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Growth and Foliar Nutrition of Douglas-Fir Seedlings Provided with Supplemental Polymer-Coated Fertilizer

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ABSTRACT: *Polymer-coated fertilizer (PCF) provides a potential means to optimize nutrient delivery for plant uptake, while minimizing leaching. Coating technology varies by manufacturer, which may alter patterns of nutrient release over time among comparable products. Three months following sowing, Douglas-fir (*Pseudotsuga menziesii *(Mirb.) Franco) seedlings were transplanted into containers with Osmocote Plus (OS) (15-9-12) and Apex (AP) (16-5-9) PCF (each with 5–6 month longevity) applied at four rates (0, 600, 1200, and 1800 mg total N per seedling) as a supplement to periodic addition of conventional water-soluble fertilizer. Seedlings fertilized with OS had 11% greater stem diameter growth during the first 4 months after transplant than those fertilized with AP, but differences were negligible after 9 months. After 4 months, foliar concentrations were 11% higher for N and 10% higher for P in seedlings fertilized with AP, although contents were the same. These results suggest that different PCF types have variable temporal patterns of nutrient release, which may affect seedling development over time. Differences among products must be understood by growers to help formulate fertilizer prescriptions that optimize plant response. Seedling response varied marginally among PCF rates, suggesting little benefit to PCF when used in conjunction with water-soluble fertilizer. West. J. Appl. For. 20(1):58–63.*

Key Words: Controlled-release fertilizer, seedling nutrition, reforestation, container nursery, *Pseudotsuga menziesii.*

A goal of forest tree nursery operations is to produce high-quality seedlings with target characteristics capable of maximum performance potential after outplanting into the field (Rose et al. 1990). Mineral nutrition is a critical aspect of seedling quality. Fertilization during nursery culture can enhance plant growth, nutrient storage reserves, root growth potential, and resistance to drought stress, freezing temperatures, and diseases (Landis 1985, Rook 1991, van den Driessche 1991).

Use of controlled-released fertilizer (CRF) as a means to optimize nutrient delivery in the nursery has increased greatly in the last decade (Donald 1991, Haase and Rose 1997). Compared to conventional water-soluble fertilizers, CRF offers the advantage that a single application can supply seedlings with enhanced nutrition throughout a growing season while minimizing seedling damage or nutrient loss through leaching (Hauck 1985, Bunt 1988, Donald 1991). Use of CRF has potential to decrease nursery labor and fertilizer costs while also reducing groundwater pollution associated with nutrient runoff. However, specific research concerning the use of CRF in forest tree nurseries, particularly with Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco), has been limited.

Many CRF types are currently marketed for use with forest tree seedlings. CRF types differ by nutrient formulation, coating, and estimated nutrient release rate. Polymer-coated fertilizer (PCF) comprises the majority of CRF used in containerized nursery plant production (Bunt 1988, Goertz 1993, Huett and Gogel 2000). Nutrient release from PCF is activated by the diffusion of water through the prill membrane, which creates an osmotic pressure gradient leading to outward leakage of the nutrient solution into the growing media (Gambash et al. 1990). Media temperature is the primary environmental mechanism controlling this process (Kochba et al. 1990), with release rates increasing with increasing temperature (Kochba et al. 1990, Huett and Gogel 2000). Labeled release rates are based on manufacturer's

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