

Efficacy of Cultural Management and Fungicidal Spray to Control Sugarcane Smut

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ABSTRACT

A field experiment was conducted to evaluate the efficacy of cultural management and fungicidal spray to control sugarcane smut and contribution on juice quality and yield parameters of ratoon crop. Eight treatments were consisted with control, crop sanitation, roguing, foliar spray with companion, tilt 250 EC in different combination or alone. Results revealed from the experiment, the incidence of smut ranged 0.88-2.89% in different treatment. Stubble sprouting, number of millable cane, cane height, cane girth, and cane yield ranged from 87.51 - 90.53%, 49.17-58.06x10³ ha⁻¹, 1.95-2.36 m, 2.05-2.25 cm, and 54-60 t ha⁻¹ respectively under different treatments. Juice extraction was 48.59-58.94%, brix varied from 18.57-20.20%, pol 12.33-13.82%, reducing sugar content 0.09-0.37% and the purity was 84.31- 87.15% under various treatments. Findings of the experiment revealed that influence of sanitation, roguing, foliar spray with companion and tilt 250 EC in different combination or alone on smut incidence, juice quality parameters i.e brix%, pol%, reducing sugar%, purity% and yield contributing parameters such as stubble sprouting, number of millable cane, cane height, girth, and yield showed no significant increased difference compared to control.

Key words: Sugarcane, smut, roguing, sanitation, ratoon crop

INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is one of the major food-cum-industrial cash crops in Bangladesh. The crop is generally cultivated by planting the apical soft part of the plant, commonly known as sett. After harvest plant cane, the left-over underground part of the stem(stubbles) in the field and their subterranean buds give rise to a succeeding crop usually referred as ratoon crop. Ratooning is progressively used in many sugarcane growing countries of the world as a device to cut down cost of production (Humbert, 1968). In Hawaii, Mauritius, Philippines and Cuba 4 to 6 ratoons are quite common (Majid and Alam, 1998). In Bangladesh, only 15-20% of sugarcane area is under ratoon cultivation. The average yield of ratoon cane is poor in Bangladesh which is below 40 t ha⁻¹ while the potential yield is around 80 t ha⁻¹ (Khan *et al.*, 2007).

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Sugarcane is attacked by different diseases caused by fungi, bacteria, viruses and nematodes throughout the world (Anon., 2015a). All of them smut is worldwide distributed. Sugarcane smut is caused by the basidiomycetes fungus, *Ustilago scitaminea* Sydow that occurs in Bangladesh (Ahmed, 1976; Ahmad, 1988). Smut is endemic in most of the ratoon canes. Ratooning can induce symptom development in latently infected plants (Croft and Braithwaite, 2006). The increase in smut incidence between the plant and ratoon crop has been widely reported overseas (Comstock, 2000; Lee-Lovick, 1978). Better agronomic practices and use of improved varieties resistant to smut have shown promising results in keeping the diseases at low levels. Integrated management tactics, consisting of stubble management, roguing and fungicidal spray, may be recommended to control smut disease of sugarcane ratoon crop (Anon., 2015c,d,e). In Bangladesh, ratooning of sugarcane is not popular due to low cane yield resulting from inadequate management practices and higher incidence of smut disease. To popularize ratoon cane cultivation, it is necessary to develop effective control measures against the disease. Considering the above circumstances, the present experiment was conducted to test the efficacy of cultural management and fungicidal spray in an integrated approach to control smut disease of sugarcane ratoon crop.

MATERIALS AND METHODS

The experiment was conducted in the experimental farm of Bangladesh Sugarcane Research Institute (BSRI), Ishurdi during the cropping season 2012-2013 with the smut susceptible variety Isd 37 under eight treatments namely, T₀ - Control (water spray), T₁ - Sanitation alone, T₂ - Roguing alone, T₃ - Companion spray alone, (1.0% -A biofungicide, active ingredient: *Bacillus subtilis* GB03 0.03%), T₄ - Tilt 250 EC (0.10% - Propinacozole) spray alone, T₅ - Sanitation + Roguing, T₆ - Roguing + Companion spray, and T₇ - Roguing + Tilt 250 EC spray. The experiment was set up in randomized complete block design (RCBD) using unit plot size 7 m x 4m with three replications and row spacing of 1.5 m and row to row distance 2.0 m. After harvesting of plant cane, stubble shaving was done with sterilized sharp spades. The ratoon was during 2012-2013 after harvest of 2011-2012 plant crop.

All the treatments were done at 30, 60 and 90 days after sprouting (DAS), Tilt 250 EC @ 0.1% and Companion @ 1.0% were sprayed over the ratoon crop. The control plots were sprayed with water. Only roguing of diseased stubble and canes and only sanitation (cleaning of dead leaves, stubbles and diseased canes) were done at 30 days interval starting from 30 days after sprouting. At the same time sanitation followed by spray with Tilt 250 EC or Companion and roguing followed by spray with Tilt 250 EC or Companion spray were done at 30, 60 and 90 DAS.

The ratoon field was visited regularly at 30 days interval starting from 60 DAS and continued for 120 days to collect data on smut incidence. Smut incidence was determined by counting the number of infected stumps per plot. The ratoon canes were harvested at the age of 12 month after sprouting. After harvest, the total number and weight of millable cane per unit plot under each treatment was recorded and data were expressed in yield per hectare. From each plot 10 millable canes were randomly selected and height and girth of the cane stumps were recorded.

For biochemical analysis, juice was extracted from 10 randomly selected healthy and smut infected canes following the procedures as described by Spancer and Meade (1952). Data on percentage of juice extraction, brix%, pol%, purity%, reducing sugar content and sugar recovery were determined. The collecting data were analyzed by using MSTAT-C program.

RESULTS AND DISCUSSION

Smut incidence

Smut incidence in sugarcane ratoon crop under different treatments including control ranged 2.06-2.89, 0.88-1.64 and 1.17-1.93% at 60, 90 and 120 DAS under different treatments, respectively. Differences in smut incidence under various treatments at 60, 90 and 120 DAS were not significant (Table 1).

Table 1. Effect of cultural and chemical treatments against smut disease incidence of sugarcane ratoon crop, BSRI, Ishurdi, 2012-13

Treatments	Sugarcane smut disease incidence (%)		
	60 days after sprouting	90 days after sprouting	120 days after sprouting
T ₀ -Control (water spray)	2.24	1.64	1.93
T ₁ -Sanitation	2.89	1.74	1.74
T ₂ -Roguing	2.41	1.56	1.68
T ₃ -Companion spray	2.06	1.10	1.29
T ₄ -Tilt spray	2.23	1.43	1.42
T ₅ -Sanitation + Roguing	2.41	1.45	1.52
T ₆ -Roguing+ Companion spray	2.76	0.88	1.17
T ₇ -Roguing+ Tilt spray	2.06	1.00	1.27
LSD (0.05)	NS	NS	NS

Biochemical parameters of smutted sugarcane

Juice extraction

Juice extraction was 48.59-58.94% in cane under different treatments. The highest quantity of juice was extracted from the canes harvested from the plots having the treatment roguing + Tilt 250 EC spray and the lowest from the treatment sanitation. The juice extraction percentage under different treatments was statistically similar (Table 2).

Brix (%)

Brix% of juice varied from 18.57 to 20.20 under different treatments including the control. The highest Brix was observed in the treatment sanitation + roguing which was

followed by treatment roguing + Tilt 250 EC spray. The Brix% was statistically similar under various treatments including control (Table 2).

Pol (%)

The highest pol% in juice was observed 13.82 in the treatment sanitation + roguing. The lowest pol of 12.33 was found under Tilt 250 EC spray. There were no significant differences in pol percent under various treatments (Table 2).

Reducing sugar

The reducing sugar (RS) content varied from 0.09-0.30%. There were no significant differences in reducing sugar content of juice among the treatments (Table 2).

Purity

The maximum purity in juice was 87.15% found in the treatment sanitation + roguing followed by the treatment roguing alone. The lowest purity of 84.31 was found in sanitation alone, which was followed by Tilt 250 EC spray, roguing + companion spray and roguing + Tilt 250 EC spray. The purity percent under various treatments was not significant (Table 2).

Table 2. Effect of cultural and chemical treatments against smut disease on juice quality parameters and recovery of sugarcane ratoon crop

	Juice extraction %	Brix %	Reducing sugar %	Pol %	Purity %
T ₀ -Control (water spray)	52.27	19.00	0.120	13.02	86.71
T ₁ -Sanitation	48.59	18.63	0.136	12.33	84.31
T ₂ -Roguing	48.96	19.40	0.113	13.31	86.75
T ₃ -Companion spray	51.51	19.63	0.093	13.11	85.07
T ₄ -Tilt spray	52.82	18.57	0.180	12.62	85.97
T ₅ -Sanitation + Roguing	48.98	20.20	0.370	13.82	87.15
T ₆ -Roguing + Companion spray	50.92	19.57	0.127	13.22	85.53
T ₇ -Roguing + Tilt spray	58.94	20.00	0.107	13.49	85.90
LSD (0.05)	NS	NS	NS	NS	NS

Growth parameters of smutted sugarcane

Stubble sprouting

Sprouting of cane stubble varied from 87.51 to 90.53% under different treatments. The highest sprouting was observed in case of the treatment sanitation alone followed by roguing alone and lowest under sanitation + roguing followed by control. However, the effect of different treatments on sprouting was not significant (Table 3).

Number of millable cane

The number of millable canes varied from 49.17 to 58.06 × 10³ ha⁻¹. The highest number of millable cane 58.06 × 10³ ha⁻¹ was recorded from the treatment roguing +

companion spray followed by sanitation alone $56.67 \times 10^3 \text{ ha}^{-1}$. The lowest number of millable cane $49.17 \times 10^3 \text{ ha}^{-1}$ was found in plots sprayed with Tilt 250EC. The difference in millable cane number was not significantly different (Table 3).

Plant height and girth

The range of stalk height ranging from 1.95-2.36 m and stalk girth was ranging from 2.05-2.25 cm per cane. The influence of all treatments on those parameters was not significant compared to control (Table 3).

Table 3. Effect of cultural and chemical treatments against smut disease on plant growth, yield parameters and yield of sugarcane ratoon crop

Treatments	Sprouting (%)	Millable cane $\times 10^3 \text{ ha}^{-1}$	Stalk height (m)	Stalk girth (cm)	Cane yield (t/ha)
T ₀ -Control (water only)	82.84	51.11	1.95	2.07	54.56
T ₁ -Sanitation	90.53	56.67	2.36	2.24	54.23
T ₂ -Roguing	87.50	49.44	2.23	2.09	55.56
T ₃ -Companion spray	83.44	51.94	2.14	2.11	55.00
T ₄ -Tilt spray	84.66	49.17	2.35	2.25	59.44
T ₅ -Sanitation + Roguing	81.51	51.83	2.30	2.05	60.00
T ₆ -Roguing+ Companion spray	87.89	58.06	2.23	2.07	54.23
T ₇ -Roguing+ Tilt spray	83.91	52.78	2.13	2.05	56.78
LSD (0.05)	NS*	NS	NS	NS	NS

Yield

Cane yield ranged from 50-60 t ha^{-1} . The maximum yield was obtained from the treatment sanitation + roguing and the lowest from companion spray. The difference in cane weight per hectare was not significantly different (Table 3). The incidence of sugarcane smut in ratoon crop ranged 0.88-2.89% during 60-120 DAS. The results reveal that incidence of the disease was very low. Stubble sprouting, number of millable cane, cane height, cane girth, and cane yield ranged 87.51 - 90.53%, 49.17 - $58.06 \times 10^3 \text{ ha}^{-1}$, 1.95-2.36 m, 2.05-2.25 cm, and 50-60 t ha^{-1} , respectively under different treatments. Juice extraction was 48.59-58.94%, Brix varied 18.57-20.20%, pol varied from 12.33-13.82%, reducing sugar content varied 0.093-0.370% and the purity was 84.31- 87.15% under various treatments.

Results of the experiment reveal that influence of foliar spray with Companion and Tilt 250 EC, sanitation and roguing alone or in integrated approach on smut incidence, plant growth, cane yield and juice quality not differed significantly compared to control.

The findings of the present experiment do not commensurate with the findings of many other researchers, who reported that fungicidal spray, sanitation and roughing of ratoon crop are effective to control smut disease (Bailey, 1977b; 1979; 1980). Wada *et al.*

(1990) reported effective strategies for the management of sugarcane smut. They found that the best disease control strategy is cultural practices and with the combination of fungicide + cultural practices. But in this experiment significant result in different treatments was not found probably due to very low incidence of smut in the experimental field of ratoon crop.

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