

Qualitative Study of Amino Acids in Red-rot Disease Infected Sugarcane Using FT-NMR Spectral Study

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An attempt has been made to determine the variation of intensity in amino groups of resistant and red-rot disease infected sugarcane crop using ^1H NMR spectral study. From this study it has been shown that the FT-NMR can be used as a rapid confirmatory method for the qualitative analysis of amino acids present in resistant and red-rot disease infected sugarcane crop.

Key Words: Sugarcane, Red-rot, Amino acid, FT-NMR.

INTRODUCTION

One of the problems, which is not clearly understood with red-rot, is the manner in which infection takes place in sugarcane. There has been considerable interest during the past ten years in the effects of amino acids in this disease infected sugarcane. There have been a number of reports^{1,2} regarding qualitative assessment of free amino acids in sugarcane affected by red-rot. Changes in the amino acid composition of sugarcane in both resistant and red-rot disease infected sugarcane have been reported³. Several workers studied the amino acid content of sugarcane incident with red rot⁴⁻⁶. The present investigation is initiated to study this aspect in relation to the sugarcane crop and the amino acid variation in both resistant and red-rot disease infected sugarcane.

EXPERIMENTAL

In the present study, twelve varieties of sugarcane (Co 86249, CoG 93076, Co 86032, CoC 99061, CoSi 95071, Co 85019 (Resistant), CoC 671, CoC 90063, CoC 98061, Mc 707, CoV 92102 and Co 6304 (Red-rot infected)) plants at the age of eight months were collected from different fields in the sugarcane growing area of EID Parry (India) Limited, Nellikuppam, Cuddalore District, Tamil Nadu, India. Samples were collected field-wise by adopting standard procedure^{7,8}.

The sugarcane plants were harvested and dried at 60°C for 24 h. The entire sugarcanes were oven-dried and powdered samples taken for this analysis. The ^1H FT-NMR spectra of both resistant and red-rot disease infected cane were recorded using D_2O as a solvent by Bruker 300 model FT-NMR spectrometer available at Spic Science Foundation, Chennai.

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RESULTS AND DISCUSSION

The variation of amino acids in sugarcane of both resistant and red-rot disease infected cane are presented by ^1H NMR spectral analysis. The chemical shift and intensity of ^1H NMR spectra of resistant and red-rot disease infected sugarcane samples are shown in Tables 1–4.

TABLE-1
CHEMICAL SHIFT OF ^1H NMR SPECTRAL DATA OF
RESISTANT VARIETY SUGARCANE

Co 86249 (ppm)	Intensity	CoC 99061 (ppm)	Intensity	Co 85019 (ppm)	Intensity
3.060	0.13	3.047	0.12	3.050	0.16
3.269	0.19	3.256	0.18	3.261	0.19
3.480	0.13	3.492	0.15	3.486	0.14
3.661	0.25	3.672	0.17	3.680	0.28
4.489	0.16	4.481	0.15	4.489	0.18
4.671	10.30	4.665	10.39	4.671	10.95

TABLE-2
CHEMICAL SHIFT OF ^1H NMR SPECTRAL DATA OF
RESISTANT VARIETY SUGARCANE

CoG 93076 (ppm)	Intensity	CoSi 95071 (ppm)	Intensity	Co 86032 (ppm)	Intensity
3.050	0.15	3.049	0.15	3.048	0.16
3.264	0.17	3.262	0.16	3.259	0.16
3.486	0.27	3.480	0.31	3.484	0.23
3.670	0.27	3.680	0.31	3.677	0.25
4.479	0.18	4.489	0.13	4.485	0.20
4.671	10.52	4.671	10.69	4.668	10.96

TABLE-3
CHEMICAL SHIFT OF ^1H NMR SPECTRAL DATA OF
RED-ROT DISEASE INFECTED SUGARCANE

CoC 671 (ppm)	Intensity	CoC 90063 (ppm)	Intensity	Mc 707 (ppm)	Intensity
3.057	0.23	3.045	0.27	3.047	0.27
3.265	0.28	3.275	0.34	3.256	0.32
3.483	0.32	3.475	0.38	3.481	0.35
3.678	0.45	3.641	0.39	3.677	0.37
4.485	0.31	4.482	0.37	4.472	0.31
4.669	26.65	4.667	11.98	4.665	14.14

TABLE-4
CHEMICAL SHIFT OF ^1H NMR SPECTRAL DATA OF
RED ROT DISEASE INFECTED SUGARCANE

CoC 98061 (ppm)	Intensity	CoV 92102 (ppm)	Intensity	Co 6304 (ppm)	Intensity
3.078	0.28	3.050	0.27	3.049	0.27
3.267	0.24	3.263	0.29	3.259	0.29
3.489	0.34	3.484	0.38	3.483	0.37
3.675	0.53	3.682	0.41	3.677	0.39
4.478	0.35	4.481	0.29	4.475	0.34
4.678	12.16	4.664	11.29	4.667	12.65

Figs. 1 and 2 show the FT-NMR spectra of the resistant and the red-rot disease infected sugarcane. All the samples were recorded under identical conditions using D_2O as a solvent.

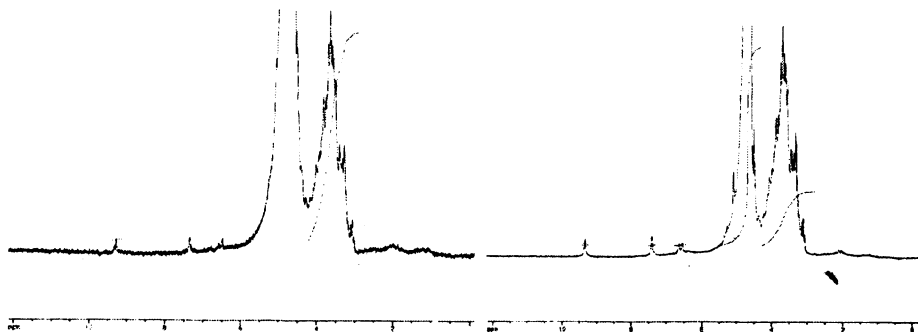


Fig. 1. ^1H FT-NMR spectra of resistant variety sugarcane (Co 86249)

Fig. 2. ^1H FT-NMR spectra of red-rot disease infected sugarcane (CoC 671)

The presence of amino acids in resistant and red-rot disease infected sugarcane crops may be identified using ^1H NMR signal due to amino group, *i.e.*, ^1H NMR spectra of sugarcane samples show a chemical shift (3.060–4.671) of wide intensity indicating the amino group. Of the different chemical shifts obtained in infected sugarcane, the chemical shifts of 4.489, 4.671, 3.661, 3.480, 3.269 and 3.060 ppm occur with increasing intensity. The intensities corresponding to the above mentioned chemical shifts are found to decrease in the case of resistant variety. Similarly consistent variation occurs in other 10 spectra of both resistant and red-rot disease infected sugarcane. The intensities are directly related to the amino acid content. Hence these chemical shifts can be taken as a tool for the level of amino acid contents in sugarcane. The results indicate that the amino acid content is of higher level in red-rot disease infected sugarcane compared to resistant variety which is in consonance with the results obtained from earlier studies^{9,10}.

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