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VIDEOGRAPHIC ASSESSMENT OF PLANT STRESS: POTENTIALS AND LIMITATIONS.

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Recent advances in computer and video technology permit non-destructive, near-real time localization of stress. By using filters to image selected wavelengths of reflected energy in the visible and near-infrared regions onto video tape, a video camera functions as a two dimensional, medium resolution reflectance radiometer. When the images are digitized and analyzed, regions of stress can be readily localized and quantified in the field. The technique is appropriate for rapid screening and analysis of stress, however, caution must be observed to minimize equipment induced artifacts during image acquisition and analysis. We have used the technique in strawberry, peach, soybean, cotton and millet.

DEVELOPING A NEW SUPERVISORS INTERIOR PLANTScape COURSE

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Prior to the fall of 1989, no Commercial Supervisory Pesticide Applicator Certification for the Interior Plantscape category existed in the State of Connecticut. The Cooperative Extension Educator for Commercial Horticulture and the Connecticut Department of Environmental Protection cooperated to establish the requirements for an Interior Plantscape Pest Control category.

Then an Extension Curriculum was developed to prepare individuals to take the CT DEP examination. Areas covered in the course included: pesticide laws, core manual, identification of flowering and foliage plants for interiorscapes, cultural requirements (light, temperature, growing media, fertilization, and water), glossary of terms, planting and maintenance tips, disease and insect pests, physiological disorders, contracts, and replacement policy.

Participant survey results of this pilot course will be presented.

FIELD PRODUCTION OF HERBACEOUS PERENNIAL CUT FLOWERS

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Mean yields (stems per plant) of 5 randomly selected plants from a block of 15 were determined for each of 13 species of 2-year old herbaceous perennials. Mean yields of Achillea filipendulina 'Coronation Gold' of 4 randomly selected plants, in each of 4 replicates in a randomized complete block design, were determined over 3 years for 3 spacings. The most consistent yields over the period, and highest in years 1 and 3, were from 60cm spacing between plant centers, with yields from 90cm and 30cm highly variable. In year 2, stems were graded by length with most stems 40 to 49cm at 30cm and 90cm spacings (19 and 46 stems) and 50 to 59cm at 60cm (27 stems). As stems per plant increased from 30 to 72 for 30cm to 90cm spacing, respectively, stems per 30cm² decreased from 30 to 8. Vase life was greatest (9 days) for stems in Oasis preservative, with less in Floralife (8 days), tap water (7 days), or distilled water (5 days). Flowers 10 days older prior to cutting lasted an average 2 days less.

GENETIC IMPACT OF THE PEA SEEDBORNE MOSAIC VIRUS ERADICATION PROGRAM ON THE U.S. NATIONAL PEA (*Pisum* spp.) COLLECTION

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Pea seedborne mosaic virus (PSBMV) in the pea collection maintained by the Northeast Regional Plant Introduction Station (NERPIS) has been a major problem for the past decade. A recent PSBMV eradication program has been conducted in collaboration with USDA-ARS scientists in Washington and Oregon. Questions regarding genetic impact of the eradication process have been raised; therefore, a study was established to assess possible changes in diversity. Forty-plant populations representing virus-infected and "cleaned" accessions were observed for morphological and biochemical changes incurred during eradication and subsequent regeneration. Preliminary results highlight that genetic shifts have resulted with particular effect on flower color, seed characters, and a number of isozyme loci. The consequences of the disease eradication program in this specific case, as well as on global genetic resource conservation and utilization will be discussed.

GERMINATION RESPONSES OF OSMOTICALLY PRIMED ASPARAGUS AND TOMATO SEEDS

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Seeds of 'Ace 55VF' tomato were soaked in solutions of -1.0 MPa Instant Ocean™ (inorganic salt mixture) or -0.6 MPa polyethylene glycol 8000 (P.E.G.) at 25 C for 1 week. 'Mary Washington' asparagus seeds were soaked in the same solutions for 2 weeks. In solutions of decreasing matrix or osmotic potentials, primed seeds germinated faster than untreated seeds. Germination percentages of primed seeds generally were greater than those of untreated seeds when water stress exceeded -0.5 MPa. All primed seeds, whether dried to a low moisture content or not, germinated faster than untreated seeds after storage for up to 3 months at 4 C or 20 C. Primed asparagus seeds germinated most rapidly and synchronously after storage at 4 C and high moisture content. Storage temperature and seed moisture content had no effect on subsequent germination of primed tomato seeds.

EFFECTS OF MACRONUTRIENT CONTENT OF CELL LAYER MEDIA ON SURVIVAL, DIAMETER AND PLATING EFFICIENCY OF 'RUSSET BURBANK' POTATO PROTOPLASTS.

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In order to determine the appropriate nutritional conditions for survival, mesophyll protoplasts cv. "Russet Burbank" were cultured in three cell layer media. Each contained the MS macronutrients at either 0, 1 or 4 times the concentration recommended by Shepard (1980). During the 14 day culture period, cells were evaluated and counted, diameter determined and plating efficiency calculated. Results will be discussed.

ASPARAGUS AUTOTOXIN AND THE POTENTIAL FOR IN VITRO SELECTION
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Purification of a root extract from Asparagus officinalis by solvent extraction and by column and thin-layer chromatography showed activity (as measured by a seed germination bioassay) to be concentrated in ethyl acetate and methanol extracts. Extraction and chromatography behavior indicate that inhibitory compounds are of low molecular weight, nonproteinaceous, polar, and appear to co-elute with a blue fluorescent compound.

Exposure of callus tissue on callus, shoot, and root induction media to different concentrations of methanol extract resulted in tissue necrosis, and the dosage relationship of extract to callus growth was linear. In vitro selection has produced callus cultures showing positive growth on all three media containing methanol extract.

COMMERCIAL FLUID DRILLING OF COLLARDS.

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Fluid drilling (gel seeding) is a crop establishment technique in which germinated seeds are transferred to the seed bed in a gel carrier. Variable results that can be ascribed largely to improper seed treatment and to inadequate attention to the seed bed microclimate have led to the slow adoption of this technique. The successful experiences of a commercial vegetable grower in fluid drilling 'Champion' collards (Brassica oleracea var. acephala) over the past two years will be relayed. From a 4-row planter during 1988, the grower during 1989 expanded to a 12-row planter that can fluid drill 4 ha without water replenishment. Some details associated with the system's success include: avoiding seed pregermination, fluid drilling into cooling soils, irrigating within a day of planting, covering the gel-seed mixture with a thin soil layer, and not using a press wheel.

INTERACTION OF FUSARIUM WITH ASPARAGUS AUTOTOXIN

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Seed germination experiments have shown consistent interaction of a filtrate from partially decayed asparagus roots, and active fractions extracted from it, with the causal organism of fusarium crown and root rot (Fusarium oxysporum f. sp. asparagi). Fusarium is much more severe in the presence of this root filtrate than in its absence, and the severity increases with increasing soil salinity. The soluble solids component of root filtrate is believed to stimulate increased fusarium activity, possibly providing nutrition for increased growth. Exclusive of soluble solids, autotoxic components also exacerbate disease activity, although the mode of action is not yet understood.

CHROMATICITY VALUES, CONSUMER EVALUATION, AND ANTHOCYANIN CONTENT OF 'DELICIOUS' APPLES.

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Following harvest fruit color of 38 'Delicious' strains was rated on a 1 to 10 scale (where 10 = excellent color). Chromaticity values ($L^*a^*b^*$) of these fruit were measured with a Minolta CR-200b colorimeter. Only in rare instances did strains receiving a low color rating have a high a^*/b^* ratio. A simple linear regression of panel rating on the ratio of a^*/b^* provided a $R^2 = 0.63$; indicating a good relationship between panel rating and a^*/b^* values.

In a separate study, $L^*a^*b^*$ values were measured at 4 sites (blushed, non-blushed, and two intermediate points) on apples of 10 strains. A disc corresponding to each measured location was removed and its anthocyanin content determined. A linear regression of anthocyanin content on the ratio of $(a^*/b^*)^2$ provided a $R^2 = 0.59$; precision was enhanced by incorporating L^* into the model ($R^2 = 0.73$). Significant differences between strains in anthocyanin content were found at each site and uniformity among sites also varied between strains.

MATURITY VARIATION BETWEEN COORDINATES ON A PEACH

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Peach (Prunus persica, L. Batsch) cultivars vary in the percent of marketable stage fruit from a once-over harvest. Maturity stages are difficult to separate. The

difficulty might be related to non-uniform ripening characteristics of the fruit. A method was developed to estimate the variability in maturity at 16 coordinates around the peach. Peaches were sampled at 5 maturity stages: 1) about 1/2 final-swell size; 2) 90% final-swell size; 3) and 4) marketable, and 5) soft ripe. Stages were separated by color chips #1 and #2, #3 and #5 (marketable), or #6. Pared flesh firmness was measured with a modified penetrometer plunger (4.47mm diameter tip 11mm long). Force (F) ranged from about 3 to 45 N. Soluble solids (SS) ranged from 10 to 13% from a 1cm³ cylinder adjacent to the puncture made by the penetrometer. Force and SS from five replications of 2 cultivars indicate that the apex and cheeks are the firmest and highest in SS for most stages tested. Reported correlations of F on the cheek with the yellow ground color or sweetness within marketable fruits are negative. However, correlations in this experiment ranged from $R^2 = 0$ to 0.18 for the green to ripe stages.

RE-EXAMINING THE BORON REQUIREMENTS FOR APPLE PRODUCTION

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We currently recommend application of 1/4 to 1 lb. of borax per tree every third year, or annual foliar application of 4 lbs. per acre of Solubor, to meet the B requirements of apple trees in the Northeast. Some other states recommend higher rates and/or more frequent applications to facilitate Ca movement to fruit. An experiment was begun in 1987 to examine effects of higher rates of borate soil applications and Solubor foliar treatments than we currently recommend, using McIntosh trees on M7A rootstock. Results to date indicate small improvements of fruit Ca levels from higher B applications. They also suggest that soil treatments should be applied annually, and that soil treatments have greater impact than foliar sprays. Increased fruit B levels hastened fruit ripening but also increased fruit firmness, both at harvest and after storage.

BROADLEAF WEED CONTROL IN ORCHARD SOD COVERS

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Clopyralid, triclopyr, and 2,4-D amine were applied singly and in combinations in two experiments during May, 1989. By mid-summer, broadleaved weeds, collectively, constituted 29.8 and 52.8 percent, respectively, of the total ground cover in non-treated control plots in the two experiments.

Clopyralid provided 95-100 percent control of clover at rate of 1-2 oz ai/a, but was not effective in controlling broadleaved plantain. Broadleaved plantain exhibited a rate response to 2,4-D amine (8 to 32 oz ai/a), with 90 percent control at the 32 oz rate. Narrow-leaved plantain and dandelion were responsive to both clopyralid and 2,4-D amine. Daisy fleabane was not observed in plots treated with triclopyr at 6 oz ai/a.

Results indicate that low-rate combinations of these materials could provide effective wide-spectrum control of broadleaved weeds.

THE INFLUENCE OF ROOTSTOCKS ON THE GROWTH, LONGEVITY AND PRODUCTIVITY OF APPLES

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The influence of rootstocks on the growth and productivity of 'Starkspur Supreme Pagnelli Delicious' was determined in an NC-140 experiment started in 1984. The planting was supplemental to the main experiment and it contained Ottawa (Ott) 3, M.20, and Arnold Lynd (AL) 800, but did not contain Budagovsky (Bud) 490, Bud 9, Antonovka 313, or C6. Trees that apparently would not stand were given support. Data on tree size and yield were collected every year. As expected, many characteristics were strongly influenced by rootstock. Yield efficiency calculated as the total fruit weight per square cm of trunk cross-sectional area was used as a measure of production efficiency. In 1989, efficient producers of fruit (all in decreasing order) were Poland (P) 2, EMLA.26, P 16, and Michigan Apple Clone (MAC) 39. Intermediate in productivity were M.20, Cornell-Geneva (CG) 10, P1, and AL 800. A lower efficiency group of rootstocks were EMLA.7, Ott 3, MAC 1, Seedling, M.4, P 18, and CG 24. 'Golden Delicious' and 'McIntoch' on EMLA.26, used as pollinizers, were ranked second and third in yield efficiency.

Lowbush Blueberry Leaf Nutrient Concentrations in Response to Phosphorus Fertilization. John M. Smagula and M. Susan Erich. Department of Plant and Soil Sciences, University of Maine, Orono, ME 04469.

Leaf tissue surveys conducted in 1987 and 1988 indicated phosphorus levels were below the suggested standard (0.125%) in most blueberry fields. To determine the amount of phosphorus needed to raise leaf tissue levels to the satisfactory level, liquid phosphorus (23% phosphoric acid) was applied preemergence at 0, 22.4, 44.8, 67.2, or 89.6 kg'ha⁻¹ treatment plots in 9 commercial blueberry fields. Fields included 3 identified in 1987 as very low (<.111%), 3 low (.111 -.125%), and 3 adequate (>.125%) in leaf phosphorus concentration. Phosphorus concentration in leaf tissue sampled in July 1989 increased linearly with increasing rates of phosphorus application. Phosphorus application raised leaf phosphorus levels more in fields which had levels below 0.125%.

EFFECTS OF CROP LOAD AND HARVEST ON APPLE RIPENING

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Studies were conducted in 1989 to determine the effects of crop load and percent harvested on apple ripening. Twenty-seven 'Golden Delicious' trees were selected and partitioned into 9 blocks. The crop load on one tree in each block was adjusted to 3.4, 6.9, or 15.0 fruit cm⁻¹ trunk circumference in late June. Internal ethylene was measured in 6-fruit samples taken from each tree on 25 Sept., 2, 9, and 16 Oct. Increasing crop load had a significant linear effect on delaying ripening. Approximately 11 days separated the ripening of fruit from the 3.4 fruit cm⁻¹ and the 15.0 fruit cm⁻¹ treatments. In a second experiment, 18 'McIntosh' trees with similar crop load were partitioned into 6 blocks. Forty percent of the crop was harvested from 1 tree and 80% from another in each block on 7 Sept. Internal ethylene was measured on 7, 14, 21, and 28 Sept. Increasing the portion of the crop initially harvested linearly delayed subsequent fruit ripening. Approximately 6 days separated the ripening of fruit from the control and the 80%-removal treatments.

EFFECT OF HYDROPHILIC POLYMER AND WETTING AGENT ON WATER ABSORPTION IN SOILLESS POTTING MEDIA

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To measure water retention, pots were filled with treated medium, irrigated and allowed to drain. After draining, pot weight was recorded and the free water pot was removed by vacuum suction. This procedure was repeated daily. Hydrophilic polymers and wetting agents improved water uptake and retention. However, the peat-perlite-vermiculite medium took up more water and at a faster rate than the peat-perlite-bark medium. Although there appear to be no significant differences among polymer types or wetting agent, best results were obtained in media amended with both wetting agent and polymer.

Asstilbe x '*Hyacinth*' was grown in the same peat-perlite-vermiculite or peat-perlite-bark medium amended with polymers and wetting agent. At flowering, water was withheld until plants wilted, then plants were irrigated. Preliminary results show all polymer and wetting agent treatments performed better than controls, but do not show dramatic differences among media, wetting agents, or polymers.

MOISTURE STRESS EFFECTS ON ASPARAGUS BUD DEVELOPMENT AND SUBSEQUENT SPEAR GROWTH

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Greenhouse and growth chamber experiments with asparagus (*Asparagus officinalis* L. cv Jersey Giant) were conducted to evaluate the effects of soil matric potential on bud development and subsequent spear growth. Decreasing soil matric potential from -0.05 to -0.50 MPa in greenhouse-grown plants resulted in a linear decrease in the number of bud clusters, total number of buds, and number of viable buds on the asparagus crown. Furthermore, bud size, as indicated by basal bud widths was reduced by decreasing soil matric potentials.

Following 3 months in the greenhouse, plants were placed in cold storage for 6 months to mimic field dormancy. Plants were removed from storage and placed in growth chambers so that spear growth and development could be monitored under constant environmental conditions. Neither the total number

of spears which emerged, nor the relative spear growth rates were influenced by previous moisture stress. However, reductions in soil matric potential in the greenhouse resulted in deviations in the distribution of spear diameters from that of a predicted normal distribution.

NOTCHING TECHNIQUES TO INCREASE BRANCHING OF YOUNG APPLE TREES

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A series of experiments were initiated to evaluate the influence of notching on improving lateral branching of young apple trees. Buds on 2-year-old wood of 'Redspur' Delicious/MM.111 were notched at 2-week intervals from 6 weeks before bloom to 2 weeks after. Notching increased lateral branching cubically with the greatest response occurring when notching was done 2 to 4 weeks before bloom. Bud break occurred equally well and shoots grew comparably when 'Redcourt'/M.7 were notched at the tip, middle, or base. Bud break and shoot growth from unnotched buds was greatest at the tip, intermediate in the middle and least at the base. Limbs of 'Spygold'/M.7 were spread to a 45 degree angle then one bud from each 1-year-old shoot was notched at either the top, side or on the bottom of the shoot. Notching increased lateral branching from all bud positions, but the greatest response was from buds notched at the top and least from those located at the bottom of a branch. Buds of 'Marshall McIntosh' were notched on either 1 or 2-year-old wood. Notching increased lateral branching more on 2-year than on 1-year old wood.

EFFECTS OF FRUIT STAGE AND DURATION OF FEEDING ON STRAWBERRY MALFORMATION CAUSED BY THE TARNISHED PLANT BUG.

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Greenhouse experiments were designed to study conditions affecting strawberry malformation caused by the tarnished plant bug (TPB). Duration of blossom exposure to TPB affected the type of malformation. Exposure at anthesis for 8 hours caused visible deformity. Exposure for 48 hours caused some apical seediness, the malformation most commonly associated with TPB. Continuous exposure to TPB usually caused blossom death. Increased exposure to TPB caused a higher percentage of nonviable achenes per strawberry. Some effects appeared to be cultivar-dependent. Honeoye strawberries were less likely to show apical seediness than Redchief strawberries, but were more likely to experience blossom death. Malformation was also affected by strawberry development stage at the time of TPB feeding. Feeding at prebloom caused blossom death. Feeding at petal fall or achene separation resulted in fruit malformation, about half of which was apical seediness. Feeding at pink receptacle stage caused little visible damage.

FLUID DRILLING AS A DELIVERY SYSTEM FOR ASEXUAL EMBRYOS

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Torpedo-shaped asexual embryos of *Daucus carota* L. 'Orlando Gold' were mixed into N-gelTM containing pesticides or biological agents and then were extruded through the cut corner of a plastic bag into greenhouse flats. Before incorporation in the gel mixtures, embryos were either pretreated under light (60 μm m⁻² s⁻¹) or dark, chilled (4°C) for varying periods, and/or were incubated in gel mixtures. Embryos 'germinated' under septic conditions and grew into full-grown plants in the greenhouse and laboratory.

FLOWER BUD COLD HARDINESS OF NATIVE AZALEA ECOTYPES.

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Flower buds of eight ecotypes representing three native North American azalea species being grown in Burlington, Vermont were compared for cold hardiness by laboratory freezing during the cold acclimation period for three years. Species were *Rhododendron calendulaceum*, *R. prinophyllum*, and *R. viscosum*. There was a high variation in the number of florets killed within an inflorescence in response to freezing temperatures. There was little difference in the cold hardiness of florets of *R. prinophyllum* and *R. calendulaceum* florets, but *R. viscosum* florets were hardier. Some differences were noted in cold hardiness of florets of ecotypes, but these were not necessarily related to latitude of origin. Cold hardiness showed a relationship with the daily mean temperature of the three days preceding freezing tests.

FRUIT ROT CONTROL IN SMALL FRUIT CROPS WITH A NATURALLY-PRODUCED CHEMICAL
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Restrictions on pesticide usage and the occurrence of fungicide resistant strains of postharvest pathogens have necessitated research for alternative methods of disease control. *Pseudomonas cepacia* was tested for control of Botrytis fruit rot in strawberry. Results of field applications of *P. cepacia* were variable. A compound isolated from *P. cepacia*, identified as pyrrolnitrin, was as effective as Benlate/captan (2,000 ppm) sprays in field applications. Postharvest pyrrolnitrin (100 ppm) dip inhibited growth of pathogens for three days at room temperature. A pyrrolnitrin dip followed by storage at 1°C for five days extended the shelf-life for another five days. Preharvest pyrrolnitrin sprays to 'Bristol' black raspberry delayed rot development by 4 to 5 days. Captan (2,000 ppm) treatment provided no protection. In vitro tests showed that *B. cinerea* isolated from the fruit had developed resistance to captan. These results suggest that the use of a naturally-produced compound might afford another opportunity to reduce postharvest rots without the use of synthetic fungicides.

EFFECTS OF STEM ROOTS ON GROWTH AND FLOWERING OF ASIATIC LILIES

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Asiatic lilies are popular flowering pot plants. If grown in 10-12 cm containers, stem root growth is restricted, but it is unreported whether this influences plant growth and flowering. Four Asiatic lily cultivars were used: two genetic dwarf cultivars, Golden Pixie and Peach Pixie, and two non-dwarfs, Aristocrat and Snowstar. The bulbs were planted into 10 cm X 15 cm nursery containers in Metro Mix 200, and placed on a flood and drain irrigation system. Bulbs were planted either 2.5 cm from the bottom of the pot to allow growth of stem roots, or at the surface of the medium to restrict the growth of stem roots. The effect of stem roots on growth and flowering was cultivar dependent. All cultivars without stem roots were significantly shorter. Days to bloom for Crimson Pixie and Aristocrat decreased significantly when stem roots were absent. Golden Pixie, Snowstar, and Aristocrat reached visible bud significantly sooner when stem roots were absent.

SURVEY OF ALLIUM PLANT INTRODUCTIONS FOR ONION MAGGOT INJURY

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Onion maggot (*Delia antiqua* Meigen) is a major pest of common onion (*Allium cepa* L.) throughout production areas in the northern USA. Continued use of chemicals to control onion maggot (OM) is threatened by the increased resistance of OM to available pesticides and tighter restrictions on chemical use, making host plant resistance a desirable goal. Approximately 400 accessions of various *Allium* species were planted in a commercial onion field of muck soil near Geneva, NY. These plantings lacked treatment for protection from OM attack. The greatest damage in the planting occurred on *A. cepa* with an average of 79% stand loss for 144 accessions. Accessions of *A. ampeloprasum* L. (leek) averaged 36% stand loss in June with a 55% infestation level in October, while accessions of *A. schoenoprasum* L. (chives) averaged 36% stand loss in June with a 55% infestation level in October.

ETHYLENE EVOLUTION BY FRUITS OF TOMATO STRESSED BY AMMONIUM NUTRITION

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Studies were made of ethylene evolution by 'Heinz 1350' tomato fruits from plants that had received nitrogen nutrition from ammonium or nitrate salts in soil-based media.

Fruits of plants receiving ammonium nutrition had higher ammonium concentrations, higher occurrences of blossom-end rot, and higher rates of ethylene evolution than fruits from nitrate-grown plants. Fruits showing blossom-end rot had higher ammonium concentrations and higher rates of ethylene evolution than normal fruits only if the plants received ammonium nutrition. Ethylene evolution increased as fruits from nitrate-grown plants ripened but without a concurrent increase in ammonium concentrations in the fruits. Ammonium accumulation in fruits apparently induces blossom-end rot and enhances ethylene evolution, but ammonium accumulation does not appear to be a naturally occurring phenomenon in ripening fruits or in fruits that have blossom-end rot arising from other casual factors.

EFFECT OF SOIL-APPLIED POLYMER AND NITROGEN APPLICATION ON CAULIFLOWER GROWTH

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"Majestic" cauliflower plants were transplanted into furrows with either a polymer alone or in combination with ammonium nitrate. The polymers were banded in the furrow at planting time at 16.9, 33.7 or 67.4 kg/ha with or without a concurrent application of nitrogen at 44.9 kg/ha. The cauliflower received at least 1.2 cm water from an overhead irrigation system immediately after transplanting. Checks were both watering as plants were set in the field and water with a 12-48-8 starter fertilizer. Highest total yields were recorded when polymers were applied alone in the furrows. The addition of 44.9 kg/ha of the nitrogen generally decreased total marketable yields, head weight and plant weight. Soil samples were taken in the treatment rows after crop harvest. One of the polymer materials reduced soil pH by an average of 0.4 units and decreased the percent saturation of calcium from 90% to 70%.

PERFORMANCE AND POTENTIAL OF SOLAR INFRARED TRANSMITTING MULCHES

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Experimental mulches which transmit high levels of solar infrared radiation and low levels of photosynthetically active radiation were compared to clear and black polyethylene mulches. Increases in soil temperature under infrared transmitting (IRT) mulches were intermediate between those under black and clear mulch. The IRT mulch with the highest solar transmittance (50%) produced soil temperatures close to those under clear mulch ($T = 87\%$). Early leaf canopy development in muskmelon was enhanced more by both IRT and clear mulches than with black mulch. Minimal weed growth occurred under IRT mulches, but there was severe weed pressure from purslane under clear mulch with no herbicide.

THE EFFECT OF ASPARAGUS VIRUS INFECTION ON THE ROOTING AND SURVIVABILITY OF ASPARAGUS TISSUE CULTURE CLONES.

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Commercial asparagus (*Asparagus officinalis* L.) is currently planted from seed but there is a growing interest in the use of tissue culture clones. The worldwide occurrence of asparagus virus I (AV-I) and asparagus virus II (AV-II) in asparagus production areas has led to an investigation of the effect of these viruses singly and in combination on the propagation of asparagus via tissue culture. Bud explants from field-grown, virus-infected asparagus plants were cultured in-vitro to induce shoots and roots. Explants derived from singly or doubly-infected plants were slow to develop roots and often died in culture. The four virus groups were ranked for the explants' capacity to produce roots and shoots: virus-free > AV-II > AV-I > AV-I and AV-II. Plants derived from explants of AV-II-infected plants exhibited a mild weight reduction after three months in the greenhouse. Greater reductions were associated with AV-I and double infections when compared to healthy controls.

STUDIES OF A CALCIUM INHIBITOR ON GIBBERELLIN RESPONSE IN 'DELICIOUS' APPLE

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In 1988, solutions of the calcium modifiers verapamil (50 μ M) or trifluoperazine (100 μ M) were prepared alone or combined with gibberellin GA₄ (100 ppm). 50 μ l aliquots were injected into the calyx end of fruit 15 days after full bloom (FB) to fruit thinned to one fruit per cluster on randomly selected limbs of a spur-type 'Delicious'/M.26 apple trees. Developing fruit were collected at FB+16 plus weekly thereafter for an additional 3 weeks and analyzed for fruit Ca, Mg, and K. GA₄ increased fruit weight. There was no treatment effect on fruit Ca, Mg or K. Calcium decreased quadratically over time and Mg and K decreased in a cubic manner over time. At harvest, fruit treated with a calcium modifier had greater Ca. GA₄ increased fruit K and the length/diameter (L:D) ratio. In 1989, verapamil (300 μ M) was applied alone or in combination with gibberellins GA_{4/7} (100 ppm) at FB+16 days using the same method as in 1988. Developing fruit were collected 2, 5, 9, and 16 days after treatment. GA_{4/7} increased fruit weight, Ca, and Mg. At harvest, there was no response to verapamil. GA_{4/7} increased fruit length and L:D ratio and promoted seedlessness.

FISH HYDROLYSATE FERTILIZER: ITS POTENTIAL ROLE IN COMMERCIAL CRANBERRY PRODUCTION

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Productivity in cranberry plots receiving either fish hydrolysate fertilizer or inorganic soluble fertilizer at the same dose has been studied for the past three seasons. In the past two seasons, fish hydrolysate fertilizer (produced from cod frames and stabilized with phosphoric acid) has been used experimentally on a commercial scale. Both series of experiments lead to the conclusion that fish hydrolysate is an acceptable alternative to soluble fertilizer for cranberries. In fact, fish hydrolysate will be included in the University fertilizer guidelines for cranberries to be issued in the spring of 1990. The evidence will be presented along with the arguments in favor of the use of this organic-type material. Continuing lines of research which may lead to increased grower acceptance will be outlined.

RELATING PREHARVEST ENVIRONMENTAL CONDITIONS TO POSTHARVEST SCALD DEVELOPMENT IN APPLES

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Scald development on apples is related to preharvest environmental conditions. For Cortland, a highly scald-susceptible cultivar, a quadratic negative relationship exists between hours below 10°C experienced before harvest, and scald development after 3 or more months of storage. If a hexane extract of fruit surfaces is made at harvest, the OD at 200 nm of the extract has a negative linear relationship to scald development. Although both preharvest temperature records and OD 200 values of hexane extracts at harvest can predict scald development, hours below 10°C appears to be the better indicator. Since both fruit maturity and preharvest light intensity also influence scald development, the effects of hours below 10°C, fruit maturity, and light intensity on endogenous antioxidant activity in apple peel are being examined. Data to date indicate that hours below 10°C and fruit maturity substantially influence total antioxidant activity, but light intensity has little effect.

STABILITY INDICES FOR HORTICULTURAL CROPS

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Several different types of stability indices have been developed to assess the performance of a crop genotype across a number of years or locations. These indices may be used in conjunction with absolute measurements of performance to identify, for example, high yielding, stable cultivars. Some indices reflect a static concept of stability, while others are more dynamic. Two basic approaches have been taken to assess stability; one involves an analysis of variance approach and the other a regression approach. Yield data for 10 strawberry cultivars

measured over 5 locations and 6 years were subjected to 5 different stability analyses. In general, there was little agreement among methods as to the relative amount of stability inherent in each of the genotypes, and there was no consistency when stability was measured in different years. The reasons for this are many. First, different indices are sensitive to different types of stability. Second, disagreement exists as to the proper concept of stability. Third, the methods themselves violate several assumptions of the statistics upon which they are based. When using a stability index, one must be aware that outliers have a significant impact on the stability estimates, other cultivars in the data set can have strong influences, indices are often inconsistent from year to year, and indices may not have predictive value or be heritable.

ETHEPHON EFFECTS ON TART CHERRY PULL FORCE AND FRUIT QUALITY

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Ethephon is used to promote tart cherry fruit loosening and early uniform ripening. The maximum label rate has recently been reduced from 0.70 to 0.28 kg/ha. The objective of this research was to determine the efficacy of low ethephon rates on tart cherry. Five treatments (check, 0.19 kg/ha dilute, 0.19 kg/ha airblast (A5), 0.33 kg/ha AB, and 0.47 kg/ha AB) were applied on 3 July 1989 to 'Montmorency' tart cherry. Pull force (PF), a/b color ratio (a/b), soluble solids (SS), titratable acidity (TA), and fruit weight (WT) were measured on 12, 14, and 17 July 1989. No differences in PF, a/b, SS, TA, or WT were found between the dilute, low AB, or the check on any date. There was no linear relationship between AB rate and a/b, SS, TA, and WT on any date. There was a linear relationship between AB rate and PF each date; however, the r-square values ranged from 0.02 to 0.07. Under Pennsylvania's conditions, the lower label rates of ethephon were ineffective in promoting fruit loosening and early uniform ripening.

EFFECTS OF REFLECTIVE MULCH ON YIELDS OF BELL PEPPER

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The effects of black plastic, silver coated black plastic and aluminum foil mulches were compared on yields of a fall planting of Capsicum annuum L. cv. Bell Captain. Yields and numbers of #1 quality fruit (> 5.33 oz) were highest in the black plastic plots, however, there were no significant differences between the three mulches. The effect of mulch treatment on bacterial leaf spot infection was evaluated at harvest. The severity was greatest in the aluminum foil covered plots followed by the silver and black plastic respectively. The initial objective of this study was to evaluate the effect of mulch on the incidence and severity of cucumber mosaic virus (CMV). As such, source plants systemically infected with CMV were used in this study. However, disease severity was extremely low due to very low numbers of alate aphids until the last week of the trial.

BIOSTIMULATION OF PLANT PROPAGATION BY SEAWEED/HUMUS EXTRACTS

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A seaweed/humus extract (ROOTS) was tested as a propagation biostimulant. Transplants from seed showed enhanced root, root hair, and shoot growth. Cultivars tested included: Broccoli 'Bonaza', Coleus 'Park's Brilliant', Dahlia 'Redskin', Eggplant 'Early Bird', Gazania 'Pinata', Geranium 'Earliana' and 'Hybrid Orbit', Impatiens 'Shady Lady' and 'New Guinea', 'Tango', Marigolds 'Gay Ladies' and 'Climax', Nicotiana 'Nikki', Pepper 'Park's Whopper', Petunia 'Total Madness', and Tomatoes 'Sweet Million', 'Good n' Early', 'Better Boy', 'Early Girl', 'Lady Luck' and 'Super Steak'. Cuttings from citrus cultivars showed improved rooting (Lemon 'Ponderosa', Lime 'Bearss', and Orange 'Calamondin'). Cuttings from succulents also showed improved propagation (Pedilanthus tithymaloides cucullatus, Senecio deflersii, and an unknown stapeliad species). Seaweed extracts, known growth stimulants, when fortified with humic acid, offer promise as a propagation biostimulant.

GROWTH AND FLOWERING OF POINSETTIA WITH MILLED OR UNMILLED PINE WOOD PEELINGS IN THE ROOT MEDIA
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Rooted cuttings of 'Brilliant Diamond' poinsettia were planted one per 6 inch pot in peat:vermiculite in which were mixed 20, 40, or 60 percent of unmilled or milled pinewood peelings. Unmilled and milled peelings similarly increased air space and decreased water capacity of peat vermiculite root media. Unmilled peelings at 40 and 60% decreased available water more than did milled peelings. Total pore space was not altered except that 60% milled peelings increased it above that of the peat vermiculite control medium. Plants in 60% unmilled peelings were shorter than those in all percentages of milled peelings. Inflorescence number per plant was unaltered by treatment. Inflorescence diameters were reduced below those of control plants by 60% milled and unmilled peelings. Dry weight was increased above control and all other treatment dry weights by 40% milled pine peelings. Reduction in inflorescence diameters at 60% levels of unmilled and milled peelings may be associated with the great reduction in available water noted at these levels.

IN VITRO FORMATION OF STORAGE ROOTS IN SWEET POTATO *Ipomoea batatas*.

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An experiment was designed to determine if different sweet potato cultivars perform similarly with regard to the storage root initiation. Six cultivars representing different genotypes; four levels of sucrose; 2, 4, 8 and 12%; in combination with three levels of BA; 0, 1 and 5 ppm; were used in this experiment. Fibrous roots of 4-5 cm were excised and cultured on half strength medium of the MS salts in addition to Staba vitamins, 7% agar, and 100 mg/l myo-inositol. With regard to the storage root initiation, and callus formation there was significant differences between the cultivars, sucrose, and BA levels. Four cultivars were able to form storage roots when high level of sucrose (8%) in combination of either 1 or 5 ppm of BA were used. High level of callus was formed when 5 ppm of BA were used in addition to low level of sugar (2%). No difference was found between the cultivars to form fibrous roots and 4% sugar with no BA was the most effective combination.

UPDATE ON IN VITRO REGENERATION OF COMMERCIAL MINT
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Leaf discs and petioles from commercial peppermint (CP), *Mentha piperita*; orange mint (OM), *M. citrata*; native spearmint (NS), *M. cardiaca*; and scotch spearmint (SS), *M. spicata* were cultured on basal medium containing MS salts and vitamins, 10 mg l⁻¹ BA, 2% sucrose, and 25% coconut milk. Petioles from all mint species regenerated shoots, whereas only leaf discs from CP and OM were regenerative. There were no differences in contamination rate or number of regenerated shoots whether petioles were the first or second expanded pair. Petioles from in vitro stock plants regenerated a greater number of shoots at a faster rate compared to petioles from greenhouse stock plants. Leaf discs and petioles were irradiated using a cobalt 60 source delivering 0.27 krad min⁻¹ for 0 to 160 minutes. Shoots regenerated from one OM leaf disc, one CP and NS petiole each after 4 min exposures; and one SS petiole after a 2 min exposure. Preliminary studies indicate 3 cm microshoots root faster than 1 cm microshoots when stuck in vermiculite or a 1:1 mix of vermiculite and RediEarth[®].

EFFECTS OF CYTOKININ ON SHOOT PRODUCTION IN VITRO FROM PETUNIA LEAF EXPLANTS.
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Leaf discs of *Petunia hybrida* 'Coral Sea' were cultured on a modified MS media, with varying amounts of four different cytokinins. A correlation was found between type or concentration of cytokinin and shoot production. Kinetin failed to produce shoots, BA was intermediate, and 2ip and zeatin produced the most shoots. BA, 2ip and zeatin led to shoot initiation within 13 days of culturing, but BA stimulated more synchronous shoot production. In other studies, it was found that a minimum of 10 days on medium combining BA was required to produce shoots. The longer the culture period on BA, the greater the number of shoots. Cultures grown on media without BA for more than 15 days and then transferred to media with BA failed to produce shoots.

GERMINATION OF DOUBLY DORMANT CHIONANTHUS VIRGINICUS SEEDS.
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Seeds of *Chionanthus virginicus* L. have a double dormancy associated with germination. Seeds are inhibited by a hard bony endocarp. Inhibition may also be due to the endosperm and possibly embryo dormancy. Experiments were performed on excised embryos in sterile culture. Little growth was noted on excised embryos, which possibly indicates dormancy within the embryo. In another experiment, whole seeds, seeds with endocarp removed, and acid scarified seeds were germinated in moist peat moss to observe inhibition by the endocarp. Seeds with endocarps removed, germinated quicker and in higher percentages than whole seed or scarified seed. Scarified seeds showed no improvement over whole seeds and radicles which were produced tended to be less vigorous. Whole seeds were also soaked for 24 hours in 1000 ppm GA and germinated in moist peat moss. Treatment with GA did improve radicle emergence.