ANNUAL REPORT - 2016-17

OF

ENTOMOLOGY DISCIPLINE UNDER

AICRP ON SUGARCANE

REGIONAL AGRICULTURAL RESEARCH STATION, ANAKAPALLE

ANGRAU, ANDHRA PRADESH

TECHNICAL PROGRAMME OF ENTOMOLOGY DISCIPLINE UNDER AICRP ON SUGARANE, RARS, ANAKAPALLE (2016-17)

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DETAILED REPORT OF ENTOMOLOGY DESCIPLINE
AICRP ON SUGARCANE

Project No. E.4.1 (1)

1.Title	**:**	Evaluation zonal varieties / genotypes for their reaction against major insect pests
2.Objective	**:**	To grade the entries in the trials for their behaviour towards damage by key pest in the area.
3. Year of start	**:**	1990-91
4. Duration	**:**	Recurring study
5. Location	**:**	Regional Agricultural Research Station, Anakapalle
6. Project leader and her associates	:	Dr. B. Bhavani, Senior Scientist (Entomology) Dr. A. Appala swamy, Principal Scientist (Plant Breeding) Dr. K. Veerabhadra Rao, Principle Scientist (Sugarcane)

Experimental Details :

a	**Date of Planting**	**:**	24/03/2016
b	**Varieties :**	**:**	**17 + 2**
IVT (early)		**:**	Co A 14 321, Co A 14 322, Co C 14 336, Co A 14 321
IVT (midlate**)**		**:**	Co A 14 323, Co A 14 324
AVT (Early)-I plant		**:**	Co A 13 322, Co C 13 336, Co C 13 337, Co V 13 356
AVT(midlate)-I Plant		**:**	Co C 13 339, Co Or 13 346
AVT (early)-II Plant		**:**	Co A 12 321, Co A 12 322, Co A 12 323, Co C 12 336 , Co Or 12 346
Susceptible checks		**:**	Co A 99082 (93 A 145) for ESB & INB; Co A 92081 (87 A 298) for scale insect
c	**Fertilizers**	**:**	112:100:120 NPK (Kg ha $^{-1}$)
d	**Intercultural operations**	**:**	Weeding as and when required and earthing up after 4 months after planting.
e	**Irrigation**	**:**	At an interval of 10-15 days as per requirement
f	**Plant protection measures**	**:**	Not applied.
g	**Plot size**	**:**	6 m X 0.8 m X 3R
h	**Design**	**:**	RBD
i	**Replications**	**:**	Three
j	**Harvesting date**	**:**	12/01/2017

7. Methods of recording observations:

a Early shoot borer :

The observations on the total number of shoots and number of dead hearts due to the early shoot borer were recorded at 30, 60, 90 and 120 days after planting and cumulative per cent incidence upto 120 DAP and number of bored plants /ha was worked out.

b. Internode borer :

The observations were recorded at harvest on 10 randomly selected canes of each entry per replication. The per cent incidence, intensity of internode borer and infestation index was worked out.

8. Results of the previous year:

During 2013-14, among three test entries in IVT (early), Co C 10 336 (16.38%DH) recorded highest incidence of early shoot borer whereas Co A 11 321 (12.50%) and Co A 11 323 (11.33%) recorded less incidence of early shoot borer as against 17.22% DH in the susceptible check, 93 A 145 (Co A 99082) and found promising against early shoot borer. All the entries found susceptible to internode borer.

During 2014-15, in Initial varietal trial (early), out of four test entries, lowest cumulative per cent incidence of early shoot borer was recorded in Co A12 322 (6.91 %DH) and highest incidence was recorded in Co A 12 323 (12.85 %DH) as against 37.89%DH in susceptible check, 93 A 145 (Co A 99082). However, all the test entries found promising against early shoot borer as compared to the susceptible check, 93 A 145 (37.89 %). Internode borer incidence and intensity were also less in Co A 12 322 (26.67%, 1.83%) and more in Co A 12 323 (66.67%, 6.61%).

During 2015-16, among four Initial varietal trial (Early) entries, Co A 13 324 recorded significantly less incidence of early shoot borer (12.23%), internode borer (33.33%) as compared to the susceptible check, Co A 99082 (23.29%DH; 56.67%) and found least susceptible towards early shoot borer and moderately susceptible towards internode borer whereas the entry, Co A 13 322 with 63.33% incidence showed high susceptible reaction towards internode borer. However, very less incidence of scale insect was recorded on all test entries of IVT (early) which was ranged between 0 % on Co A 13324 to 6.67% on Co A 13322 compared to susceptible check, Co A 92081 (96.67%). Among three IVT (mid-late) entries, Co A 13 327 (9.62%DH) and Co A 13 328 (10.69%DH) showed least susceptible reaction towards early shoot borer and Co A 13 328 showed moderate susceptible reaction towards internode borer (23.47%) compared to susceptible check, A 99082 (23.29%DH; 56.67%) whereas two entries Co A 13336 (0%) and Co A 13 337(3.33%) showed less susceptible reaction towards scale insect compared to susceptible check, Co A 92081 (96.67%) and found promising against scale insect

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc., :

During 2016-17, all the IVT and AVT entries have shown least susceptible reaction towards early shoot borer (<10% DH) compared to susceptible check, Co A 99082 (15.96%DH). Among the test entries, lowest incidence of early shoot borer (1.95%DH) was recorded in Co A 12 322 (1.95 %DH) in Advanced varietal trial (early)-II plant . While two entries *viz.*, Co Or 13 346 (16.1%) and Co A 12 321 (16.7) have showed least susceptible reaction and four (4) entries viz., Co A 14 324 (25. 80%), Co C 13 336 (26.1%) , Co V 13 356 (33.3%), Co A 12 322 (33.3%) showed moderate susceptible reaction towards internode borer compared to susceptible check, Co A 99082 (55.8%) and Co A 92081 (61.9%) and found promising against internode borer (Table 1a). Negligible incidence of scale insect was recorded in all the test entries due to scattered rainfall received during July-September months.

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Table 1a Reaction of IVT, AVT entries against early shoot borer and internode borer in Ratoon crop during 2016-17											
Genotype	**Incidence of ESB upto 120 DAP**							**Internode borer**			
	30 DAP	**60 DAP**	**90 DAP**	**120 DAP**	**Cumulative upto 120 DAP**	**No. of bored plants**	**Reaction**	**Incidence**	**Intensity**	**Infestation index**	**Reaction**
IVT (Early)											
Co A 14 321	6.73	0.00	1.98	0	4.32	11993	LS	43.1	3.5	1.51	HS
Co A 14 322	5.51	2.04	2.80	0	5.48	15230	LS	45.8	2.7	1.24	HS
Co C 14 336	5.77	2.16	1.31	0	5.42	15045	LS	48.4	3.8	1.84	HS
IVT (Midlate)											
Co A 14 323	3.94	1.03	1.55	0	4.65	12912	LS	42.4	3.1	1.31	HS
Co A 14 324	6.19	2.01	2.31	0	6.29	17460	LS	25.8	1.5	0.39	MS
AVT (early)-I Plant											
Co A 13 322	7.30	0.00	1.15	0	5.92	16443	LS	44.4	3.9	1.73	HS
Co A 13 323	7.14	4.20	2.95	0.36	10.51	29192	LS	48.48	4.76	2.31	HS
Co C 13 336	5.58	1.15	0.89	0	3.28	9105	LS	26.1	1.8	0.47	MS
Co C 13 337	9.80	2.09	1.51	0	6.06	16833	LS	49.4	3.5	1.73	HS
Co V 13 356	5.95	1.06	1.45	0	4.75	13197	LS	33.3	2.5	0.83	MS
AVT (midlate)-I Plant											
Co C 13 339	1.57	0.76	3.59	0.61	6.70	18620	LS	50.0	2.7	1.35	HS
Co Or 13 346	3.42	0.45	2.19	0	4.55	12652	LS	16.1	1.0	0.16	LS
AVT (early)-II Plant											
Co A 12 321	4.82	2.86	1.98	0	4.50	12492	LS	16.7	0.9	o.15	LS
Co A 12 322	2.57	0.00	1.02	0	1.95	5416	Ls	33.3	2.5	0.83	MS
Co A 12 323	4.24	0.38	0.35	0	2.86	7937	LS	51.2	3.4	1.74	HS
Co C 12 336	5.42	1.73	1.15	0	6.14	17049	LS	51.8	3.5	0.18	HS
Co Or 12 346	4.99	0.58	1.86	0.52	3.76	10452	LS	55.6	3.7	2.06	HS
Sus. checks											
Co A 99082 (93A 145)	15.30	3.60	2.08	0	15.96	44322	15.30	55.8	3.2	1.79	HS
Co A 92081 (87A 298)	15.04	4.10	2.23	0	12.14	33719	15.04	61.9	5.8	3.59	HS
SEd	0.84	1.02	0.55		1.77		0.84	9.87	0.50		
CD(p=0.05)	1.71	2.06	1.11		3.60		1.71	20.02	1.00		

Project No 1	**:**	**E 4.1 (2)**
1.Title	**:**	**Evaluation zonal varieties / genotypes for their reaction against major insect pests [IVT -early/midlate] –Ratoon crop**
2.Objective	**:**	To grade the entries in the trial for their behaviour towards damage by key pest in the area.
3.Year of start	**:**	1990-91
4.Duration	**:**	Long term
5.Location	**:**	Regional Agricultural Research Station, Anakapalle
6.Project leader and her associates	:	Dr. B. Bhavani, Senior Scientist (Entomology) Dr M. Charumathi, Senior Scientist (Plant Breeding) Dr. K. Veerabhadra Rao, Principle Scientist (Sugarcane)

Experimental Details :

A	**Date of Ratooning**	**:**	22/02/2016
B	**Varieties - IVT (early)**	**:**	Co A 13321, Co A 13322, Co A 13323, Co A 13324
	IVT (midlate)	**:**	Co A 13326, Co A 13 327, Co A 13 328
	Susceptible checks	**:**	Co A 99082 (93 A 145) for ESB & INB; Co A 92081 (87 A 298) for scale insect & INB.
C	**Fertilizers**	**:**	112:100:120 NPK (Kg ha $^{-1}$)
D	**Intercultural operations**	**:**	Weeding as and when required and earthing up after 4 months after planting.
E	**Irrigation**	**:**	At an interval of 10-15 days as per requirement
F	**Plant protection measures**	**:**	Not applied.
G	**Plot size**	**:**	6m X 0.9 m X 3R
H	**Design**	**:**	RBD
I	**Replications**	**:**	Three
J	**Harvesting date**	**:**	3/01/2017

7. Methods of recording observations :

1 Early shoot borer :

The observations on the total number of shoots and number of dead hearts due to the early shoot borer were recorded at 30, 60, 90 and 120 days after planting and cumulative per cent infestation was worked out.

2 Internode borer and scale insect:

The observations were recorded at harvest on 25 canes in each genotype per replication. The per cent incidence and intensity of internode borer and scale insect were worked out.

8.Results of the previous year:

During 2013-14, among three test entries in IVT (early), Co C 10 336 (16.38%DH) recorded highest incidence of early shoot borer whereas Co A 11 321 (12.50%) and Co A 11 323 (11.33%) recorded less incidence of early shoot borer as against 17.22% DH in the susceptible check, 93 A 145 (Co A 99082) and found promising against early shoot borer. All the entries found susceptible to internode borer.

During 2014-15, In AVT (early), out of three entries, Co C 10 336 recorded less incidence of early shoot borer (10.15%) and highest incidence was recorded in Co A 11 323 (14.45%) as against 17.58% DH in susceptible check, 93 A 145 (Co A 99082).However, all the three entries showed least susceptible reaction towards early shoot borer and found promising. Among test entries, Co A 11 323 recorded less incidence of internode borer (36.67%) and showed moderate susceptibility whereas highest incidence was recorded in Co C 10 336 (46.67%). However, all the entries showed susceptible reaction towards internode borer. Incidence of scale insect was nil in Co A 12 323 and found less susceptible to scale insect. Remaining two test entries (Co C 10 336 & Co A 11321) recorded highest incidence and showed high susceptible reaction towards scale insect.

During 2015-16, among four entries of Advanced varietal trial (early), Co V 12 356 (6.69 % DH) and Co A 12 322 (6.82%DH) recorded lowest cumulative incidence of early shoot borer compared to susceptible check, Co A 99082 (18.09%DH). However, all the test entries recorded <15 % DH and found least susceptible and promising against early shoot borer where as all the AVT entries showed high susceptible reaction towards internode borer (43.33 % to 76.67 %) and scale insect (30% to 83.33%).

9.Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc., :

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Among IVT (early & midlate) -Ratoon crop entries, all the entries except Co A 13 322 (15.96%DH) showed least susceptible reaction compared to susceptible check, Co A 99082 (16.53%DH). Lowest incidence of early shoot borer was recorded in Co A 13 327 (3.51%), Co A 13321 (5.07%DH) & Co A 13 324 (5.07%DH), Co A 328(5.54%) and found promising against early shoot borer whereas all the entries showed high susceptible reaction towards internode borer (48.48%- 83.22%) compared to the susceptible checks , Co A 99082 & Co A 92081 (71.82% , 88.89%) in ratoon crop (Table 1b).

Table 1b	Reaction of IVT (early & midlate) entries against early shoot borer and internode borer in Ratoon crop during 2016-17										
Genotype		**Incidence of ESB upto 120 DAP**						**Internode borer**			
	30 DAP	**60 DAP**	**90 DAP**	**120 DAP**	**Cumulative upto 120 DAP**	**No. of bored plants**	**Reaction**	**Incidence**	**Intensity**	**Infestation index**	**Reaction**
IVT (early)											
Co A 13321	0.41	6.15	2.26	0.42	5.07	14084	LS	83.22	6.34	5.28	HS
Co A 13322	10.35	2.52	9.08	0.42	15.96	44334	MS	85.21	11.93	10.17	HS
Co A 13323	7.14	4.20	2.95	0.36	10.51	29192	LS	48.48	4.76	2.31	HS
Co A 13324	1.85	2.31	3.10	0.60	5.07	14088	LS	76.69	9.90	7.59	HS
IVT (midlate)											
Co A 13 326	7.51	6.24	2.23	0.76	10.49	29147	LS	58.70	6.17	3.62	HS
Co A 13 327	0.75	2.18	1.73	0.17	3.51	9742	LS	60.77	4.69	2.85	HS
Co A 13 328	2.78	2.61	1.33	0.41	5.54	15394	LS	53.33	4.17	2.22	HS
Sus. checks											
Co A 92081 (87A 298)	1.12	3.70	2.56	0.28	9.41	26150	LS	88.89	8.49	7.55	HS
Co A 99082 (93A 145)	1.89	1.84	6.00	0.00	16.53	45912	MS	71.82	6.26	4.49	HS
F test	sig	sig	sig	NS	Sig.			Sig.	Sig.		
SEd	1.18	0.88	0.86		1.078			7.26	7.03		
CD(p=0.05)	2.50	1.86	1.82		2.29			15.39	14.77		

II

Experiment No.2 : Project E 28

1. **Title** : **Survey and surveillance of sugarcane insect pests.**

2**. Objective** : To identify key insect pests of sugarcane in the area.
3.Year of start : 2003-04
4.Duration : Long term
5.Location : Regional Agricultural Research Station, Anakapalle
6. Project leader and her associates : Dr. B. Bhavani, Senior Scientist (Entomology)
Dr. K. Veerabhadra Rao, Principle Scientist (Sugarcane)

Experimental Details :
a. Season : 2016-17

7. Methodology & observations recorded :

Roving survey of sugarcane fields at 5-8km distance and different sugar factory operational areas in Andhra Pradesh.

Observations on incidence of borers were recorded by examining 100 canes at five places (four corners and in the middle), sucking pests by examining 20 canes. Sucking pests were recorded by examining 20 canes

8.Results of the previous year :

During 2015-16, it was observed that moderate to severe incidence of early shoot borer incidence during the months of April to June (6.00 to 47.00 %) on all popular sugarcane varieties *viz*., 87 A 298, 86 V 96, 83 V15, 2001 A 63, 2003 V 46 & Co 86032, . The per cent incidence of internode borer was more on early planted crop and it was ranged from 15 to 85 per cent on all popular sugarcane varieties (87 A 298, 2003 V 46, 2001 A 63 & Co 86032). Moderate to severe incidence of red mite (4 to 45%) was observed during the months of May, June and July months due to high temperature and late onset of monsoons. The incidence of scale insect ranged from 5 to 70 percent on varieties viz., 87 A 298, Co 7219, 83 V 15. *Pyrilla* population (4-18 N &A/ leaf) was observed from August month and continued up to November month. Parasitisation of *Epiricania melanoleuca* (1-5%) was observed on adults & on eggs during the months of August-September, 15.Remaining all other insect pests viz., whitefly, mealybug, leafhoppers and grasshoppers were observed in minor status during 2015-16 (Table 3).

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc.,

During 2016-17, survey and surveillance of sugarcane insect pests was done in Chodavaram, Thandava, Etikoppaka sugar factory areas in Visakhapatnam district, Navabharath sugars & Chelluru sugar factory area in East Godavari district. During surveys it was observed that early shoot borer and internode borer were the major problems in all commercial varieties which were grown in different areas. The incidence o early shoot borer was ranged between 4.0- 47% in different sugarcane growing areas due to high day temperatures coupled with low relative humidity during the months of March and April. Later the incidence was declined due to well distributed rainfall during the months of June-August. The incidence of internode borer was relatively low to moderate (5-50%) when compared to last year (2015) due to scattered rainfall received during the months of June-August. Moderate to severe incidence of whitefly (10-39N&P/2.5cm^2) was observed in many ratoons in Chodavaram division of Visakhapatnam district. Incidence of red mite was ranged between 5-36% and termite incidence was 12-40% in different sugarcane growing areas. In East Godavari district, Chelluru low to moderate incidence of *Pyrilla* (2-16A&N/leaf) was observed during the month of August month(Table 2).

Table 2 Survey and surveillance of sugarcane insect pests(E.28)

S. No.	Variety	Location	Name of the pest	% incidence or population			Remarks
				Min.	Max.	Aver.	
1	87 A 298, 86 V96, 2003 V 46 Co 86032	Navabharat Ventures Pvt., Ltd., Samalkot, East Godavari district	Early shoot borer (*Chilo infuscatellus*)	4.00	30.00	17.00	Incidence of early shoot borer and internode borer were high on variety, Co 86032. Moderate to high incidence of scale insect was observed on variety, 87 A 298 (Viswamitra) both on plant and ratoon crops.
			Root borer (*Emmalocera depresella*)	1.00	5.00	3.00	
			Top shoot borer (*Scirpophaga exrceptalis)*	2.00	8.00	5.00	
			Internode borer (*Chilo sacchariphagus indicus*)	5.00	40.00	22.50	
			Pyrilla perpusilla / leaf	3.00	12.00	7.50	
			Scale insect (*Melanaspis glomareta)* (incidence)	10.00	40.00	25.00	
			Mealy bug (*Saccharicoccus sacchari*) (%incidence)	8.00	12.00	10.00	
			Red Mite (*Oligonychus indicus*) (% incidence)	7.00	25.00	16.00	
			Termite *(Odontotermes obesus)* (% incidence)	5.00	15.00	10.00	
			Derbid leafhoppers (*Proutista moesta)* / leaf	2.00	8.00	5.00	
2	Co7219, 87 A 298 , Co 62175, 2001 A 63 & Co7805	Chodavaram sugar factory operational area, Visakhapatnam dt.	Early shoot borer (% incidence)	12.00	30.00	21.00	Along with early shoot borer, internode borer incidences, moderate to severe incidence of white fly was observed in neglected ratoon crop in many places.
			Internode borer (% incidence)	10.00	50.00	30.00	
			Pyrilla/leaf	2.00	6.00	4.00	
			Whitefly (per 2.5sq.cm.)	10.00	39.00	24.50	
			Mealy bug (%incidence)	3.00	12.00	7.50	
			Woolly aphid (Average grade)	1.00	1.00	1.00	
			Scale insect (% incidence)	5.00	20.00	12.50	
			Red mite (% incidence)	2.00	40.00	21.00	
			Termite (% incidence)	15.00	40.00	27.50	

3	87 A 298, 2001 A 63, 93 A 145, Co7219, 81 V 48, Co 62175 & Co7805	Thummapala Sugar factory area, Anakapalle, Munagapaka villages of Visakhapatnam district	Early shoot borer (% incidence)	13.00	47.00	30.00	Due to high temperature during April month and late planted conditions, moderate to severe incidence of early shoot borer was observed on all popular varieties.
			Internode borer (% incidence)	10.00	40.00	22.50	
			Pyrilla/leaf	2.00	10.00	6.00	
			Whitefly	10.00	22.00	16.00	
			Termite (% incidence)	12.00	20.00	16.00	
			Derbid planthoppers/leaf	2.00	10.00	6.00	
			Mealybug(%incidence)	4.00	10.00	7.00	
			scale insect(% incidence)	5.00	30.00	17.50	
			Red mite (% incidence)	5.00	36.00	20.50	
4	87 A 298, Co 62175, 2001 A 63 & 2003 V46 81 V48	Etikoppaka sugar factory operational areas, Visakhapatnam district	Early shoot borer (% incidence)	12.00	38.00	25.00	Early shoot borer and interndoe borer were the predominant species prevailed in the early stage of the crop period in Visakhapatnam district
			Internode borer (% incidence)	20.00	40.00	30.00	
			Pyrilla/leaf (A &N)	3.00	7.00	5.00	
			Red Mite (% incidence)	12.00	30.00	21.00	
			Whitefly(%incidence)	10.00	18.00	14.00	
			scale insect (incidence)	5.00	30.00	17.50	
			Termite (% incidence)	20.00	40.00	30.00	
			Pyrilla per leaf	2.00	12.00	7 .00	
5	87 A 298, Co 7805, 2003 V46, Co 86032, 2001 A 63	Sri Sarvaraya sugars Ltd., Chelluru, East Godavari dt.	Early shoot borer (% incidence)	5.00	28.00	16.50	Moderate to high incidence of early shoot borer and internode borer were observed all commercial varieties *viz.*, Co 86032, 2003 V 46. & 87 A298.
			Top shoot borer (% incidence)	1.00	3.00	2.00	
			Internode borer (% incidence)	20.00	40.00	30.00	
			Pyrilla/leaf (A &N)	3.00	16.00	9.50	
			Whitefly (per 2.5sq.cm.)	5.00	20.00	12.50	
			Woolly aphid (Average grade)	1	1	1	
			Scale insect (incidence)	5.00	20.00	12.50	

Experiment No.3 : **Project E 30**

1. Title : **Monitoring of insect pests and bio-agents in agro ecosystem.**

2. Objective : To monitor the key insect pests and natural enemies in the area.

3. **Year of start** : 2006-07

4. **Duration** : Long term.

5. **Location** : Regional Agricultural Research Station, Anakapalle

6. Project leader and her associates : Dr. B. Bhavani, Senior Scientist (Entomology)
Dr. K. Veerabhadra Rao, Principle Scientist (Sugarcane)

Experimental Details

a Season : 2016-17

b Plot size : 0.5ac

c Design : Bulk plot

d Date of planting : 05-04-2016

e. Date of harvest : 12- 2-2017

f. Observations recorded :

Observations on incidence of borers were recorded by examining 100 canes at five places (four corners and in the middle), sucking pests by examining 20 canes.

8.Results of the previous year :

During 2015-16, the infestation of early shoot borer was ranged from 8.60% to 38.60% and peak incidence (38.60%) was noticed in 21st SW (i.e. 3rd week of May). Low to moderate incidence of red mite (3.0 to 42.60%) was observed from 12th SW (i.e. 2nd week of March) to 25th SW (4th week of June). Incidence of internode borer was noticed from 26th SW (2.6%) and the peak incidence was noticed in 35th SW i.e., last week of August (52%). Low to moderate incidence of scale insect was observed during September – December months (5- 50%). Peak incidence of scale insect was observed in 44th SW (50%). Peak incidence of *Pyrilla* was observed during 43rd SW and maximum parasitisation of *Epiricanea* was observed during 48th SW. Parasitisation of *T. chilonis* was ranged between 1.0 - 4.2% on the eggs of *C. infuscatellus* and parasitisation of *Sturmiopsis inferens* on larvae of *C. infuscatellus* ranged between 0.6% and 3.80% from April to July months. Higher activity of *Euborellia annulipes* (5-6/clump) was observed during April month. On internode borer, parasitisation of ***T****. chilonis (*1-3.6*%), Sturmiopsis inferens* (0.4 -3.3%) and *Cotesia flavipes* (0.60 -5.40%) were observed during the months of September- January, 2016. Higher activity of the parasitoid, *Encarsia flavoscutellum* was observed during the month of January.

9.Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc., :

During 2016-17, major insect pests and their bio-agents in sugarcane variety 93 A 145 (Co A 99082) were monitored. The incidence of early shoot borer (ESB) was ranged between 1.6 and 21% with peak incidence during the month of May (21%). On early shoot borer, parasitisation of *Trichogramma chilonis* (0.2-3.8%), *Sturmiopsis inferens* (1-2%) were observed during the months of . Internode borer incidence was ranged between 6-32% with maximum incidence (32%) during the month of October and parasitisation of *T.chilonis* (0.2-4.0%), *S. inferens* (1-2%), *Cotasia flavipes* (0.4-2.2%) (Table 4a). Red mite incidence (6-28%) was noticed during the months of May-August with maximum incidence during the month of June (28%). Mealy bug incidence was very meager and predatory Coccinellids viz., *C. Septumpuctata* & *C. sexmaculata* were also observed on mealybugs. The incidence of scale insect was also very less and it was ranged between 5-40% & a peak incidence in December month (40%) (Table 4b).

The peak population of *Pyrilla* (10-18/ leaf) was observed during the month of October. The parasitisation of *Epiricania melanoleuca on Pyrilla* nymphs & adults was ranged between 2-9% with maximum parasitisation during November month (9%). The parasitisation by *Tetrastichus pyrillae* on *Pyrilla* eggs was also observed (1-4%). The prevalence of effective parasitoids of major insect pests of sugarcane was identified *viz. Trichogramma chilonis, Sturmiopsis inferens, Cotesia flavipes* parasitising on early shoot borer & internode borer eggs, larvae and *Tetrastichus pyrillae, Epiricania melanoleuca* parasitising on *Pyrilla* eggs and nymphs, adults, respectively. A new insect pest, Spittle bug, *Poophilus costalis* (Walker) incidence was observed during the months of August to November, 2016 on sugarcane leaves(Table 4c).

Table 4a. Monitoring of insect pests and bio-agents in Sugarcane agro-ecosystem

Period of observation	% incidence of ESB	% parasitism (ESB), if any			% incidence of Internode borer	% parasitism (INB)		
		T. chilonis	***E. annulipes***	***S. inferens***		***T. chilonis***	***S. inferens***	***Cotesia flavipes***
April,16	2.00	0.20	5-6/clump	-	-	-	-	-
May,16	21.00	1.60	4-3/clump	-	-	-	-	-
June, 16	13.00	3.80	2-3/clump	1.00	-	-	-	-
July,16	8.00	3.00	2-3/clump	2.00	-	--		-
August, 16	1.60	1.40	4-6/clump	2.00	6.00	1.00		-
September,16	-	-	5-6/clump	-	20.00	3.00	-	
October,16	-	-	2-3/cane	-	32.00	2.80	1.00	
November,16	-	-	2-3/cane	-	12.00	3.10	1.60	0.40
December,16	-	-	-	-	8.00	-	2.10	1.00
January,17	-	-	-	-	--		2.80	2.20

Table 3b Incidence of Red mite, mealy bug and scale insect & their bioagents

Period of observation Date/MW	**Red mite incidence (% incidence)**	**Mealy bug**		**Coccinellids/cane**		**incidence of Scale insect (%)**	**Coccinellids/cane**	
							C. nigritus	***P. horni***
		% incidence	% intensity	*Coccinella septum-punctata*	*Cheilomenes sexmaculata*			
29-4-16/19MW	-	-	-	-	-	-	-	-
31-5-16/24MW	11.00	--	-	-	-	-	-	-
28-6-16/27MW	28.00	-	-	-	-	-	-	-
29-7-16/32MW	12.00	-	-	-	-	-	-	-
28-8-16/36MW	6.00	1.0	0.20	2	1-2	-	-	1-2
27-9-16/40MW		2.0	0.70	1-2	1-2	-	-	1-2
30-10-16/44MW	-	4.0	1.50	1-2	1-2	5.00	2-3	1-3
27-11-16/48MW	-	1.0	0.20	1-2	1-2	10.00	2-3	1-2
29-12-16/52MW	-	-	-	1	1	40.00	1-3	1-3
5-1-17/1MW	-	--	-	-	-	10.00	1-2	1-2

Table 3c Incidence of *Pyrilla perpusilla* and *Proutista moesta* and spittle bugs on sugarcane during 2016-17										
Period of observation	Incidence of *P. perpusilla*				% Parasitization (*Pyrilla*)				Incidence of Derbid hoppers (*Proutista moesta* (Adults /leaf)	Incidence of Spittle bug (no. of damaged leaves/ plant)
					Epiricania melanoleuca			*Tetristichus pyrillae*		
	No. of adults/ leaf	No.of Nymphs/ leaf	No .of egg mass/ leaf	Total	Cocoons	Adults	Total			
April,16	-	-	-	-	-	-	-	-		
May,16	-	-	-	-	-	-	-	-		
June, 16	-	-	-	-	-	-	-	-	-	
July,16	1	-	1	2	-	-	-	-	-	
August,16	2-4	3-6	2-3	7-13	-	-	-	-	-	
September,16	2-5	6-9	1-3	9-17	1	-	1	1.0	-	3-4
October,16	2-6	6-8	2-4	10-18	2	1	3	2.0	1-2	3-6
November,16	1-3	4-5	5-6	10-14	7	2	9	4.0	2-4	3-6
December,16	1-2	2-3	1-4	4-9	3	2	5	3.0	2-4	-
January,17	1	1	-	2	2	2	4	3.0	1-2	-

Expt No.5	**:**	**Project E.34**
1.Title	**:**	Standardization of simple, cost effective techniques for mass multiplication of sugarcane bioagents.
2.Objective	**:**	To develop simple and cost effective mass multiplication technique of promising bio- agents of the area *Beauveria bassiana*.
3. Year of start	**:**	2012-13
4 .Location	:	Regional Agricultural Research Station, Anakapalle
5. Duration	**:**	Long term
6. Project leader and her associates	**:**	Dr. B. Bhavani, Senior Scientist (Entomology) Dr. N. Raj Kumar, Scientist (Plant Pathology) Dr. K. Veerabhadra Rao, Principle Scientist (Sugarcane)

7. Methodology adopted :

Simple and cost effective host media for multiplication of insect pathogen, *Beauveria bassiana*

Mycelial discs of *Beauveria* were inoculated in PDA broth supplemented with 1% yeast extract and incubated at 26 ^{0}C for 48 h with shaking at 180 rev min^{-1}.

The mass culturing of *Beauveria* is being done on yeast broth as well as on solid medium (whole grains) supplemented with 1% yeast extract.

Yeast broth was made by mixing 20 g of brewer's yeast and 20g of sucrose in one liter of water. The mixture was dispensed into 250 ml conical flasks and three replications (flasks) maintained then plugged loosely with a bung of non-absorbent cotton wool and autoclaved at 121^0 C, 15 psi for 40 minutes. After cooling, each flask was inoculated with loopful spores from *B. bassiana* culture and were then incubated at room temperature (25 ± 5^{0}C), on a rotary shaker revolving at 150 rpm for 72 hours as described (Jenkins *et al.* 1998) for production of spores.

Whole grain media

Grains are cheap, easily available and act a best nutritive media for the mass multiplication of many micro and macro organisms. Hence, five whole grains *viz*., rice, ragi, sorghum, pearl millet and maize are used for estimating the sporulation of *B. bassiana* at 28^0 c. 100 g of each grain are washed well and soaked in water overnight except rice and pearl millet which are soaked for 2-3 hours prior to starting the experiment. The excess water is drained by decanting and shade drying it for half an hour to further remove the excess moisture. Three replications maintained for each grain. The grains are packed separately in individual 500 ml flask for *B. bassiana*. They are plugged with cotton wool and autoclaved at 15psi for 1 hour. After cooling, 1ml of the spore suspension of fungal pathogen is inoculated in to each bottle, separately. All these procedures are done under laminar air flow chamber. They are incubated in BOD incubator at 28^{0}c for 15 days.

To avoid clumping, after 7 days of inoculation, the flasks and bottles are shaken vigorously to separate the grain and to break the mycelia mat. After 15 days of incubation,10g homogenous grain sample drawn from each replicate uniformly sporulating bottle/ flasks are transferred to 100 ml sterilized distilled water containing Tween 80 (0.05%) solution in 250 ml conical flasks. The flasks are shaken in mechanical shaker for 10 min. The suspension is made after the serial dilution of the suspension using double ruled Neubauer hemocytometer for determining the number of conidia in 1 g of the cereal grains.

8. Results of previous year:

During 2015-16, mass culturing of *Beauveria bassiana* on different solid media was tried and the results indicated that among the solid media, par boiled rice produced highest spore count of 13 X **10 ^{8}** per ml with less biomass (0.13g/ 100gm) followed by maize (12.1 X10^8 /ml), rice (12 X10^8 /ml) and found as the best suitable media for mass culturing of *Beauveria bassiana*. No fungal

spores of *B. bassiana* were found in sugarcane bagasse + 1.0g dextrose whereas in press mud + 1g dextrose found considerably low spore yields as compared to food grains (Table 5).

Based on cost incurred for the production of spores, *Corcyra cephalonica* rearing waste (Rs. 0.20) and press mud + 1.0 dextrose (Rs. 0.26) were the best low cost substrates compared to PDA medium (Rs.0.45) if, *Corcyra* rearing waste (maize broken grains) or press mud are available on free of cost. Among *in vitro* produced cereal media for the production of spores, parboiled rice + 1.0g dextrose (Rs. 0.32), ragi + 1.0g dextrose (Rs. 0.33), rice + 1.0g dextrose (Rs. 0.36) and maize + 1.0g dextrose (Rs. 0.36) were the best low cost substrates for 1 X 10^8 spore production compared to PDA medium (Rs. 0.45) (Table 5).

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc., :

During 2016-17, among the solid media, par boiled rice produced highest spore count of 21.10 X 10^8 per ml with less biomass (0.38g/ 100gm) followed by rice (20.8 X 10^8/ml) and were found as the best suitable media for mass culturing of *Beauveria bassiana* whereas PDA medium produced 24.30 X 10^8/ml spores per ml with a biomass of 0.41g/100gm (Table 4) . Based on cost incurred for the production of spores, among *in vitro* produced cereal media for the production of spores, parboiled rice (Rs. 0.38) and rice (Rs. 0.39) and sorghum (Rs.0.39) were the best suitable low cost substrates for 1 X 10^8 spore production compared to PDA medium (Rs. 0.52)

Around 200 kg of rice based *B. bassiana* culture was produced (under AICRP on Biological control & Revolving fund) and supplied to farmers for the control of root grub in sugarcane through sugar factories on cost basis.

Table 5. Spore (X 10^8) and biomass production (g) of entomopathogenic fungi, *B. bassiana* on different whole grains.

Media	Spore count (X 10^8) per ml	Biomass (g) per 100 gm	Cost of production of 1 X 10^8 spores (Rs)
Parboiled rice	21.10	0.38	0.38
Rice	20.80	0.40	0.39
Sorghum	20.62	0.70	0.39
Pearl millet	18.50	0.80	0.49
Ragi	20.10	1.00	0.36
Maize	20.14	1.63	0.43
Rice bran	-	-	-
Corcyra rearing waste (Maize)	20.30	1.70	0.30
Pressmud (Sugar mill)	17.70	0.20	0.46
Sugarcane bagasse	-	-	-
PDB	24.30	0.41	0.52
CD(p=0.05)	0.10	0.07	
CV%	2.13	2.60	

Expt No.6 : Project E 36
1.Title : Management of borer complex of sugarcane through lures.

2. Objective : To manage sugarcane borers (early shoot borer, top borer, internode borer and stalk borer) through pheromone traps
3.Year of start : 2013-14
4. Duration : Three years
5.Location : Regional Agricultural Research Station, Anakapalle

6. Project leader and her associates : Dr. B. Bhavani, Senior Scientist (Entomology)
Dr. K. Veerabhadra Rao, Principle Scientist (Sugarcane)

Experiement details :

1	Season	:	2016-17
2	Plot size	:	0.5 acre each
3	Variety	:	93 A 145 (Co A 99082)
4	Planting Date	:	10/04/ 2016
5	Harvesting Date	:	30/03/2017

Treatment details : Pheromone lures of sugarcane early shoot borer and internode borer
Plot Size : Two blocks, each of minimum half acre. In first block, trap should installed and the second be kept as such (control). In between both blocks, one acre sugarcane crop was taken to avoid the pheromone effect.

7.Methodology adopted :
- The test insect pests at RARS, Anakapalle were early shoot borer and internode borer.
- Five pheromone traps were installed in the month of April in half acre of sugarcane crop for mass trapping of ESB & INB moths..
- The pheromone lure changes were done at 21 days interval for ESB upto 120 days and 45 days interval for INB after 120 days.

Observation recorded :
- Number of moths trapped at weekly interval.
- The mean number of moths captured was worked out.
- Infestations of each borer were recorded in both blocks.
- Quality parameters and cane yield at harvest

8. Results of the previous year:

During 2013-14, the plot with pheromone traps installed@ 10 traps/acre for mass trapping of adult moths of ESB as well as INB (T1) recorded lowest cumulative incidence of early shoot borer (8.33%) as against 26.94% in untreated control. Low per cent incidence (11.30%) and intensity (5.40%) of internode borer was recorded T1 compared to untreated plot (84.2% incidence and 15.40% intensity of internode borer). Highest cane yield was recorded in plot with pheromone traps @10/acre (89.50t/ha) as compared to control plot (85.50t/ha).

During 2014-15, the plot with pheromone traps installed @ 10/acre (T1) recorded less incidence of early shoot borer (13.33%) and internode borer (19.0%) as compared to control plot (36.94%; 34.60%) resulting in 63.91 and 45.87 per cent reduction over control respectively. Highest per cent sucrose (16.60%) and cane yield (71.70 t/ha) were recorded in Plot with pheromone traps (T1) as against 15.98% and 68.50t/ha respectively, in plot without pheromone traps.

During 2015-16, Early shoot borer moth catch high during 17th SW (122 moths / 5 traps / week) whereas internode borer moth catches were high during 24th SW (119 moths/ 5 traps/week) (Table 6a). Maximum temperature showed negative correlation (r = -0.48) and morning relative humidity showed positive correlation (r = 0.48) with ESB moth catches whereas maximum temperature (r= 0.58) morning RH (r=0.46) and evening RH (r=0.60) showed positive correlation with INB moth catches in pheromone traps. The plot with pheromone traps @ 25 /ha reduced the incidence of early shoot borer and internode borer to an extent of 72.04 % and 49.60% respectively, and recorded high percent juice sucrose (20%) and cane yield (82.44t/ha) which resulted in 7.34% increase of cane yield over control (19.20%; 76.80t/ha) with a cost benefit ratio of 1 : 1.25.

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc.,

Maximum number of early shoot borer moths was captured during 23MW (31 moths/ trap/week) where maximum & minimum temperatures were 31.9^{0}C & 27^{0}C and morning & evening RH were 71& 89%, respectively. Maximum internode borer moth catch (23 moths/ trap/week) was recorded in 36 MW where maximum, minimum temperatures were 30.8^{0}C & 26.3^{0}C and morning & evening RH were 90 & 77%, respectively (Table 5a).

Correlation studies of pheromone trap catches with weather parameters indicated that evaporation has exerted significant positive correlation (r=0.50) with ESB moth catches in pheromone traps whereas maximum temperature (r=0.55) and evening relative humidity (r=0.67) showed significant positive correlation with INB moth catches in pheromone traps (Table 5b).

The plot with pheromone traps @ 25 traps/ha reduced the incidence of early shoot borer to an extent of 44.83 % (Table 5c) and internode borer to an extent of 50.79% over control and recorded high percent sucrose (21%) and cane yield (82 t/ha) compared to control (plot without pheromone traps - 20.6%; 78.98 t/ha) with a cost benefit ratio of 1:1.20 (Table 5c).

Table 5a Association between weekly moth catches of ESB & INB in pheromone traps and weather parameters

Standard week	Moth catches/ week/ trap		Temperature (^{0}C)		Relative humidity (%)		Evapora-tion (mm)	Rainfall (mm)	Rainy days	Sunshine hours
	ESB moths	INB moths	Max	Min	Morning	Evening				
15	-	-	21.1	37.8	84	45	0	0	2.2	7
16	-	-	27.7	35.6	84	53	0	0	3.3	6.8
17	-	-	29.2	36.8	81	54	0	0	4.1	7.5
18	-	-	27.7	36.8	79	52	16.4	1	3.2	7.4
19	-	-	27.8	35.9	78	55	39	1	1.8	5.5
20	6	-	27.2	32.9	91	43	148.8	3	3.7	5.9
21	15	-	29.2	37.9	82	51	3.4	1	1.6	5
22	26	-	28	36.3	85	61	13.2	1	1.6	5.3
23	**31**	**-**	**27**	**31.9**	**89**	**71**	**70.4**	**1**	**1.6**	**2.6**
24	4	-	28.5	37.3	81	56	21	1	2.4	5.4
25	6	1	27.5	32.4	90	65	10	2	1.1	3.8
26	6	3	26.1	29.6	91	84	89.4	5	0.8	2.4
27	4	11	27	32.3	88	66	49.2	2	1.7	3.4
28	4	14	27.8	33	80	61	1.2	0	1.3	4.6
29	4	18	27.3	32.3	87	71	11.4	1	0.7	3.9
30	5	13	26	30.2	95	79	24.8	4	0.2	3.1
31	3	**23**	**26.3**	**30.8**	**90**	**77**	**56**	**4**	**0.4**	**3**
32	0	10	28.3	34.4	83	53	2	0	0.3	4.4
33	0	13	27.6	34.7	80	53	5.6	1	0.5	4.9
34	0	17	27	34.2	86	59	71.2	2	0.3	4.7
35	0	10	27.1	31.8	90	73	58.8	6	0.4	3.8
36	0	21	26.8	33.6	84	59	2.8	1	0.1	3.2
37	0	17	26.7	29.5	93	73	114.6	5	0.2	2.2
38	0	13	26.5	31	94	59	93.4	4	0.2	2.7
39	0	18	25.9	28.5	97	86	135.5	6	0.2	1.4
40	0	11	26	31.5	93	81	116	4	0.1	2.6
41	0	10	25.7	32.4	87	88	50.6	1	0.1	3.4
42	0	11	23.8	32.5	79	43	0	0	0.1	3.5
43	0	8	23.1	31.9	54	47	3.2	1	0.02	3.5
44	0	5	24.7	30.6	89	67	14.2	1	0.3	3.2
45	0	9	20.5	31.5	85	38	0	0	0.2	3.6
46	0	3	21.4	31.2	85	50	0	0	0.03	3.2
47	0	3	17.9	30.7	87	34	0	0	0.03	3.6
48	0	3	18.3	31.6	89	43	0	0	0.01	3.4

49	0	1	19.5	30.9	86	40	0	0	0.02	3.4
50	0	1	21.2	30.2	80	44	0	0	0.5	3.3
51	0	1	17.2	30.4	89	41	0	0	0.05	3.4
52	0	1	17.9	30.5	91	46	0	0	0.3	2.8
1	0	1	17.1	30.8	91	46	0	0	0.1	3.2
2	3	0	16.5	30.6	91	50	0	0	0.1	3.1
3	2	0	15.9	31.1	87	31	0	0	0.5	4
4	2	0	15.4	31.4	88	38	0	0	0.5	4.2
5	6	0	18.3	31.9	96	48	0	0	1	3.6
6	9	0	17	33	96	43	0	0	0.1	4.2
7	6	0	16.2	32.7	89	38	0	0	0.2	4.6
8	2	0	21	33.9	93	51	0	0	0.2	4.3
9	1	0	17.6	34.2	93	41	0	0	0.2	4.9
10	0	0	22.3	34.4	89	59	26.6	2	1	5.3

Table 5b Association of ESB & INB moth catches in pheromone traps with weather parameters

Weather parameters	Early shoot borer moth catch	Internode borer moth catch
Rainfall	0.06	0.50
No. of rainy days	-0.04	-0.24
Max. temp (°) C	0.25	0.55
Min. temp (°) C	0.35	-0.11
Morning RH (%)	0.06	-0/07
Evening RH (%)	0.14	0.67
Evaporation (mm)	0.50	0.37
Sunshine hours	0.18	-0.35

Table 5C Impact of pheromone traps on the incidence of early shoot borer (%DH) up to 120 DAP

Treatment	Per cent incidence of ESB (%DH)					
	at 30 DAP	at 60 DAP	at 90 DAP	at 120 DAP	Cumulative up to 120 DAP	Per cent reduction over untreated control
Plot with pheromone traps @ 25 traps/ha	4.47	10.58	2.71	0	17.76	44.83
Plot without pheromone traps	9.04	17.33	5.82	0	32.19	-

Table 5c Impact of pheromone traps on the incidence of internode borer, cane yield and per cent sucrose

Treatment	Internode borer (%)			Per cent sucrose (%)	Cane yield (t/ha)	Per cent increase over control	Cost Benefit ratio
	Incidence	Intensity	Per cent reduction over untreated control				
Plot with pheromone traps @ 25traps/ha	31.00	2.60	50.79	21.00	82.00	3.82	1:1.20
Plot without pheromone traps	63.00	6.80	-	20.6 0	78.98	-	1:1.03

Expt No.6	**:**	**Project E 37**
1. Title	**:**	**Bioefficacy of new insecticides for the control of sugarcane early shoot borer**
2. Objective	**:**	To find out effective strategy for the management of sugarcane early shoot borer.
3. Year of start	**:**	**2013-14**
4. Location	**:**	**Regional Agricultural Research Station, Anakapalle**
5. Project leader and her Associates	**:**	Dr. B. Bhavani, Senior Scientist (Entomology) Dr. K. Veerabhadra Rao, Principle Scientist (Sugarcane)
6 Experimental detail	:	
a. Design	**:**	RBD with three replications
b. Plot size	**:**	6 X 0.9m X6R (Gross plot size)
c. Variety	**:**	93 A 145 (Co A 99082)
d. Date of Planting	**:**	04/03/2016
e. Date of harvesting	**:**	30/02/2017
f. Treatments	**:**	8

1. Soil application of fipronil 0.3G @ 25 kg/ha at the time of planting and 60 DAP (75 g a.i./ha)
2. Soil application of chlorantraniliprole 0.4G @ 22.5kg/ha at the time of planting and 60 DA (90g a.i./ha)
3. Spraying of chlorantraniliprole18.5 SC @ 375 ml/ha at 30 and 60 DAP (70 g a.i./ha)
4. Spraying of spinosad 45SC @ 90 ml/ha at 30 and 60DAP (40 g a.i./ha)
5. Spraying of flubendiamide 39.35SC @ 125 ml/ha at 30 and 60 DAP (50 g a.i./ha)
6. Soil application of phorate 10 G @ 15 kg/ha at the time of planting and 60 DAP (1500 g a.i./ha)
7. Soil application of carbofuran3G @ 33kg/ha at the time of planting and 60 DAP (1000 g a.i./ha)
8. Untreated control.

7. Observation recorded:

a. Data on germination recorded at 30 DAP

b. Incidence of early shoot borer recorded at 30, 60, 90 and 120 days after planting.

c. Tillering per cent at 120 DAP

d. Data on single cane weight, cane height & girth were recorded.

e. Data on cane yield and juice quality were also recorded at harvest.

8 . Results of the previous year:

During 2013-14, among the test insecticides, soil application of chlorantraniliprole 0.4G @ 22.5kg/ha at the time of planting and 60 DAP recorded less cumulative incidence of ESB (14.86%) as compared to untreated control (43.15%). Highest cane yield was recorded in chlorantraniliprole 0.4G @ 22.5kg/ha (99.10t/ha) followed by fipronil 0.3G @ 25kg/ha (97.76t/ha) and flubendiamide 20 SC @ 250ml/ha (97.64t/ha).

During 2014-15, incidence of early shoot borer (11.47%) was significantly reduced in chlorantraniliprole 0.4G @ 22.5 kg/ha applied at the time of planting and 60 DAP as compared to untreated control (32.67%) which was statistically on par with chlorantraniliprole 18.5SC @ 375ml/ha (12.76%), fipronil 0.3G @25 kg/ha (13.47%) and flubendiamide 20 SC @ 250 ml/ha (15.00%). Highest cane yield was recorded in chlorantraniliprole 0.4G @ 22.5kg/ha (71.04 t/ha) and it was statistically on par with chlorantraniliprole 18.5SC @ 375ml/ha (69.82 t/ha) and flubendiamide 20SC @ 250 ml/lt (70.10 t/ha) and fipronil 0.3G@ 25kg/ha (68.96t/ha) as compared to untreated control (63.20t/ha). Among the treatments soil application of chlorantraniliprole 0.4G @ 22.5kg/ha at planting and 60 days after planting found effective against early shoot borer and recorded highest cane yield.

During 2015-16, among eight treatments, soil application of chlorantraniliprole 0.4G @ 22.5kg/ha (2.31%DH), fipronil 0.3G @ 25kg/ha (5.40 %DH) at planting and 60 days after planting (DAP) significantly reduced the incidence of early shoot borer compared to untreated control (30.66%) and were statistically at par with each other. The next best treatments in reducing the incidence of early shoot borer were spraying of chlorantraniprole18.5SC @ 375ml/ha (7.15%) and flubendiamide 39.35SC @ 125ml/ha (7.52%) at 30 and 60 DAP. Highest number of millable canes were recorded in soil application of chlorantraniliprole 0.4 G @ 22.5kg/ha (58951/ha) compared to untreated control (52778/ha). Highest cane yield was recorded in chlorantraniliprole 0.4G @ 22.5kg/ha (86.46 t/ha) compared to untreated control (75.65t/ha) and was statistically at par with fipronil 0.3G @ 25kg/ha (85.82 t/ha), chlorantraniliprole 18.5SC @ 375ml/ha (84.92 t/ha) and flubendiamide 39.35SC @ 125ml/ha (84.00/ha). However, no significant differences were observed among different treatments in case of growth parameters.

9. Results of the current year with tables, clearly indicating the details regarding name of the pest, insecticidal sprays etc.,

During 2016-17, among the treatments, soil application of chlorantraniliprole 0.4G @ 22.5kg/ha (5.8%DH), fipronil 0.3G @ 25 kg/ha (5.87 %DH) at planting and 60 days after planting, spraying of chlorantraniprole18.5SC @ 375ml/ha (5.95%DH) at 30 & 60 days after planting significantly reduced the incidence of early shoot borer and found effective compared to untreated control (20.58%DH). However, significant differences were not observed in between the insecticidal treatments and were statistically at par with each other (Table 6a). Very less Incidence of internode borer was recorded in soil application of chlorantraniliprole 0.4G @ 22.5kg/ha (0%) and spray of chlorantraniliprole 18.5SC @375ml/ha (3.33%) compared to untreated control (36.67%). No significant differences were observed in between treatments in case of growth parameters *viz*., height, weight and girth of the cane. However, significant differences were observed in between treatments in case of number of millable canes and cane yield. Highest number of millable canes with superior cane yields were recorded in chlorantraniliprole 0.4G @ 22.5kg/ha (90514/ha; 114.94t/ha), fipronil 0.3G @ 25kg/ha (89486/ ha; 113. 88 t/ha) and chlorantraniliprole 18.5SC @375ml/ha (88782/ha; 110.57t/ha) compared to untreated control (82490/ha; 93.47t/ha) (Table 6b).

Table 6a. Bio-efficacy of new insecticides on the incidence of sugarcane early shoot borer

Treatment	Per cent incidence of Early shoot borer (%DH)				
	30 DAP	60 DAP	90 DAP	120 DAP	Cumulative upto 120 DAP
T1- Fipronil 0.3G @ 25 kg/ha	6.55	2.78	0.87	0	5.87
T2- Chlorantraniliprole 0.4 G @ 22.5kg/ha	7.41	2.24	0.58	0	5.80
T3- Chlorantraniliprole 18.5 SC @ 375ml/ha	7.23	1.37	0.77	0	5.95
T4- Spinosad 45SC @ 90 ml/ha	12.27	4.36	0.93	0	8.47
T5- Flubendiamide 39.35 SC @ 125ml/ha	10.27	0.75	0.58	0	6.65
T6- Phorate 10G @ 15 kg/ha	9.13	2.46	0.91	0	6.69
T7- Carbofuran 3G @ 33 kg/ha	7.70	2.83	0.68	0	6.08
T8- Untreated control	15.36	6.74	0.77	0	20.58
SEd	0.83	0.49	0.09	NS	0.83
CD (p=0.05)	1.79	1.06	0.19		1.79

Table 6b. Impact of new insecticides on the growth parameters , per cent sucrose , NMC and cane yield

Treatment	Incidence of internode borer	Cane height (mt)	Cane weight (kg/cane)	Cane girth (cm)	Juice sucrose (%)	NMC/ha 000′/ha	Cane yield (MT/ha)
T1- Fipronil 0.3G @ 25 kg/ha	19.39	2.78	1.36	1.63	18.92	89486	113.88
T2- Chlorantraniliprole 0.4 G @ 22.5kg/ha	0.00	2.63	1.23	1.48	18.86	90514	114.94
T3- Chlorantraniliprole 18.5 SC @ 375ml/ha	3.33	2.65	1.39	1.60	18.61	88782	110.57
T4- Spinosad 45SC @ 90 ml/ha	26.67	2.48	1.27	1.55	18.81	83313	104.48
T5- Flubendiamide 39.35 SC @ 125 ml/ha	16.67	2.67	1.40	1.60	19.20	84444	105.91
T6- Phorate 10G @ 15 kg/ha	26.67	2.54	1.27	1.51	18.88	84753	101.96
T7- Carbofuran 3G @ 33 kg/ha	23.33	2.52	1.17	1.50	18.47	87428	106.34
T8- Untreated control	36.67	2.24	1.09	1.55	17.71	82490/ha , 93.47	93.47
SEd	NS	NS	NS	NS	NS	1640	2.20
CD(p=0.05)						3520	4.72
CV %						11.20	17.69