



## Assessment of Varietal Response and its Impacts on Different Cane Attributes due to Sugarcane Wilt caused by *Fusarium Sacchari*

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### ABSTRACT

Sugarcane (*Saccharum officinarum* L.) of Poaceae family is an important agro-industrial crop of tropical and subtropical regions of India. A vast industrial set-up, the value-chain, supply-chain, and several stakeholders are mutually impacted by the success and failure of the sugarcane crop. In Bihar, more than 20 diseases of sugarcane have been reported which are caused by pathogens of varying group, which get sufficient time to establish themselves in the long duration annual crop of sugarcane. The crop is affected by majority of diseases among which wilt disease caused by *Fusarium sacchari* is one of the most prevalent in the Bihar region. Out of thirty evaluated varieties against *Fusarium sacchari*, it was observed that 6 varieties (20.69%) were resistant, 15 varieties (51.72%) were moderately resistant, 5 varieties (17.24%) were moderately susceptible, and 3 varieties (10.34%) were susceptible in field condition. The pot experiments revealed 6 varieties (20.69%) as resistant, 11 varieties (37.93%) as moderately resistant, 4 varieties (13.79%) as moderately susceptible and 8 varieties (31.03%) as susceptible. A significant loss was noticed in different quantitative and qualitative attributes of sugarcane due to wilt disease. The reduction in germination% (6.14%-38.20%), settling mortality% (4.55%-41.24%), cane height (6.66%-27.83%), cane girth (2.67%-45.16%), cane weight (6.40%-47.27%), brix % (4.04%-25.58%), sucrose % (6.96%-49.16%) and in purity % (3.04%-31.69%) was observed.

**Key Words:** *Fusarium sacchari*, sugarcane, wilt, quantitative and qualitative attributes

### INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is grown in more than 110 countries, occupying about 26.5 million ha, and producing about 1949 Mt of cane. The largest sugarcane producer in the world is Brazil with India ranking second (FAO Stat Yearbook 2021). In India, it is cultivated in an area of 50.98 lakh ha of land with a production of 430.50 million tonnes and average cane productivity of 84.44 t/ha. In Bihar, it is cultivated in an area of 2.11 lakh ha of land with a production of 13.97 Mt and cane productivity of 60.25 t/ha (Directorate of Economics and Statistics, 2021-22). There are around 700 installed sugar factories in the nation, and they produce over Rs 80,000 crores annually and have a crushing capacity of about 340 lakh million tonnes of sugar. More than 125 sugarcane diseases caused by fungi, bacteria, viruses, phytoplasma, and nematodes have been documented worldwide (Rott *et al*, 2000). In India, there have been 180 sugarcane diseases reported due to which 10-15% of the sugar is lost (Viswanathan

and Rao, 2011). In Bihar, more than 20 diseases of sugarcane have been reported which are caused by pathogens of varying groups. The observations made during 2019-2022 revealed that among the important diseases like red rot, wilt, pokkah boeng, smut, leaf spot and ratoon stunting the diseases red rot and wilt are of serious concern in Bihar (Minnatullah *et al*, 2022).

### MATERIALS AND METHODS

During the cropping season of 2021-2022 field experiments were carried out at Research Farm, SRI, RPCAU, Pusa, geolocated at 25.98' N latitude and 85.67'E longitude and 52.0 meters high from mean sea level.

The inoculum was prepared for application in soil and the process is explained as follows:

The grinded maize grains 250 g and 750 g sand in 1:3 ratio and 100 ml of distilled water were thoroughly mixed in a container. In 250 ml conical flasks 100 g of the maize-sand mixture were put and then these flasks were sterilized at 15 lb psi for 2 hr. After 2 days each

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flask was inoculated with 4-5 mycelia discs from inoculated petriplates of *Fusarium sacchari* grown on oat meal agar media. These inoculated conical flasks were incubated at  $22 \pm 1$  °C for 15 days. On the 16<sup>th</sup> day the whole inoculum was collected in one tray and mixed thoroughly. This inoculum mixture was applied (@100g/ meter row) over the setts uniformly in the furrows and the pots at the time of planting.

The thirty sugarcane varieties (Table 3) including the Control (CoSe 95422), with three budded setts were planted in the wilt sick plot at a row-row distance of 90 cm in three replications, while in the case of pots two budded setts were planted with same setts of thirty varieties including one control in wilt sick soil and normal agronomic practices were adopted.

Observations for disease development on the individual varieties were taken to know their response to the pathogen. The varieties were evaluated according to the disease rating scale of (0-4).

**Observations:**

- i. Germination count at 45 days after planting
- ii. Appearances of wilt symptoms on the standing canes (on clumps)
- iii. After 10 months, ten clumps were uprooted with roots. All the canes from clumps were split open longitudinally and the wilt severity index was scored on a 0-4 scale.

**The evaluation was made on the following 0-4 scale:**

- 0. Healthy canes and roots with no external or internal symptoms of wilt.
- 1. No wilting or drying of leaves, no stunting or shrinking of the stalk or rind, slight pith formation with yellow discoloration of the internal tissues in one or two lower internodes only. No cavity formation or fungal growth seen. Apparently normal and healthy roots.
- 2. Mild yellowing of top leaves and drying of lower leaves, mild stunting and shrinking of the stalk and rind. Yellowish discoloration of the internal tissues extending to three or four bottom internodes. Slight cavity formation of the pith, no fungal growth seen, slightly discoloured roots.
- 3. Mild yellowing of top leaves and drying of lower leaves, mild stunting and shrinking of the stalk and rind. Light brown discoloration of internal tissues throughout the entire length of the cane except the top. Severe pith and cavity formation. Sparse

fungal growth observed in the pith cavities.

- 4. Complete yellowing and death of the leaves, marked stunting, shrinking and drying of the stalk and rind, dark brown discoloration of internal tissues extending throughout the entire length of the cane. Large pith cavities with profuse overgrowth of the associated fungi. Most of the roots necrotic with dark discoloration dislodge easily from the stalks. Roots mildly discoloured and slightly necrotic.

The mean wilt severity index is worked out based on the number of cane samples.

$$\text{Mean wilt severity index} = \frac{\text{Sum of wilt indices of individual stalks}}{\text{Number of stalk samples}}$$

**The varieties were graded as follows:**

Rating score	Disease Reaction
0-1.0	R (Resistant)
1.1-2.0	MR (Moderately Resistant)
2.1-3.0	MS (Moderately Susceptible)
3.1 and above	S (Susceptible)

The extent of losses on various cane parameters due to wilt disease were assessed. For this study the observations were taken as: germination count at 45 days after planting, disease incidence at 75 days after planting and settling mortality at 90 days after planting. At the time of harvesting the observations were taken on three quantitative parameters which are cane height (cm), cane girth (cm), cane weight (kg) and three qualitative parameters viz. brix %, sucrose % and purity %. Juice samples were obtained from inoculated (diseased) and uninoculated (healthy) canes to determine the juice qualities. Brix percent was measured using brix hydrometer, Sucrose percent by polariscope and Purity was recorded as the coefficient of purity following the method of Browne and Zerban (1941) and Spancer and Meade (1955).

The reduction and purity coefficient were calculated as follows respectively:

$$\text{Reduction \%} = \frac{H-D}{H} \times 100 \quad \text{Here, H-Healthy, D-Diseased}$$

$$\text{Purity Coefficient} = \frac{\text{Sucrose (\%)}}{\text{Brix (\%)}} \times 100$$

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### RESULTS AND DISCUSSION

#### Evaluation of sugarcane varieties in field condition

It was observed that in the field conditions six (20.69%) varieties showed resistant reaction, fifteen varieties (51.72%) showed moderately resistant reaction, five (17.24%) varieties showed moderately susceptible reaction whereas, three (10.34%) varieties showed susceptible reaction against wilt disease (Table 1, Table 3, Figure 1).

#### Evaluation of sugarcane varieties in pot condition

It was observed that in pot conditions six (20.69%) varieties showed resistant reaction, eleven (37.93%) varieties showed moderately resistant reaction, four (13.79%) varieties showed moderately susceptible reaction whereas, eight (31.03%) varieties showed susceptible reaction against wilt disease (Table 2, Table 3, Figure 1).

#### Assessment of Quantitative and Qualitative attributes of sugarcane varieties affected by wilt disease

The extent of losses on quantitative and qualitative cane parameters was observed for the thirty sugarcane varieties including one control against the wilt disease caused by *Fusarium sacchari*. Germination count of healthy plots varied from 31.91% to 17.21% in comparison to control i.e., 16.36%. The germination count of diseased plots varied from 29.95% to 11.84% in comparison to control i.e., 10.11%. The calculated reduction % in germination count of the varieties graded as resistant varied from 6.14% to 9.89%, moderately resistant varied from 10.17% to 16.24%, moderately susceptible varied from 21.55% to 26.87% whereas, in susceptible varieties the reduction % in germination count varied from 28.96% to 31.20% while, in control the reduction % in germination count was observed as 38.20% (Table 4).

Settling mortality % of healthy plots varied from 4.83% to 13.98% in comparison to control i.e., 18.69%. The settling mortality % of diseased plots varied from 5.06% to 19.71% in comparison to control i.e., 31.81%. The calculated reduction % in settling mortality % of the varieties graded as: resistant varied from 4.55% to 7.08%, moderately resistant varied from 7.84% to 20.08%, moderately susceptible varied from 21.25% to 27.54% whereas, in susceptible varieties the reduction % in settling mortality % varied from 28.82% to 29.07% while, in control the reduction % in settling

mortality was observed as 41.24% (Table 4).

Cane height of healthy plots of the varieties varied from 234.71 to 154.65 cm in comparison to control i.e., 139.84 cm. The cane height of diseased plots varied from 219.08 cm to 123.12 cm in comparison to control i.e., 100.92 cm. The calculated reduction% in cane height of the varieties graded as: resistant varied from 6.66% to 6.90%, moderately resistant varied from 7.08% to 9.89%, moderately susceptible varied from 12.94% to 14.32% whereas, in susceptible varieties cane height varied from 20.02% to 20.39% while, in control the reduction % in cane height was observed as 27.83% (Table 5).

Cane girth of healthy plots varied from 7.07 cm to 2.48 cm in comparison to control i.e., 1.95 cm. The cane girth of diseased plots varied from 6.88 cm to 1.73 cm in comparison to control i.e., 1.07 cm. The calculated reduction% in cane girth of the varieties graded as: resistant varied from 2.67% to 5.34%, moderately resistant varied from 7.88% to 15.38%, moderately susceptible varied from 19.26% to 24.47% whereas, in susceptible varieties cane girth varied from 27.06% to 30.38% while, in control the reduction % in cane girth was observed as 45.16% (Table 5).

Cane weight of healthy plots varied from 1.25 kg to 0.54 kg in comparison to control i.e. 0.55 kg. The cane weight of diseased plots varied from 1.17 kg to 0.37 kg in comparison to control i.e. 0.29 kg. The calculated reduction % in cane weight of the varieties graded as: resistant varied from 6.40% to 8.49%, moderately resistant varied from 8.74% to 16.90%, moderately susceptible varied from 17.14% to 25.40% whereas, in susceptible varieties cane weight of diseased plots varied from 27.12% to 31.48% while, in control the reduction % in cane weight was observed as 47.27% (Table 5).

Brix % of healthy plots varied from 20.03% to 14.24% in comparison to control i.e., 13.41%. The brix % of diseased plots varied from 19.22% to 11.45% in comparison to control i.e., 9.98%. The calculated reduction % in brix % of the varieties graded as: resistant varied from 4.04% to 4.48%, moderately resistant varied from 4.80% to 8.21%, moderately susceptible varied from 11.24% to 16.33% whereas, in susceptible varieties brix % varied from 16.54% to 19.59% while, in control the reduction % in brix % was observed as 25.58% (Table 6).

Sucrose % of healthy plots varied from 17.53% to 10.06% in comparison to control i.e., 8.97%. The sucrose % of diseased plots varied from 16.31% to 6.08% in comparison to control i.e., 4.56%. The calculated reduction % in sucrose % of the varieties graded as: resistant varied from 6.96% to 8.74%, moderately resistant varied from 9.40% to 18.36%, moderately susceptible varied from 22.72% to 31.44% whereas, in susceptible varieties sucrose % varied from 33.33% to 39.56% while, in control the reduction % in sucrose % was observed as 49.16% (Table 6).

Purity % of healthy plots varied from 87.52% to 70.65% in comparison to control i.e., 66.89%. The purity % of diseased plots varied from 84.86% to 53.10% in comparison to control i.e., 45.69%. The calculated reduction % in purity % of the varieties graded as: resistant varied from 3.04% to 4.46%, moderately resistant varied from 4.83% to 11.06%, moderately susceptible varied from 12.93% to 18.06% whereas, in susceptible varieties purity % varied from 201.12% to 24.84% while, in control the reduction % in purity % was observed as 31.69% (Table 6).

The same varieties were evaluated in field and pot conditions and observed that the wilt severity was more in pot condition than in field condition as seen that the disease reaction of seven varieties inclined towards susceptibility in pot condition which is discussed here: Two varieties (CoLk 16466 and CoSe 17451) which were graded as moderately resistant in field condition showed susceptible reaction in pot condition, two varieties (CoP17446 and CoSe 16452) which were graded as moderately resistant in field condition showed moderately susceptible reaction in pot conditions, three varieties (CoBlN 17501, CoBlN 16502 and CoLk 94184) while, which were graded as moderately susceptible in field conditions showed susceptible reaction in pot condition. These findings were also supported by results obtained by Hossain *et al* (2017). Minnatullah *et al* (2016) evaluated 26 sugarcane varieties against wilt and found 5 resistant varieties, 15 moderately resistant varieties and 4 moderately susceptible varieties. Similar results were also recorded by Viswanathan (2019, 2020), Kishore Varma *et al* (2021).

The extent of losses on quantitative and qualitative cane parameters were observed for the thirty sugarcane varieties including one control (CoSe 95422) against the wilt disease caused by *Fusarium sacchari*. The reduction in germination varied from 6.14% to 38.20%, reduction in settling mortality ranged from 4.55% to 41.24%, reduction in cane height varied from 6.66% to 27.83%, 2.67% to 45.16% of reduction was observed in cane girth, 6.40% to 47.27% reduction was noted in cane weight, the reduction in brix % ranged from 4.04% to 25.58%, reduction in sucrose % varied from 6.96% to 49.16% and 3.04% to 31.69% reduction was noticed in purity %. The results were as comparable to the findings of Minatullah *et al* (2012), Viswanathan *et al* (2012). Minnatullah & Kamat (2018) had also observed reduction in brix (16.60-20.80%), sucrose (31.60-38.26%) and purity (18.00-22.10%) of cane. Sanjeev *et al* (2015) observed the reduction in sett germinability (40.2-50.1%) number of millable cane (39.9 to 50.9 %) cane yield (45.2-51.2 %) juice (10.0-14.9%), Brix (31.4-44.8%) and purity (12.9-25.7%).

## **CONCLUSION**

The comparison of the varietal reaction in field and pot condition revealed that the wilt severity was more in the pot condition than in field condition. Thus, it was concluded that to evaluate the level of resistance in different varieties against wilt disease and for discarding susceptible varieties the pot experiments are more reliable. Due to wilt disease a significant reduction was noticed in germination, settling mortality, cane height, cane girth, cane weight, brix, sucrose and purity. On the basis of observations, there is need to frequently visit the sugarcane growing regions to know the disease status and varietal susceptibilities so that we can advocate the suitable varieties graded as resistant against wilt disease to minimize the losses on cane parameters.

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**Table 1.** Percentage of varieties showing different disease reaction against *Fusarium sacchari* in field conditions.

Sr. No.	Rating score	Disease Reaction	Number of varieties	Percentage
1	0-1.0	R (Resistant)	6	20.69
2	1.1-2.0	MR (Moderately Resistant)	15	51.72
3	2.1-3.0	MS (Moderately Susceptible)	5	17.24
4	3.1 and above	S (Susceptible)	3	10.34

**Table 2.** Percentage of varieties showing different disease reaction against *Fusarium sacchari* in pot condition.

Sr. No.	Rating score	Disease Reaction	Number of varieties	Percentage
1	0-1.0	R (Resistant)	6	20.69
2	1.1-2.0	MR (Moderately Resistant)	11	37.93
3	2.1-3.0	MS (Moderately Susceptible)	4	13.79
4	3.1 and above	S (Susceptible)	8	31.03

**Figure 1.** Evaluation of sugarcane varieties under field and pot conditions against *Fusarium sacchari*

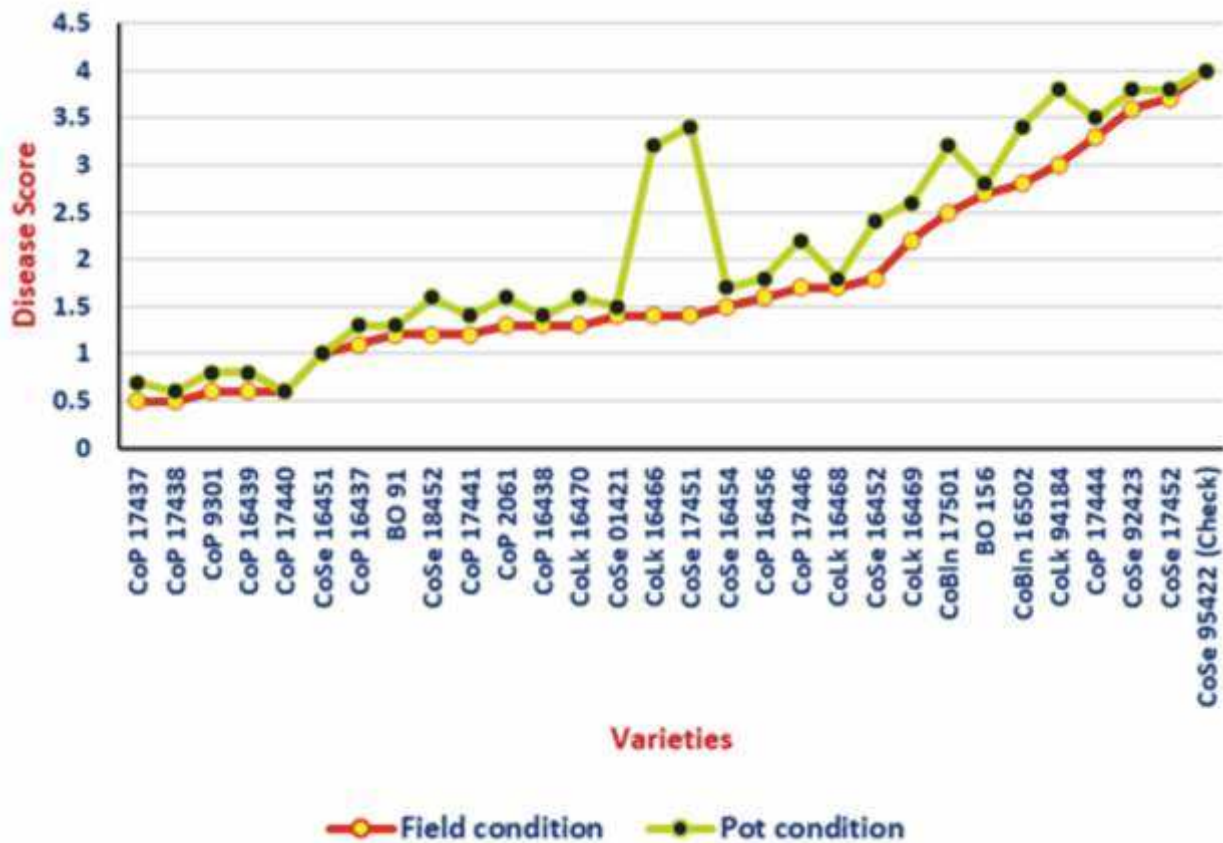


Table 3. Evaluation of sugarcane varieties under field and pot conditions against *Fusarium sacchari*

Sr. No.	Variety	Under field conditions		Under pot conditions	
		Disease Score	Disease Reaction	Disease Score	Disease Reaction
1	CoP 17437	0.5	R	0.7	R
2	CoP 17438	0.5	R	0.6	R
3	CoP 9301	0.6	R	0.8	R
4	CoP 16439	0.6	R	0.8	R
5	CoP 17440	0.6	R	0.6	R
6	CoSe 16451	1.0	R	1.0	R
7	CoP 16437	1.1	MR	1.3	MR
8	BO 91	1.2	MR	1.3	MR
9	CoSe 18452	1.2	MR	1.6	MR
10	CoP 17441	1.2	MR	1.4	MR
11	CoP 2061	1.3	MR	1.6	MR
12	CoP 16438	1.3	MR	1.4	MR
13	CoLk 16470	1.3	MR	1.6	MR
14	CoSe 01421	1.4	MR	1.5	MR
15	CoLk 16466	1.4	MR	3.2	S
16	CoSe 17451	1.4	MR	3.4	S
17	CoSe 16454	1.5	MR	1.7	MR
18	CoP 16456	1.6	MR	1.8	MR
19	CoP 17446	1.7	MR	2.2	MS
20	CoLk 16468	1.7	MR	1.8	MR
21	CoSe 16452	1.8	MR	2.4	MS
22	CoLk 16469	2.2	MS	2.6	MS
23	CoBln 17501	2.5	MS	3.2	S
24	BO 156	2.7	MS	2.8	MS
25	CoBln 16502	2.8	MS	3.4	S
26	CoLk 94184	3.0	MS	3.8	S
27	CoP 17444	3.3	S	3.5	S
28	CoSe 92423	3.6	S	3.8	S
29	CoSe 17452	3.7	S	3.8	S
30	CoSe 95422 ( Control )	4.0	S	4.0	S

R-Resistant, MR-Moderately Resistant, MS- Moderately Susceptible, S- Susceptible

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**Table 4. Extent of losses on germination % and settling mortality of sugarcane varieties due to *Fusarium sacchari*.**

Sr. No.	Variety	Disease score	Rating	Germination%			Settling mortality %		
				H	D	R	H	D	R
1	CoP 17437	0.5	R	31.91 (34.37)	29.95 (33.16)	06.14 (14.22)	04.83 (12.68)	05.06 (12.95)	04.55 (12.29)
2	CoP 17438	0.5	R	31.62 (34.18)	29.58 (32.92)	06.45 (14.69)	04.91 (12.78)	05.16 (13.09)	04.84 (12.69)
3	CoP 9301	0.6	R	30.85 (33.68)	28.62 (32.32)	07.23 (15.52)	05.18 (13.14)	05.46 (13.45)	05.13 (13.04)
4	CoP 16439	0.6	R	30.82 (33.70)	28.51 (32.24)	07.50 (15.78)	05.19 (13.04)	05.48 (13.45)	05.29 (13.25)
5	CoP 17440	0.6	R	30.76 (33.66)	28.41 (32.17)	07.64 (15.96)	05.22 (13.10)	05.56 (13.57)	06.12 (14.29)
6	CoSe 16451	1.0	R	30.14 (33.28)	27.16 (31.39)	09.89 (18.22)	06.04 (14.12)	06.50 (14.62)	07.08 (15.30)
7	CoP 16437	1.1	MR	30.09 (33.23)	27.03 (31.30)	10.17 (18.53)	06.11 (14.27)	06.63 (14.87)	07.84 (16.20)
8	BO 91	1.2	MR	29.81 (33.05)	26.64 (31.04)	10.63 (18.98)	06.62 (14.86)	07.25 (15.55)	08.69 (17.04)
9	CoSe 18452	1.2	MR	29.68 (32.98)	26.41 (30.89)	11.02 (19.34)	06.59 (14.76)	07.32 (15.64)	09.97 (18.33)
10	CoP 17441	1.2	MR	29.63 (32.95)	26.33 (30.83)	11.14 (19.44)	06.85 (15.15)	07.65 (16.02)	10.46 (18.78)
11	CoP 2061	1.3	MR	28.95 (32.52)	25.61 (30.36)	11.54 (19.83)	07.01 (15.31)	07.88 (16.26)	11.04 (19.31)
12	CoP 16438	1.3	MR	28.73 (32.36)	25.36 (30.20)	11.73 (20.00)	07.15 (15.46)	08.09 (16.46)	11.62 (19.90)
13	CoLk 16470	1.3	MR	28.58 (32.20)	25.14 (30.06)	12.04 (20.25)	07.20 (15.54)	08.21 (16.62)	12.30 (20.50)
14	CoSe 01421	1.4	MR	27.81 (31.75)	24.38 (29.55)	12.33 (20.53)	07.52 (15.9)	08.64 (17.02)	12.96 (21.08)
15	CoLk 16466	1.4	MR	27.75 (31.75)	24.14 (29.38)	13.01 (21.10)	07.59 (15.93)	08.75 (17.18)	13.26 (21.31)
16	CoSe 17451	1.4	MR	27.69 (31.73)	23.95 (29.24)	13.51 (21.53)	07.65 (16.01)	08.91 (17.36)	14.14 (22.04)
17	CoSe 16454	1.5	MR	27.32 (31.49)	23.46 (28.91)	14.13 (22.01)	07.81 (16.18)	09.17 (17.54)	14.83 (22.60)
18	CoP 16456	1.6	MR	26.87 (31.09)	22.91 (28.53)	14.74 (22.54)	07.88 (16.18)	09.39 (17.83)	16.08 (23.60)
19	CoP 17446	1.7	MR	26.41 (30.90)	22.41 (28.23)	15.15 (22.86)	08.03 (16.39)	09.69 (18.12)	17.13 (24.41)
20	CoLk 16468	1.7	MR	26.23 (30.67)	22.17 (28.03)	15.48 (23.12)	08.05 (16.46)	09.80 (18.19)	17.86 (24.88)
21	CoSe 16452	1.8	MR	25.74 (30.45)	21.56 (27.61)	16.24 (23.72)	08.12 (16.52)	10.16 (18.56)	20.08 (26.57)
22	CoLk 16469	2.2	MS	21.86 (27.84)	17.15 (24.41)	21.55 (27.63)	08.56 (16.98)	10.87 (19.21)	21.25 (27.39)
23	CoBln 17501	2.5	MS	21.21 (27.34)	16.36 (23.83)	22.87 (28.54)	09.04 (17.43)	11.70 (19.89)	22.74 (28.41)
24	BO 156	2.7	MS	19.65 (26.30)	14.84 (22.60)	24.48 (29.63)	09.53 (17.95)	12.45 (20.62)	23.45 (28.91)
25	CoBln 16502	2.8	MS	19.27 (26.02)	14.46 (22.42)	24.96 (29.96)	09.79 (18.19)	12.98 (21.06)	24.58 (29.67)
26	CoLk 94184	3.0	MS	18.94 (25.76)	13.85 (21.81)	26.87 (31.20)	10.05 (18.44)	13.87 (21.83)	27.54 (31.61)
27	CoP 17444	3.3	S	17.85 (24.97)	12.68 (20.79)	28.96 (32.52)	12.84 (20.96)	18.04 (25.10)	28.82 (32.42)
28	CoSe 92423	3.6	S	17.34 (24.59)	12.09 (20.28)	30.28 (33.35)	13.43 (21.46)	18.89 (25.73)	28.90 (32.44)
29	CoSe 17452	3.7	S	17.21 (24.50)	11.84 (20.08)	31.20 (33.93)	13.98 (21.92)	19.71 (26.28)	29.07 (32.56)
30	CoSe 95422 (Control)	4	S	16.36 (23.84)	10.11 (18.45)	38.20 (38.16)	18.69 (25.58)	31.81 (34.30)	41.24 (39.93)
	SEm(+)			1.32	1.15	1.01	0.86	0.95	1.18
	CD(5%)			3.75	3.27	2.88	2.44	2.7	3.37
	CV			7.52	7.18	7.61	9.05	9.02	9.07

H- Healthy, D- Diseased, R- Reduction, R-Resistant, MR-Moderately Resistant, MS- Moderately Susceptible, S- Susceptible

**Table 5. Extent of losses on various quantitative cane parameters due to *Fusarium sacchari***

Sr. No.	Varieties	Disease score	Rating	Cane Height (cm)			Cane girth (cm)			Cane Weight (Kg)		
				H	D	R	H	D	R	H	D	R
1	CoP 17437	0.5	R	234.71	219.08	6.66	7.07	6.88	2.67	1.25	1.17	6.40
2	CoP 17438	0.5	R	231.89	216.43	6.67	6.98	6.79	2.70	1.23	1.15	6.50
3	CoP 9301	0.6	R	230.25	214.83	6.70	6.91	6.66	3.64	1.19	1.10	7.56
4	CoP 16439	0.6	R	229.78	214.25	6.76	6.85	6.57	4.13	1.16	1.07	7.76
5	CoP 17440	0.6	R	229.69	214.14	6.77	6.76	6.41	5.12	1.11	1.02	8.11
6	CoSe 16451	1.0	R	228.84	213.04	6.90	6.47	6.13	5.34	1.06	0.97	8.49
7	CoP 16437	1.1	MR	228.23	212.07	7.08	6.38	5.88	7.88	1.03	0.94	8.74
8	BO 91	1.2	MR	227.85	211.66	7.11	6.32	5.81	7.96	0.98	0.89	9.18
9	CoSe 18452	1.2	MR	227.37	211.13	7.14	6.22	5.72	8.08	0.96	0.87	9.38
10	CoP 17441	1.2	MR	227.04	210.78	7.16	6.13	5.63	8.21	0.95	0.86	9.47
11	CoP 2061	1.3	MR	226.35	210.06	7.20	5.91	5.41	8.51	0.93	0.83	10.75
12	CoP 16438	1.3	MR	226.49	209.98	7.29	5.85	5.31	9.14	0.91	0.81	10.99
13	CoLk 16470	1.3	MR	225.52	209.03	7.31	5.75	5.22	9.29	0.88	0.78	11.36
14	CoSe 01421	1.4	MR	225.16	207.68	7.76	5.63	5.03	10.61	0.86	0.76	11.63
15	CoLk 16466	1.4	MR	224.81	207.03	7.91	5.59	4.97	11.24	0.84	0.74	11.90
16	CoSe 17451	1.4	MR	224.24	206.43	7.94	5.53	4.87	11.93	0.83	0.73	12.05
17	CoSe 16454	1.5	MR	222.93	204.13	8.43	5.28	4.62	12.50	0.79	0.68	13.92
18	CoP 16456	1.6	MR	218.95	200.16	8.58	5.15	4.46	13.41	0.77	0.66	14.29
19	CoP 17446	1.7	MR	215.63	197.09	8.60	4.93	4.24	14.01	0.74	0.63	14.86
20	CoLk 16468	1.7	MR	214.04	194.71	9.03	4.81	4.09	15.03	0.73	0.62	15.07
21	CoSe 16452	1.8	MR	211.75	190.81	9.89	4.49	3.80	15.38	0.71	0.59	16.90
22	CoLk 16469	2.2	MS	193.58	168.54	12.94	4.24	3.43	19.26	0.70	0.58	17.14
23	CoBln 17501	2.5	MS	184.65	160.32	13.18	4.02	3.21	20.31	0.69	0.54	21.74
24	BO 156	2.7	MS	175.87	151.54	13.83	3.61	2.80	22.61	0.67	0.52	22.39
25	CoBln 16502	2.8	MS	174.00	149.56	14.05	3.05	2.39	21.65	0.66	0.51	22.73
26	CoLk 94184	3.0	MS	161.82	138.65	14.32	2.95	2.23	24.47	0.63	0.47	25.40
27	CoP 17444	3.3	S	159.93	127.92	20.02	2.67	1.95	27.06	0.59	0.43	27.12
28	CoSe 92423	3.6	S	157.91	125.87	20.29	2.58	1.82	29.27	0.57	0.41	28.07
29	CoSe 17452	3.7	S	154.65	123.12	20.39	2.48	1.73	30.38	0.54	0.37	31.48
30	CoSe 95422 (Control)	4.0	S	139.84	100.92	27.83	1.95	1.07	45.16	0.55	0.29	47.27
	SEm(+)			9.54	7.58	0.43	0.22	0.19	0.63	0.04	0.04	0.75
	CD(5%)			27.07	21.5	1.21	0.63	0.55	1.79	0.12	0.1	2.14
	CV			7.96	7.03	7.01	7.97	7.77	7.68	8.69	8.61	8.35

**Table 6. Extent of losses on various qualitative cane parameters due to *Fusarium sacchari***

Sr. No.	Varieties	Disease score	Rating	Brix %			Sucrose %			Purity %		
				H	D	Red (%)	H	D	Red (%)	H	D	Red (%)
1	CoP 17437	0.5	R	20.03 (26.55)	19.22 (25.98)	04.04 (11.59)	17.53 (24.73)	16.31 (23.81)	06.96 (15.29)	87.52 (69.32)	84.86 (67.10)	03.04 (10.04)
2	CoP 17438	0.5	R	19.97 (26.53)	19.16 (25.95)	04.06 (11.59)	17.47 (24.67)	16.25 (23.76)	06.98 (15.31)	87.48 (69.27)	84.81 (67.04)	03.05 (10.05)
3	CoP 9301	0.6	R	19.86 (26.45)	19.04 (25.86)	04.13 (11.69)	17.31 (24.57)	15.98 (23.55)	07.68 (16.07)	87.16 (69.00)	83.93 (66.35)	03.71 (11.10)
4	CoP 16439	0.6	R	19.77 (26.37)	18.95 (25.79)	04.15 (11.73)	17.17 (24.46)	15.84 (23.44)	07.75 (16.16)	86.85 (68.75)	83.59 (66.09)	03.75 (11.14)
5	CoP 17440	0.6	R	19.74 (26.36)	18.91 (25.76)	04.20 (11.81)	17.11 (24.42)	15.68 (23.32)	08.36 (16.79)	86.68 (68.58)	82.92 (65.58)	04.34 (12.01)
6	CoSe 16451	1.0	R	19.41 (26.12)	18.54 (25.49)	04.48 (12.21)	16.59 (24.02)	15.14 (22.89)	08.74 (17.19)	85.47 (67.60)	81.66 (64.62)	04.46 (12.19)
7	CoP 16437	1.1	MR	19.36 (26.06)	18.43 (25.41)	04.80 (12.65)	16.27 (23.77)	14.74 (22.57)	09.4 (17.84)	84.04 (66.45)	79.98 (63.43)	04.83 (12.69)
8	BO 91	1.2	MR	19.33 (26.06)	18.39 (25.38)	04.86 (12.73)	16.21 (23.72)	14.66 (22.5)	09.56 (18.00)	83.86 (66.32)	79.72 (63.23)	04.94 (12.84)



### Assessment of Varietal Response and its Impacts on Different Cane Attributes

Sr. No.	Varieties	Disease score	Rating	Brix %			Sucrose %			Purity %		
				H	D	Red (%)	H	D	Red (%)	H	D	Red (%)
9	CoSe 18452	1.2	MR	19.28 (26.01)	18.34 (25.34)	04.88 (12.75)	16.16 (23.69)	14.61 (22.46)	09.59 (18.03)	83.82 (66.31)	79.66 (63.19)	04.96 (12.85)
10	CoP 17441	1.2	MR	19.21 (25.98)	18.26 (25.28)	04.95 (12.83)	15.95 (23.52)	14.39 (22.28)	09.78 (18.21)	83.03 (65.67)	78.81 (62.6)	05.09 (13.03)
11	CoP 2061	1.3	MR	19.09 (25.88)	18.15 (25.20)	04.92 (12.81)	15.74 (23.36)	14.13 (22.07)	10.23 (18.64)	82.45 (65.24)	77.85 (61.94)	05.58 (13.65)
12	CoP 16438	1.3	MR	19.03 (25.84)	18.08 (25.15)	04.99 (12.88)	15.69 (23.32)	14.05 (22.00)	10.45 (18.85)	82.45 (65.27)	77.71 (61.88)	05.75 (13.87)
13	CoLk 16470	1.3	MR	18.96 (25.78)	18.01 (25.10)	05.01 (12.92)	15.59 (23.24)	13.86 (21.85)	11.10 (19.45)	82.23 (65.08)	76.96 (61.32)	06.41 (14.66)
14	CoSe 01421	1.4	MR	18.83 (25.68)	17.86 (24.98)	05.15 (13.10)	15.35 (23.05)	13.62 (21.65)	11.27 (19.60)	81.52 (64.54)	76.26 (60.83)	06.45 (14.70)
15	CoLk 16466	1.4	MR	18.77 (25.65)	17.81 (24.95)	05.11 (13.06)	15.29 (23.01)	13.56 (21.60)	11.31 (19.64)	81.46 (64.49)	76.14 (60.75)	06.53 (14.80)
16	CoSe 17451	1.4	MR	18.74 (25.64)	17.77 (24.89)	05.18 (13.14)	15.19 (22.92)	13.42 (21.48)	11.65 (19.94)	81.06 (64.20)	75.52 (60.34)	06.83 (15.14)
17	CoSe 16454	1.5	MR	18.62 (25.54)	17.57 (24.77)	05.64 (13.73)	15.01 (22.78)	13.18 (21.27)	12.19 (20.42)	80.61 (63.90)	75.01 (60.00)	06.94 (15.26)
18	CoP 16456	1.6	MR	18.43 (25.41)	17.38 (24.63)	05.70 (13.81)	14.89 (22.67)	13.07 (21.19)	12.22 (20.45)	80.79 (63.99)	75.20 (60.14)	06.92 (15.23)
19	CoP 17446	1.7	MR	18.31 (25.32)	16.95 (24.24)	07.43 (15.81)	14.76 (22.58)	12.49 (20.68)	15.38 (23.07)	80.61 (63.88)	73.69 (59.13)	08.59 (17.04)
20	CoLk 16468	1.7	MR	18.25 (25.28)	16.87 (24.22)	07.56 (15.95)	14.68 (22.52)	12.28 (20.50)	16.35 (23.83)	80.44 (63.80)	72.79 (58.55)	09.51 (17.95)
21	CoSe 16452	1.8	MR	18.14 (25.20)	16.65 (24.07)	08.21 (16.64)	14.43 (22.31)	11.78 (20.05)	18.36 (25.34)	79.55 (63.14)	70.75 (57.26)	11.06 (19.42)
22	CoLk 16469	2.2	MS	17.62 (24.81)	15.64 (23.28)	11.24 (19.58)	13.91 (21.89)	10.75 (19.13)	22.72 (28.45)	78.94 (62.68)	68.73 (56.00)	12.93 (21.07)
23	CoBln 17501	2.5	MS	17.25 (24.52)	15.01 (22.77)	12.99 (21.12)	13.25 (21.33)	10.03 (18.43)	24.30 (29.52)	76.81 (61.22)	66.82 (54.83)	13.01 (21.13)
24	BO 156	2.7	MS	16.93 (24.29)	14.72 (22.55)	13.05 (21.17)	12.73 (20.88)	09.38 (17.82)	26.32 (30.85)	75.19 (60.12)	63.72 (52.95)	15.25 (22.98)
25	CoBln 16502	2.8	MS	16.21 (23.73)	13.76 (21.76)	15.11 (22.87)	11.91 (20.16)	08.45 (16.88)	29.05 (32.60)	73.47 (58.99)	61.41 (51.59)	16.42 (23.90)
26	CoLk 94184	3.0	MS	15.98 (23.55)	13.37 (21.43)	16.33 (23.82)	11.64 (19.94)	07.98 (16.36)	31.44 (34.08)	72.84 (58.58)	59.69 (50.58)	18.06 (25.14)
27	CoP 17444	3.3	S	15.36 (23.06)	12.82 (20.96)	16.54 (23.99)	11.04 (19.39)	07.36 (15.71)	33.33 (35.24)	71.88 (57.96)	57.41 (49.25)	20.12 (26.64)
28	CoSe 92423	3.6	S	14.87 (22.67)	12.31 (20.50)	17.22 (24.51)	10.53 (18.92)	06.67 (14.95)	36.66 (37.24)	70.81 (57.29)	54.18 (47.38)	23.48 (28.97)
29	CoSe 17452	3.7	S	14.24 (22.16)	11.45 (19.73)	19.59 (26.26)	10.06 (18.48)	06.08 (14.27)	39.56 (38.96)	70.65 (57.18)	53.10 (46.76)	24.84 (29.87)
30	CoSe 95422 (Check)	4.0	S	13.41 (21.47)	09.98 (18.36)	25.58 (30.37)	08.97 (17.42)	04.56 (12.32)	49.16 (44.50)	66.89 (54.92)	45.69 (42.51)	31.69 (34.24)
	SEm(±)			0.46	0.43	0.32	0.46	0.39	0.46	1.11	1.50	0.31
	CD(5%)			1.31	1.22	0.91	1.31	1.10	1.31	3.14	2.98	0.88
	CV			3.19	3.12	3.40	3.58	3.31	3.39	3.00	3.10	3.08

H- Healthy, D- Diseased, R- Reduction, R-Resistant, MR-Moderately Resistant, MS- Moderately Susceptible, S- Susceptible

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