	14.67	22.52	4.46	12.19	4.00	(11.54)	1.79	(7.69)
	S.Em.± (T)	0.59		0.75		1.18		0.74	
	C. D @ 5%	1.79		2.26		3.54		2.22	
	C. V. %	9.84		15.76		9.72		12.30	

Figures in the parenthesis are arcsine transformed values and those outside are original values

Scale insects, *Melanaspis glomerata* (Green)

Differences in respect of per cent incidence of scale insects of various genotypes were found significant. On the basis of data per cent incidence ranged from 1.33 to 14.67 per cent. Maximum per cent incidence (14.67.0%) was observed in CoC 671 followed by Co 85004 (13.33%).

The data shows that per cent intensity of various genotypes against scale insect was found significant. Per cent intensity of scale insect ranged from 0.80 to 4.46 per cent. Maximum scale insect per cent intensity was observed in CoC 671 (4.46 %).

Mealy bugs: *Saccharicoccus sacchari* (Cockerell)

The data are presented in table indicate that per cent incidence of mealy bugs in various genotypes were significant. Per cent incidence ranged from 2.67 to 20.0 per cent. No incidence was observed in Co 10026, Co 10027, CoT 10366 and CoT 10367. Maximum per cent incidence was observed in Co 85004 (20.0 %).

From the data it is seen that differences due to various genotypes in respect of per cent intensity of mealy bugs were significant. Per cent intensity of mealy bugs, ranged from 0.87 to 12.71 per cent. Least per cent intensity was observed in Co 10004 (0.87%) and maximum per cent intensity was observed in Co 85004 (12.71 %) followed by Co 10005 (8.0 %), respectively

Project E.4.1.4 IVT (ML):

Table -4.1.4.1 Screening of sugarcane varieties against ESB in IVT (ML) at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	%Incidence of Early Shoot Borer							Cumulative % incidence	No. of bored plants/ha
		30 DAP	60 DAP		90 DAP		120 DAP			
1	Co 13005	0.00	15.79	(23.41)	15.53	(23.21)	16.51	16.51	15.97	76667
2	Co 13006	0.00	4.60	(12.38)	8.82	(17.28)	3.23	3.23	5.24	21667
3	Co 13008	0.00	2.04	(8.21)	6.31	(14.54)	1.87	1.87	3.48	18333
4	Co 13009	0.00	10.11	(18.54)	1.89	(7.90)	2.02	2.02	4.42	21667
5	Co 13011	0.00	0.93	(5.55)	6.92	(15.26)	1.57	1.57	3.30	20000
6	Co 13013	0.00	2.06	(8.26)	5.30	(13.31)	0.79	0.79	2.81	16667
7	Co 13014	0.00	3.90	(11.38)	5.04	(12.98)	1.83	1.83	3.61	18333
8	Co 13016	0.00	1.09	(5.98)	5.00	(12.92)	1.98	1.98	2.88	15000
9	Co 13018	0.00	15.53	(23.21)	15.38	(23.09)	15.97	15.97	15.63	91667
10	Co 13020	0.00	5.08	(13.03)	3.65	(11.01)	1.54	1.54	3.38	21667
11	CoM 13082	0.00	13.00	(21.13)	1.85	(7.82)	1.92	1.92	5.45	28333
12	CoN 13073	0.00	2.90	(9.80)	9.41	(17.87)	2.33	2.33	5.00	20000
13	CoN 13074	0.00	15.96	(23.54)	15.15	(22.91)	15.32	15.32	15.43	90000
14	CoSnk 13103	0.00	0.98	(5.68)	3.45	(10.70)	2.31	2.31	2.39	15000
15	CoSnk 13104	0.00	15.96	(23.54)	16.67	(24.09)	15.97	15.97	16.22	91667
16	CoSnk 13105	0.00	2.78	(9.59)	2.99	(9.95)	1.60	1.60	2.45	15000
17	CoSnk 13106	0.00	3.28	(10.43)	2.07	(8.27)	1.43	1.43	2.21	15000
18	CoT 13366	0.00	15.28	(23.01)	16.22	(23.75)	16.35	16.35	16.00	66667
19	PI 13131	0.00	16.42	(23.90)	15.56	(23.23)	17.05	17.05	16.33	66667
20	PI 13132	0.00	3.53	(10.83)	5.00	(12.92)	2.08	2.08	3.56	16667
21	Co 99004	0.00	9.59	(18.04)	2.22	(8.57)	2.25	2.25	4.37	18333
22	Co 86032	0.00	15.63	(23.28)	16.67	(24.09)	17.20	17.20	16.49	78333
	S.Em.+(T)	-	1.20		0.91		0.79		-	-
	C. D @ 5%	-	3.63		2.79		2.31		-	-
	C. V. %	-	14.34		13.46		11.83		-	-

Figures in the parenthesis are arcsine transformed values and those outside are original values

Early shoot borer, *Chilo infuscatellus* (S.):

From the table, it is concluded that differences in respect of cumulative per cent infestation of early shoot borer in various genotypes at 60, 90 and 120 DAP were found significant. Based on the cumulative per cent infestation of early shoot borer the least incidence was observed in CoSnk 13106 (2.21%) while, maximum incidence was observed in check Co 86032 (16.49) followed by PI 13131 (16.33 %) and CoT 13366 (16.00%).

Table -4.1.4.2 Screening of sugarcane varieties against top borer and root borer in IVT (M) at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	% incidence of Top Borer						Root Borer % incidence	
		5 th month		7 th month		At harvest			
1	Co 13005	10.25	(18.67)	10.25	(18.67)	10.05	(18.48)	16.00	(23.58)
2	Co 13006	3.67	(11.04)	2.80	(9.63)	3.60	(10.94)	8.00	(16.43)
3	Co 13008	3.25	(10.39)	4.17	(11.78)	4.10	(11.68)	8.00	(16.43)
4	Co 13009	2.54	(9.17)	4.42	(12.14)	3.42	(10.66)	16.00	(23.58)
5	Co 13011	2.48	(9.06)	2.56	(9.21)	2.50	(9.10)	20.00	(26.57)
6	Co 13013	3.25	(10.39)	2.56	(9.21)	3.23	(10.35)	8.00	(16.43)
7	Co 13014	4.21	(11.84)	4.17	(11.78)	4.30	(11.97)	8.00	(16.43)
8	Co 13016	2.52	(9.13)	2.65	(9.37)	3.45	(10.70)	8.00	(16.43)
9	Co 13018	2.38	(8.87)	3.33	(10.51)	2.42	(8.95)	12.00	(20.27)
10	Co 13020	3.03	(10.02)	3.15	(10.22)	3.08	(10.11)	8.00	(16.43)
11	CoM 13082	2.63	(9.33)	4.46	(12.19)	2.61	(9.30)	8.00	(16.43)
12	CoN 13073	2.27	(8.67)	2.41	(8.93)	2.33	(8.78)	16.00	(23.58)
13	CoN 13074	5.17	(13.14)	4.46	(12.19)	5.22	(13.21)	16.00	(23.58)
14	CoSnk 13103	4.80	(12.66)	3.31	(10.48)	4.07	(11.64)	8.00	(16.43)
15	CoSnk 13104	10.46	(18.87)	10.34	(18.76)	10.41	(18.82)	8.00	(16.43)
16	CoSnk 13105	3.82	(11.27)	3.20	(10.30)	3.08	(10.11)	8.00	(16.43)
17	CoSnk 13106	3.73	(11.14)	2.33	(8.78)	3.76	(11.18)	16.00	(23.58)
18	CoT 13366	10.42	(18.83)	10.53	(18.94)	10.35	(18.77)	8.00	(16.43)
19	PI 13131	6.74	(15.05)	5.62	(13.71)	6.67	(14.97)	8.00	(16.43)
20	PI 13132	6.06	(14.25)	5.15	(13.12)	7.00	(15.34)	16.00	(23.58)
21	Co 99004	11.08	(19.44)	10.92	(19.30)	10.06	(18.49)	20.00	(26.57)
22	Co 86032	6.67	(14.97)	5.26	(13.26)	6.42	(14.68)	16.00	(23.58)
	S.Em.+(T)	0.58		0.64		0.47		0.49	
	C. D @ 5%	1.76		1.93		1.43		1.48	
	C. V. %	10.29		9.68		10.93		11.32	

Figures in the parenthesis are arcsine transformed values and those outside are original values

Top borer: - *Scirpophaga excerptalis* (Wlk):

The data are presented in table shows that difference in respect of per cent incidence of top borer in various genotypes at 5th, 7th month and at harvest shows significant reaction.

Per cent incidence of top borer infestation at 5th month ranged from 2.27 to 11.08 per cent. Maximum incidence was observed in Co 99004 (11.08 %). Whereas, at 7th month per cent incidence ranged from 2.33 to 10.92 per cent. Highest incidence was observed in Co 99004 (10.92 %).

Based on the per cent incidence of top borer at harvest infestation was ranged from 2.33 to 10.41 per cent.

Root borer: *Emmalocera depressella* (Swinhoe)

The data are presented in table shows that differences in respect of per cent incidence of root borer in various genotypes were significant. Per cent incidence of root borer ranged from 8.00 to 20.00 per cent. Highest per cent incidence was observed in Co 99004 and Co 13011(20.00 %)

Table -4.1.4.3 Screening of sugarcane varieties against Mealy bugs in IVT (M) trial at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	Mealy bugs			
		% incidence		% intensity	
1	Co 13005	0.00	(0.00)	0.00	(0.00)
2	Co 13006	0.00	(0.00)	0.00	(0.00)
3	Co 13008	0.00	(0.00)	0.00	(0.00)
4	Co 13009	20.00	(26.57)	9.92	(18.36)
5	Co 13011	0.00	(0.00)	0.00	(0.00)
6	Co 13013	13.33	(21.41)	8.26	(16.70)
7	Co 13014	20.00	(26.57)	12.98	(21.12)
8	Co 13016	22.67	(28.43)	12.10	(20.36)
9	Co 13018	13.33	(21.41)	9.32	(17.78)
10	Co 13020	22.67	(28.43)	12.00	(20.27)
11	CoM 13082	0.00	(0.00)	0.00	(0.00)
12	CoN 13073	13.33	(21.41)	9.15	(17.61)
13	CoN 13074	20.00	(26.57)	11.11	(19.47)
14	CoSnk 13103	0.00	(0.00)	0.00	(0.00)
15	CoSnk 13104	26.67	(31.09)	12.28	(20.51)
16	CoSnk 13105	28.00	(31.95)	13.27	(21.36)
17	CoSnk 13106	29.33	(32.79)	12.90	(21.05)
18	CoT 13366	17.33	(24.60)	8.27	(16.71)
19	PI 13131	0.00	(0.00)	0.00	(0.00)
20	PI 13132	0.00	(0.00)	0.00	(0.00)
21	Co 99004	4.00	(11.54)	1.59	(7.24)
22	Co 86032	13.33	(21.41)	3.42	(10.66)
	S.Em.+(T)	1.43		0.87	
	C. D @ 5%	4.30		2.62	
	C. V. %	15.94		11.13	

* Figures in the parenthesis are arcsine transformed values and those outside are original values

Mealy bugs: *Saccharicoccus sacchari* (Cockerell)

Per cent incidence of mealy bugs among various genotypes was found significant. Maximum per cent incidence was observed in CoSnk 13106 (29.33%)

The data on of per cent intensity of mealy bugs were found significant and ranged from 1.59 (Co 99004) to 13.27 (CoSnk 13105).

Project E.4.1.5 AVT (ML): I Plant**Table -4.1.5.1 Screening of sugarcane varieties against ESB borer in AVT (ML) I Plant at Main Sugarcane Research Station, Navsari (2016-17).**

Sr. No.	Genotype	%Incidence of Early Shoot Borer							Cumulative % incidence	No. of bored plants/ha
		30 DAP	60 DAP		90 DAP		120 DAP			
1	Co 11005	0.00	2.75	(9.55)	2.88	(9.77)	3.13	(10.19)	2.93	18333
2	Co 11007	0.00	5.00	(12.92)	5.95	(14.12)	4.29	(11.95)	5.14	18333
3	Co 11012	0.00	4.17	(11.78)	6.58	(14.86)	2.82	(9.67)	4.62	15000
4	Co 11019	0.00	3.70	(11.09)	8.18	(16.62)	4.12	(11.71)	5.56	26667
5	CoM 11085	0.00	5.06	(13.00)	6.36	(14.61)	8.24	(16.68)	6.57	30000
6	CoM 11086	0.00	4.76	(12.60)	6.42	(14.68)	7.69	(16.10)	6.34	30000
7	Co 99004	0.00	3.45	(10.70)	6.25	(14.48)	7.07	(15.42)	5.70	28333
8	Co 86032	0.00	10.17	(18.60)	10.32	(18.74)	11.11	(19.47)	10.51	61667
	S.Em.+(T)	-	0.58		0.89		0.63		-	-
	C. D @ 5%	-	1.75		2.68		1.90		-	-
	C. V. %	-	11.47		12.56		10.38		-	-

Figures in the parenthesis are arcsine transformed values and those outside are original values

Early shoot borer, *Chilo infuscatellus* (S.):

From the table, it is concluded that cumulative per cent infestation of early shoot borer in various genotypes at 60, 90 and 120 DAP were found significant. Data of cumulative per cent infestation shows that least incidence was observed in Co 11005 (2.93 %). Whereas, incidence was observed maximum in Co 86032 (10.51 %).

Table -4.1.5.2 Screening of sugarcane varieties against top borer and root borer in AVT (ML) I Plant at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	% incidence of Top Borer						Root Borer % incidence	
		5 th month		7 th month		At harvest			
1	Co 11005	3.03	(10.02)	3.17	(10.26)	2.36	(8.84)	8.00	(16.43)
2	Co 11007	3.66	(11.03)	3.66	(11.03)	3.70	(11.09)	16.00	(23.58)
3	Co 11012	5.33	(13.35)	9.09	(17.55)	8.00	(16.43)	8.00	(16.43)
4	Co 11019	2.94	(9.87)	4.04	(11.60)	5.10	(13.05)	8.00	(16.43)
5	CoM 11085	2.91	(9.82)	3.92	(11.42)	3.54	(10.84)	16.00	(23.58)
6	CoM 11086	3.88	(11.36)	4.00	(11.54)	3.77	(11.20)	12.00	(20.27)
7	Co 99004	10.14	(18.57)	10.19	(18.62)	10.24	(18.66)	20.00	(26.57)
8	Co 86032	4.17	(11.78)	4.35	(12.04)	3.94	(11.45)	16.00	(23.58)
	S.Em.+(T)	0.49		0.57		0.34		0.76	
	C. D @ 5%	1.49		1.73		1.05		2.29	
	C. V. %	13.28		12.73		10.51		11.53	

Figures in the parenthesis are arcsine transformed values and those outside are original values

Top borer: - *Scirpophaga excerptalis* (Wlk):

The data are presented in table shows that difference in respect of per cent incidence of top borer in various genotypes at 5th and 7th month and at harvest shows significant reaction.

Per cent incidence of top borer infestation at 5th month ranged from 2.91 (CoM 11085) to 10.14 (Co 99004) per cent. Whereas, at 7th month per cent incidence ranged from 3.17 to 10.19 per cent. Highest incidence was observed in Co 99004 (10.19 %).

Based on the per cent incidence of top borer at harvest infestation was ranged from 2.36 to 10.24 per cent.

Root borer: *Emmalocera depressella* (Swinhoe)

The data presented in table shows that difference in per cent incidence of root borer in various genotypes were significant. Per cent incidence of root borer ranged from 8.00 to 20.00 per cent. Highest per cent incidence was observed in Co 99004 (20.00 %).

Table -4.1.5.3 Screening of sugarcane varieties against Mealy bugs in AVT (ML) I Plant trial at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	Mealy bugs			
		% incidence		% intensity	
1	Co 11005	0.00	(0.00)	0.00	(0.00)
2	Co 11007	0.00	(0.00)	0.00	(0.00)
3	Co 11012	20.00	(26.57)	11.63	(19.94)
4	Co 11019	22.67	(28.43)	13.27	(21.36)
5	CoM 11085	0.00	(0.00)	0.00	(0.00)
6	CoM 11086	0.00	(0.00)	0.00	(0.00)
7	Co 99004	4.00	(11.54)	1.59	(7.24)
8	Co 86032	13.33	(21.41)	3.42	(10.66)
	S.Em.+(T)	0.43		0.78	
	C. D @ 5%	1.30		2.35	
	C. V. %	12.84		13.65	

* Figures in the parenthesis are arcsine transformed values and those outside are original values

Mealy bugs: *Saccharicoccus sacchari* (Cockerell)

Per cent incidence as well as per cent intensity of mealy bugs among various genotypes was found significant. Per cent incidence and per cent intensity was recorded maximum in Co11019 (22.67%) and (13.27 %), respectively.

Project E.4.1.6. AVT (ML): II Plant**Table -4.1.6.1 Screening of sugarcane varieties against ESB borer in AVT (ML) II Plant at Main Sugarcane Research Station, Navsari (2016-17).**

Sr. No.	Genotype	%Incidence of Early Shoot Borer								Cumulative % incidence	No. of bored plants/ha
		30 DAP	60 DAP		90 DAP		120 DAP				
1	Co 09009	0.00	4.96	12.87	2.82	9.67	3.08	10.11	3.56	23333	
2	Co 10015	0.00	2.74	9.53	6.54	14.82	6.41	14.67	5.43	23333	
3	Co 10017	0.00	3.23	10.35	8.89	17.35	8.70	17.15	7.24	26667	
4	Co 10031	0.00	6.31	14.55	2.11	8.35	2.27	8.67	3.38	21667	
5	Co 10033	0.00	7.53	15.93	3.25	10.39	8.51	16.96	6.13	31667	
6	CoM 10083	0.00	3.08	10.11	2.08	8.29	2.53	9.15	2.50	10000	
7	CoT 10368	0.00	4.08	11.65	2.52	9.13	3.92	11.42	3.45	18333	
8	CoT 10369	0.00	2.75	9.55	3.45	10.70	3.57	10.89	3.26	18333	
9	CoVC 10061	0.00	4.35	12.04	1.95	8.03	3.77	11.20	3.04	16667	
10	PI 10131	0.00	6.06	14.25	3.13	10.19	4.94	12.84	4.53	18333	
11	PI 10132	0.00	4.49	12.23	3.17	10.26	4.44	12.16	3.93	20000	
12	Co 99004	0.00	3.45	(10.70)	6.25	(14.48)	7.07	(15.42)	5.70	28333	
13	Co 86032	0.00	10.17	(18.60)	10.32	(18.74)	11.11	(19.47)	10.51	61667	
	S.Em.+(T)	-	0.78		0.89		0.38		-	-	
	C. D @ 5%	-	2.36		2.68		1.15		-	-	
	C. V. %	-	11.65		13.56		12.82		-	-	

Figures in the parenthesis are arcsine transformed values and those outside are original values

Early shoot borer, *Chilo infuscatellus* (S.):

From the table, it is concluded that cumulative per cent infestation of early shoot borer in various genotypes at 60, 90 and 120 DAP were found significant. Data of cumulative per cent infestation indicated that least incidence was found in CoM 10083 (2.50 %). Whereas, incidence was observe maximum in Co 86032 (10.51 %).

Table -4.1.6.2 Screening of sugarcane varieties against top borer and root borer in AVT (ML) II Plant at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	% incidence of Top Borer						Root Borer % incidence	
		5 th month		7 th month		At harvest			
1	Co 09009	3.03	(10.02)	3.15	(10.22)	3.05	(10.06)	8.00	16.43
2	Co 10015	1.92	(7.96)	2.80	(9.63)	1.69	(7.47)	16.00	23.58
3	Co 10017	3.70	(11.09)	3.74	(11.15)	3.60	(10.94)	8.00	16.43
4	Co 10031	2.29	(8.70)	3.13	(10.19)	2.40	(8.91)	8.00	16.43
5	Co 10033	2.65	(9.37)	4.39	(12.09)	3.23	(10.35)	16.00	23.58
6	CoM 10083	4.44	(12.16)	3.30	(10.47)	3.33	(10.51)	8.00	16.43
7	CoT 10368	1.74	(7.58)	3.60	(10.94)	2.54	(9.17)	8.00	16.43
8	CoT 10369	3.20	(10.30)	3.17	(10.26)	3.25	(10.39)	8.00	16.43
9	CoVC 10061	2.21	(8.55)	3.08	(10.11)	2.22	(8.57)	8.00	16.43
10	PI 10131	3.41	(10.64)	4.65	(12.45)	3.30	(10.47)	16.00	23.58
11	PI 10132	4.17	(11.78)	3.45	(10.70)	2.92	(9.84)	8.00	16.43
12	Co 99004	10.14	(18.57)	10.19	(18.62)	10.24	(18.66)	20.00	26.57
13	Co 86032	4.17	(11.78)	4.35	(12.04)	3.94	(11.45)	16.00	23.58
	S.Em.+(T)	0.38		0.58		0.29		0.47	
	C. D @ 5%	1.15		1.76		0.88		1.42	
	C. V. %	11.24		13.33		12.45		12.35	

Figures in the parenthesis are arcsine transformed values and those outside are original values

Top borer: - *Scirpophaga excerptalis* (Wlk):

The data presented in table shows difference in respect of per cent incidence of top borer in various genotypes at 5th and 7th month and at harvest was significant.

Per cent incidence of top borer infestation at 5th month ranged from 1.74 (CoT 10368) to 10.14 (Co 99004) per cent. Whereas, at 7th month per cent incidence ranged from 2.80 to 10.19 per cent. The highest per cent incidence was observed in Co 99004 (10.19 %). While; top borer incidence at harvest was ranged from 1.69 to 10.24 per cent.

Root borer: *Emmalocera depressella* (Swinhoe)

The data shows difference in per cent incidence of root borer in various genotypes were significant. Per cent incidence of root borer ranged from 8.00 to 20.00 per cent. Highest per cent incidence was observed in Co 99004 (24.00 %).

Table -4.1.6.3 Screening of sugarcane varieties against Mealy bugs in AVT (ML) II Plant trial at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Genotype	Mealy bugs			
		% incidence		% intensity	
1	Co 09009	21.33	(27.51)	10.64	(19.04)
2	Co 10015	0.00	(0.00)	0.00	(0.00)
3	Co 10017	0.00	(0.00)	0.00	(0.00)
4	Co 10031	0.00	(0.00)	0.00	(0.00)
5	Co 10033	0.00	(0.00)	0.00	(0.00)
6	CoM 10083	18.67	(25.60)	11.36	(19.70)
7	CoT 10368	20.00	(26.57)	12.71	(20.89)
8	CoT 10369	0.00	(0.00)	0.00	(0.00)
9	CoVC 10061	22.67	(28.43)	10.79	(19.18)
10	PI 10131	20.00	(26.57)	11.36	(19.70)
11	PI 10132	0.00	(0.00)	0.00	(0.00)
12	Co 99004	4.00	(11.54)	1.59	(7.24)
13	Co 86032	13.33	(21.41)	3.42	(10.66)
	S.Em.+(T)	0.37		0.59	
	C. D @ 5%	1.12		1.78	
	C. V. %	12.83		11.86	

* Figures in the parenthesis are arcsine transformed values and those outside are original values

Mealy bugs: *Saccharicoccus sacchari* (Cockerell)

Per cent incidence as well as per cent intensity of mealy bugs among various genotypes was found significant. Per cent incidence was ranged from 4.00 to 22.67 %. Whereas, per cent intensity was ranged from 1.59 to 12.71 per cent.

Project E. 28:

Title	:	Survey and surveillance of Sugarcane insect pests.
Objectives	:	To identify key insect pests of Sugarcane in the area.
Duration	:	Long term.
Year of start	:	2015–2016
Location	:	Main Sugarcane Research Station N.A.U, Navsari and South Gujarat area.
Methodology	:	Roving Survey was carried out of sugarcane fields South Gujarat. Observations on incidence of sugarcane borer pests and sucking pests were recorded.

Table 1: Survey and surveillance of insect pests of sugarcane in South Gujarat during 2016-17.

Name of pest	Varieties	Location	Per cent Incidence	Remarks
White fly	Co 86032 Co 86002 Co M 265 MC 707	Ganpatpara, Vebhardi, Mangrol, Karmal,Nishaliya,Alampuraand Karjan, (Vadodara sugar factory)	40 to 60 %	April- 2016
	Co 86032 CoM 0265 (ratoon)		More than 90%	
	Co 86032 CoM 0265	Other villages surrounding to vadodara sugar factory	30 to 35 %	April- 2016
	Co 86032 Co 86002	Valvada,Butwada and vanskui of Mahuva Sugar factory	8 to 15 %	Feb-2016
	CoM 0265 Co 86032 Co86002	Dungar, Chikhali, Ten,Movasa and Kharvasa village, Bardoli sugar factory	20 to 40 %	Aug- 2016
	Co 86032 CoM 0265	Mohni,Kharvasa,Magob and surrounding villages of Chalthan Sugar factory	10 to 20 %	Jan-2016
Early shoot borer & Top borer	Co 97009 (MC- 707) CoC 671 Co 86032 CoN 07072 CoM 0265	Kachholi, Gandevi, Vanzana and Surkhai. Gandevi sugar factory	5 to 10 %	Janu- 2016
Root borer	CoM 0265 Co 86002 Co86032	Chalthan sugar :Mohni,Niyol,Magob and surrounding villages Vihan, Rundh Vaktana, Vanz and Vav.	10 to 18 %	May- 2016
		Kamrej sugar : Kanyasi, Navi Pardi, Karjan, Ghala and Bodhan.	5 to 10 %	
White woolly aphid	Co 86032 Ratoon	Valvada,vanskui and Butwada Madhi sugar factory	2 to 3 %	-

Result:-

In South Gujarat incidence of insect pest was found in trace to moderate intensity. During the period of survey incidence of early shoot borer and top borer was ranged from 5 % to 10 % in Co 86032, Co 97009 (MC 707), Co 86032, Co 86002, and CoM 0265, respectively. White fly incidence varies from 8 to 60 % in plant sugarcane and in ratoon it was more than 90 %. Incidence of root borer found to be increased in the area and varies from 5 to 18 %. Rodent damage was ranged from 5-10%.

Project No. E. 30: Monitoring of insect pests and bio-agents in sugarcane agro ecosystem

Title	: Monitoring of insect pests and bio-agents in sugarcane agro-ecosystem.
Objective	: To monitor the key insect pests and natural enemies in the area.
Locations	: M.S.R.S., N.A.U., Navsari
Year of start	: 2015-16
Duration	: Long term
Date of Planting	:13-01-2016
Variety	: Co 86032
Methodology	: 1. Planting of sugarcane variety recommended for the region in 0.2 ha.area.
	: 2. All recommended agronomical practices was followed without application of insecticide.
Observations were recorded	: 1.Observations on incidence of borers were recorded by examining 20 canes at five places (four corners and in the middle), sucking pests by examining 25 canes.
	2. Observations for all the bio-agents were recorded.

A. Early shoot borer (ESB)

Period of Observation (SMW)	% incidence of ESB	% Parasitism		
		<i>T. Chilonis</i>	<i>E. annulipes</i>	<i>S. inferens</i>
7	2.34	9.73	-	-
11	1.43	4.25	-	-
16	0.98	2.43	-	-

Incidence of early shoot bore in 7, 11 and 16 SMW was 2.34, 1.43 and 0.98 respectively. During period of study only *T. chilonis* was found to parasitized early shoot borer. Parasitism ranged from 2.43 to 9.73 per cent.

B. Top borer (TSB)

Period of Observation (SMW)	% incidence of TSB	% Parasitism			
		<i>T. japonicum</i>	<i>T. chilonis</i>	<i>Apanteles flavipes</i>	<i>B. bassiana</i>
20	1.68	5.69	1.48	1.25	1.18
28	1.42	3.25	2.42	2.34	1.26
50	2.53	1.63	1.19	1.87	1.32

Incidence of top shoot bore in 20, 28 and 50 SMW was 1.68, 1.42 and 2.53 respectively. During period of study per cent parasitism by *T. japonicum* was 5.69, 3.25 and 1.63, respectively. Whereas *T. chilonis* found to be parasitizing at the rate of 1.48, 2.42 and 1.19 per cent, Parasitism done by *Apanteles flavipes* was ranged from 1.25 to 2.34 per cent. Fungus parasitism ranged from 1.18 to 1.32 % caused by *B. bassiana*.

Project No. E. 36

Project Title : Management of borer complex of sugarcane through lures

Objective : To manage sugarcane borers (Early shoot borer, top borer, and internode borer) through pheromone traps and influence of weather parameters on moth catches.

Year of start : 2015-16

Variety : Co 86032

Location : Main Sugarcane Research Station, NAU, Navsari

Date of planting : 25.01.2016

Treatments : Pheromone lures of sugarcane early shoot borer, top borer, and internode borer

Plot size : 1 acre

Methodology : The test insect-pests were early shoot borer, top borer, and internode borer. Three pheromone traps for each pest were installed in the second fortnight of the February till harvest of crop in one acre of sugarcane crop. The pheromone lure was changed after 2 months.

Observation to be recorded :

1. Observation on number of moths trapped was recorded at weekly interval.
2. The mean number of moth capture was worked out.
3. The correlation and regression of moth captures with weekly meteorological parameters was worked out.
4. Each borer infestation was recorded in both blocks.

Table: A The meteorological data recorded at Meteorological observatory College farm, N.M.C.A., N.A.U., Navsari for the crop year 2016-2017.

STW	Date	Temperature °C		RH %		Sun shine (hrs/day)	Rain Fall (mm)	Rainy days	ESB	TB	INB
		Max °C	Min °C	Mor.	Eve.						
1	2	3	4	5	6	7	8	9	10	11	12
1	1-7	33.1	26.8	82.8	24.8	8.9	0.0	0.0	2	2	2
2	8-14	30.9	12.5	86.5	31.9	7.8	0.0	0.0	2	2	1
3	15-21	28.1	11.3	82.6	35.2	6.9	0.0	0.0	1	2	2
4	22-28	30.1	10.4	69.1	30.9	9.6	0.0	0.0	1	3	2
5	29-4	31.8	12.9	84.6	30.7	9.4	0.0	0.0	3	2	2
6	5-11	30.3	12.9	86.7	38.0	9.9	0.0	0.0	1	2	1
7	12-18	29.5	13.8	85.1	35.1	7.7	0.0	0.0	1	2	2
8	19-25	32.6	15.9	84.3	34.7	8.6	0.0	0.0	2	2	2
9	26-4	34.3	18.6	79.5	34.9	8.6	0.3	0.0	2	3	2
10	5-11	33.9	17.4	88.3	27.7	8.6	0.0	0.0	2	2	2
11	12-18	33.5	18.4	84.7	35.9	9.0	0.0	0.0	1	2	2
12	19-25	36.3	19.0	82.5	21.1	9.1	0.0	0.0	1	4	1
13	26-1	38.0	19.6	87.5	29.7	8.2	0.0	0.0	3	3	1
14	2-8	34.8	21.5	91.4	41.7	7.5	0.0	0.0	1	2	2
15	9-15	36.8	21.0	83.0	30.6	9.4	0.0	0.0	2	2	1
16	16-22	36.5	22.9	84.9	39.4	9.8	0.0	0.0	2	1	1
17	23-29	33.8	22.8	69.6	45.5	10.5	0.0	0.0	1	4	2
18	30-6	34.9	24.1	86.7	53.2	9.3	0.0	0.0	1	3	3
19	7-13	33.8	25.2	86.8	59.6	9.3	0.0	0.0	2	2	2
20	14-20	36.0	26.4	87.5	54.2	9.2	0.0	0.0	1	2	1
21	21-27	33.5	28.4	78.5	62.7	8.6	0.0	0.0	2	2	1
22	28-3	34.7	28.1	74.2	60.0	9.4	0.0	0.0	3	3	4
23	4-10	34.2	28.3	83.9	76.9	7.5	0.0	0.0	0	2	1
24	11-17	34.3	28.3	82.3	69.1	7.2	0.1	0.0	2	3	1
25	18-24	33.6	27.2	83.6	62.4	3.4	0.7	0.1	1	2	3
26	25-1	32.7	25.2	91.1	79.9	4.8	12.2	0.3	1	1	3
27	2-8	30.0	25.6	93.8	85.1	1.9	28.7	0.7	1	2	1
28	9-15	30.1	25.5	91.6	83.0	0.7	2.9	0.4	2	1	2
29	16-22	29.9	24.4	92.1	79.6	2.7	12.2	1.0	1	2	1
30	23-29	29.5	24.3	95.4	83.2	0.4	12.3	0.4	1	2	2
31	30-5	28.3	24.5	95.3	90.0	0.6	30.4	1.0	2	4	3
32	6-12	29.2	24.5	94.5	87.9	1.7	16.7	1.0	1	2	1
33	13-19	30.2	25.5	90.5	77.5	3.4	0.3	0.0	1	2	2
34	20-26	29.9	25.0	86.6	80.1	2.6	1.8	0.4	2	1	1
35	27-2	30.4	24.8	95.4	69.1	4.1	3.1	0.4	0	2	2
36	3-9	30.1	23.9	88.4	73.3	6.4	21.4	0.3	1	1	1
37	10-16	30.3	23.6	103.7	73.4	4.9	2.9	0.3	1	1	1
38	17-23	28.7	23.6	98.6	88.3	0.4	41.4	0.7	1	3	2
39	24-30	31.1	23.1	95.5	74.6	4.5	9.4	0.4	1	2	1
40	1-7	29.8	23.9	97.4	81.8	2.9	8.4	0.6	2	2	1
41	8-14	30.4	22.7	95.7	72.9	5.6	5.3	0.1	3	2	2
42	15-21	33.5	19.9	93.9	46.3	8.3	0.0	0.0	2	3	2
43	22-28	33.1	18.3	84.4	37.7	9.3	0.0	0.0	2	2	3
44	29-4	31.9	17.2	67.6	58.8	9.5	0.0	0.0	3	5	1
45	5-11	33.5	14.5	82.2	21.6	9.4	0.0	0.0	1	3	4
46	12-18	33.2	15.9	75.4	32.0	8.7	0.0	0.0	2	1	5
47	19-25	33.1	13.4	69.3	24.0	9.3	0.0	0.0	3	2	2
48	26-2	33.7	13.1	79.2	25.8	9.7	0.0	0.0	4	5	3
49	3-9	32.6	15.2	69.5	31.8	9.0	0.0	0.0	2	2	2
50	10-16	32.0	13.3	71.7	27.4	9.4	0.0	0.0	2	1	4
51	17-23	32.1	14.5	72.0	27.4	8.7	0.0	0.0	2	3	2
52	24-31	31.5	12.2	72.4	27.3	9.0	0.0	0.0	2	5	3

Table: 1 Correlation between populations of early shoot borer, top borer and internode borer with weather parameters (2016-2017)

Pests	Temperature °C		Relative Humidity %		Rain-Fall (mm)	No.of rainy days	Sun shine hours
	Max.	Min.	Morning	Evening			
1	2	3	4	5	6	7	8
ESB	0.2409*	-0.2744*	-0.3503**	-0.3250**	-0.2343*	-0.2610*	0.3170**
TB	0.1501	-0.2316*	-0.3583**	-0.2266*	-0.0163	-0.1125	0.2480*
INB	0.0497	-0.2456*	-0.3119*	-0.2728*	-0.1065	-0.2028	0.1723

* Significant at 0.05 (0.2262), ** Significant at 0.01 (0.3158)

ESB=Early shoot borer, TB= Top borer and INB=Internode borer

Early shoot borer:

Maximum (4.0) moths of early shoot borer were collected in 48th SMW. Data from the Table-1 revealed that there is negative significant correlation between early shoot borer with minimum temperature (-0.2744), rain fall (-0.2343) and no. of rainy days (-0.2610), negative highly significant relation with relative humidity per cent at morning (-0.3503) and evening (-0.3250), whereas it shows positive significant correlation with maximum temperature (0.2409) and sunshine hours (0.3170)

Top borer:

Maximum moths (5.0) of top borer were catches during 44th, 48th and 52ndSMW. From the Table-1 it is revealed that there is significant negative correlation between top borer and minimum temperature (-0.2316), non-significant negative relation with no. of rainy days and rainfall. Whereas, negative highly significant relation with minimum morning relative humidity (-0.2266). Whereas, it shows positive significant correlation with Sunshine hours 0.2480, (Table-1).

Internode borer:

Maximum number of moth (20) was trapped during 46th SMW. From the Table-1 it is stated that there is positive non-significant correlation between internode borer moth catches and maximum temperature (0.0497) and sunshine hours (0.1723).Whereas negative significant relation with minimum temperature (-0.2456) and morning (-0.3119) and evening (-0.2728) relative humidity per cent. Rainfall (-0.1065) and rainy days (-0.2028) were exhibited negative non-significant relation with internode borer incidence.

Project E. 37:**Title: Bio-efficacy of new insecticides for the control of sugarcane early shoot borer**

Objective	: To find out effective strategy for the management of sugarcane early shoot borer
Yearly of started	: Co 86032
Location	: MSRS farm, Navsari Agricultural University Navsari.
Design	: RBD
No. of treatment	: 8 (Eight)
No. of replication	: 3 (Three)
Date of Planting	: 04.01.2016
Plot size	: Gross plot: 6.0 m x 5.4 m Net: 5.0 m x 4.5 m
Spacing	: Between two row; 0.9 m (R-R)
Seed rate	: Recommended
Fertilizer application	: Recommended dose

Treatment detail:

1. Soil application of Fipronil 0.3 G @ 25 kg a.i./ha at the time of planting and 60 DAP
2. Soil application of Chlorantraniliprole 0.4 G @ 22.5 kg/ha at the time of planting and 60 DAP
3. Spraying of Chlorantraniliprole 18.5 SC 375 ml/ha at 30 and 60 DAP
4. Spraying of Spinosad 45 SC @ 90 ml/ha at 30 and 60 DAP
5. Spraying of Flubendiamide @ 250 ml/ ha at 30 and 60 DAP
6. Soil application of Phorate 10 G @ 15 kg /ha at the time of planting and 60 DAP
7. Soil application of Carbofuran 3 G @ 33 kg /ha at the time of planting and 60 DAP
8. Untreated control

Observation were recorded**(A) Early shoot borer:**

- ESB infestation will be recorded by counting number of dead hearts easily pulled out and emitting offensive odour as well as total number of shoots/plant in each net plot on **45, 60, 90, and 120 DAP.**
- The per cent incidence of shoot borer will be worked out by following formula:

Per cent incidence = $\frac{\text{Number of dead hearts}}{\text{Total number of shoots}} \times 100$

- The cumulative per cent infestation will be worked out by taking progressive total of infested shoots in proportion to total of infested shoots in proportion to total shoot formed.

Yield, Growth and quality parameter:

- (a) Germination (%)
- (b) Tillering per cent at 120 DAP
- (c) Number of millable cane
- (d) Cane yield (kg/ha)
- (e) Growth parameter [total cane height (cm), Millable cane height (cm), number of internodes (10 canes / treatment/replication) and girth of cane (10 canes/ treatment/replication).
- (f) Quality parameters.

Research result

The data in table 1 revealed that difference due to application of various insecticides in respect of per cent incidence of early shoot borer at 45 DAS, 60 DAP, 90 DAP and 120 DAP were found significant. Incidence of early shoot borer at 45 DAP was ranged from 20.59 to 28.46 per cent. The least incidence was observed in Soil application of Chlorantraniliprole 0.4 G @22.5 kg/ha at the time of planting and 60 DAP (20.59%).

Incidence of early shoot borer was ranged at 60 DAP 23.23 to 30.58 per cent and at 90 DAP was 24.55 to 31.45 per cent, respectively. It is also seen from the table per cent incidence of early shoot borer at 120 DAS was found significant and ranged from 24.89 to 32.44 per cent. The least incidence was observed in Soil application of Chlorantraniliprole 0.4 G @ 22.5 kg/ha at the time of planting and 60 DAP during period of study.

The same trend was observed in pooled data, indicates differences between various treatment of insecticide in respect of per cent incidence of early shoot borer were significant. The per cent incidence of early shoot borer was ranged from 23.48 to 30.81 per cent. The least incidence was observed in Soil application of Chlorantraniliprole 0.4 G @ 22.5 kg/ha at the time of planting (23.48 %), while maximum incidence was observed in Untreated control (30.81 %).

Table -1 Bio-efficacy of new insecticide for the control of sugarcane ESB trial at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No	Treatments	% Incidence of Early Shoot Borer				Pooled	Cumulative % incidence
		45 DAP	60 DAP	90 DAP	120 DAP		
1	Soil application of Fipronil 0.3 G @ 25 kg a.i./ha at the time of planting and 60 DAP	15.14	16.16	18.34	20.24	17.57	20.12
		(22.90)	(23.70)	(25.36)	(26.74)	(24.78)	
2	Soil application of Chlorantraniliprole 0.4 G @ 22.5 kg/ha at the time of planting and 60 DAP	12.37	15.56	17.27	17.72	15.88	13.94
		(20.59)	(23.23)	(24.55)	(24.89)	(23.48)	
3	Spraying of Chlorantraniliprole 18.5 SC 375 ml/ha at 30 and 60 DAP	15.58	15.27	16.64	19.47	16.82	16.47
		(23.25)	(23.00)	(24.08)	(26.18)	(24.21)	
4	Spraying of Spinosad 45 SC @ 90 ml/ha at 30 and 60 DAP	17.20	16.38	19.06	21.76	18.71	22.26
		(24.50)	(23.87)	(25.89)	(27.80)	(25.63)	
5	Spraying of Flubendiamide @ 250 ml/ha at 30 and 60 DAP	16.58	16.11	17.74	21.19	18.02	21.36
		(24.03)	(23.66)	(24.91)	(27.41)	(25.12)	
6	Soil application of Phorate 10 G @ 15 kg /ha at the time of planting and 60 DAP	18.05	17.57	20.91	22.89	19.96	24.41
		(25.14)	(24.78)	(27.21)	(28.59)	(26.54)	
7	Soil application of Carbofuran 3 G @ 33 kg /ha at the time of planting and 60 DAP	18.63	18.81	18.73	22.25	19.67	25.19
		(25.57)	(25.71)	(25.64)	(28.14)	(26.33)	
8	Untreated control	22.71	25.89	27.23	28.78	26.23	34.85
		(28.46)	(30.58)	(31.45)	(32.44)	(30.81)	
	S.Em ± (T)	1.72	0.39	0.44	0.48	0.42	-
	C. D @ 5%	1.18	1.21	1.33	1.46	1.28	-
	C. V. %	11.44	11.63	12.27	10.81	11.13	-

*Figures in the parenthesis are arcsine transformed values and those outside are original values

On the basis of cumulative per cent incidence treatment of Soil application of Chlorantraniliprole 0.4 G @ 22.5 kg/ha at the time of planting and 60 DAP recorded minimum cumulative per cent incidence (13.94%). while, maximum cumulative per cent incidence (34.85%) was recorded in untreated control.

Table -2 Effect of new insecticide on yield and quality parameter at Main Sugarcane Research Station, Navsari (2016-17).

Sr. No.	Treatments	Yield (t/ha)	Quality parameter (%)			
			Brix	Sucrose	Purity	C.C.S.
1	Soil application of Fipronil 0.3 G @ 25 kg a.i./ha at the time of planting and 60 DAP	123.63	20.78	18.32	89.01	12.67
2	Soil application of Chlorantraniliprole 0.4 G @ 22.5 kg/ha at the time of planting and 60 DAP	132.21	21.27	18.51	87.85	12.71
3	Spraying of Chlorantraniliprole 18.5 SC 375 ml/ha at 30 and 60 DAP	128.61	21.85	18.85	87.00	12.89
4	Spraying of Spinosad 45 SC @ 90 ml/ha at 30 and 60 DAP	120.36	19.93	17.60	89.21	12.18
5	Spraying of Flubendiamide @ 250 ml/ ha at 30 and 60 DAP	121.44	21.74	18.58	86.15	12.65
6	Soil application of Phorate 10 G @ 15 kg /ha at the time of planting and 60 DAP	104.87	21.98	20.01	90.42	13.94
7	Soil application of Carbofuran 3 G @ 33 kg /ha at the time of planting and 60 DAP	94.76	20.78	18.32	89.01	12.67
8	Untreated control	80.06	21.27	18.51	87.85	12.71
	S.Em ± (T)	1.82	1.42	1.51	1.21	1.12
	C. D @ 5%	5.52	NS	NS	NS	NS
	C. V. %	12.81	11.24	12.17	13.42	12.17

Yield and Quality parameters viz., Brix %, Sucrose %, Purity %, C.C.S %

The highest millable cane yield of sugarcane was recorded in T2 (132.21 t/ha) and it was at par with T3 (128.61t/ha).The significant lowest yield was found in untreated control T8 (80.06 t/ha).Brix per cent, Sucrose per cent, Purity per cent and C.C.S per cent were found non- significant. The treatment did not show any significant difference in quality parameter.

Appendix-I

Grades of insect pests infestation

Pest	LS	MS	HS
Early shoot borer	Below 15.0	15.1 - 30.0	Above 30.0
Top borer	Below 10.0	10.1 - 20.0	Above 20.0
Internode borer	Below 30.0	30.1 - 50.0	Above 50.0
Root borer	Below 15.0	15.1 - 30.0	Above 30.0
Scale insect	Below 10.0	10.1- 35.0	Above 35.0
Mealy bugs	Below 5.0	5.1 - 30.0	Above 30.0
Woolly aphid	0 (Resistant) :Free		
	1 (Moderately Resistant) : Less than 25% leaf area covered		
	2 (Moderately susceptible): 25% leaf area covered		
	3 (Susceptible) : 25%-50% leaf area covered		
	4 (Highly susceptible) : More than 50% leaf area covered		
