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Influence of intercropping with leguminous crops on the incidence of early shoot borer, *Chilo infuscatellus* snell in sugarcane

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Abstract
Early shoot borer, *Chilo infuscatellus* Snell. is a major insect pest affecting sugarcane crop, reducing the cane yield and juice quality. Management of this pest would avoid inter node borer damage in the grand growth period. Field experiment was conducted to find out best companion crops for sugarcane shoot borer management and its effect on yield and juice quality parameters. In order to generate information on the impact of intercropping with certain legumes *viz.*, cow pea, cluster bean, black gram, green gram, soya bean, sun hemp and groundnut on sugarcane early shoot borer experiments were conducted at Sugarcane Research Station, Vuyyuru for two years. In general all the intercrops gave suppressing effect on dead hearts due to shoot borer and percent incidence and intensity due to inter node borer. Lowest percent incidence of dead hearts due to shoot borer was recorded in sugarcane + black gram followed by sugarcane + cow pea and sugarcane + soya bean which were at par. Highest cane yield of 114.74t /ha was recorded in sugarcane + soya bean plots followed by sugarcane + cow pea (109.42 t /ha) which were at par. The percent juice sucrose was not altered significantly due to different intercrops.

Keywords: Genetic combining ability, specific combining ability, okra, variance, growth, yield and quality

Introduction
India occupies an important position amongst the sugar producing countries of the world. Of the various factors responsible for decline in sugarcane yield and recovery, losses caused by the pests are of prime importance. Among the insect pests of sugarcane stem borers, leaf hoppers and termites are the most important. Early shoot borer, Chilo infuscatellus Snell is an important pest of sugarcane in almost all cane growing areas, causing growth losses about 20 per cent in yield and 15 per cent in sugar recovery. Its infestation causes mortality of mother shoots (60%), primary tillers (43%) and tertiary tillers (35%), thereby reducing the yield at the rate of 3.5 per cent per 5 per cent increase in incidence. During summer months its infestation reaches a mean density which often exceeds threshold levels under water scarcity condition and causes extensive dead hearts necessitating insecticide application for its control. For controlling ESB many methods have been adopted, among, which chemical, cultural and biological methods are important. The generally accepted method of ESB control over the years has been pesticides. However, pesticides are not only expensive but also have many harmful effects. The control of ESB in the sugarcane was largely conducted with the application of insecticides. These insecticides in liquid or dry formulations have been suggested as sett treatment in furrows before the first irrigation. The success of such treatment is highly variable. Intercropping is one of the suggested controls to refrain ESB access to the sugarcane setts and seedlings. It has become the subject of increased interest primarily because of its reported advantages in decreasing pest population and additional cash benefits. Many workers have reported on the potential of crop diversification as suppression method for the control of early shoot borer in sugarcane. Intercropping is useful to improve the economics of sugarcane crop. The intercrops were successful in fetching additional income to the farmers, in addition to that from sugarcane. Moreover, the addition of organic matter in many forms in the soil can help to prevent the damage to the crop. An attempt was made to study the potential of intercropping as a non-chemical control technique involving different inter crops in developing effective pest controlling strategies.

Materials and Methods
Field experiments were conducted at Sugarcane Research Station, Vuyyuru. A highly sucrose rich sugarcane variety, 93V297 was planted alone (mono crop) and inter cropped with leguminous crops *viz.*, cow pea, cluster bean, black gram, green gram, soya bean, sun hemp and ground nut.

All the legumes seed used were local varieties. There were eight treatment combinations, tested in a randomized block design with three replications. Plot size was 12 meters length of 12 rows. Plantings were taken up after formation of ridges and furrows at 80 cm apart. Sugarcane setts were planted in the furrows and intercrops were 80cm in two rows on either side of the ridge. All the agronomical practices except plant protection measures were followed to harvest a good crop. The dead heart counts were recorded on 45th, 60th, 90th and 120th day after planting and then cumulative per cent incidence of shoot borer worked out. The shoot borer continues as inter node borer after the information of internodes. Hence, the data pertaining to inter node borer was recorded on cane basis and nodal basis at the time of harvest. Cane yield and juice quality were also recorded at the time of harvest.

Results and Discussions

In general, all the intercrops *viz*., cow pea, cluster bean, black gram, green gram, soya bean, sun hemp and groundnut gave suppressing effect on dead hearts due to shoot borer and per cent incidence and intensity due to inter node borer. Lowest per cent incidence of dead hearts due to shoot borer was recorded in sugarcane + black gram (13.17%) followed by sugarcane + cow pea (13.60%) and sugarcane + soybean (13.66%). Highest per cent incidence of shoot borer was recorded in control plot i.e., sole crop of sugarcane (25.79%) (Table1). The per cent incidence and intensity of inter node borer varied from 75.00 (sugarcane + soya bean) to 93.33 (sole crop of sugarcane) and 5.24 (sugarcane +ground nut) to 13.59 (sole crop of sugarcane). Similar results of reduction in pest incidence with intercrops were also reported by Mehta *et al*., 1988 [6]. Gopalasundaram *et al*., 2012 [2] also reported that both soya bean and black gram could be raised as profitable intercrops. Short duration legumes are the most suitable inter crops in main season planted sugarcane (Kailasam, 2008) [3]. Use of leguminous intercrops leads to natural increase in the available soil nitrogen thereby reducing the use of inorganic fertilizers (Tosti and Guiducci, 2010) [9]. Diversification practices such as intercropping are beneficial because of lower damage by insect pests (Risch *et al*., 1983) [7] as indicated by the experimental results.

Analysis of the data revealed that there was significant difference with respect to cane yield. Highest cane yield of 114.74t /ha was recorded in sugarcane + cow pea 109.42t/ha) which were at par followed by sugarcane + cluster bean (105.95 t/ha), sugarcane + ground nut (103.10 t/ ha) and sugarcane + sun hemp (101.79 t/ha) which were at par. According to Kathiresan and Rajasekaran (1990) [4], there were no significant differences in yield of cane when two rows of green gram or black gram were grown in between rows of sugarcane. Mahendran *et al*. (1996) [5] found that soybean intercropped with sugarcane in different inter –row spaces did not affect cane yield. Chakor *et al*., (1996) [1] also reported higher sugarcane yields with cow pea intercropping followed by green gram or black gram while it was lowest with sole crop of sugarcane. The percent juice sucrose was not altered significantly due to different intercrops (Singh *et al*., 1997).

Table 1: Influence of Intercrops on pest incidence, Juice quality and cane yield of sugarcane

S. No	Treatment	Cumulative % Dead Hearts	Inter node Borer		% Juice Sucrose	Cane Yield t/ha
			%Incidence	%Intensity		
1.	T1 – Sugarcane + Cow pea	13.60 (21.62)	78.33(62.40)	5.65(13.73)	20.65	109.42
2.	T2–Sugarcane+Cluster bean	14.25(22.15)	85.00(67.40)	6.85(15.13)	20.66	105.95
3.	T3 – Sugarcane + Black gram	13.17 (21.10)	86.66(68.85)	7.82(16.23)	20.34	105.76
4.	T4 – Sugarcane + Green gram	14.15 (21.90)	81.67(64.81)	5.99(14.13)	21.07	105.76
5.	T5 – Sugarcane + Soya bean	13.66 (21.52)	75.00(60.08)	5.82(13.96)	20.57	114.74
6.	T6 – Sugarcane +Sun hemp	14.59 (22.09)	85.00(67.40)	5.51(13.55)	20.97	101.79
7.	T7 – Sugarcane + Ground nut	16.00 (25.58)	78.33(62.29)	5.24(13.20)	20.79	103.10
8.	T8 – Sugarcane Sole crop	25.79 (30.53)	25.79 (30.53)	13.59(21.66)	20.58	93.87
	S Em	1.63	2.54	0.49	0.31	2.37
	C D	4.95	7.71	1.51	N S	7.19
	C V (%)	12.10	6.60	5.70	2.00	3.90

* Figures in parenthesis are Arc sine transformed values

Conclusion

Intercropping is the agricultural practice of cultivating two or more crops in the same space at the same time. A practice often associated with sustainable agriculture and organic farming It benefits crop yields, controls some kind of pests, increase crop productivity per unit area of land and other agronomic benefits. For an intercrop combination to be biologically advantageous, agro techniques such as fertilizer application, seed rate of inter crops and base crop, and selection of suitable genotypes must be taken care of to reduce the depressing effect of inter crops on sugarcane and to increase the productivity and profitability of the inter cropping system.

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