to plants over an extended time period. In citrus production, a season-long supply of nutrients from a single controlled release fertilizer (CRF) application would be beneficial if it can reduce application costs, enhance nutrient uptake by the trees, and reduce the leaching of nutrients, especially nitrate-N to groundwater. The objectives of this study were to test the impact of two CRFs alone and in combination with quick release fertilizer (QRF) on groundwater nitrate concentrations, fertilizer N uptake, and fertilization costs in a mature 'Valencia' orchard. A field experiment was established in a 16.2-ha orchard of 'Valencia' sweet oranges, using large plots of 174 trees (6 rows × 29 trees) to permit groundwater monitoring. Two groundwater monitoring wells were installed near the centerline of each plot and water samples were collected monthly for analysis of pH, EC, ORP, and nitrate-N concentration. The standard 100% N fertilization rate for these trees was 202 kg·ha^{-1} per year in 2005 and 224 kg·ha^{-1} per year in 2006. CRF1 was a commercial coated granular 15–3–19 (15%N–1.3%P–15.8%K) product designed to supply mature trees with nutrients for 12 months. CRF2 was a 10–2–12 (10%N– 0.874%P–9.96%K) liquid product based on urea formaldehyde and designed to supply nutrients over a 2- to 4-month period. Treatments consisted of one QRF and the two CRF fertilizers in the following combinations: (1) 100% QRF in four splits/year; (2) 75% CRF1 in one winter application; (3) 50% CRF1 in one winter application; (4) 25% QRF in winter, followed by 50% CRF1 in spring; (5) 50% CRF1 in winter, followed by 25% QRF in spring; (6) 75% CRF2 in three splits/year. Average nitrate-N concentrations in the groundwater were significantly affected by fertilizer treatments in the first 20 months of the experiment. Treatments were ranked 1, 5, 4, 2, 3, 6 in order of decreasing groundwater nitrate-N impact but treatment 6 supplied inadequate nutrients to the trees for normal production.

Specified source(s) of funding for the work presented in this abstract: Department, College, State and/or HATCH

8:15–8:30 am

Lime (Kagzi Lime): A Novel Source of Bioactive Principles

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Mexican lime (*Citrus aurantifolia* Swingle) is called kagzi lime in India and mainly used for pickles. Lime has certain health-maintaining properties. While conventional wisdom says citrus fruits are a good source of vitamin C, recently emerging research suggests that citrus may have at least 100 bioactive compounds, such as flavonoids, limonoids, folic acid, carotenoids. Some of these compounds have potential for prevention of certain diseases, based on in vitro and in vivo studies. Our study was focused on the isolation and characterization of specific bioactive principles from kagzi lime seeds from India. Seeds were dried, powdered, and subjected to successive extraction using hexane and ethyl acetate in a Soxhlet-type extractor. Furthermore, EtOAc extract was subjected to purification on a silica gel column using different mobile phases. The fractions were analyzed by TLC and HPLC. Fractions with similar peaks were pooled and crystallized to obtain two compounds, which were identified by mass spectra as limonin (0.14 %) and sitosterol glucoside (0.011%). This is the first report on the isolation of these compounds from *C. aurantifolia*. It is possible that the results of the study may open a new vista for industrial utilization of seeds for bioactive principles. This project is based upon work supported by the USDA-CSREES #2006-34402-17121, "Designing Foods for Health," through the Vegetable and Fruit Improvement Center.

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8:30–8:45 am

Growth Flush and Flowering is Delayed by Winter Drought Stress in 'Valencia' Orange Trees

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We determined if drought stress during winter could delay spring vegetative flush and flowering of 'Valencia' sweet orange trees in order to avoid young fruit loss during late-season mechanical harvesting. Using Tyvek® as a rain shield groundcover under 10-year-old trees, four treatments were begun in December: 1) drought, no irrigation and covered soil; 2) partial drought, occasional irrigation under the cover; 3) rain only, no irrigation, no cover; and 4) normal irrigation, no cover. There were significant treatment differences in soil water and midday covered leaf water potentials throughout January and February. Flush growth and flowering were visible about 1 Feb. in irrigated treatments but was delayed about 4 weeks in the drought stressed treatments. Covers were removed during the third week in February and normal irrigation and fertilization was resumed. Bi-weekly numbers of mature leaves per branch, new expanding leaves, flower buds and flowers revealed less initial growth and flowering in drought stressed treatments but this difference diminished in March after treatments ceased. Fruit growth after delayed bloom in the drought treatment partially caught up with the previously well watered treatments since early fruit development occurred later in the season during warmer weather. New flush growth and flowering clearly were delayed by winte-time drought and final yield will determine if the delay in flowering was accomplished without loss of yield or fruit quality.

8:45–9:00 am

Nitrogen and Phosphorus Applications for Fertigated Young Navel Orange Trees in Arizona

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A field experiment was conducted using 7- to 9-year-old trees in central Arizona (AZ) to evaluate effects of N and P fertigation on leaf N and P concentrations, fruit yield and quality along with N and P removal in 'Newhall' and 'Fukumoto' navel oranges (*Citrus sinensis*) on 'Carrizo' citrange (*Porcirus trifoliata* × *Citrus sinensis*) rootstock. Trees were grown in a calcareous Gilman fine sandy loam soil. The experiment included 5 × 2 factorial design with five N rates (0, 91, 181, 272, 363 g of N/tree/year) from urea ammonium nitrate (32–0–0) and two P rates (0, 91 g of P/tree/year) from phosphoric acid (0–52–0). Phosphorus application did not affect yield, juice quality, leaf N and P concentrations or N and P removal in fruit. Leaf P in most of the treatments of both varieties was above the critical tissue P rate of 12 mg·g^{-1}. Maximum yields occurred at N rates of 150 to 250 g of N/tree/year equal to about 27% to 33% of currently recommended N rates for flood irrigated citrus grown in Arizona. At these rates, leaf N concentration was at or near the critical level of 25 to 27 mg·g^{-1} N removal in fruit accounted for 50% to 84% of the N applied in both varieties so N use efficiency was relatively high. N rate did not affect fruit quality. Our results suggest that optimum N rates for microsprinkler-irrigated 'Newhall' and 'Fukumoto' navel orange trees are much lower than currently recommended N rates.