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Estimation of Losses Caused by Major Insect Pests in Some Sugarcane Clones

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ABSTRACT

A field experiment was conducted to estimate yield and recoverable sucrose loss of some sugarcane clones viz. I 103-93, I 172-93, I 110-93, I 93-93, I 67-93, I 204-93, I 154-93, I 44-93, I 88-93 and one standard variety Isd 16 during December 1997 to December 1998 at Bangladesh Sugarcane Research Institute (BSRI), Ishurdi, Pabna. Insects infestation resulted in weight loss and reduced sucrose content of the plants. All the major pests except early shoot borer and white grubs were found to cause loss in weight and sucrose content to the cane. A maximum weight loss due to attack of top shoot borer was found in the clone I 154-93 (25.67%) followed by I 93-93 (14.17%). The weight loss of the clone due to stem borer infestation ranged from 17 to 43%. The highest weight loss by rootstock borer was observed in the clones I 103-93 (16.67%) and I 44-93 (16.23%) and the lowest was in I 204-93 (7.0%). Weight loss by mealy bug and scale insect was very low. The results on the variation of the sucrose loss due to SB, RSB, MB and SI infestation were not significant. Four BSRI clones showed significantly lower loss in sucrose content than that of standard variety Isd 16 due to TSB infestation. The clones I 110-93 and I 67-93 gave higher yield of 58 t/ha and 56 t/ha, respectively.

Key words : Sugarcane clones, insect pests, estimation, losses.

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is one of the most important cash-cum industrial crop in Bangladesh. It is a long durable crop, which requires 12-16 months from planting to harvesting. Various factors are responsible for low yield of cane in Bangladesh (42.0 t/ha)(Anon., 1996) as against 56.0 t/ha in India (Yadava, 1991). The average yield of sugarcane in Bangladesh is very low compared to other sugarcane growing countries of the world. Alam (1967) reported insects pests alone caused damage ranging from 20-60% in the field condition. Among various factors, insect pests inflicts considerable losses which are estimated to be around 20% in cane yield and 15% in sugar recovery (Avasthy, 1983). The yield loss and sucrose loss varies on the level of infestation. Little work has been done in this respect in Bangladesh. But now, it is a demand to know how much loss is caused due to insect infestation. Therefore, ten promising clones have been evaluated to find out the weight and sucrose loss caused by different insect pests.

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MATERIALS AND METHODS

The field experiment was conducted during 1997-98 cropping season at BSRI farm. Experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The experimental materials included 10 sugarcane clones obtained from Breeding Division of BSRI and one was standard variety Isd 16. The clones/variety tested were I 103-93, I 172-93, I 197-93, I 110-93, I 93-93, I 67-93, I 88-93, I 204-93, I 154-93, I 44-93 and Isd 16. Conventional method was followed for plantation. The plot size was 12 x 10 m. There was no buffer row between plots. All normal agronomical practices like weeding, mulching, irrigation, fertilization, earthing-up, top dressing etc. were carried out as and when necessary.

The weight loss of the plants due to the attack of insect pest was recorded at harvest. The data was collected from $10m^2$ area of the plot. Plants were separated into several groups including the healthy and infested by different insect species. Ten plants were selected randomly from each group and then weight of healthy and infested plants were measured separately. The weight loss (%) was estimated by using the formula,

$$\text{Weight loss} = \frac{A-B}{A}$$, where A = weight of healthy plant, B = weight of infested plant.

Estimation of recoverable sucrose from each clones/variety was estimated at harvesting. For this purpose, samples of four healthy and four infested canes were selected randomly. Each sample was then crushed separately in a crushing machine to extract sugarcane juice. The juice factor (Khan and Podder, 1982) was determined by using the formula :

$$\text{Juice factor} = \frac{\text{Weight of the juice}}{\text{Weight of the plants}}$$

$$\text{Recoverable sucrose (\%)} = \frac{\text{(Pol - Brix -Pole)}}{2} \times \text{Juice factor}$$

RESULTS AND DISCUSSION

The cane yield of ten clones and one variety of sugarcane after natural infestation by some major insects was recorded and presented in the Table 1. The data revealed that the cane yields of clones and variety were significantly different. The lowest cane yield (44t/ha) was observed in clone I 103-93 followed by yields of I 172-93 (46t/ha), I 88-93 (48t/ha), I 44-93 (48.8 t/ha) and I 197-93 (48.9t/ha). The highest cane yield (58t/ha) was observed in clone I 110-93 followed by I 67-93 (56t/ha), variety Isd 16 (55.57 t/ha) and I 93-93 and I 204-93 (50t/ha).

The recoverable sucrose in healthy canes after harvest from ten clones and one standard variety showed significant variation. The highest sucrose content (11.50%) was observed in clone I 110-93 followed by I 93-93, I 67-93, I 88-93, I 197-93 and I 154-93 with sucrose percents at 11.17, 11.17, 11.50, 10.67 and 10.67 respectively (Table 1). The sucrose content of variety Isd 16 was 10.33%. The lowest sucrose content of 9.33% was recorded in I 44-93.

Among major insect pests five pests viz. top shoot borer, stem borer, rootstock borer, mealy bug and scale insect caused weight loss in infested cane (Table 2).

Infestation by early shoot borer (ESB) and white grubs (WGs) did not cause weight loss to the cane. The highest weight loss (25.67%) due to infestation by TSB was recorded in the clone I 154-93 which was significantly higher over the variety Isd 16 and all other clones (Table 2). The weight loss in the variety Isd 16 was 12.33% which is similar to other higher clones. TSB infestation caused 14.17% weight loss in the clone I 93-93. The results of weight loss due to pest infestation indicated that the clone I 154- 93 was susceptible to TSB while clone I 93-93 was slightly susceptible. The other clones were resistant against top shoot borer. Kalra and Chaudhary (1964) reported that top shoot borer alone caused yield loss from 4.7 to 30.0% which is closer to the results of weight loss due to TSB in present finding.

The weight loss due to SB infestation varied from 17.00 to 43% and the variations were not significant. However six clones I 197-93, I 110-93, I 67-93,I 88-93, I 154-93 and I 44-93 and variety Isd 16 with more than 25% weight loss were moderately susceptible to SB (Table 2). The clones I 103-93, I 172-93, I 93-93 and I 204-93 were slightly susceptible to SB. Agarwal (1964) reported that internode borer caused 10.7% loss in weight in 30 varieties. The actual field loss amounted to 19.0, 16.0 and 8.6 tonnes per hectare, respectively, when the mean percent canes damaged was 40.0, 42.4 and 55.4 (David, 1986). These reported results satisfy the result of weight loss due to SB in the present study.

Rootstock borer significantly affected the weight of the clones (Table 2). The highest weight loss was observed in the clones I 103-93 and I 44-93 followed by the clones I 172-93, I 197-93 and I 110-93 with weight loss of 14%. The lowest weight loss (7.0%) was found in I 204-93 closely followed by I 154-93 (9% and above). The variety Isd 16 and clone I 93-93 had equal weight loss (13%) due to RSB. The results of weight loss due to RSB infestation indicate that the clones I 204-93 and I 154-93 could be considered as resistant against the pest while clones I 93-93 and variety Isd 16 as slightly resistant. Gupta *et al.* (1966) reported that cane damaged by the larvae of third brood of RSB show a reduction of 17% in weight. At harvest, a decrease in yield upto 10% was reported in India by Gupta and Avasthy (1952). In Bangladesh, Miah *et al.* (1986) reported 8.55% yield loss by rootstock borer. These results have similarities with the result of weight loss due to RSB in the present study.

The weight loss in cane due to mealy bug infestation was very low (around 1%) and statistically not significant (Table 2). All the clones and the variety Isd 16 were resistant to mealy bug attack. The weight loss in cane by scale insect infestation ranged from 2 to 5% (Table 2) and were non significant. It may be concluded that all the tested clones and the variety Isd 16 of the sugarcane were resistant against scale insect attack.

The sucrose content in mature canes of the clones infested by five different major pests was analysed and shown in the Table 3. The percent sucrose loss due to attack of five major insect pests in the variety Isd 16 and ten clones were estimated and presented in the Table 4. The sucrose content due to TSB infestation varied from 6.67% in Isd 16 to 9.53% in I 103-93 and the variations were statistically non-significant (Table 3). Sucrose content of 7 to 8% were found in three clones (I 197-93, I 110-93, I 44-93), 8 to 9% in three clones (I 172-93, I 88-93, I 204-93), and 9 to 10% in four clones (I 103-93, I 93-93, I 67-93, I 154-93) infested by TSB. TSB infestation reduced the sucrose contents in the standard variety Isd 16 while four clones (I 103-93, I 93-93, I 67-93 and I 154-93) had above 9% sucrose content. The percentage of sucrose loss in TSB infested sugarcane clones and variety Isd 16 varied significantly (Table 4). The highest sucrose loss (3.73%)

was in the clone I 110-93 which was closely followed by the clones I 197-93 and I 88-93. The loss in sugar recovery due to top borer infestation varies from 0.2-4.1 units (Gupta *et al.*, 1965; Pandey and Singh, 1997).

The sucrose content due to SB infestation varied from 7.37% in Isd 16 to 10.08% in the clones I 88-93 and I 67-93 (Table 3). Sucrose content of more than 9% was found in clones I 197-93, I 110-93, I 93-93 and I 154-93 infested by SB. However, variations in sucrose content were not significant. The percentage of sucrose loss in SB infested cane clones and variety Isd 16 did not vary significantly (Table 4). However, all the clones showed lower loss in sucrose than standard variety Isd 16 with 2.97% sucrose loss due to SB infestation. The sucrose loss in the clones varied from 0.97 to 2.28%. David and Ranganathan (1960) reported a maximum reduction of 1.12% in recovery in Co-449 by internode borer, *Chilo sacchariphagus indicus*. Gupta and Avasthy (1960) reported 0.5-3.5 unit loss in sugar recovery by *Chilo auricilius* in India. The recoverable sucrose loss due to SB infestation has similarity with above reports. The reduction in sucrose content is variable depending on the variety, age of the crop infested and intensity of attack.

There was no significant variation in sucrose content of ten clones and variety Isd 16 infested by RSB. However, the infested canes had sucrose content from 8.37 to 9.85% (Table 3). The loss in sucrose due to RSB infestation between variety Isd 16 and the clones did not vary significantly. The sucrose loss varied from 0.45% in the clone I 44-93 to 2.78% in the clone I 88- 93 and loss of 1.92% sucrose was observed in variety Isd 16 (Table 4). It was evident from the percentage of sucrose loss data that three clones showed more sucrose loss (above 2%) than Isd 16 variety while seven clones showed less sucrose loss (less than 1.29%) than Isd 16. Some times root borer attack became so severe (60-70%) that crop is damaged very badly which reduced the sugar recovery up to 1-2% (Ali *et al.*, 2001). Gupta and Avasthy (1952) reported 0.3% sucrose loss in the juice of root borer infested canes in Uttar Pradesh whereas Agarwal and Prasad (1954) reported 2.9% sucrose loss in Bihar. The reported results have similarity with the present study. Although the sucrose content of TSB, SB and RSB infested canes did not vary statistically, variety Isd 16 and some clones were recorded with lower sucrose content than normal healthy sugarcanes.

The sucrose content of mealy bug infested canes varied from 7.83% in I 44-93 to 10.28 in I 93-93 clone (Table 3). However, the differences in mealy bug infested sucrose content of Isd 16 (9.40%) and those of ten clones were not statistically significant The results suggests that mealy bug infestation do not affect sucrose content much in comparison to healthy canes. Sucrose loss of ten clones and standard variety (Isd 16) was not affected due to MB infestation. The lowest sucrose loss (0.45%) in clone I 88-93 and highest in clones I 67-93 (2.83%) and I 197-93 (2.72%) while that in variety Isd 16 was 0.93% (Table 4). The data revealed that four clones were recorded with lower sucrose loss and six clones with higher sucrose loss than that of variety Isd 16 (0.93%). Kalra and Sidhu (1964) reported that sucrose content decreased by 24.1% in cane severely infested by mealy bug. The variations in sucrose loss in clones may be due to extent of MB infestation together with percent infestation.

There was no significant variation in sucrose content of ten clones and one standard variety Isd 16 infested by scale insect. The SI infested cane showed sucrose content of 7.50 to 10.88% (Table 3). The results indicate that sucrose content in one clone (I 44-93) had slightly reduced from 8%, the lowest sucrose level in healthy canes. The variations in loss in sucrose due to SI infestation of ten clones and the variety Isd 16 was

not significant. The lowest loss in sucrose (0.28%) was observed in the clone I 93-93 and highest (2.23%) was in the clone I 88-93 (Table 4). The variety Isd 16 showed sucrose loss of 1.18% by SI infestation. Four clones have higher sucrose loss (over 1.18%) than Isd 16 and the rest six clones showed lower sucrose loss. Shukla and Tripathi (1980) reported that the sugar recovery reduced by 1.7, 2.3, 3.3 and 9.1 unit under varying levels of scale insect infestation in Uttar Pradesh.

Table 1. Yield and recoverable sucrose in different clones of sugarcane at harvest. BSRI, Ishurdi, Pabna, 1997-98.

Clones/Variety	Cane yield (t/ha)	% Recoverable sucrose (healthy cane)
I 110-93	44.00 d	10.50 abc
I 172-93	46.00 cd	9.83 bc
I 197-93	48.90 abcd	10.67 abc
I 110-93	58.00 a	11.50 a
I 93-93	50.33 abcd	11.17 ab
I 87-93	56.00 ab	11.17 ab
I 88-93	48.00 bcd	11.50 a
I 204-93	50.68 abcd	9.67 c
I 154-93	50.17 abc	10.67 abc
I 44-93	48.80 abcd	9.33 c
Isd 16	55.57 ab	10.33 abc
Probability	0.035	0.020

Table 2. Mean weight loss of different clones of sugarcane infested by different insects pests at harvest. BSRI, Ishurdi, Pabna, 1997-98.

Clones/ variety	Mean (%) of wt. loss in different infested cane				
	TSB	SB	RSB	MB	SI
I 103-93	8.00 b	17.00	16.67 a	1.03	2.67
I 172-93	8.05 b	21.19	14.00 ab	1.03	4.90
I 197-93	9.33 b	30.00	14.00 ab	1.06	2.80
I 110-93	10.33 b	28.00	7.00 d	1.03	2.86
I 93-93	14.17 b	24.00	13.33 ab	1.03	2.66
I 67-93	11.67 b	41.87	11.88 bc	1.03	2.22
I 88-93	12.00 b	25.67	13.33 ab	1.02	2.86
I 204-93	8.67 b	23.00	7.00 d	1.03	2.27
I 154-93	25.67 a	43.57	9.00 cd	1.03	2.80
I 44-93	9.67 b	32.17	16.23 a	1.12	2.45
Isd 16	12.33 b	33.67	13.23 ab	1.14	2.35
Probability	0.0036	NS	0.0001	NS	NS

Table 3. Percentage of recoverable sucrose content in different clones of sugarcane infested by different insect pests at harvest, BSRI, 19979-98.

Clones/ Variety	Mean percentage of sucrose content in different insect infested cane				
	TSB	SB	RSB	MB	SI
I103-93	9.53	8.50	8.62	8.98	8.95
I 172-93	8.32	7.67	8.74	8.62	8.33
I 197-93	7.17	9.42	9.31	8.15	9.58
I 110-93	7.77	9.22	9.85	9.67	10.72
I 93-93	9.42	9.07	8.37	10.28	10.88
I 87-93	9.08	10.00	8.42	8.33	9.92
I 88-93	8.17	10.08	8.72	10.05	9.27
I 204-93	8.25	8.53	8.45	8.85	9.03
I 154-93	9.20	9.30	8.84	9.83	9.72
I 44-93	7.37	8.37	8.88	7.83	7.50
lsd 16	6.67	7.37	8.41	9.40	9.15
Probability	NS	NS	NS	NS	NS

Table 4. Percentage of recoverable sucrose loss in different clones of sugarcane infested by different insect pests at harvest. BSRI, Ishurdi, Pabna, 1997-98.

Clones/ Variety	Mean percentage of sucrose loss in different insect infested cane				
	TSB	SB	RSB	MB	SI
I103-93	0.97 c	2.00	1.88	1.52	1.50
I 172-93	1.52 bc	2.17	1.09	1.22	1.50
I 197-93	3.50 ab	1.25	1.36	2.72	1.08
I 110-93	3.73 a	2.28	1.65	1.83	0.78
I 93-93	1.75 abc	2.10	2.30	2.43	0.28
I 87-93	2.08 abc	1.17	2.75	2.83	1.25
I 88-93	3.33 ab	1.42	2.78	0.45	2.23
I 204-93	1.42 bc	1.13	1.22	0.82	0.63
I 154-93	1.47 bc	1.37	1.83	0.78	0.95
I 44-93	1.97 abc	0.97	0.45	1.50	1.83
lsd 16	3.67 a	2.97	1.92	0.93	1.18
Probability	0.0278	NS	NS	NS	NS

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