**Title** Application of cold neutron and synchrotron x-ray imaging to investigate rose bent neck syndrome

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**Abstract**

Water status parameters of cut roses that determine bent-neck susceptibility and vase life were examined using cold neutron radiography and tomography (CNR, CNT) with $D_2O$ tracer at CONRAD, Helmholtz Center Berlin for Materials and Energy (former HMI) in Berlin, Germany. Also, structural and functional differences of the conductive tissue in bent neck-susceptible and resistant roses were evaluated using synchrotron x-ray tomography at BAM-line, BESSY (Berliner Elektronenspeicherring-Gesellschaft für Synchrotronstrahlung) in Berlin, Germany. The *Rosa hybrida* L. cultivars 'Akito' and 'Red Giant', respectively, which largely differ in their vase life and bent-neck resistances were used for the experiments. Cut rose samples were placed in a crystal glass tube with their stems immersed in pure water. CNR and CNT with $D_2O$ tracer was conducted to investigate water uptake before stressing well-watered plants. Then samples were drought-stressed by removing vase water for 4 or 6 h. After this treatment, water uptake by the samples was investigated by CNR and CNT with $D_2O$ tracer again. The obtained statistics in CNR and CNT of the rose stem was sufficient for a quantitative analysis of the data. As indicated by CNR, water flow velocity was different in stems of 'Red Giant' and 'Akito'. In this way it was proved that the $D_2O$ tracer method was applicable to observe xylem blockage in rose stems. The high resolution of the synchrotron tomographic images allowed the investigation of plant tissues micro structures. As a conclusion, the combination of CNR, CNT with $D_2O$ tracer and synchrotron tomography, are highly applicable to non-destructively and three dimensionally study the water movement in rose peduncles for the investigation of the bent neck syndrome and stem water transport in general.