Carbohydrate sources used in new root growth following transplant of *Quercus rubra* L. seedlings

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**Abstract**

To determine the extent to which northern red oak (*Quercus rubra* L.) relies on current photosynthate when developing new roots following transplanting, 1+0 seedlings were transplanted and a batch of seedlings was exposed to 14CO2 at one of three successive growth stages as identified by the *Quercus* morphological index (QMI) (Hanson et al. 1986). Following a translocation period, seedlings were harvested at time of transplant (FIH) and prior to bud break (BUD). At the shoot linear (SL), leaf linear (LL), and lag (LAG) stages, groups of seedlings were removed from the growth chambers and current photosynthate was labeled with 14C in a gas-tight closed-loop chamber containing 14CO2. The seedlings were then placed in growth chambers for a translocation period of 48 hours. Following the translocation period, seedlings were separated by organ and flush, oven-dried, ground, and analyzed for 14C via accelerator mass spectrometry (AMS) at the Purdue Rare Isotope Measurement Laboratory (PRIME Lab).

**Introduction**

Few studies have examined carbon allocation in hardwood tree species that exhibit episodic growth patterns, characterized by the recurrent development of flushes throughout the growing season (Dickson et al. 2000a, Dickson et al. 2000b). Published literature, often using northern red oak as the species of interest, indicates that patterns of allocation vary greatly depending upon the growth stage of the seedling, as measured against the *Quercus* Morphological Index (QMI) (Dickson et al. 2000a, Dickson et al. 2000b, Hanson et al. 1986). Until now, most studies have focused upon allocation and partitioning patterns only during the first growing season. Additional studies are needed to better understand northern red oak seedling physiology will allow for the production of higher quality target seedlings and help to improve outplanting success.

**Materials and methods**

1+0 container-grown northern red oak seedlings of half-sib seed origin were transplanted into a mixture of sand and peat (1:1 by volume) in 7.6L pots and placed in environmental growth chambers (27°C/16h days, 21°C/8h nights). Seedlings were irrigated to maintain pots at container capacity. Unlabeled seedlings were harvested at time of transplant (FIH) and prior to bud break (BUD). At the shoot linear (SL), leaf linear (LL), and lag (LAG) stages, groups of seedlings were removed from the growth chambers and current photosynthate was labeled with 14C in a gas-tight closed-loop chamber containing 14CO2. The seedlings were then replaced in growth chambers for a translocation period of 48 hours. Following the translocation period, seedlings were separated by organ and flush, oven-dried, ground, and analyzed for 14C via accelerator mass spectrometry (AMS) at the Purdue Rare Isotope Measurement Laboratory (PRIME Lab).

**Results and Discussion**

Significant new root growth occurred beginning at the shoot linear stage of growth, while current photosynthate contributed to root growth only after the flush matures. Additionally, current photosynthate begins to accumulate in old roots during lag phase, perhaps to replenish depleted carbohydrate reserves (Fig. 2, Table 1). The apparent reliance upon stored carbohydrates for post-transplant root initiation highlight the potential importance of managing for ample carbohydrate reserves during nursery production.

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**References**


