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POSTHARVEST PRESERVATION OF BLUEBERRIES (*VACCINIUM CORYMBOSUM*) CV. BLUECROP

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Due to increased consumer awareness of pesticides in fruits, a nonchemical approach using modified atmosphere is preferred for postharvest preservation. Blueberries cv. Bluecrop, organically grown in western Washington, were subjected to postharvest treatments of decreased oxygen and increased carbon dioxide concentrations under controlled conditions. Fruit was stored at 0C for prolonged storage periods. Oxygen and carbon dioxide were monitored at regular intervals. Quality parameters including freshness, berry firmness, and moisture loss were recorded periodically. Under imposed gas mixtures of decreased oxygen and increased carbon dioxide, blueberries maintained the original freshness and quality for extended postharvest periods up to 65 days. The major advantages of this system are reduction in decay caused by *Botrytis cineraria* and reduction in moisture loss.

THERMOPERIODIC EFFECTS DURING PEACH SEED STRATIFICATION

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According to some studies, thermoperiodic cycling at temperatures between 9 to 15 and 6C accelerate the required chilling accumulation for dormancy release of leaf buds of rooted peach shoots. Buds and seed of a cultivar require about the same amount of chilling for dormancy release. Seed experimentation logistics are advantageous. Therefore, we tested the effect of thermoperiodic cycling temperatures on peach seed chilling. 'Johnson Elberta' seed were rinsed in running water for a 24-hr period before they were placed on blotters in 9-cm petri dishes with 6 ml of 0.3% Captan solution. Dishes were sealed against water loss with parafilm. The containers were automatically transferred by an elevator apparatus between 2 and 14C chambers on 12/12-, 14/10-, 16/8-, and 18/6-hr cycles. A low isothermal chilling temperature had the best efficiency for seedling emergence. Cycled temperature treatments were no more efficient in removal of seed dormancy than isothermal treatment.

SIMAZINE RESIDUES IN CITRUS ORCHARD SOILS UNDER LONG-TERM CHEMICAL WEED CONTROL

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Simazine is a pre-emergent herbicide of low water solubility (5 ppm) that is long-lasting and has high crop selectivity. Simazine residues in a citrus orchard, portions of which have been under chemical weed control for an extended period, were quantified. The orchard is located in the semi-tropical region of South Texas on alluvial Hidalgo sandy clay soil of relatively uniform

profile. The orchard investigated had been included in a long-term weed control study lasting 30 years. Three treatments were established based upon the history of the herbicide use. Treatment A had received herbicide applications for 30 years and simazine applications during the last 8 years (22.8 kg·ha⁻¹ total simazine application). Treatment B was mechanically cultivated without herbicides for 28 years and received annual simazine applications the last 2 years (7.6 kg·ha⁻¹ total). Treatment C was maintained in grass sod and received no herbicide. Soil fractions were taken at 15-cm increments by soil probe to a total depth of 1.5 m. Three probes in each of three replicate plots for each treatment were analyzed. The highest concentration of simazine was found near the surface and decreased with depth. The rate of this decrease was less with treatment A than with B. In the depth range of 15 to 105 cm, treatment A had a greater simazine content than with treatment B. Simazine was detected in some samples below the 120 cm depth.

EFFECTS OF CO₂ CONCENTRATIONS ON ETHYLENE BIOSYNTHESIS IN 'BARTLETT' PEAR FRUIT

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Mature, intact 'Bartlett' pear fruit (*Pyrus communis* L.) were placed under a continuous flow of air, air + 5% CO₂, or air + 20% CO₂ for 11 days at 20C. Pears stored in air enriched with 5% or 20% CO₂ exhibited reduced rates of ethylene production and respiration and remained greener than fruit stored in air. Ethylene-forming enzyme and ACC synthase activities declined, while ACC content increased in pears kept in air + 20% CO₂. These results are analyzed in light of a probable inhibitory effect of CO₂ on the activity of some of the enzymes involved in the biosynthesis of ethylene. The highest correlations were found between skin color and ethylene production, ACC content and CO₂ production rate, and skin color and respiration rate.

DEVELOPMENTAL ANATOMY OF DIRECT SHOOT ORGANOGENESIS IN LEAVES OF *VITIS VINIFERA*

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The developmental anatomy of direct shoot organogenesis from in vitro leaves of *Vitis vinifera* L. cv. French Colombard was studied by light microscopy. Regenerating petiole stubs of leaf explants were fixed at intervals and were sectioned longitudinally to determine the developmental sequence of direct shoot organogenesis. After 6 days, three distinct regions of meristematic activity were apparent within expanding petiole stub: the wound-response, organogenic, and vascularization regions. In the organogenic region, divisions of vacuolate outer cortical cells formed nodular bumps that sometimes became adventitious leaves. Promeristems, which had the potential to become adventitious shoot meristems, were also initiated asynchronously in the organogenic region. Promeristem initiation occurred by two or several synchronous cell divisions occurring in the epidermal

and subepidermal cell layers. Adventitious shoots and leaves developed new vascular bundles that connected to the pre-existing vascular bundles of the explant.

GERMINATION AND STORAGE OF *PHYTOLACCA DODENCANDRA* L. (ENDOD) POLLEN

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The effect of sucrose, H_3BO_3 , KNO_3 , $Ca(NO_3)_2 \cdot 4H_2O$, and $MgSO_4 \cdot 7H_2O$ on pollen germination of *Phytolacca dodencandra* (ended) in a liquid medium was evaluated. Sucrose and H_3BO_3 were critical to pollen germination. A concentration of 10% sucrose and $161.8 \mu M H_3BO_3$ gave >70% germination, $Ca(NO_3)_2 \cdot 4H_2O$, KNO_3 , and $MgSO_4 \cdot 7H_2O$ did not affect the germination of pollen. Ended pollen was dehydrated over $CaCl_2$ and stored in gelatin capsules in cryogenic vials at $-175C, 1 \pm 1C$ and $24 \pm 2C$. The moisture content of pollen at collection was $\approx 7.8\%$ and dehydration over $CaCl_2$ reduced it to $\approx 1.4\%$. Pollen stored at $1 \pm 1C$ and $-175C$ maintained viability for >6 months. Pollen stored at room temperature lost viability within 4 weeks of storage. Cryopreserved pollen produced normal fruit.

SOLAR HEATING REDUCES INSECT INFESTATIONS IN RIPENING AND DRYING FIGS

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Several experimental procedures were used to evaluate the influence of solar radiation on insect infestations in Calimyma and Adriatic variety figs (*Ficus carica* L.). Direct sunlight eliminated infesting insects and prevented further infestation of ripe figs drying on the ground for at least 10 days. Placement in the shade resulted in 12% insect infestation in figs within 3 days. Figs that fell naturally into sunlit areas contained almost no insects, whereas 31% of figs that fell into dense shade were infested. While ripening figs were still attached to trees, the level of insect infestation was 50% higher on the shady north side than the sunny south side. The insect pests most frequently encountered in these experiments were nitidulid beetles and their larvae. Disease incidence was not affected by degree of exposure. We propose that cultural techniques to maximize exposure of ripening and drying figs to solar radiation could be developed as important pest management tools.

FERTILIZATION EFFECTS ON MYCORRHIZAL FORMATION AND GROWTH OF *PINUS NIGRA*, *P. PONDEROSA*, AND *P. SYLVESTRIS*.

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Fertilization effects on mycorrhizal formation by *Tricholoma virgatum* with three pine species were studied. Inoculum was mixed into a 1 peat : 1 vermiculite media (1:9, v/v), prior to seeding in 160-cm³ "Leach Containers". Four nutritional regimens were used: Full-strength Ingstad solution with 10% P, 10% Ingstad solution, modified-exponential Ingstad, and a slow-release fertilizer (Sierra TM, 17N-6P-10K). Seedlings were harvested at 3, 4, and 5 months after sowing. *Tricholoma* inoculation resulted in 11% of the short roots of all species forming ectomycorrhizae (ECM) and 40% of the seedlings being colonized. *P. sylvestris* and *P. nigra* had significantly more ECM than did *P. ponderosa*. The number of ECM increased from the 3rd to the 4th month, but no increase occurred after the 4th month. Treatment with full-strength Ingstad/10% P yielded the largest seedlings and the least ECM, while exponential and 10% Ingstad produced smaller seedlings with the most ECM. The slow-release fertilizer treatment resulted in trees with intermediate growth and ECM formation. No differences in growth were found between inoculated and uninoculated trees.

FIELD PERFORMANCE ANALYSIS OF ARTICHOKE TISSUE CULTURE AND ROOTSTOCK PROPAGULES

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Artichokes (*Cynara scolymus*) are traditionally propagated by rootstock (RS) transplants. Tissue culture (TC) transplants are not yet used in commercial stands in the United States. TC has been successfully used in other crops to produce uninfested propagules. Artichokes are commonly inhabited by various bacteria and viruses. Their influence on growth and production is not fully established. The objective of this study was to determine if the field performance of TC and RS propagules was different over a 2-year period. A completely randomized design with 48 plants each was established Mar. 1988. Commercial cultural practices were followed, 1988–89. TC had better stand establishment. TC and RS showed a similar harvest pattern of two intervals. TC yield, bud size 24 and number of flowering stalks were significantly different. TC showed potential as an annual. 1989–90. Tissue sample analysis in May 1989 indicated TC had become inhabited by bacteria. Stand establishment at 2 years was TC 98% and RS 90%. TC and RS showed a typical one-season harvest pattern. Other data in progress.

INTERACTION BETWEEN SOLUBLE SOLIDS AND ETHANOL IN DETERMINING FLAVOR AND TOLERANCE OF FRUITS TO LOW OXYGEN ATMOSPHERES

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Selected cultivars of several fruit species were exposed to 0.25% or 0.02% O_2 at 0, 5, or 10C for short durations to investigate the potential of these treatments as quarantine procedures for postharvest insect control. Beneficial effects of such low O_2 treatments included inhibition or delay of ripening processes as indicated by reduction in respiration and ethylene production rates, retardation of skin color changes and flesh softening, and maintenance of titratable acidity. While appearance was not adversely influenced by the short-term low O_2 treatments, the development of alcoholic off-flavor was the most important detrimental effect, which limited the tolerance of fresh fruits to low- O_2 atmospheres. Ethanol content and flavor score of the fruits had a logarithmic relationship. The threshold ethanol concentration associated with off-flavor detection (E_o) increased with SSC of the commodity at the ripe stage, and it could be estimated using the following formula ($\log E_o$)/SSC = 0.228. Using SSC of ripe fruits and average ethanol accumulation rate per day (V_E) from each low O_2 treatment, the tolerance limit (T_i) of fruits to low O_2 atmospheres could be predicted as follows: $T_i = E_o / V_E = 10^{(0.228 \cdot SSC) / V_E}$.

BIOASSAY TO DETERMINE CHERRY ROOTSTOCK TOLERANCE TO 'BACTERIAL CANKER' CAUSED BY *PSEUDOMONAS SYRINGAE PV SYRINGAE*

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An excised twig assay was developed to evaluate cherry genotypes for their tolerance to *Pseudomonas syringae* pv. *syringae*. One-year-old wood was collected at monthly intervals from October until January of 'Royal Ann', 'Corum', and a number of cherry rootstock. The rootstock included; F/12–1 and Giessen (GI) and M x M selections. A 2-cm incision ("N"-shaped flap) was made on each twig. A 20- μ l droplet of inoculum or water was placed onto each incision. The inoculum was prepared with one avirulent (K4) and three virulent strains (W4N54, AP₁, B₁₅) concentrations (10^5 , 10^6 , or 10^7 cfu). Inoculated twigs were placed in test tubes and incubated at 15C in high relative humidity for 3 weeks. After incubation, twigs were evaluated for gummosis production (0–3, 0 = no gummosis), incision browning (1–4, 1 = yellow pith), and callus production (0–1, 0 = no callus). The concentration of bacterial suspension had no effect on symptom development. No gummosis or browning was observed on twigs inoculated with water or the avirulent strain. Based on the gum-

mosis and browning ratings, rootstock M × M 2, M × M 39, M × M 60, GI 148-1, GI 154-2, and GI 154-4 were found to be resistant to these three strains of *P. syringae* in this assay. Rootstock F 12-1, GI 169-15, GI 172-9, and GI 173-9 were found to be tolerant.

NO₃:NH₄ RATIO AND SUPPLEMENTAL CALCIUM IN NUTRIENT SOLUTION INFLUENCE WATERMELON SEEDLING GROWTH AND MINERAL COMPOSITION

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Watermelon (*Citrullus vulgaris* L. 'Crimson Sweet') was seeded in plastic multicell trays containing a commercial peat mix amended with CaCO₃ (10%, w/v). Fertigation with five NO₃:NH₄ ratios and five levels of supplemental Ca (4, 8, 12, 16 mmol) were applied daily in factorial combinations to determine optimal N ratio and Ca effects on NH₄-N use. Shoot dry weight and leaf area measurements were taken 21 and 28 days after seeding. Plant mineral analysis, media EC, and pH determined on day 28. The highest NO₃:NH₄ ratio produced greatest shoot dry weight, shoot N, and Shoot NO₃-N and K concentrations. Increasing NH₄ and Ca decreased media pH and increased EC. At the first sampling date, supplemental Ca decreased shoot N and dry weight, but, by day 28, had no effect. Additional Ca increased shoot Ca while decreasing Mg and K. Supplemental Ca and N ratio interacted to affect leaf area.

IMPACT OF POSTHARVEST TEMPERATURE REGIMES ON FIRMNESS AND SLICE INTEGRITY OF SELECTED TOMATO CULTIVARS

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This study focused on tomatoes harvested both as vine-ripes and mature-greens, and evaluated at the table-ripe and over table-ripe stages at 20C, 85% RH. Firmness was evaluated by deformation of intact fruits under a 500-g weight; slice integrity was estimated by loss of locular tissue after slicing on a percent weight basis. Firmness was similar for fruits harvested at both mature-green and vine-ripe stages, and ranged from 1.4 to 2.0 mm and 1.9 to 3.2 mm at the table-ripe and table-ripe + 8 days stages, respectively. Loss of locular tissue at the table-ripe stage was usually less for fruits harvested as mature-greens, and ranged from 7.5% to 17.8%. At the over table-ripe stage, maturity at harvest had less influence on loss of locular tissue. Delays in treatment of mature-green tomatoes with ethylene resulted in less firmness than if they were treated immediately after harvest. Holding ripening tomatoes at lower temperatures (5 and 10C for 5 or 10 days) did not improve firmness at the table-ripe stage in comparison to those held continuously at 20C.

THE EFFECT OF AN ELECTRICAL FIELD ON GERMINATION AND GROWTH OF SEEDLINGS

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A weak electrical field has a stimulatory effect on germination of seeds and the early growth of young plants. Waldo bean seeds were placed in a chamber with moistened filter paper. Oppositely charged aluminum plates were used to stimulate growth. The top plate was suspended above the filter paper to eliminate the possibility of a direct current flow through the paper. Each set of samples was examined after 5 days. The average root length of the test groups was significantly greater than that of the control groups. Additional experiments suggested that the rate of growth of the plants in soil was enhanced by applying a weak electric field to the soil. Using electricity to stimulate better germination has many practical applications. A current agricultural practice is to germinate seeds in dissolving tubes for planting as individual plants. Results of these experiments suggest that apply-

ing an electric current to the germinating seeds would stimulate them to grow more vigorously for more successful growth in the field. The use of electricity may have important applications as art adjunct to organic farming practices. Experiments are under way to apply the use of electricity to hydroponic systems.

Foster, K.R. and H.P. Schwann. 1986. In: C. Polk and E. Postrow (eds.). CRC handbook of biological effects of electromagnetic fields. CRC Press, Inc., Boca Raton, Fla.

Weaver, J.C. and R.D. Astumian. 1990. The response of living cells to very weak electric fields: The thermal noise limit. *Science* 247:459-462.

DEVELOPMENT OF A MIDWINTER ARTICHOKE FOR SOUTHWESTERN UNITED STATES

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Artichokes are normally grown as perennials for mid-spring and summer in California. 'Imperial Star' is a uniform, early, high-yielding, globe artichoke cultivar developed for direct-seeded production during the winter and spring months in the warmer areas of the southwestern United States. It was developed by means of mass crosses and selections from segregating breeding lines released by the USDA in 1985. The initial cross from which this cultivar was derived was 'Green Globe Improved' × 'Italian Thorny Type' (an individual plant from an Italian line from Bari, Italy). Depending on location, it has been successfully planted from late spring to early fall for harvest from November to March (excluding the coldest period from late December to late January).

ENHANCED GERMINATION OF ACTINIDIA SP. BY H₂SO₄ TREATMENT

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Recommendations for germinating kiwifruit [*Actinidia chinensis* (Planch.) cv. Hayward] seeds involve stratification and/or alternating temperatures prior to planting. These treatments often produce slow and uneven germination, causing difficulties in obtaining uniform populations. Our initial studies have shown that uniform germination could be obtained by treatment with concentrated H₂SO₄ as a scarification procedure. Subsequent experiments were performed to determine appropriate environmental conditions, concentration of H₂SO₄, and length of treatment time. Uniform germination of 50% to 60% was obtained in 28 days when 1-year-old 'Hayward' seeds were treated with concentrated H₂SO₄ for 2 to 3 min. Greenhouse experiments are underway using fresh seeds of 'Hayward' and other *Actinidia* spp. A simple technique that produces a high rate of uniform germination would be beneficial to researchers who are trying to improve such traits as resistance to diseases and soil-borne pests, and to the kiwifruit industry, which is dependent on seedlings for rootstocks.

METABOLIC CHANGES ASSOCIATED WITH OXYGEN STRESS IN PEAR FRUITS

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The response of pear fruits and suspension-cultured pear fruit cells to 0% or 0.25% O₂ is being examined to evaluate the feasibility of using such atmospheres for postharvest insect control. These treatments inhibited ethylene production, had no effect on acetaldehyde content, and increased ethanol production in pears kept at 20C for 10 days. The blossom end area of pear fruits was more prone to anaerobiosis, as indicated by increased alcohol dehydrogenase activity and ethanol content. Pear fruit plugs showed increased respiration and ethylene production rates when skin was present compared to plugs without skin. Methods for

measuring activity of alcohol dehydrogenase, pyruvate decarboxylase, and pyruvate kinase have been modified and optimized and will be used to determine changes in pear fruit tissue during low O₂ treatment and subsequent recovery in air.

VARIATION IN CULTIVATED AND FREE-LIVING CHAYOTE *SECHIU EDULE* IN MEXICO

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Chayote (*Sechium edule*, Cucurbitaceae), a promising tropical and subtropical one-seeded squash, was originally domesticated in Mexico and Guatemala, but the extent of variation in the crop has been little studied. The range of variation found in Mexico, the center of diversity, is described using phenetic analyses. Since the fruits show the greatest variation in cultivation, fruit morphology and composition of >200 accessions to the Mexican gene banks form the basic data matrix. The variation in Mexico is comparable to that found in the Central American genebanks and affinities between cultivars and free living populations recently discovered in Mexico provide insight into the evolution of the crop.

POSTHARVEST CONTROL OF *BOTRYTIS CINEREA* ON TOMATOES BY HOT WATER AND HOT AIR TREATMENTS

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Application of postharvest fungicides and waxes is becoming less acceptable as a handling treatment. The present study explored the effectiveness of a range of time-temperature treatments of nonhumidified forced air and hot water. Tomatoes (turning stage) were inoculated with nongerminated spores of *Botrytis cinerea* (100 spores/10 µl) and within 10 hr were treated under a range of hot air (40 to 60C for 0.5 to 16 hr) and hot water (40 to 55C for 3 to 20 min) conditions. Fruits were then held on trays at 20C and evaluated every 3 days for decay development. Fruits were evaluated for firmness, color, compositional (%SSC and titratable acidity) and sensory quality (difference testing of uninoculated fruits by trained panelists) 14 days after treatment. Initial experiments determined the treatment regimes that did not result in visible injury to the fruit. Fruits treated 5 to 7 min with 47.5C water showed a relative decay of ≈15% that of control fruits. Several experiments with hot air showed that treatment of ripening fruits for 2 hr with air at 60C and 20% to 30% RH resulted in a similar level of control and did not significantly decrease fruit firmness or sensory quality. These results indicate that such treatments merit further evaluation as possible alternatives to current postharvest practices.

IN VITRO ACCLIMATIZATION OF TOBACCO WITH POLYETHYLENE GLYCOL AND SALT

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In vitro plantlets were subjected to polyethylene glycol (PEG) or salt (NaCl+CaCl₂) for 3, 7 or 10 days. PEG (*M*_w8000) concentrations were evaluated at levels of 1.0%, 2.0%, 2.5%, 5.0%, 10.0%, 15.0%, and 20% (w/v). The concentration that produced more normal growth with minimal leaf injury and still reduced subsequent moisture loss from detached leaves was 2.0% for 3 days. Salt concentrations of 0.5%, 1.0%, 1.5%, and 5.0% were compared. Concentrations of 1.5% or 2.0% for 7 days showed significant reduction of subsequent moisture from detached leaves.

INFLUENCE OF HIGH OSMOTICUM IN VITRO ON LEAF ANATOMY AND CUTICLE LAYER OF TOBACCO PLANTLETS

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Leaf anatomy and cuticle layer of in vitro tobacco plants grown on 0.25%, 1.0%, 2.5%, and 5.0% polyethylene glycol 8000 (PEG) were compared to in vitro plantlets without PEG and greenhouse-grown plants. Treated plants (PEG-grown) had leaves that showed a well-defined palisade layer and smaller and more compact mesophyll cells (similar to greenhouse-grown plants) as compared to in vitro plants with no PEG. Fluorescence microscopy of the leaf sections of the treated and greenhouse-grown plants revealed greater fluorescence of the cuticle and the xylem vessels than the untreated in vitro plants.

NITROGEN RATE EFFECTS ON YIELD IN ARTICHOKE GROWN AS ANNUALS FROM SEED

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Four N rates were evaluated on drip-irrigated artichokes grown as annuals from seed for winter (November through February) production. Rates of 56, 112, 224, and 448 kg N/ha were used. Early yield increased as the N rate increased from 56 to 224 kg ha⁻¹. The 224 and 448 kg ha⁻¹ rates gave similar early yield results. Total yield differences between treatments were not significant.

KARYOTYPE ANALYSIS OF *ALSTROEMERIA PELEGRINA*

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Karyotype of several plants of *A. pelegrina* were studied. Root tips were collected and pretreated for 18 hr in ice-cold water (0 ± 1C). Slides were prepared using the aceto-carmin squash technique. *A. pelegrina* is a diploid species (2n = 2x = 16) with the eight pairs of chromosomes being homologous. The karyotype consists of four pairs of metacentric, submetacentric, or subtelocentric chromosomes of different sizes. The chromosome pair no. 4 (the smallest submetacentric chromosome pair) showed polymorphism relative to the presence or absence of satellite on the short arm. The remaining four pairs are acrocentric chromosomes with long arms and short arms that are often shorter than the satellites found on three of the pairs. Chromosome configurations in meiotic Metaphase I showed eight bivalents in all sporocytes examined.

EFFECTS OF MICROORGANISM INOCULATIONS AND NITROGEN FERTILIZATION ON EASTER LILY GROWTH

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In a four-factor factorial inoculation with four pathogens, one vesicular-arbuscular (VA) mycorrhizal fungus, six biocontrol organisms, and ammonium or nitrate fertilization significantly affected growth of Easter lily (*Lilium longiflorum*) cv. Nellie White.

PHENOLIC METABOLISM AND INTERNAL BREAKDOWN (CHILLING INJURY) OF PEACH FRUIT

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Internal breakdown (IB) is the limiting factor in the storage and postharvest handling of stone fruits. The symptoms of IB appear when fruits are kept for prolonged periods at temperatures below 10C and include leatheriness, mealliness, browning and bleeding of the flesh, and failure to ripen normally. We investigated the changes in phenolic compounds associated with IB of stone fruits. Twenty-eight phenolic compounds were separated by HPLC. Ten of these components were significantly affected by chilling temperatures. The concentration of six phenols changed in response to ripening after chilling temperatures, par-

allel to the appearance of IB symptoms. Most phenols showed a concentration gradient from the inside to the outside of the fruit. Comparison between peach cultivars showed characteristic differences in phenol metabolism during ripening. In both cultivars the most predominant phenol, chlorogenic acid, showed little change in concentration during storage. The structure of key phenolic compounds will be determined in order to elucidate the biochemical relationship between the phenols and the related enzymes. In this respect, a method was developed to detect phenylalanine ammonia-lyase (PAL) activity in peach fruit.

CULTIVAR AND *FUSARIUM* INCIDENCE AFFECT STORAGE LIFE AND QUALITY OF CELERY

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Current *Fusarium*-related production problems in California and development of new cultivars dictate the need for updated information on postharvest behavior of celery. Celery with even a low level of *Fusarium* infection (visible in root, but not stem tissues) showed reduced shelf life and quality when stored at 2.5C for 3 weeks. The quality measurements most affected by *Fusarium* incidence were: pithiness, decay incidence of petiole and leaves, color, and sugar content. Only small differences were observed in toughness, measured by shear press. Estimation of sugar by soluble solids content (range of 2.6% to 3.2%) showed few differences among cultivars with storage. Sugar levels (colorimetric determination) varied significantly among cultivars, showing a range of 0.87% to 1.33% and 0.54% to 1.12% with storage at 2.5 and 7.5C for 3 weeks, respectively. Among the seven cultivars studied, some were less affected by temperature of storage than others.

IMPROVING TOMATO QUALITY USING BIOTECHNOLOGY

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The objective of this study is to tailor-make tomato composition to meet specific processing standards. Somaclonal tissue culture technology is combined with feedback inhibition challenges to create and to select mutants with heritable quality traits for high soluble-solids content, high juice consistency, low pH, and deep red juice color. Variants are also being selected for morphological changes in plant structures and fruit size and shape. At least 50 lines with high soluble solids (7.0% to 11.0%) have been created and selected. Heritability of the high-solids trait was evaluated through the creation of hybrids developed from high solids variants and testing under field conditions. Cooperative studies are now being initiated with horticulturists in a major seed company to evaluate different variant lines for plant structure, disease resistance, and fruit quality factors, and to determine their potential in the upgrading of elite inbred lines already in commercial use. Fresh market, greenhouse and cherry-type tomatoes are being selected and evaluated. Arrangements are being made with a processor to compare some of the high solids, high-consistency hybrids with commercial hybrids in preparing different tomato products.

REVOLUTION IN HORTICULTURE: COMPUTERS, SENSORS AND CONTROL TECHNOLOGY

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For the past 100 years, university and extension research has spearheaded virtually all advances in the field of horticulture. During the 1980s, however, the cost of computers, sensors, and monitor/control technologies dropped so rapidly that these technologies have been implemented in U.S. commercial facilities at a far faster pace than in the universities, extension services, and land-grant colleges. A growing segment of commercial horticulture is now better instrumented, better controlled, and more envi-

ronmentally integrated than many university research facilities. Commercial growers are now performing their own basic and advanced research, and are asking questions that, because of facility limitations, many universities and researchers simply cannot address. Growers are demanding university accountability for past recommendations that are now unacceptable. In the past, solutions from the universities were "idiot proof" so that anyone could get a successful crop, rather than optimal environmental solutions to compete in a world economy. The challenge of horticultural science in the 1990s is *integration*. Integrated pest management, integrated fertilization systems, integrated facilities management, integrated environmental control, and integrated postharvest systems, for example, must be integrated with each other in future production facilities. Many universities are already moving in this direction. Priorities for horticulture departments in the '90s are: 1) Modernization of facilities; 2) interdepartmental research cooperation; and 3) strategy for integration of research results into production facilities.

EFFECTS OF LANDFILL BIOGAS ON SOIL AND TURF ON GOLF COURSE GREENS

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Two golf greens, built over a sanitary landfill with areas of poor to no growth, were examined to determine if biogas production was a causal agent of these poor growth areas and how it affected turf growth as well as soil conditions. This was accomplished by measuring methane flux, methane oxidation, soil temperature, pH, noting anaerobic conditions and percent microbial mat that covered the ground. The areas of poor growth showed a significant relationship to methane flux. Flux readings as high as 41.69 liter·m⁻²·hr⁻¹ were recorded. Oxidation of methane at rates of nearly 10 liter·m⁻³·hr⁻¹ showed significant relationship to percent of microbial mat that covered the ground as well as to soil temperature on both greens.

SELENIUM TOLERANCE, SALT TOLERANCE, AND SELENIUM ACCUMULATION AMONG TALL FESCUE (*FESTUCA ARUNDINACEA* SCHREB.) CULTIVARS

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Tall fescue (*Festuca arundinacea* Schreb.) is a potentially useful crop plants for forage and seed production and selenium (Se) accumulation in land contaminated with high concentrations of Se and salinity. The finding of genetic variation in Se and salt tolerance within this species is of importance in Se bioaccumulation management. Genetic variation of both Se tolerance and salt tolerance was detected among 13 tall fescue lines. Six American commercial lines exhibit higher Se tolerance, but are less variable than the seven worldwide fescue collections. Selenium tolerance and salt tolerance were found to be negatively correlated with tissue Se and salt concentrations. These findings suggest that an exclusion mechanism is responsible for the tolerance. Genetic variation exists for the characters of Se tolerance and accumulation among the cultivars having higher salt tolerance. Thus, this diversity of genotypes is particularly useful for Se bioaccumulation and soil and water quality improvement in saline soils with variable elevated Se levels. Selenium tolerance and salt tolerance were found to be independent of each other. Further studies will determine if these traits can be independently selected and combined into desirable genotypes.

INHERITANCE OF FLOWERING TIME AND ITS APPLICATION FOR INDIRECT SELECTION IN THE DAVIS POPULATION OF GERBERA

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Genetic components of variance and heritability of flowering time were estimated for five generations of the Davis Population

of *Gerbera hybrids*, Composite, Estimates of narrow-sense heritability averaged 0.50 and broad-sense heritability averaged 0.77 using the NCII design. Narrow-sense heritability was also estimated with two models of parent-offspring regression, resulting in average heritability of 0.49 and 0.51. Estimates of components of variance indicated that the major genetic effect controlling flowering time is additive. However, the dominance component accounted for 28% of the total variance; the environmental component was only 23%. Flowering time is negatively

correlated with cut-flower yield. The phenotypic coefficient was -0.34 ; genetic correlations were -0.47 when estimated from the NCII design, and -0.72 when estimated from the parent-offspring method. A practical model was constructed to assess the efficiency of indirect selection for cut-flower yield using flowering time as a marker trait. The advantages of indirect selection accruing from increased population size and reduced generation time are discussed.