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Urea uptake and nitrogen mobilization by apple leaves in relation to tree nitrogen status in autumn

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Summary

Bench-grafted Fuji/M.26 trees were fertigated with one of seven nitrogen concentrations (0, 2.5, 5, 7.5, 10, 15 or 20 mM), using a modified Hoagland's solution from 30 June to 1 September. In mid-October, plants in each N treatment were randomly divided into three groups. One group was sampled destructively to determine background tree N status before foliar urea applications. The second was painted with a 3% ^{15}N-enriched urea solution twice, at weekly intervals, on both sides of all leaves. The third group served as the control. All the fallen leaves from both the ^{15}N-treated and the control trees were collected during leaf abscission. The trees were harvested at the end of natural leaf fall. Nitrogen fertigation during the growing season resulted in a wide range of tree N status, as indicated by leaf N (1.3–3.5.g m^{-2}) in the autumn. The percentage of N partitioned into the foliage increased linearly with increasing leaf N content up to 2.2 g m^{-2}, then reached a plateau of 50–55% with further rise in leaf N. ^{15}N uptake and mobilization per unit leaf area and the percentage of ^{15}N mobilized

from the leaves decreased with increasing leaf N content. Of the ^{15}N mobilized back to the tree, the percentage of ^{15}N partitioned into the root system decreased with increasing tree N status. For the control trees, N mobilization per unit leaf area increased with increasing leaf N up to 3 g m^{-2}, then levelled off with any further increase in N content. The percentage of N mobilization remained at approximately 60% until leaf N reached 3 g m^{-2}, then declined with a further increase in leaf N content. Foliar ^{15}N-urea applications reduced mobilization of endogenous leaf N regardless of tree N status. On a whole-tree basis, foliar ^{15}N-urea applications increased the total amount of N across N fertigation treatments. We conclude that trees with low N status are more efficient in absorbing and mobilizing N from foliar urea than those with high N status. Likewise, more N derived from foliar urea is partitioned into the root systems of low N trees than of high N trees.