

WHAT IS CLAIMED

1. A method of diagnosing nitrogen deficiency in a plant comprising:
 - obtaining a Raman spectra of nitrate *in vivo* and *in situ* in tissue of a plant leaf at a first point in time, wherein the Raman spectra includes a peak characteristic of nitrate;
 - obtaining a Raman spectra of nitrate *in vivo* and *in situ* in the tissue of the plant leaf at a second point in time, wherein the Raman spectra includes the peak characteristic of nitrate;
 - comparing relative intensity of the peak characteristic of nitrate from the Raman spectra obtained at the first point of time with relative intensity of the peak characteristic of nitrate from the Raman spectra obtained at the second point of time; and
 - determining if there is a decrease in the relative intensity of the peak characteristic of nitrate from the Raman spectra obtained at the second point in time,
 - wherein a relative decrease in intensity of the peak characteristic of nitrate from the Raman spectra obtained at the second point of time is indicative of nitrogen deficiency.
2. The method of claim 1, wherein the tissue of the plant leaf is a leaf blade.
3. The method of claim 1 or 2, wherein the peak characteristic of nitrate in the Raman spectra is 1046 cm^{-1}
4. The method of any one of claims 1-3, wherein the Raman spectra is obtained using near-infrared excitation wavelength.
5. The method of claim 4, wherein the near-infrared excitation wavelength is 830 nm.
6. The method of any one of claims 1-5, wherein obtaining the Raman spectra is non-invasive and non-destructive to the tissue of the plant leaf.
7. A method of reversing the development of nitrogen deficiency in a plant comprising:
 - diagnosing nitrogen deficiency in a plant according to the method of any one of claims 1-6; and
 - adding a source of nitrogen to the plant.

8. The method of claim 7, wherein nitrogen is added to the plant by fertilizing the plant.