

Abstract:

Neutron radiographic methods are suitable for obtaining images of water distribution in intact plants. When a neutron beam irradiates a plant sample, the number of neutrons penetrating the sample decreases with the number of hydrogen atoms in the sample. Generally, plants contain more than 80% water, so a neutron image of a plant is approximately equivalent to its water distribution. In this study, the senescence of cut carnation flowers was observed using thermal neutron (TN) radiography and very cold neutron (VCN) radiography. A CCD-cooled camera intermittently photographed neutron images during neutron irradiation.

To evaluate the advancement of senescence, carbon dioxide production from a flower placed in a gas-tight container was measured using a CO₂ gas sensor. The gas-tight container had aluminum windows to allow better penetration of the neutron beam, and the sample was placed behind that window. Exogenous ethylene was added in order to force senescence.

A highly parallel TN beam provided high-resolution neutron images, and detailed images of the carnation ovary were obtained. VCN neutron images provided high-contrast images of water content due to the low energy of the neutron beam. From the neutron images obtained, petal wilting and dehydration, and shrinkage of the whole flower were observed. The decrease in water rate was calculated from the part of the sample in which the petal density was high. The change in the water rate corresponded with the change in respiration rate (climacteric).