(psbA, rbcL-ORF106, atpB-rbcL). PCR products generated from these three domains were digested by 12 restriction enzymes. RFLPs were detected among varieties and subjected to the UPGMA. Thirty-six varieties were classified approximately into two groups: "Plum group" and "Cherry group." It was inferred that these two groups were divided in old time. *P. tomentosa*, *P. japonica*, *P. glandurosa*, and *P. besseyi*, which are classified into the cherries, showed the same fingerprint patterns from chloroplast DNA of the plum group; plums and cherries have a large genetic diversity. It was supposed that the diversity of plums depended on nuclear DNA, besides the diversity of cherries on both nuclear and chloroplast DNA.

092

Genetic Relationships of Diploid Plums Based on RAPD Polymorphisms

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Diploid plums such as *Prunus salicina*, *P. simonii*, *P. cerasifera*, *P. americana*, *P. angustifolia*, *P. mexicana*, and their hybrids have a high level of RAPD polymorphisms. Of 71 successfully used primers, there are 417 reproducible RAPD markers and only 55 (13%) markers are not polymorphic. Genetic relationships of these diploid plums based on RAPD data is estimated using genetic distance (GD) defined as $GD_{ij} = 1 - S_{ij}$, where S_{ij} is similarity coefficient. Two similarity coefficients, Jaccard's and simple matching coefficient, are compared. Simple matching always yields higher similarity coefficients. Genetic distance within and between each gene pool: California, southeastern U.S., foreign, is estimated. Genetic distances of these diploid plums ranged from 0.32 to 0.68, and agreed well with the natural geographic distribution of the species. The cluster analysis using unweighted pair-group methods using arithmetic averages (UPGMA) was used to construct phenograms to summarize the relationships among these cultivated diploid plums and plum species.

093

Heritability, Genetic, and Phenotypic Correlations of Several Peach Traits

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Heritability estimates are useful to predict genetic progress among offspring when the parents are selected on their performance, but they also provide information about major changes in the amount and nature of genetic variability through generations. Genetic and phenotypic correlations, on the other hand, are useful for better planning of selection programs. In this research, seedlings of 39 families resulting from crosses among 27 peach [*Prunus persica* (L.) Batsch] cultivars and selections were evaluated for date of full bloom (DFB), date of ripening (DR), fruit period development (FDP), flower density (FD), node density (ND), fruit density (FRD), fruit weight (WT), soluble solids content (SS), apical protuberance (TIP), red skin color (BLUSH), and shape (SH) in 1993 and 1994. The data were analyzed using the mixed linear model. The best linear unbiased prediction (BLUP) was used to estimate fixed effects and predict breeding values (BV). Restricted maximum likelihood (REML) was used to estimate variance components, and a multiple-trait model to estimate genetic and phenotypic covariances between traits. The data indicates high heritability for DFB, DR, FDP, and BLUSH, intermediate heritability for WT, TIP, and SH, and low heritability for FD, ND, FRD, and SS. They also indicate year effect as a major environmental component affecting seedling performance. High correlation estimates were found between some traits, but further analysis is needed to determine their significance.

45 ORAL SESSION 11 (Abstr. 091–100) Nutrition/Floriculture

094

Influence of Fertilizer Rregime on Leaf Chlorosis/Necrosis of Two Varieties of Chrysanthemum

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'Tara' and 'Boaldi' were fertilized with 150 and 450 ppm from 20N–4.7P–16.6K soluble fertilizer and moved at flowering to postproduction conditions (21 ± 2C and 10 $\mu mol \cdot m^{-2} \cdot s^{-1}$). Shipping was simulated for 1 week at 26C. 'Tara' exhibited burned leaf margins (necrosis) and chlorosis following shipping. At 150 ppm, leaves had brown, dried margins, but the damage did not progress indoors. Necrosis was worse at 450 ppm. Leaf chlorosis/necrosis of non-shipped plants at the 450 fertilizer level did not appear until the 3rd week indoors. At experiment termination, no leaf damage occurred in non-shipped 'Tara' or 'Boaldi' with 150 ppm. 'Boaldi' did not show damage after shipping regardless of the treatment but symptoms (necrosis and wilting of leaves) evolved during the first 2 weeks indoors on plants fertilized with 450 ppm. A 50% reduction in root soluble carbohydrates was found at the highest fertilizer rate at flowering, suggesting that leaf chlorosis/necrosis is related to carbohydrate depletion in chrysanthemum.

095

Aluminum Amendments Increase Retention of Triple Superphosphate-P in Soilless Container Media

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Soilless container medium components such as peatmoss and perlite have almost no capacity to retain PO_4-P, and preplant amendments of triple superphosphate (TSP) are readily leached. Al amendments were tested to reduce P losses from these media. $Al_2(SO_4)_3$ solutions at rates of 320 and 960 µg Al/cc were applied to a 70 peat : 30 perlite medium and dried at 70C. Adsorption isotherms were created at 25C for the $Al_2(SO_4)_3$-amended media and an unamended control using solutions of $Ca(H_2PO_4)_2$ at concentrations of P ranging from 0 to 500 $\mu g \cdot ml^{-1}$. Isotherms showed that P retention increased as Al concentration increased. In a greenhouse study, *Dendranthema xgrandiflorum* 'Sunny Mandalay' was grown in these media with 100 g P/m^3 from TSP incorporated into the mixes before planting. PO_4-P, soluble Al, and pH were determined on unaltered medium solutions collected throughout the cropping cycle and foliar analyses were determined on tissue collected at mid- and end-crop. The highest rate of Al was excessive and resulted in low pH and soluble Al levels in the medium solution early and in the cropping cycle, which were detrimental to plant growth. When Al was applied at 320 µg/cc, soluble Al levels in medium solution were not significantly higher than in the unamended control, PO_4-P leached from TSP was reduced, and sufficient PO_4-P was released throughout the cropping cycle to result in optimal plant growth.

096

Persistence and Replacement of Preplant Fertilizers from Highly Leached Peat-based Root Media

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A series of experiments was conducted to quantify the rate of nutrient loss from a container medium in a 15-cm-wide (1.3-liter) pot with a container capacity (CC) of 0.7 liter/pot under mist propagation and to determine the effectiveness of reapplying fertilizer to medium at 90% of CC with either top watering or subirrigation. Reducing the volume of water applied per day decreased the rate of nutrient leaching. Based on CC leached (CCL), the rate of nutrient loss was similar for all treatments. Differences in the rate of macronutrient removal from the media were measured, but, by 2 CCL, the concentration of all nutrients tested was below acceptable levels for the saturated media extract. With top watering, reapplying water-soluble fertilizer (WSF) at volumes under 0.2 liter/pot did not affect the nutrient concentration in the lower half of the pot at WSF concentrations up to 86 mol N/m^3. Applying up to 0.8 liter/pot did increase nutrient concentrations in the lower half of the pot, but the media nutrient concentrations were lower than that of the applied WSF concentration. Applying WSF with subirrigation was limited by the moisture content of the media prior to the irrigation.

097

Effect of Lime, Irrigation Water Quality, and Water-soluble Fertilizer on pH and Macronutrient Management of Peat-based Root Media

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Impatiens were planted into peat-based media containing two dolomitic liming materials [$Ca(OH)_2 \cdot Mg(OH)_2$ at 1.8 $kg \cdot m^{-3}$ or $CaCO_3 \cdot MgCO_3$ at 8.4 $kg \cdot m^{-3}$] and subirrigated for 17 weeks using four irrigation water qualities (IWQ) with varied alkalinity, Ca^{2+}, Mg^{2+}, and SO_4-S content and three water-soluble fertiliz-

ers (WSF) with varied NH_4:NO_3 ratio, Ca^{2+}, Mg^{2+}, and SO_4-S content. After 8 weeks, medium pH ranged from 4.5 to 8.5. Lime type did not affect the long-term increase in medium pH, Ca^{2+}, and Mg^{2+} concentrations with IWQ/WSF solutions containing low NH_4-N and high Ca^{2+} and Mg^{2+} concentrations. The carbonate *lime did buffer* the medium pH, Ca^{2+}, and Mg^{2+} concentrations with IWQ/WSF *solutions* containing high NH_4-N and low Ca^{2+} and Mg^{2+} concentrations. With both lime types, there was a linear increase in tissue Ca and Mg as the applied concentrations increased from 0.5 to 4.0 mol•m^{-3} Ca^{2+} and 0.3 to 3.0 mol•m^{-3} Mg^{2+} with the various IWQ/WSF. The relationship was similar for both lime types up to week 8, after which tissue Ca and Mg decreased with the hydrated lime and low solution Ca^{2+} and Mg^{2+}. Relationships were also developed between the applied SO_4-S concentration and tissue S and medium pH and tissue P.

098

Controlled-release Fertilizer and Constant Media Moisture Affects the Growth of a Salt-sensitive and Salt-tolerant New Guinea Impatiens Cultivar

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Salt-sensitive ('Illusion') and salt-tolerant ('Blazon') New Guinea impatiens cultivars were grown for 70 days with a controlled-release fertilizer at 3.3, 6.6, or 9.9 g/pot under constant media moisture of 1–3 kPa or 4–6 kPa. Optimum growth for both cultivars occurred using 6.6 g/pot and a media moisture level of 1–3 kPa. The leaf area (LA), leaf number (LN), leaf dry weight (LDW), stem dry weight (SDW), and root dry weight (RDW) were significantly reduced at 9.9 g/pot in 'Illusion', with values similar to those at 3.3 g/pot. LDW, SDW, RDW, LA, and LN were similar for 6.6 g/pot and 9.9 g/pot in 'Blazon'. At 4–6 kPa LDW, SDW, RDW, LA, and LN decreased from low to high in 'Illusion'. LA in 'Blazon' also decreased from low to high, but LDW, SDW, RDW, and LN were unaffected. Media EC levels were greater in the upper half of the media regardless of moisture level. EC values as high as 7.3 dS•m^{-1} in the upper half of the media and as high as 5.2 dS•m^{-1} in the lower half of the media were measured without causing plant mortality.

099

Response of New Guinea Impatiens to Various Levels of Salinity in a Subirrigation System

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Concerns over groundwater contamination due to greenhouse runoff have caused many growers to turn to subirrigation as an alternative watering method. One reported problem is the movement of salts to the top layer of the rootzone due to zero leaching. Many growers are faced with the added challenge of subirrigating plants with poor-quality water than contains a high salt content before the addition of fertilizer. An experiment was conducted to investigate the movement of salts in the root zone and the effects on root development and overall plant growth. Plants were grown using water treated with NaCl + $CaCl_2$ (1:1 equivalent basis) at the following total concentrations: 0, 2, 4, 6, 8, 10, 14, and 18 mM. Treatment time was 10 weeks (marketable stage). At harvest, height was measured and plants were cut off at the soil line and divided into shoots (stems and leaves) and roots for fresh and dry weight. Leaf area was measured. The root zone was divided into three layers—top, middle, and bottom (≈3 cm each). Roots were separated from each soil layer and soil samples collected for measuring EC and pH using 1:2 dilution. Soil samples showed EC in the top layer of the root zone was much higher than the middle and bottom layers. Root weight also decreased substantially in the top layer of the root zone. Height, FW, DW, and leaf area of plants did decrease with increasing salt concentration, indicating that the detrimental effects of poor-quality water on subsequent plant growth, especially in a subirrigation system.

100

Effects of Fertilizers, Salinity, and Medium on Growth of *Phalaenopsis* Orchid

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Seedling *Phalaenopsis* (*P.* Taisuco Eagle x *P.* Taisuco Rose) plants with an 8- to 10-cm leaf span were grown in 10-cm pots filled with a medium consisting of 70% fine fir bark and 30% peatmoss (by volume). Plants were given (in N–P_2O_5–K_2O) 10–30–20, 15–10–30, 15–20–25, 20–5–19, 20–10–20, or 20–20–20 fertilizers at the 100 or 200 mg N/liter rate. Pots were leached with water following every two fertigations. After 7 months, leaf span, leaf size, total leaf area, and fresh weight were not affected by fertilizer type. The differences in leaf numbers were small. The higher rate of fertilizer resulted in plants with wider leaf span (32.8 vs. 28.5 cm), more (5.5 vs. 4.8), larger (103 vs. 89 cm^2) leaves, and greater total leaf area (355 vs. 275 cm^2) than did the lower rate. In another experiment, similar plants with a leaf span of 15 to 18 cm were grown in 10-cm pots with 100% fine fir bark or a mixture of 80% fine fir bark and 20% peatmoss. They were fertigated with water having an EC - 0.05, 0.40, 0.75, 1.10, or 1.40 dS•m^{-1} containing 1 g•liter^{-1} 20–20–20 fertilizer three times and then drenched with their respective water containing 0.6 g•liter^{-1} Ca $NO_3)_2$•$4H_2O$. After 11 months, water salinity did not affect the date of spiking. Plants receiving water with EC = 1.10 dS•m^{-1} had more leaves and spikes than other treatments. Plants in the bark/peatmoss mix began spiking earlier, had more leaves (6.7 vs. 5.7), and more inflorescences (1.9 vs. 1.5) than those in 100% bark. There was no salinity x medium interaction in all the parameters recorded.

100A

Phytotoxicity and Plant Growth Regulation Associated with Insecticidal Dipping of Rooted Poinsettia Cuttings

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Potential phytotoxicity and plant growth-regulating activity of insecticidal dips for poinsettias was investigated by dipping, then growing unpinched, rooted cuttings of 'Red Sails', 'Freedom', and 'V-14 Glory' in the following insecticidal emulsions for five durations: 2% insecticidal soap (Safer's), 2% horticultural oil (Sunspray Ultrafine), fluvalinate (Mavrik Aquaflow), oxythioquinox (Joust), kinoprene (EnstarII), azadirachtin (Margosan-O), fenoxycarb (Precision), and an oil-carrier formulation of *Beauveria bassiana* (Naturalis-L). Dips in soap, oxythioquinox, Naturalis-L, and oil were phytotoxic to all three cultivars. Also, kinoprene and fenoxycarb were phytotoxic to 'Red Sails'. At dip durations of 10 s and greater, soap, Naturalis-L, and oil were phytotoxic. Oxythioquinox was phytotoxic at durations of 1 min, 15 min, and 1 h. Only fluvalinate was not phytotoxic as a 4-h dip. After 2 weeks, plants dipped in oxythioquinox, Naturalis-L, and oil were stunted. By week 4, differential cultivar effects were seen: six dips (all but fluvalinate and azadirachtin) stunted growth of 'Red Sails', whereas only Naturalis-L and oil retarded growth of 'V-14 Glory'. Six weeks after treatment, growth of all cultivars was stunted by oxythioquinox, Naturalis-L, and oil, but was not retarded by fluvalinate or azadirachtin. Dip duration significantly affected growth by weeks 4 and 6, when all durations of Naturalis-L and oil reduced growth. Additionally, 4-h dips of oxythioquinox and kinoprene stunted plants after 4 weeks, and 1- and 4-h dips of oxythioquinox, kinoprene, and fenoxycarb adversely affected growth after 6 weeks.

46 ORAL SESSION 12 (Abstr. 101–108) Growth Regulators/Fruits & Nuts

101

Improving Fruit Firmness and Reducing the Need for Hand-thinning in Peach by using Sprays of Release® LC

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'Loadel' cling peach [*Prunus persica* (L.) Batsch] trees were sprayed with Release® LC (Abbott Laboratories, North Chicago, Ill.) in 1993. Preharvest (harvested 16 July) sprays of 50, 75, 100, and 120 ppm applied on 15 June improved fruit firmness without altering fruit maturity (flesh color by commercial standards) in 1993. In the following 1994 season, flower number per centimeter of shoot length was reduced by sprays ranging from 50 to 120 ppm applied on 15 June and 9 July. No hand-thinning was required on trees treated on 15 June. Trees treated 9 July had 50% fewer fruit removed than on untreated trees, where more than 3000 fruit were removed by hand-thinning. Salable yield was higher than untreated control trees where Release® LC had been applied at 50 ppm on 15 June and 9 July. Fruit size equaled those of hand-thinned controls. As concentration increased on 15 June, salable yield decreased linearly. Fruit size (diameter and individual weight) increased with reductions in salable yield. Interestingly, fruit were evenly distributed along shoots after Release® LC treatment, similar to those found after hand-thinning. Release® LC will be available for commercial