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ASSESSMENT OF YIELD LOSSES CAUSED BY BORER PESTS OF SUGARCANE UNDER CHANGING CLIMATE SCENARIO

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Abstract– The field experiment was conducted during 2021-22 at Central Sugarcane Research Station, Padegaon Maharashtra to assess actual yield loss due to different species of borer pests of sugarcane in changing climatic scenario. There were two treatments, each 0.1 ha size plot for treated and untreated separated by keeping 100 meter distance. Treated plot applied with recommended effective chemical insecticide by soil application of Chlorantroniliprol 0.4 GR @ 18.75 kg/ha and foliar application of Chlorantroniliprol 18.5 % SC @ 375 g/ha following pair plot technique design. Percent infestation of early shoot borer was noticed at 30 DAP, 60 DAP, 90 DAP and 120 DAP in treated plot with recommended effective chemical insecticide were 2.59, 4.22, 6.93 and 0.83, respectively, while in untreated plot were 5.63, 8.06, 10.08 and 2.78, respectively. The cumulative percentage incidence of early shoot borer was found in 3.637 % in treated plot and 6.817 % in untreated plot. Total number of bored plants / ha was 3637 in treated plot and 6817 in the untreated plot. Whereas, per cent incidence of Internode borer in treated plot with recommended effective chemical insecticide and untreated plot showed a 1.50% and 4.40% in untreated plot, respectively. Top borer was not observed throughout the crop period in both plots. Among different treatments, plot treated with recommended effective chemical insecticide recorded highest germination percent (60.40 %), No. of milliable cane (87.50 thousands ha^{-1}), Average cane weight (1.265 kg) and Yield (101.25 t/ha) in treated plot as against untreated plot. The brix percentage, purity percentage, sucrose content and CCS% in treated with recommended effective chemical insecticide were recorded as 23.37, 92.28, 20.96 and 14.22, respectively, while in untreated plot were recorded as 22.68, 89.68, 20.93 and 14.12, respectively

INTRODUCTION

Sugarcane is one of the most important cash and industrial crops after cotton and cultivated in about 5 million hectares. Sugarcane plays key role in the socioeconomic development of rural India by providing employment to over a million people directly or indirectly besides contributing significantly to the national economy. Globally, Brazil is the largest producer of sugarcane followed by India, China, Thailand, Pakistan and Mexico (Sarwar *et al.*, 2010). The demand for sugarcane is growing worldwide with the population growth and by 2030, it is estimated that the sugar requirement will be 50 per cent higher. The global production of sugarcane has been estimated to be at the level of 1869.71 million metric tons and the area under sugarcane cultivation is estimated at 160 million hectare. India is one among the first five countries in the world in sugar production. The major cane growing areas in the country lie in the tropical and sub-tropical belt comprising the states of U.P., Bihar, Maharashtra, Karnataka, Tamil Nadu, Punjab and Haryana which account for about 70 per cent of the total area and 50 per cent of the total production. In India, Uttar Pradesh is having maximum are under sugarcane (2.31Mha) with the production of 135.64 MT, where as the productivity is highest in Tamil Nadu 134.2 ton/ha (Anonymous, 2021). In Maharashtra's cane area has gone up by about 11 per cent in 2021-22, from 11.48 lakh hectares in 2020-21 to 12.75 lakh hectares in 2021-22. Estimated sugar production, expected to be around 121.28 lakh tons in 2021-22, without diversion into ethanol (Anonymous, 2021).

Climate change has become a major threat to agricultural productivity due to rise in temperature, altered rainfall pattern (intensity and frequency), emergence of new insect pests and diseases, introduction of new weeds and soil related

problems like salinity and water logging (Zhao and Li, 2015). Pests constitute an important biotic stress in the cultivation of sugarcane and a serious limiting factor in the productivity of the crop, despite occupying a position next to diseases in severity. More than 200 species of insect and a few species of non-insect pests have been reported on sugarcane in the country. Close to a dozen of them assume major pest status in a given geographical area and these include aerial pests such as tissue borers, sucking pests, subterranean pests, defoliators and non-insect pests. Among these, nine lepidopteron borers are considered as most detrimental in both tropical and sub-tropical sugarcane fields. Top borer, shoot borer and stalk borer are found pre-dominantly in sub-tropical areas whereas internodes borer and early shoot borer are prevalent in tropical region. The larvae of borers may reduce yield upto 80 per cent (Goebel *et al*., 2011; Kalra and Sidha, 1955). Sugarcane borers cause death of the shoots and stalks by blocking food supply to aerial parts of stem and leaves (Gul *et al*., 2008; Dinardo-Miranda *et al*., 2012). The damage caused by these sugarcane borers include destruction of buds in planting material; injury to seedlings, resulting in the so-called 'dead heart'; and perforations to fully developed stalks, reducing internode growth and allowing the propagation of microorganisms that decrease sucrose content (Gomez and Michaud, 2015). Database of loss estimates related to crops and pests are important prerequisites for economic management of pests and for evaluating the efficacy of the present crop protection practices. Based on these data, strategies for the use of limited resources may be developed in order to optimize productivity. Therefore, to improve pest management and increase the sustainability of agriculture, it is necessary to take an integrated system approach of management. Considering these facts, the present experiment has been carried out to assess actual yield loss due to different species of borer pests of sugarcane in changing climatic scenario

MATERIALS AND METHODS

The present field experiment was conducted at Central Sugarcane Research Station, Padegaon, Tal. Phaltan, Dist. Satara, Maharashtra during 2021-22. Two eye budded sets of variety Co 86032 was planted in moist soil in the field @ 20 setts per row of 6 m length. There were two treatments, each 0.1 Ha size plot for treated and untreated separated by keeping 100 meter distance. Treated plot applied with recommended effective chemical insecticide by soil application of Chlorantroniliprol 0.4 GR @ 18.75 kg/ha and foliar application of Chlorantroniliprol 18.5 % SC @ 375 g/ha following pair plot technique design with four replications. Percent infestation of early shoot borer was recorded on the basis of total number of shoots and numbers 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. While, the observation on the per cent incidence of internode and top shoot borer, were recorded at time of harvest on 25 canes. It is calculated by following formula

$$\text{Percent incidence} = \frac{\text{Total no. of infested cane}}{\text{Total no. of cane observed}} \times 100$$

The assessment of reaction of shoot, internode and top shoot borer based on cumulative % incidence were worked out and the genotypes were categorized as per Anonymous (2021) as follows.

An individual plant from the same field were examined and the pest incidence and their yield are determined individually. The loss in yield (quantitative and qualitative) is estimated by comparing the average yield of treated plot with that of untreated plot showing different degrees of infestation.

Treatment details

Treatment No.	Name of the treatment
1.	Treated with recommended effective chemical insecticide Soil application of Chlorantroniliprol 0.4 GR @ 18.75 kg/Ha Foliar application of Chlorantroniliprol 18.5% SC @375 g/ha
2.	Untreated open for natural normal infestation of borers

S. N.	Grade	Cumulative% incidence of ESB	Cumulative % incidence of IB	Cumulative % incidence of TSB
1	Less Susceptible (LS)	0-15	0 – 20	0 – 10
2	Moderate Susceptible (MS)	15.1-30	20.1 – 40	10.1 – 20
3	Highly Susceptible (HS)	above 30	Above 40	Above 20

RESULTS AND DISCUSION

Borer Incidence in treated and untreated plot

Percent infestation of early shoot borer was noticed at 30 DAP, 60 DAP, 90 DAP and 120 DAP in treated plot with recommended effective chemical insecticide were 2.59, 4.22, 6.93 and 0.83, respectively, while in untreated plot were 5.63, 8.06, 10.08 and 2.78, respectively. The cumulative % incidence of early shoot borer was found in 3.637 % in treated plot and 6.817 % in untreated plot. Total number of bored plants / ha was 3637 in treated plot and 6817 in the untreated plot. Whereas, per cent incidence of Internode borer in treated plot with recommended effective chemical insecticide and untreated plot showed a 1.50% and 4.40% in untreated plot, respectively. Top borer was not observed throughout the crop period in both the plots.

Growth, yield and quality parameter in treated and untreated plot

The data pertaining to the effect borer pests of sugarcane on growth, yield and quality parameters of sugarcane treated plot with recommended effective chemical insecticide and untreated (control) plot are presented in Table 1. Among different treatments, plot treated with recommended effective chemical insecticide recorded highest germination percent (60.40 %), No. of milliable cane (87.50 thousands ha^{-1}), Average cane weight (1.265 kg) and yield (101.25 t/ha) in treated plot as against untreated plot

The quality parameters viz., Brix, purity sucrose and CSS% are influenced by plot treated with recommended effective chemical insecticide. The brix percentage, purity percentage, sucrose content and CCS% in treated with recommended effective chemical insecticide were recorded as 23.37, 92.28, 20.96 and 14.22, respectively, while in untreated plot were recorded as 22.68, 89.68, 20.93 and 14.12, respectively. Assessment of actual yield loss due to different species of borer pests of sugarcane in changing climatic scenario helped us to understand the extent of losses in sugarcane yield under prevailing pest scenario is offered by borer pests and how eco-safe management options respond to crop pest competition. By minimizing the losses due to these major borer pests the sugarcane productivity could be increased to the desired level. Eco-safe integrated management of all these major pests during their critical crop pest competition period, so that the infestation could be brought below the ETL. The findings of the experiment may also help farmers to strategize their crop protection plan accordingly in sugarcane in the light of individuals' resource affordability.

Conflict of Interest: None

Table 1. Effect of borer pests incidence of sugarcane on growth, yield and quality parameters of sugarcane.

Parameters	Treated with recommended effective chemical insecticide				Untreated open for natural normal infestation of borer			
Area	0.1 ha				0.1 ha			
Borer Incidence Early Shoot Borer (% incidence)	30 DAP	60 DAP	90 DAP	120 DAP	30 DAP	60 DAP	90 DAP	120 DAP
	2.59	4.22	6.93	0.83	5.63	8.06	10.08	2.78
Cumulative incidence of ESB	3.637				6.817			
No. of bored plants/ha.	3637				6817			
Internode Borer (% Incidence)	1.50				4.40			
Top Shoot Borer (% Incidence)	0.00				0.00			
Growth and Yield Parameter								
Germination %	60.40				52.45			
NMC (thousands ha^{-1})	87.50				79.18			
Average Cane Weight(kg)	1.265				1.108			
Yield (t/ha)	101.25				85.83			
Quality Parameter								
Brix	23.37				22.68			
Purity	92.28				89.68			
Sucrose	20.96				20.93			
CCS%	14.22				14.12			

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