

Growth and Development of Lingonberry Cultivars as Affected by In Vitro and Ex Vitro Culture Methods and Source Propagule

Samir Debnath*¹

¹Atlantic Cool Climate Crop Research Centre, Agriculture and Agri-Food Canada, St. John's, NL, A1E 5Y7, Canada

The morphological development of lingonberry (*Vaccinium vitis-idaea* L.) plants propagated either by conventional softwood cuttings or by in vitro shoot proliferation from nodal explants or by shoot regeneration from excised leaves of micropropagated shoots, was studied in cultivars 'Regal', 'Splendor', and 'Erntedank'. Significant differences were observed between the treatments. In vitro-derived plants produced more shoots branches and rhizomes in contrast to conventional cuttings which rarely produced rhizomes. Plants propagated from cuttings had a lower number but vigorous shoots and thicker rhizomes than in vitro-derived plants. Source propagule had significant effect on multiplication rate. Another experiment evaluated the effect of indole-3-butyric acid (IBA) application to softwood cuttings on subsequent rooting, shoot development, and rhizome production. Treating cuttings with IBA did not significantly improve rhizome formation and elongation. In vitro culture on nutrient medium apparently induces the juvenile branching characteristics that favored rhizome production. The advantage of rhizome production of in vitro-derived plants over stem cuttings varied among genotypes.

Comparative In Vitro Growth and Development of Easy- and Difficult-to-Acclimatize Sea Oats (*Uniola paniculata* L.) Genotypes

Carmen Valero Aracama*¹, Michael E. Kane², Nancy L. Philman³, Sandra B. Wilson⁴

¹Univ. of Florida, Environmental Horticulture, Gainesville, FL 32611; ²Univ. of Florida, Environmental Horticulture, Gainesville, FL 32611; ³Univ. of Florida, Environmental Horticulture, Gainesville, FL 32611; ⁴Univ. of Florida, Environmental Horticulture, Ft. Pierce, FL 34945-3138

A sea oats (*Uniola paniculata* L.) micropropagation protocol was previously developed for 28 genotypes that favored multiplication and rooting of shoots in vitro. However, microcutting size, morphology, and acclimatization ex vitro varied considerably among genotypes. In the present study we evaluated the effect of Stage III duration on in vitro morphology, biomass production, and ex vitro survivability of easy- (EK 16-3) and difficult-to-acclimatize (EK 11-1) sea oats genotypes. After 3, 6, and 9 weeks at Stage III, survivability of microcuttings was 85%, 96% and 98% for EK 16-3, and 2%, 27% and 40% for EK 11-1, respectively. After 9 weeks Stage III, EK 16-3 microcuttings had higher shoot dry weights but lower root dry weights than in EK 11-1. Moreover, roots in EK 11-1 were fewer but longer than in EK 16-3. Leaf production was similar in both genotypes. However, leaf elongation was significantly inhibited in EK 11-1, in which 95% of the leaves were ≤ 15 mm long in contrast with EK 16-3, with 50% leaves ≥ 16 mm long after 9 weeks Stage III. Light microscopy examinations showed anatomical similarities between EK 16-3 in vitro leaves and mature ex vitro leaves. Conversely, short in vitro leaves of EK 11-1 exhibited mesophyll disruption and reduced cuticle development. Conceivably, the short leaves had limited photosynthetic competency, thereby reducing ex vitro survival of rooted EK 11-1 microcuttings.

Seed Production of Field- and Greenhouse-Grown Herbaceous Ornamental Plants: Flowering and Pollinator Effects

Susan M. Stieve*¹, David Tay²

¹The Ohio State Univ., Ornamental Plant Germplasm Center, Columbus, OH 43210; ²The Ohio State Univ., Ornamental Plant Germplasm Center, Columbus, OH 43210

Seeds of herbaceous ornamental accessions conserved by the USDA National Plant Germplasm System (NPGS) are traditionally produced in summer field cages with honey bees (*Apis mellifera*) when pollinators are required. Efficient methods to produce high-quality seed in greenhouses may allow for year-round seed production. Flower quantities and effects of pollinators on number and weight of seed produced were studied in field cages and greenhouses at the Ornamental Plant

Germplasm Center in 2003 in a randomized complete-block experiment. Honey bees, bumblebees (*Bombus impatiens*), or blue bottle flies (*Diptera calliphoridae*) were used as pollinators. Field cages and greenhouse compartments with no pollinator were controls. Cultivars used were *Antirrhinum majus* 'Gum Drop', *Coreopsis tinctoria* 'Plains Bicolor', *Dianthus chinensis* 'Carnation' (NPGS accession NSL 15527), *Rudbeckia hirta* 'Indian Summer', and *Tagetes patula* 'Jaguar'. Seeds were harvested, cleaned, weighed, and 100-seed weights calculated. On average *Antirrhinum*, *Dianthus*, *Rudbeckia* and *Tagetes* produced more flowers in greenhouses, *Coreopsis* produced more flowers in the field. *Coreopsis* and *Rudbeckia* produced more seed per flower on average with field pollination by honey bees, *Antirrhinum* and *Dianthus* produced most with bumblebees in the field, and *Tagetes* produced most with blue bottle flies in the greenhouse. Each genus had similar 100-seed weights on average in all treatments. Results show pollinators other than honey bees are useful for herbaceous ornamental seed production and that seed production in greenhouses may be an alternative method for seed production of herbaceous ornamentals.

Amylase and Endo- β -mannanase Related to the Germination of Eggplant Seeds

Yu Sung*¹

¹National Chung-Hsing Univ., Hort. Dept., Taichung, Taiwan, 402, R.O.C.

Germination of 'Fond May' eggplant seeds at 25°C could be increased by after-ripening fruit or fresh seed treated with KNO₃ or GA₃ or priming. There were high amount of starch and low amount of soluble sugar in after-ripening seed or primed seed. The amount of soluble sugar in after-ripening seed was higher than that in control seed before the radicle protrusion at 25 °C and 25/30 °C. Starch amount in after-ripening seed imbibed at 25/30 °C was significantly high. Soluble sugar in un-after-ripening seed imbibed at 25 °C for 2–3 days had higher amount and the high activity of β -amylase was appeared in the second days. Activity of amylase in primed seed imbibed at 25 and 25/30 °C for 3 days increased. The activity of endo- β -mannanase was high in after-ripening or priming or GA₃ treated seed at 25 °C.

Oral Session 35—Nursery Crops

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Isotopic and Nonisotopic Estimation of Nitrogen Fertilizer Uptake in Container-grown Woody Ornamentals

David R. Sandrock*¹, Timothy L. Righetti², Anita N. Azarenko³

¹Oregon State Univ., Dept. of Horticulture, Corvallis, OR 97331; ²Oregon State Univ., Dept. of Horticulture, Corvallis, OR 97331; ³Oregon State Univ., Dept. of Horticulture, Corvallis, OR 97331

Accurate methods for determining the fate and recovery of nitrogen (N) fertilizer applied to container-grown nursery crops are essential to comply with regulations and develop innovative fertilizer programs. The objectives of this study were (i) to use ¹⁵N techniques to determine the fate of fertilizer N, (ii) to compare nonisotopic and isotopic methods of determining N recovery, and (iii) to determine the relative importance of fertilizer and non-fertilizer N at rates of 25, 50, 100, 200, and 300 mg·L⁻¹ in container-grown *Euonymus alatus* (Thunb.) Sieb., *Cornus sericea* L., and *Weigela florida* (Bunge) A. DC. In all species, root and shoot N increased with N rate, and at each rate more N was stored in the roots than in the shoots. Estimation of N recovery determined by the total N method (Kjeldahl N/applied N) was significantly higher for all species and at each N rate than estimation of N recovery determined by the labeled fertilizer N method (labeled N/total applied N). Increasing fertilizer rates up to 100 mg·L⁻¹ resulted in increased uptake of N derived from other sources (NDFO). NDFO at low N concentrations was a significant portion of the total N in the plant. As a result, the difference in estimation of percent N recovery between each method was larger at lower N concentrations for all