

Evaluation of Different Sugarcane Varieties for Resistance against Red Rot Disease

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Abstract

Red rot is one of the oldest, widely distributed and recognized as most destructive disease of sugarcane in India. It reduces the yield of cane and quality and recovery of juice. The disease is also responsible for quick decline of many elite sugarcane varieties. An experiment was conducted in 2004-05 and 2005-06 to screen out 28 promising sugarcane varieties against red rot disease resistance by artificial inoculation following standard plug method. Among the varieties tested 3 varieties, namely Co Pant 94211, Co 97009 and Co 97016 possess relative resistance, 7 varieties moderately resistant 8 varieties moderately susceptible, 8 varieties susceptible and 2 varieties highly susceptible to the red rot pathogen. These moderately resistant and resistant varieties may be much more useful and can be utilized in breeding program aimed at red rot disease resistance.

Key words : Red rot, Sugarcane, Varieties, *Colletotrichum falcatum*, Resistance.

Sugarcane is one of the most important commercial crop, remains in field for 12—16 months. During this period it passes through four distinct phases viz. germination, tillering, elongation and maturity. In these stages the crop is attacked right from top to root by different kinds of pathogen viz. fungi, bacteria, viruses, phytoplasmas and nematodes, in which red rot has been recognized as one of the most serious and important disease of sugarcane. Red rot is one of the oldest diseases of sugarcane and is caused by a fungus *Colletotrichum falcatum* Went, has its perfect stage as *Glomerella tucumanensis* (Speg.) von Arx and Muller. It is chiefly a disease of standing cane, so devastating in nature and major constraints in the profitable cultivation of sugarcane, hence also referred as cancer of sugarcane (1). It drastically retards the yield and considerably deteriorates the juice quality thus affecting the grower and millers in different states of the country. A large number of commercial varieties have been discontinued by farmers due to their high susceptibility to this disease. In recent years, the association of red rot with borer, grub and mealy bug is constantly on an increase and has assumed economic significance due to monoculture of sugarcane over large area, genetic uniformity, high popula-

tion density, better input (fertilizer and irrigation), unchecked movement of seed material from one location to another and above all ignorance of farmers to use appropriate chemical/technology (2). The disease is primarily sett born and the pathogen systemically survives inside the setts beyond the reach of surface acting non systemic fungicides. Chemical control of the disease has not been practical till now for various reasons. Presently, the disease is best managed by growing resistant varieties along with certain phytosanitary measures. In view of the non-availability of effective systemic fungicides for controlling red rot under field conditions, cultivation of disease resistant varieties alone remains the most practical, economic, safe and effective option for red rot management (3). Keeping this objective in view, an experiment was conducted during 2004-05 and 2005-06 for two seasons, with 28 promising sugarcane varieties for assessment of resistance against red rot pathogen i.e. *Colletotrichum falcatum* by rapid, reliable and reproducible plug method of inoculation at research farm of Krishi Vigyan Kendra (SVBPUA & T) Nagina, Bijnor, to check the performance of sugarcane varieties under Mid Western Plain Zone of Utter Pradesh.

Methods

A total of 28 sugarcane varieties were field evaluated against the red rot disease to find out source of resistance by the standard plug method of inoculation (4, 5). Each variety was planted in three rows, 90 cm apart and 5 m in length and inoculated by plug method with conidium-cum-mycelial suspension of pathogen.

The red rot fungus i.e. *C. falcatum* isolated from stem tissues of naturally infected sugarcane varieties and cultured on potato dextrose agar medium. Small bits of infected tissues were cut and sterilized with 0.1% of mercuric chloride solution for 1–2 minutes followed by three washings given with sterilized water and then bits were placed on agar slants under complete sterile conditions in a laminar flow and incubated in BOD incubator at temperature of 25 ± 1 C. The fungus was purified by single spore isolation technique used in present study. The conidial suspension (10^3 conidia per ml) was prepared in sterilized water from 10 days old culture of pathogen. Twenty plants of each variety were inoculated artificially with conidia-cum-mycelial suspension during the first week of September, when planted canes were about to mature. Inoculation was done in middle of the third exposed internode from bottom and 2 ml of conidial suspension was injected with a large syringe in each cane and covered with wet cotton piece. The final observations on the disease reaction were recorded by longitudinally splitting the inoculated canes after 60 days of inoculation. The reaction of varieties is evaluated as resistant (R), moderately resistant (MR), moderately susceptible (MS), susceptible (S) and highly susceptible (HS) to red rot and graded on 0–9 scale (6). Lesion width, occurrence and number of white patches, number of nodes transgressed and conditions of tops were scored for disease measurement. Average of total score is taken for assigning the grade. The reaction of different groups was grouped as follows :

Score	Reaction
0.0 to 2.0	R—Resistant
2.1 to 4.0	MR—Moderately resistant
4.1 to 6.0	MS— Moderately susceptible
6.1 to 8.0	S—Susceptible
Above 8.0	HS—Highly susceptible

Table 1. Pooled resistance rating of different sugarcane varieties to red-rot pathogen by plug method after 60 days of inoculation during 2004-05 and 2005-06.

Varieties	Plug method	
	Disease rating	Reaction
1. Co S 687	8.3	HS
2. Co S 98231	8.4	HS
3. Co S 767	7.1	S
4. Co S 94223	6.2	S
5. Co S 95422	6.5	S
6. Co S 98247	6.6	S
7. Co S 98016	7.2	S
8. Co Pant 97222	6.4	S
9. Co Pant 84212	7.3	S
10. Co 1148	6.8	S
11. Co S 97261	4.8	MS
12. Co S 97264	4.6	MS
13. Co S 96268	4.4	MS
14. Co Pant 90222	5.1	MS
15. Co Pant 90223	4.2	MS
16. Co Pant 93227	4.5	MS
17. Co Pant 94214	5.1	MS
18. Co 94018	5.5	MS
19. Co S 97265	3.0	MR
20. Co S 8436	2.7	MR
21. Co S 8432	2.2	MR
22. Co S 86218	2.8	MR
23. Co Pant 84211	2.5	MR
24. Co J 87192	3.1	MR
25. Co 89009	3.2	MR
26. Co Pant 94211	1.7	R
27. Co 97009	1.8	R
28. Co 97016	1.8	R

Results and Discussion

The red rot incidence in different varieties was recorded. All parts of the cane plant above the ground were infected by the disease. Infection first appeared as elongated red bright lesion with ash grey centers on lower side of midrib, reddish patches on leaf sheaths and continues to spread on leaf lamina. Symptoms of the disease were well recognized in field when plants approached maturity by withering third or fourth leaf of the crown either at the tip or along the margin or both. Initially affected stalks exhibited purple discoloration of rind and pith portion of internodes turned reddish, displayed white patches usually elongated at right angle to long axis of the stalk. On splitting the stalk lengthwise pith was found reddened or dull red color interrupted by crossed specific white patches.

The data on incidence of red rot on various vari-

eties to red rot pathogen are given in Table 1. The varieties are graded for various levels of resistance and susceptibility using a standard disease index. On the basis of pooled analysis of two years data it was revealed that among the 28 varieties tested, only 3 varieties i.e. Co Pant 94211, Co 97009 and Co 97016 found resistant and 7 varieties viz. CoS 97265, CoS 8436, CoS 8432, CoS 86218, Co Pant 84211, Co J 87192 and Co. 89009 showed moderately resistant reaction to the pathogen. Similarly, 8 varieties namely, CoS 97261, CoS 97264, CoS 96268, Co Pant 90222, Co Pant 90223, Co Pant 93227, Co Pant 94214 and Co 94018 gave moderately susceptible reaction and 8 varieties exhibited susceptible reaction viz. Co S 767, Co S 94223, CoS 95422, CoS 98247, CoS 98016, Co Pant 97222, Co Pant 84212, Co 1148. Remaining 2 varieties i.e. CoS 687 and CoS 98231 were found to be highly susceptible against red rot disease. None of the varieties exhibited complete resistant reaction to red-rot. Sugarcane varieties Co Pant 94211, Co 97009 and Co 97016 appeared to be the best in respect of resistance to red rot, although they were found to possess low level of resistance, scored up to 1.8 in disease rating and found to be superior among tested varieties.

These findings are in agreement to that of Nath and Bhagawati (7) who categorized Co 89003, CoS 91230 and Co J 87192 as moderately resistant cultivars to red rot but none was found to be resistant to the same disease. Mishra et al. (8) tested 16 sugarcane genotypes for resistance to red rot by plug method of an inoculation indicated CoC 97062, CoC 96062 and CoA 95081 resistant and Co 7219, Co 6304 highly susceptible to the pathogen. Similarly, Singh and Singh (9) evaluated 58 sugarcane varieties against red rot and found that none of them exhibited resistant reaction. Ahmad and Ali (10) also recorded a wide range of reaction (i.e. resistant to highly susceptible types) under inoculation of *C. falcatum* on sugarcane germplasms/varieties.

The red rot disease is mainly responsible for deterioration of many promising commercial varieties and continues to be a threat worldwide including India. The breakdown of red rot resistance is primarily

attributed to different environmental factors and new strain/pathotypes in red rot pathogens. In spite of various methods, the introduction of resistant varieties is the most effective approach for prevention and control of the disease. It is confirmed from the present study that different levels of resistance for red rot is available in different sugarcane varieties. The moderately resistant varieties viz. CoS 97265, CoS 8436, CoS 8432, CoS 86218, Co Pant 84211, Co J 87192, Co 89009 and resistant varieties Co Pant 94211, Co 97009 and Co 97016 may be utilized as one of the sources of resistance in breeding program of sugarcane to red rot disease.

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