

Gibberellic acid

Spinsolve™ 60

Gibberellic acid is a plant hormone and the most used substance from the group of Gibberellins. In the industry it is used mainly to stimulate rapid stem and root growth and to speed up the germination. Figure 1 shows the ^1H NMR spectrum of a 250 mM Gibberellic acid sample in MeOH-d_4 measured in a single scan taking 10 seconds to acquire.

1D Proton spectrum

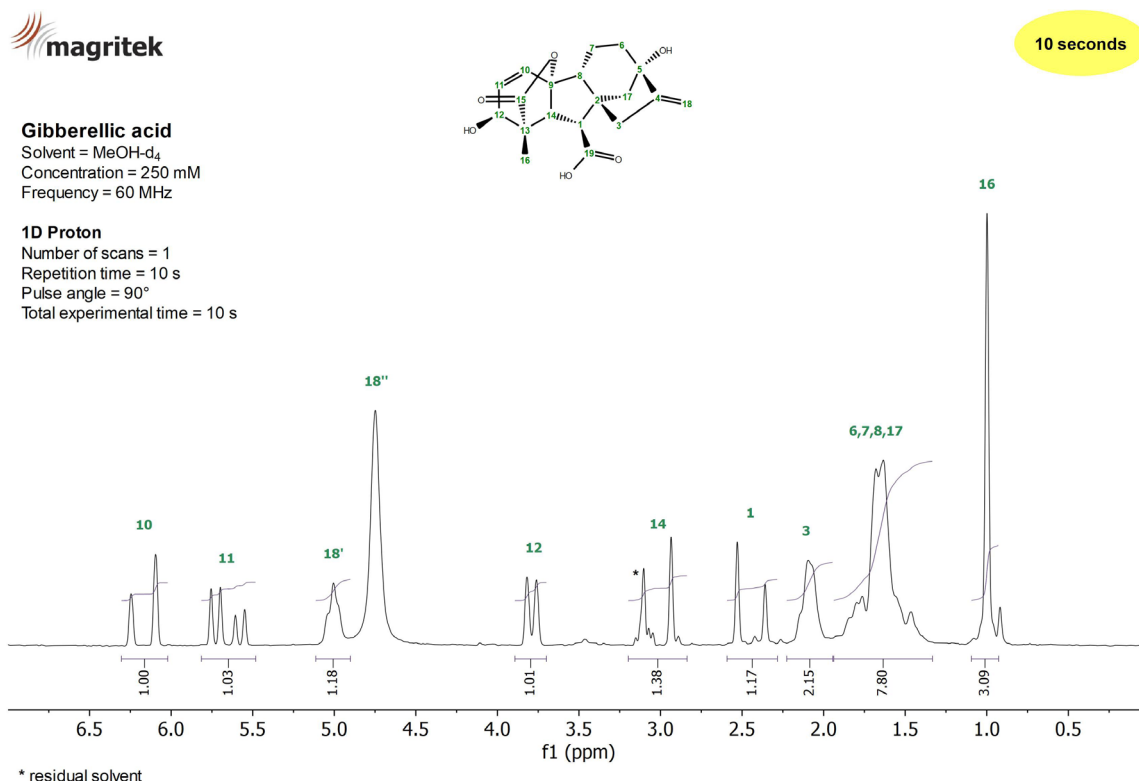


Figure 1: ^1H NMR spectrum of a 250 mM Gibberellic acid sample in MeOH-d_4 measured on a Spinsolve 60 MHz system in a single scan.

1D Carbon spectrum

Figure 2 shows the ^{13}C NMR spectrum of 250 mM Gibberellic acid in MeOH-d_4 acquired using NOE polarization transfer from ^1H to ^{13}C and ^1H decoupling. The 1D Carbon experiment using NOE is sensitive to all ^{13}C nuclei in the sample. It clearly resolves all the expected resonances.

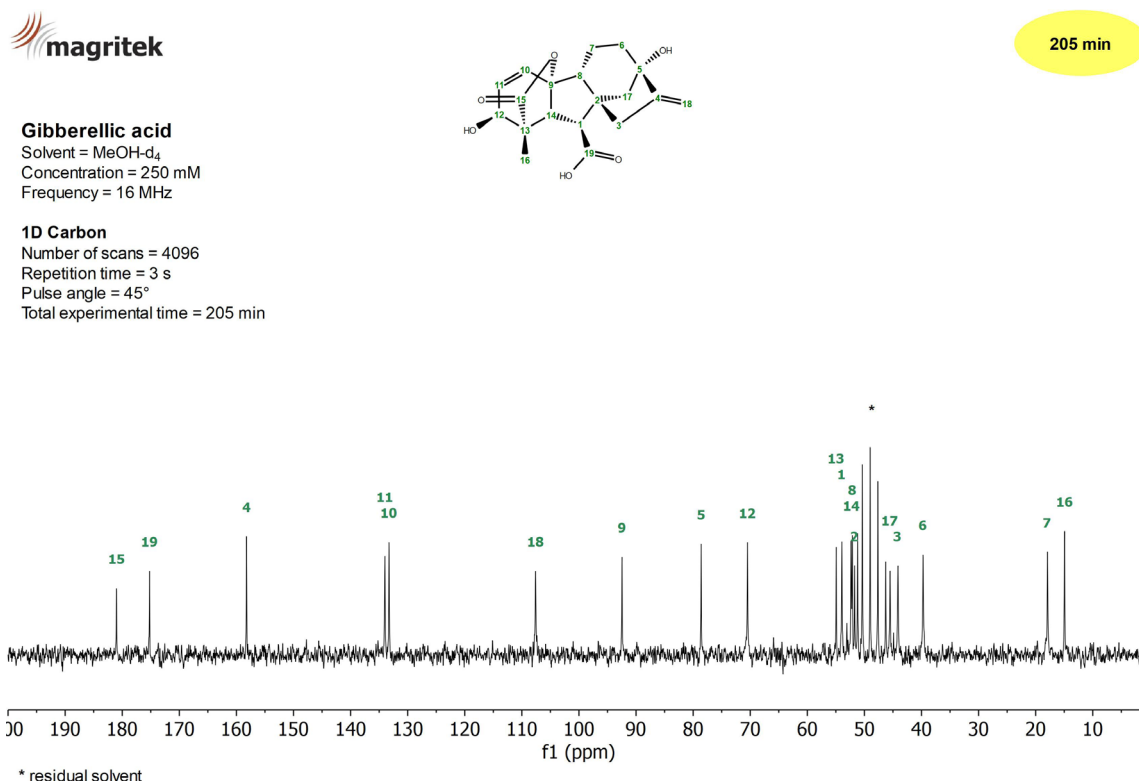


Figure 2: ^{13}C NMR spectrum of a 250 mM Gibberellic acid sample in MeOH-d_4 measured on a Spinsolve 60 MHz system in 205 minutes.

2D COSY spectrum

The 2D COSY experiment allows one to identify coupled ^1H nuclei as they generate cross peaks out of the diagonal of the 2D data set. In Figure 3 a large number of cross peaks can be nicely observed. For example, the proton at position 11 couples to protons 16 (orange), proton 12 (light green) and proton 10 (dark blue). The protons 16 couple with proton 14 (light blue) and proton 12 (dark green). In addition, the coupling between protons 1 and 14 (pink) can be observed.

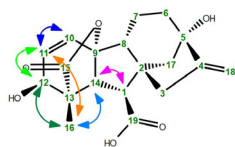


Gibberellic acid

Solvent = MeOH-d_4
Concentration = 250 mM
Frequency = 60 MHz

COSY

Number of scans = 1
Total experimental time = 17 min



* residual solvent

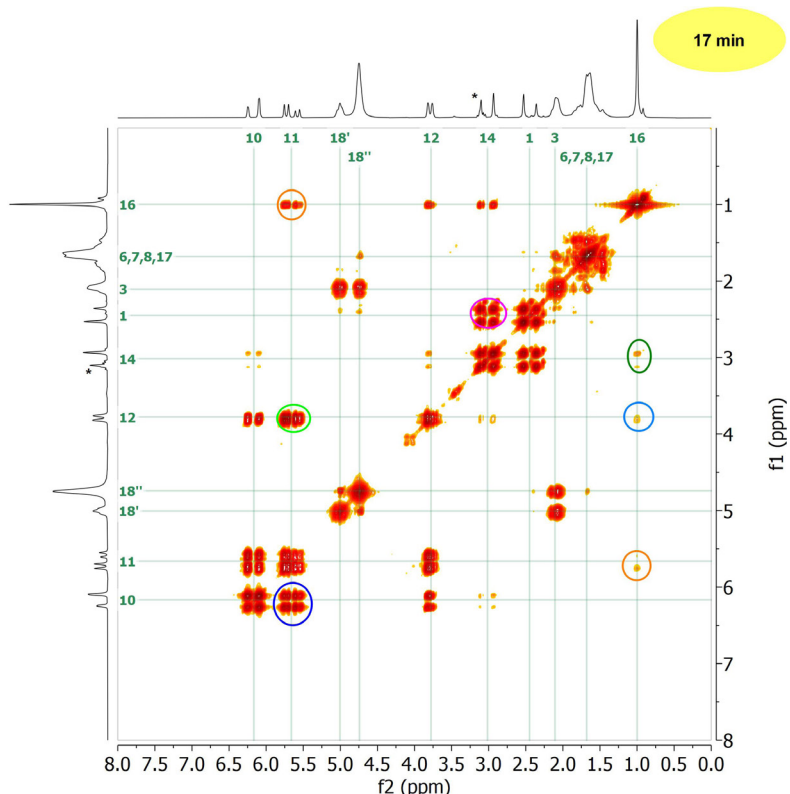


Figure 3: ^1H 2D COSY experiment of a 250 mM Gibberellic acid sample in MeOH-d_4 acquired in 17 minutes on a Spinsolve 60 MHz system.

2D HSQC-ME

The HSQC is a powerful sequence widely used to correlate ^1H with the one-bond coupled ^{13}C nuclei. The Spinsolve is equipped with a multiplicity edited version (HSQC-ME) of this method. It provides the editing power of the DEPT-135 sequence, which is useful to differentiate the signals of CH_2 groups (blue) from CH and CH_3 groups (red). Figure 4 shows the HSQC-ME spectrum of a 250 mM Gibberellic acid sample in MeOH-d_4 acquired in 8 minutes.

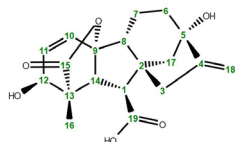


Gibberellic acid

Solvent = MeOH-d_4
Concentration = 250 mM
Frequency ^1H = 60 MHz

HSQC-ME

Number of scans = 2
Repetition time = 1 s
Number of steps = 256
Total experimental time = 8 min



Red = CH and CH_3

Blue = CH_2

* residual solvent

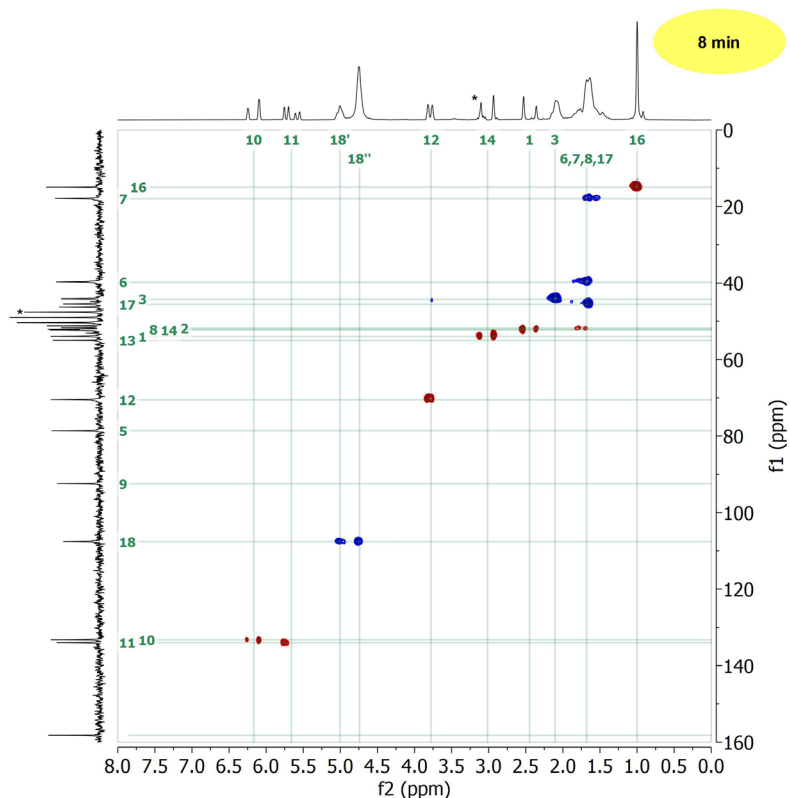


Figure 4: HSQC-ME spectrum of a 250 mM Gibberellic acid sample in MeOH-d_4 showing the correlation between the ^1H (horizontal) and ^{13}C (vertical) signals.

2D HMBC

To obtain long-range ^1H - ^{13}C correlations through two or three bond couplings, the Heteronuclear Multiple Bond Correlation (HMBC) experiment can be used. Figure 5 shows the HMBC spectrum of a 250 mM Gibberellic acid sample measured in 69 minutes on our Spinsolve 60 MHz. As an example, the long-range correlations of proton 11 with carbons 13 (orange), 12 (blue) and 9 (green) are marked with circles. The experiment shows the correlation with quaternary carbons, too.

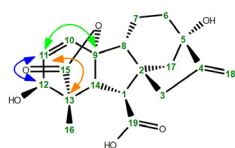


Gibberellic acid

Solvent = MeOH- d_4
Concentration = 250 mM
Frequency ^1H = 60 MHz

HMBC

Number of scans = 16
Repetition time = 1 s
Number of steps = 256
Total experimental time = 69 min



* residual solvent

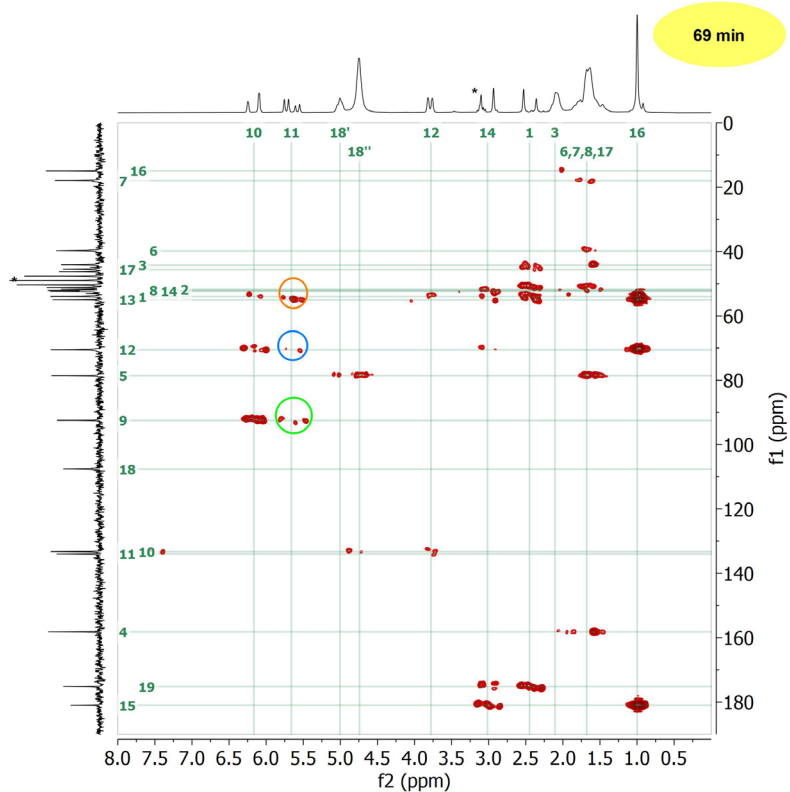


Figure 5: HMBC spectrum of a 250 mM Gibberellic acid sample in MeOH- d_4 showing the long-range couplings between ^1H and ^{13}C nuclei.