GREENHOUSE VEGETABLES
Bark and Sawdust on Soiless Media for Greenhouse Tomatoes.

D. J. Cotter, New Mexico State University, Las Cruces.

Bark and sawdust media were used successfully for growing greenhouse tomatoes over 3 crooping years. When fresh material was used, it was necessary to apply added nitrogen for the first 2 weeks to overcome the expected nitrogen deficiency associated with using fresh organic material with a wide cover nitrogen ratio. Subsequently the nitrogen added in the normal fertilizing schedule was inadequate. Yields of plants in most organic media were moderately high and not significantly different than those of plants in standard peat-lite or scoria rock. Root knot nematode infestations, previously a chronic problem in soil culture, were not a problem in bark and sawdust.

Studies on the Extended Use of Nutrient Solutions for Hydroponic Culture.

W. Berry, Los Angeles State and County Arboretum, Arcadia, California, H. Johnson, Jr., and G. Bradford, University of California, Riverside.

Historically, nutrient solutions for hydroponic culture have been used for a few weeks and then discarded. This avoids the need for frequent chemical analyses in order to keep the solution in "proper balance." Currently, there are many hydroponic greenhouse installations throughout the West which are utilizing solutions of premixed salts on a one to two-week basis, followed by disposal of the solutions on the greenhouse property. These solutions contain significant amounts of nitrates and other soluble salts which constitute a pollution hazard to groundwaters, particularly on more permeable soils. In most areas of California, this disposal practice of hydroponic waste is in violation of the current regulations of the Water Quality Control Boards.

Recent studies on greenhouse tomato crops at the University of California, Riverside, and at a commercial hydroponic installation have investigated the extended use of nutrient solutions as a means of avoiding the pollution hazard and reducing operating costs. The substrate, in both cases, was granitic pea gravel confined in beds 6 to 8 inches deep and 24 to 30 inches wide. In practice, a modified Hoagland's solution is monitored for changes in total salt content (by daily EC measurements) and small amounts of complete stock concentrate are added as required. The changes which occurred in the solution and in plant tissue were followed closely by laboratory analyses from periodic samplings.

It has been found that extended use of nutrient solutions, under the study, was limited to perhaps 90 days. This is due to the accumulation of extraneous ions brought into the system from tap water and impurities in the chemicals used to prepare the solution. At first, calcium and sodium accumulations from tap water additions caused some difficulty in estimating the concentrations of NO3-N, PO4-P, and K from total salt readings. Later, zinc, copper, and iron reached excessive levels in the solution, accumulated on the roots in high concentrations, and interfered with uptake of zinc and copper sufficiently to produce deficiency levels in leaf tissue. Phosphorus concentration in the solution has been difficult to maintain due to continuous losses to insoluble forms on the surface of gravel particles and in the beds. Nickel has entered the system from macronutrient chemicals and accumulated to possibly toxic levels in plant tissue. Cadmium accumulated to a possibly significant level.

The extended use of hydroponic solutions has many limitations; however, there is some basis for anticipating improved performance over the recent experience through additional precautions to avoid extraneous ion accumulation.

Automatic Drip Irrigation of Greenhouse Tomatoes.


An automatic drip irrigation system using a switching tensiometer, time clock, filter, water flow controls and low volume low pressure emitters kept soil moisture near field capacity in a 2-acre tomato greenhouse. Automatic soil moisture sensing and water application reduced management time and cost, eliminated wide fluctuation in available soil moisture, increased marketable yield and saved water. Simultaneous demand for water did not exceed 25% of the total water requirement of the 2-acre drip irrigation system. Tensiometer location, sensing depths and switch settings were critical. All post plant fertilizer was applied through the system as required to maintain optimum soil and plant concentrations. Initial cost of system was recovered in first crop.

LANDSCAPE, FLORICULTURE, AND TURF
A Study of the Poplar Budgall Mite, Aceria parapopuli.

J. R. Fuecht, Colorado State University, Extension Horticulturist, Denver.

The poplar budgall mite is an eriophyid which colonizes in bud primordia of Populus sargentii and several other species of cottonwood native in the Rocky Mountain area.

Knowledge of the life cycle of this eriophyid is essential to the discovery of adequate control measures. The study showed that overwintering of Aceria parapopuli is largely in the adult stage within galls formed the previous year. Females became active fully 30 days before resumption of bud growth. Eggs are laid in cavities of the galls, these hatching at the time buds break in the trees. Research included a three year series of chemical treatments using foliar, trunk-injected and soil-injected pesticides. Results showed that 25 ml per tree of metasystox-R (trunk injection) and bluguet method gave significant control if applied in early May. Metasystox-R applied to the foliage gave no significant control.

Dormant oil and dorman oil plus chlorobenzilate treatment applied mid-March, early April, and early May resulted in significant reduction of eriophyid populations in the overwintering galls but had no effect on reduction of new gall formation. Dissection of galls showed that metasystox-R (trunk injection) resulted in death of all mites and had an apparent residual effect, destroying hatching eggs. Those with dormant oil in the treatments had active mites and nymphs in some of the cavities “convolutions” of the galls, particularly those near the center.

Physiology of Pinyon Needle Gall Formation.

J. A. Byers, J. Wayne Brewer, and Donald W. Denna, Colorado State University, Fort Collins.

The physiological responses involved in the formation of insect stimulated galls are poorly understood. It appears however, that the insect somehow alters the normal plant hormone balance causing the formation of these abnormal plant growths. Pinyon needle galls provide an excellent system for study of gall formation because closely related midges cause highly different galls. Auxin and gibberellin were extracted from normal and galled needles using solvent partitioning and thin-layer chromatography. Bioassays were used to detect and quantify low levels of these hormones. Auxin level increases of 20 fold and gibberellin level increases of 5 fold were found in galls as compared to normal needles. Only low levels of gibberellin and no auxin were detected in the insects that cause the galls to be formed. Histogenic cellular changes of hypertrophy and hyperplasia support the suggestion that auxin and gibberellin are important factors in gall formation. It is postulated that the gall forming insect may produce some type of diphenol which would inhibit peroxidase or auxin oxidase enzymes, which normally destroy auxin, thus allowing the hormone to increase the unusually high levels and producing abnormal plant growth.

Biological Studies of Ponderosa Pine Needle Galls.

P. R. Johnson and J. W. Brewer, Colorado State University, Fort Collins.

A pine needle gall midge Contarinia coloradensis Felt (Diptera:Cecidomiidae) causes severe stunting of needles, g obese basal galls of various types, and premature needle drop of Pinus ponderosa. Laws in Colorado, high infestation levels, 50 to 80% of new needles, reduced tree growth and vigor. At elevations of 5 to 6,000 feet adult midges emerged from mid-April to mid-May. Females
What Tomorrow Looks Like Today.

J. E. Howland, University of Nevada, Reno.

1) Ecology concept of voter (and customer) accepted as a fact of life; 2) Safety regulations federally monitored and enforced; 3) National-wide land use planning; 4) Rural America preferred for living; 5) Flowers wanted, but without any commitment to gardening; 6) Accelerating upsurge in use of bedding plants; 7) Explosion in turfgrass varieties but less promotion of lawns and lawn care; 8) Growing interest in using native ornamentals; 9) Revival of interest in walled gardens, paved gardens, espaliers, vines and trellises; 10) Revival of street tree planting.

Control of Elm Bark Beetles Using Cacodylic Acid.

B. B. Hosteller and J. W. Brewer, Colorado State University, Fort Collins.

Dutch elm disease was detected in Ft. Morgan, Colorado in 1968 and has been spreading rapidly through Colorado since that time, creating a threat to the American elms, especially those that are in high concentrations. A research program pertaining to the Dutch elm disease problem was recently initiated at Colorado State University. This particular part of the research was concerned with control of the elm bark beetle. Thirty American elms were girdled with a hatchet 1/2 ft above the ground. Cacodylic acid was introduced into the girdles of 15 of the trees with a plastic squeeze bottle at the rate of two ml. per foot interval after a 3 week interval. The bolts were put into individual cages and the adult bark beetles that emerged were counted. Phloem samples were taken from the disks and quantitatively analyzed for arsenic with an atomic absorption unit.

Benomyl as a Tool in Dutch Elm Disease Control.

R. A. Morrow, Colorado State University, Fort Collins.

During July and August, 1972, 137 mature American elms (Ulmus americana L.) were treated with a 5000 ppm solution of solubilized benomyl. Twenty-five trees with positively diagnosed infection were treated to examine the therapeutic possibilities of benomyl. The remaining 112 trees were treated as a possible preventative measure. Tree diameter ranged from 6 to 36 inches at breast height. Trunk injection involved the use of an increment borer and a 60 ml syringe. Distribution of this systemic fungicide throughout the tree crown was insured by locating injection sites equidistant around the trunk with a bolt and a disk being taken from the five foot level and from each 10 inch circumference. The trees were felled several months later with a hatchet 1/2 ft above the ground. A research program pertaining to the Dutch elm disease problem was recently initiated at Colorado State University. This particular part of the research was concerned with control of the elm bark beetle. Thirty American elms were girdled with a hatchet 1/2 ft above the ground. Cacodylic acid was introduced into the girdles of 15 of the trees with a plastic squeeze bottle at the rate of two ml. per foot interval after a 3 week interval. The bolts were put into individual cages and the adult bark beetles that emerged were counted. Phloem samples were taken from the disks and quantitatively analyzed for arsenic with an atomic absorption unit.

Movement of Trifluralin, Nitralin and Oryzalin in Containers.

C. E. Whitcomb and J. F. Butler, Oklahoma State University, Stillwater.

Trifluralin, Nitralin and Oryzalin were applied to 6-inch containers using 25 ml sprays at 0, 5, and 10 lb ai/A. Media was a 1:1 peat and sand mix. Twenty-five containers were planted with cotton and tomato and kept in a greenhouse. The cotton and tomato were grown in an inert medium showed greater sensitivity to location as compared to those grown in soil. Analysis of Mistletoe Nectar.

J. J. Hanan, D. W. Moon, and W. D. Holley, Colorado State University, Fort Collins.

Yield and quality of cut-flower carnations as a function of bench location were obtained during the cooling season. Two 110 ft benches were divided into six plots of 'White Sim' (Dianthus caryophyllus) and seven buffer plots of 'Red Sim'. Fan and evaporative-pad cooling followed the 1971 greenhouse cooling specifications. Maximum production for the record keeping period, between Nov. 1, 1971 through Oct. 1, 1972 occurred during the 4-week periods beginning with Feb. 21 through April 17. The center third had the highest yield from March 20 through May 15. There were no significant differences between the two ends. Quality of cut flowers dropped rapidly, beginning April 17, the pad-end third of the bench showing significantly lower quality July 10 through August 7. 'Red Sim' was apparently more sensitive to temperature differences as the result of bench location than 'White Sim'. The center buffer plot of 'Red Sim' produced more than twice as many flowers between the dates of June 26 and Oct. 16 as the pad-end buffer plot. There was a similarly reduced yield toward the fan-end, though not so marked. Plants grown in an inert medium showed greater sensitivity to location as compared to those grown in soil.

Carnation Response as a Function of Location in the Bench During the Summer.

J. J. Hanan, D. W. Moon, and W. D. Holley, Colorado State University, Fort Collins.

Analysis of Mistletoe Nectar.

J. W. Brewer, K. J. Collyard, and C. E. Lott, Jr., Colorado State University, Fort Collins.

Dwarf mistletoes, Arceuthobium spp. are important parasites of conifers in many parts of the western U.S. The plant is apparently insect pollinated but little is known about the insect attractants.
involved in such pollination. This study was conducted to determine the quality and quantity of mistletoe nectar and its role as an insect attractant. Nectar was collected from dwarf mistletoe, Arceuthobium abietinum, flowers by centrifugation. Nectar analysis was conducted using liquid chromatography, infrared spectrophotometry, thin-layer chromatography, and refractometry. Based on refractometry studies, the sugar concentration was very high, averaging 86.9% (range 58 to 92). Gas chromatographic analysis of one sample indicated a lower sugar concentration of 65.6% with component sugars being dextrose (32.6%), fructose (26.2%), and sucrose (7.8%). Traces of maltose and other oligo-saccharides were also present. Thin-layer chromatography and infrared spectrophotometry confirmed the presence of these sugars. Flowers of A. abietinum are very small (0.5-1.5 mm.) inconspicuous blossoms. The average droplet produced by these flowers contained 20 µl of nectar. This spherical droplet, sometimes nearly one mm in diameter, was almost as large as the flower itself. The density of the nectar was 1.416 g/ml. This highly concentrated nectar must be an important insect attractant and undoubtedly an important factor in pollination of this parasitic plant.

The Induction of Water Stress in Tree Seedlings and Fungi by Use of Polyethylene Glycol.

J. Mecal and C. P. P. Reid, Colorado State University, Fort Collins.

Polyethylene glycols (esp. PEG 4000) are useful in adjusting the water potential (Ψ) of liquid cultures. Water stress studies have been conducted with Agaricus bisporus and conifer seedlings in which the Ψ of the nutrient solutions was adjusted with PEG 4000. PEG has the advantages over other osmotic in that it is not readily absorbed as salts nor is it readily metabolized. It is also not biodegradable, and as such will not support fungal growth. Thermocouple psychrometric determinations of PEG solutions indicate that the water potential is made up of an osmotic component at low concentrations and a matric component at higher concentrations.

Isolates of mycorrhizal fungi were grown in axenic culture to study the growth response to decreased water availability. The Ψ of the nutrient solution was adjusted from about -1 bar to -20 bars with PEG 4000. Maximum growth (measured as dry weight production of the two Basidiomycetes species occurred at -5 bars. The imperfect species grew well at all potentials, with maximum dry weight production occurring at -15 bars. The relationship between substrate Ψ and shoot dry weight of Pinus ponderosa Laws and P. contorta Doug. ex L. seedlings was also investigated. PEG 4000 shows good potential as an osmoticum for artificially inducing plant water stress. The characteristics of PEG solutions also allow a comparison between controlled studies and natural soil water stresses.

Comparisons of Levels of Some Macronutrients in Soil and in Plant Tissue.

G. J. Odegard and C. P. P. Reid, Colorado State University, Fort Collins.

Several macronutrients were chemically analyzed from the components of soil, herbaceous vegetation, tree reproduction, and overstory trees in a stand of mature lodgepole pine (Pinus contorta Doug.) on the east slope of the Front Range of Colorado. Comparisons are made for levels of nitrogen, phosphorus, potassium, calcium in the soil horizons with the understory and overstory reported in the literature. The soils are of low fertility and this is reflected in the chemical analysis of plant tissues. Ranges of N, P, K, and Ca for lodgepole pine foliage are 0.23-0.50%, 0.03-0.05%, 0.08-0.16%, and 0.23-0.39% respectively; for lodgepole pine branches 0.73-0.86%, 0.06-0.08%, 0.16-0.33%, 0.06-0.16%; for tree reproduction 0.36-0.84%, 0.05-0.14%, 0.07-0.33%, and 0.29-1.33%; for herbaceous vegetation 0.79-1.50%, 0.04-0.16%, 0.17-1.13%, and 0.34-0.66%, and for the soil A2 horizon 0.02-0.10%, 6-58 ppm, 15-165 ppm, and 0.5-3.4 meq/100 g. Comparisons are made between experimental data and values reported in the literature.

Patterns of Water Stresses in Trees as Related to Environmental Parameters.

Kent Evans and C. P. P. Reid, Colorado State University, Fort Collins.

Tree moisture stress is an important limiting factor to tree growth. High stresses can be induced by atmospheric conditions which cause high transpiration rates or by soil conditions which reduce water uptake by roots. Moisture stress data collected over two growing seasons for Engelmann spruce and quaking aspen are used to demonstrate diurnal and seasonal patterns of water stress and their relationship to environmental parameters. More than 75% of the variability in moisture stress can be accounted for by measurements of certain variables including air temperature and relative humidity, soil temperature at several depths, and solar radiation. Soil water deficits limit the amount of recovery from stress that a tree can make during the night. Implications of water stress to growth and vegetative management are presented.


J. R. Feucht, Colorado State University, Fort Collins.

An urban environment results in special horticultural problems requiring special and sometimes unique solutions. This paper discusses some of the more unique problems encountered in the rapidly growing Denver metropolitan area. Included are examples of long-term but gradual deterioration of certain species of woody landscape plants caused by poor water quality compounded by inadequate soil drainage, a near epidemic of a pine beetle normally confined to forested areas, caused by incorrect cultural practices and a build-up of an insect pest as a consequence of commercial contract spraying, a common and accepted practice in urban areas. Attempts to reduce these and other problems through educational programs will be briefly discussed.

The Consumer’s View Today for Horticulture.

J. E. Howland, University of Nevada, Reno.

Lawns currently are the largest agricultural crop in annual dollar expenditures in many parts of the U.S., yet little has been published about the interests of the homeowner responsible for deciding what is to be done this year or how much money will be spent. Reliability of a structured method of selection for personal interviewing has been established by comparison with sales data for lawn seeds, fertilizers, and pesticides. Interest in lawn care typically develops rapidly during the first three years of home ownership, then declines rapidly to a static low after year five. Moving to another house reactivates the cycle. Interest levels in areas initially reached never reaches levels for areas developed from tract model selling or custom building.

Temperature Management and Quality of Cut Flowers.

E. C. Maxie, University of California, Davis.

Packages of cut carnations and roses are often exposed to in-transit temperatures detrimental to subsequent quality. Temperatures well above 40°C have been recorded in packages of both species when exposed to simulated transit conditions. In 5 of 10 air test shipments, recording thermographs showed in-package temperatures in the 27°C range for carnations. Current methods of packaging involving insulating layers of paper often give an effect directly opposite to the intent of the methods. Sensitivity to ethylene increases dramatically with increasing product temperature. Carnations are remarkably resistant to mechanical injury and appear well adapted to surface (truck) transport if marketing systems can be adjusted to it.

Breeding Perennials.

R. D. Uhlinger, University of Nebraska, North Platte.

Chrysanthemum and carnation are the perennial species which receive most of the effort in the North Platte ornamentals breeding program. Penstemon breeding receives less attention at the present time. Potential stock used in our mum breeding program has its origin in material screened by Hildreth at Cheyenne and improved by Howard at the same station. Work by Viehmeyer at North Platte plus some advanced generation hybrids of Dianthus plumarius x Chabaud carnation. D. plumarius imparts some hardiness plus a tendency toward evergreen habit but reduces flower size. Selecting for hardiness and field performance is complicated by soil borne diseases. Breeding procedures for chrysanthemum and carnation plus examples of selected clones are included in a slide presentation.
Container Production of Woody Ornamentals.

C. E. Whitcomb, Oklahoma State University, Stillwater.

Container production of woody ornamentals is dependent on the successful integration of 1) propagation, 2) growing medium, 3) surface drainage, 4) container size, 5) irrigation system, 6) water quality, 7) nutrition, 8) weed control, and 9) overwintering. Container production, compared with conventional field production, 1) totally restricts plant roots, limiting the quantity of nutrients and moisture available only to that which is provided; 2) because of the above ground position of the container, summer temperatures are much higher and winter temperatures much lower and 3) the physical structure of the container presents an entirely different system of water movement, aeration of roots, nutrient leaching, and nutrient absorption.

Selection and Breeding of Shrubs at the U.S. National Arboretum.

D. R. Egolf, U.S. National Arboretum, Washington, D. C.

The U.S. National Arboretum has become a major center for the development, evaluation, and distribution of woody ornamental cultivars. Triploid hybrids of syringa L. (rose of sharon), which are highly sterile, continue flowering throughout the summer and are more tolerant of atmospheric pollution. Interspecific hybridization of Lagerstroemia indica L. (crepe myrtle) x L. fauriei Koehne produced shrub or tree-like, mildew resistant progeny of limited color range; but in advanced seedling generations a wider flower color range and diversity of growth habits have been recovered. Pyracantha (firethorn) with scab and fire blight resistance; evergreen foliage; abundant, persistent, brilliantly colored fruit; and greater hardness have been selected. Viburnum cultivars with disease resistance, fragrant flowers, abundant fruit, and compact growth habits have been introduced. Recent research includes work with Cercis, Malus, Syringa, and a number of Rosaceae genera.

VEGETABLE CROPS

Developments in Pickle Culture.

W. L. Sims and R. N. Campbell, University of California, Davis.

The performance results of the 1972 pickling cucumber variety tests conducted at Davis clearly illustrate the rapid changes occurring in varieties. Perfecto Verde, 14A x 40B, Bravo, Earlipik, and Mariner gave outstanding performance in yield and dollar value per acre. Premier, Bounty, and Pioneer produced satisfactory yields.

A New Strategy in Breeding Cucumbers for Mechanical Harvest.

D. W. Denna, Colorado State University, Ft. Collins.

It is proposed that potentially, the most efficient cucumber plant for mechanical harvest would be the mature fruit having the size, shape and other qualities desired in the processed product. This would allow for a maximization of the fruit yield per plant, flexibility in harvest timing, and probably also for a high fruit to vine ratio. The fruit would need to be parthenocarpic, and it would probably be desirable for it to retain its immature green color during the approach of maturity. The development of the seedless condition would also require that the plant be completely gynoecious. All of these characteristics are presently available in commercial varieties. In most cases, the mature fruit dimensions would need to be smaller than those of any currently available cultivars. Our current research indicates that suitable genetic material for this purpose may be available.

A Look at Pickle Harvesting Labor.

J. E. Ellis, Colorado State University Fort Collins.

Pickle harvesting labor is difficult to acquire and is becoming more difficult each year. Factors contributing to this situation have been the termination of the Bracero program which permitted Mexican nationals to enter the country for the purpose of harvesting seasonal crops, the increase in welfare benefits and coverage, social legislation and activities, and a national advancement of living standards. The ultimate answer seems to be to delegate the task of harvesting pickles to machines but for many areas this is not yet economical. In the meantime, sources of labor other than migrants are being investigated. CSU is in its second year of operating a program to involve high school students in pickle harvesting. This program will be discussed.

Demonstration Garden as a Learning and Teaching Tool.

D. L. Hatch, Cooperative Extension Service, Oregon State University, Eugene.

Gardening techniques such as anti-crustants, plastic and organic mulches, density plantings and plant supports were demonstrated in garden grown by Extension Agent. Selection of adapted cultivars was a major consideration. Cooperation of various gardening included. Application of garden to Extension methods is discussed.

Micronutrient Deficiencies and Toxicities for Vegetable Crops.

W. L. Lindsay, Colorado State University, Fort Collins.

The soil is a chemical and biological matrix in which the various plant nutrients are held with varying degrees of tenacity. In the case of micronutrients, the solubility and availability of Zn, Fe, Mn, and Cu decrease with increase in pH, that of Mo increases with pH, and that of B and Cl are relatively independent of soil pH. These solubility relationships can be predicted from a theoretical basis. The availability of micronutrients in soils is also affected by the quantity of labile nutrients in the solid phase that can readily replace that in solution as plants remove them from solution. Chemical extractants such as chelating agents have been found useful in assessing available micronutrient cations. Example will be given of the DTPA (diethylenetriaminepentaacetic acid) as an extractant for Zn, Fe, Mn, and Cu. This soil test is capable of predicting both deficient and toxic levels of micronutrient cations. The results of this soil test will be discussed in terms of mineral deficiencies and toxicities in vegetable crops.

Response of Seed of 27 Cucumis melo Cultivars to Three Storage Conditions.

L. N. Bass, National Seed Storage Laboratory, Fort Collins, Colorado.

Seeds of several cantaloupe cultivars retained essentially their full initial germination during 12 years' storage under all conditions tested. However, seeds of other cultivars showed some reduction in germination after 7 years, and after 12 years under the higher temperatures, very few seeds germinated.

Researching Market Potential and Implementing Results.

T. S. Cleverly, New Mexico State University, Las Cruces.

Vegetable marketing projects tend to be feasibility studies. The content here will be that more can be done than to determine "This crop has potential." Production potential and market potential need joint and interactive determination. If the crop is found to have potential, then how do you achieve it and what may be done through a research project to provide assistance? This paper will present an approach that is to be used. Given production and market potential, alternative approaches to implementing that potential are defined. These are evaluated and a plan specified with allowances for contingencies. Individuals and agencies are named and their roles indicated. Cooperation for the approach and assistance in implementing the results are sought throughout the project.

Experiences with Ethephon on Melons.

H. Johnson, Jr., University of California, Riverside.

Ethephon has been tested for several years in California as a harvest aid for cantaloupes. It is applied as a foliar spray at the time when some natural fruit maturity has occurred in the planting, with the objective of concentrating harvest and reducing the harvest labor requirement. Rate and timing are of critical importance, as well as all growth-regulating materials. The major effect of ethephon on cantaloupes is that of promoting abscission so that fruits separate easily from the vine. Abscession is induced in immature fruits as well as those of marketable maturity, and generally begins about three days after application. It has been found that quality of harvested fruit (i.e., firmness of soluble solids and flesh color) is essentially the same as it was at the time of application; implying that there is little or no effect of ethephon in accelerating maturity of the edible flesh. Premature applications have yielded poorly-colored or green-fleshed fruits which are frequently substandard in soluble solids. When application is delayed until some fruits of natural maturity have developed in the planting, fruit quality from treated plots is similar to that from nontreated plots. Results to date have shown that 0.8 lb per acre provides the best yield response and significantly reduces the
number of harvests required. Lower rates provide a lower and slower yield response, but are still under investigation as a means of avoiding fruit quality problems. Higher rates (1.2 to 1.6 lb per acre) have caused excessive foliage yellowing and loss of leaves with resultant sunburn to the fruit.

Experiences with Ethephon Onions.

J. W. Sims, University of California, Davis.

Ethephon applications of 2500 to 5000 ppm to onions strongly promote bulbing and inhibit top and root growth, even during short photoperiods. Fall planted onions treated with ethephon shortly after germination have severely retarded leaf growth for several weeks after treatment. Ethephon promotes larger bulbs for several weeks to a few months, but control plants continue to produce leaves, and by harvest time the following spring have the larger bulbs. Fall ethephon treatment inhibits bolting, probably indirectly due to its effect on plant size in early spring during flower inductive conditions. Spring ethephon applications to fall seeded onions enhance rate of bulbing and also partially inhibit bolting. Effects of these late applications, 30 to 60 days before harvest, on bulb size and yields are inconclusive, but in one experiment in which bolting was excessive, ethephon increased yields as a result of fewer seedstalks and higher percentage marketable bulbs. Ethephon applied to long day, spring seeded onions 30 to 60 days before harvest enhanced rate of bulbing and also inhibited seedstalk production.

Experiences in the Use of Ethephon on Tomatoes During the 1972 Season.

W. L. Sims, University of California, Davis.

During the 1972 season, approximately 5,000 acres of processing tomatoes in California were treated with ethephon, the plant regulator which accelerates fruit ripening. Treatments of the first commercial fields began on May 30 in the desert area near Blythe and continued into practically every tomato district in the state ending in late September and early October. Performance information is still coming in but generally, the results have been satisfactory and a great deal of experience and information has been gained this year in the use of the material as to rates and timing of applications. Variety, field maturity, season, temperature, and vine condition are factors influencing ethephon performance.

Interactions of Carbon Dioxide and Ethylene in Overcoming Thermodynamic of Lettuce Seeds: The Role of Phytochrome.

F. B. Negma, O. E. Smith, and J. Kumamoto, University of California, Riverside.

Ethylene and CO₂ were used to control induction of germination in thermodynamant lettuce (Lactuca sativa L.) seeds at 35°C. These experiments ultimately showed that germination depends on the presence of the active form of the phytochrome (Pfr). The phytochrome system is functional and stable at 35°C, a temperature which completely inhibits germination. Phytochrome responses to red or far-red light and darkness showed that this inhibition of germination at high temperature must be due to some other block(s) rather than to a direct inactivation of the phytochrome system itself.

Inhibition of Chlorophyll and Solanine Formation and Sprouting of Potato Tubers by Mineral Oil Treatments.

S. J. Jadhav and D. K. Salunkhe, Utah State University, Logan.

Potato tubers on a cumulative exposure to light turn green as a result of chlorophyll synthesis and develop a bitter taste and off-flavor due to accumulation of highly toxic solanine alkaloid. Sprouting of potatoes is another problem that confronts the potato industry. To approach the problem of greening and solanine formation, ‘Norgold Russet’ tubers were treated with mineral oil (0.125, 2.5, 5, 10, 15, 20, and 100% w/v) in ether or petroleum ether and subsequently displayed under a fluorescent light (200 ft-c) for seven days at 60°F. Treatments at or above 10% concentration of mineral oil significantly inhibited the formation of chlorophyll as well as solanine. A treatment at 10% level also effectively inhibited sprouting of stored potatoes (60°F and 60-80% R.H.). In general, mineral oil dipping is potentially an effective and efficient method to prevent these defects. From the point of practical application, such a method has long been sought by the potato industry.

Interrelations Between Nitrogen Nutrition and Early Blight Control on Yield of Potatoes.

P. N. Soltanpour and M. D. Harrison, Colorado State University, Fort Collins.

Three different rates of soil-applied nitrogen were combined in a complete factorial way with different schedules of fungicidal sprays for early blight control in field experiments for three consecutive years. The results indicated that yield response to fungicides was more pronounced when potato plants had adequate amounts of nitrogen than when they were deficient. Both spraying and nitrogen applications reduced the percentage of leaves affected by early blight lesions. However, the effect of fungicide was more than that of nitrogen. Economic analyses based on the cost and price assumptions showed that one dollar investment in the optimum number of fungicidal sprays at the adequate rate of fertilizer returned $8.34, $9.71, and $1.89 in 1970, 1971, and 1972 respectively.

Experiences in Mulching Peppers and Lettuce.

N. F. Oebker, Y. Barr, and H. J. Hopen, University of Arizona, Tucson.

Various paper mulches were evaluated on peppers and lettuce in central Arizona in 1972. In bell peppers, transplanted March 17, mulched plots produced higher yields than unmulched control plots. Generally, aluminum coated paper was more effective than clear polyethylene (PE) coated brown paper and black PE coated paper. Approximately 20% less water was used on the mulched pepper plants with aluminum mulch than with clear PE coated paper. In January-plantled lettuce, mulch speeded growth and increased head weight in the following order of effectiveness: 1) clear PE plastic, 2) black PE coated paper, 3) clear PE coated brown paper, and 4) no mulch. In a fall lettuce crop, brown paper mulch (clear PE coated) in combination with surface and subsurface drip irrigation was compared to subsurface drip without mulch. Mulched plots outyielded non-mulched plantings. Lettuce with mulch-surface drip had better germination and seedling growth than lettuce with mulch-subsurface irrigation. In general, surface irrigated mulch had higher yields than subsurface irrigated mulch.

Effect of Seed Singulation and Degradable Mulch on Emergence and Growth of Head Lettuce.

F. D. Moore, III, Colorado State University, Fort Collins, and E. E. Roos, National Seed Laboratory, Fort Collins.

Both greenhouse and field experiments involving seed singulations and mulch were carried out. Seed singulations, i.e. various pellet types and tape, were compared with uncoated seed as to their performance with regard to emergence and growth. These same parameters were measured when black paper treated with polyethylene was used as a soil covering. The contribution of the mulch to water conservation was also measured. Most singulations delayed emergence by two days. Some singulations appeared to lengthen the emergence period. The mulch hastened emergence and growth, raised soil temperatures in the seedling root zone and reduced water consumption by approximately one order of magnitude during the stand establishment period. The relationship between seed singulation, mulch and growth uniformity will be discussed.

Watermelon Pollination in Colorado.

J. W. Brewer, Colorado State University, Fort Collins.

Colorado is the leading producer of certified watermelon seed in the U.S. Pollination studies in southern Colorado indicate that insect pollinators are necessary for commercial seed production and that honey bees are adequate pollinators of this crop. The number and weight of melons was significantly higher from plots visited by bees than from those where bees were excluded. Very high populations of honey bees did not improve yield but were correlated with normally occurring bee populations. The number and weight of mature melon seeds was also significantly higher from plots visited by bees than from those where bees were excluded. A correlation coefficient of 0.90 was obtained when the number of seed per plant was correlated with melon weight. A coefficient of 0.85 was obtained when the weight of mature seeds was correlated with melon weight. Very low correlations were obtained using numbers or weight of immature seeds. Six species of native bees were found to be active
pollinators of watermelon blossoms. One of these, *Melissodes bimaculata*, seemed to be especially efficient as a pollinator, much more so than the honey bees. In southern Colorado present field populations of native and honey bees appear to be sufficient for commercial seed production and additional colonies of honey bees need not be provided.

**Paper Mulching in Muskmelon in Low Rainfall Areas.**

W. S. Peavy, Area Horticulturist, Fort Stockton, Texas.

Weed control may be achieved in muskmelon by herbicides, tillage, or mulches. Mulches not only control weeds but also conserve irrigation water and help prevent excessive salt concentrations in the plant rooting zone. For commercial muskmelon production, probably the only mulch that is economically feasible is a synthetic mulch that can be machine laid. It is also highly desirable that the mulch is biodegradable so it can be discied in the soil at the end of the season. Tests were made in the spring of 1973 in southwestern Texas on a sandy loam soil using black polyethylene coated paper mulch in a field to be planted to muskmelon transplants in peat pots. Various widths and types of paper mulch were laid with a "Yellow Devil" mulch applicator. The one PE paper in the 57 and 60 inch widths was found to be the only workable type of paper mulch. These trials will be resumed in 1974.

**FRUIT CROPS**

**Recent Developments in the Culture of Macadamias in Southern California.**

L. E. James, Whittier College, Whittier, California.

Recent developments in the culture of macadamias in southern California pertain primarily to the selection of varieties for specific climatic areas. Experiences of growers have indicated that the Hawaiian varieties do well along coastal areas but selections of *M. tetraphylla* appear to be more adapted to inland areas. Therefore a plan has been developed to evaluate existing varieties and to establish guidelines in the selection of trees. This plan has necessitated better understanding of the phenological growth stages of macadamia nut trees and a study of wind and frost resistance. Other cultural developments include recommendations of greater amounts of both fertilizers and water than heretofore used by most growers.

**What Water can do for the Arid Lands of the Navajo Reservation.**

J. M. Jordan, San Juan Branch Experiment Station, New Mexico State University, Farmington.

A slide presentation showing what can be done for the arid lands of the Navajo Indian reservation when water is delivered to the 110,000 acres of the Navajo Indian Irrigation Project now under construction. The San Juan Branch Experiment Station is located on the reservation and on the lands to be irrigated by the project. A four-season presentation shows development of the station from near-desert conditions of the Indian reservation to the present lush growth of fruits and vegetables when water is applied.

**Electron Microscopy of Cold Hardiness Changes in Peach Buds.**

Y. Feng, W. F. Campbell, and D. R. Walker, Utah State University, Logan.

The objective of this study was to define the ontogenetic changes that occurred in 'Elberta' peach flower buds (*Prunus persica* (L.) Stobes) during dormancy. Buds were collected at weekly intervals from Oct. 25, 1971 to March 29, 1972. The buds were preserved by standard electron microscopic techniques. Thin sections (500 to 700 Å) of the ovarian tissue were examined with a Zeiss EM-902 electron microscope. Electron micrographs indicated very little activity prior to Dec. 20. By Dec. 27 a single membrane bound body (microbody or lysosome) and rough endoplasmic reticulum (RER) were present. Also, the Golgi bodies (dictyosomes) were approaching a mature state. By the end of February the number of mitochondria, Golgi bodies and vehicles had increased markedly. By the first week of March, large nucleopores were observed in the nucleus. These data indicate that the cell is preparing for rapid growth long before the temperature is favorable for growth.

**Iron-Manganese Relations of Deciduous Fruits in Colorado.**

E. Rogers, Colorado State University, Austin-Rogers Mesa Research Center, Mesa.

Sodium ferric ethylenediamine di-(o-hydroxyphenylacetate) reduced Fe chlorosis, increased Fe and decreased Mn concentrations in 'Sungold' and 'July Elberta' peach and 'Starking Delicious' apple leaves. Regression coefficients indicate that there is a greater linear relationship between the N applied to the soil as (NH4)2SO4 and the composition of 'Sungold' peaches than Fe induced Mn deficiency and fruit composition. Manganese disodium ethylenediamine tetracetate at 453.6 g, 907.2 g and 1814.4 g in the presence of 113.4 g FeNa2-EDDHA increased the concn of Mn in 'July Elberta' peach leaves. Manganese disodium ethylenediamine tetracetate at 680.4 g, 1360.8 g and 2721.6 g in the presence of 226.8 g of FeNa2-EDDHA also increased the concn of Mn in 'July Elberta' peach leaves.

**Cane Characteristics Associated with Fruitfulness of Red Raspberry.**

P. C. Crandall, Washington State University, Vancouver.

Number of berries per cane and per lateral, number of fruiting laterals, number of nonfruiting laterals, and length of laterals were correlated with cane diameter and height. Data were collected for 'Puyallup' one year and 'Willamette' for 3 years. Berries per cane and per lateral and length of laterals increased with diameter. Number of nonfruiting nodes decreased and the number of fruiting nodes tended to decrease. Berries per cane and the number of nonfruiting nodes were little affected by cane height. Berries per lateral were increased while the number of fruiting nodes decreased as height increased.

**THE FUTURE OF HORTICULTURAL RESEARCH**

**Determining Research Priorities in Horticulture.**

P. Larsen, Washington State University, Tree Fruit Research Center, Wenatchee.

Every prospective research proposal should be subjected to the following questions: 1. *Does it serve a real need?* Will it provide solutions to current problems of horticultural production and marketing, or generate new knowledge which will serve horticulture in the future? There are too many important unsolved problems to permit the frittering away of research resources into unimportant or poorly considered notions.

2. *What are the possibilities of success?* All problems in horticulture cannot be resolved by research. Many industry groups try to pass off difficult climatic or environmental situations to researchers when research is not the answer. Tough problems should be tackled, but the wise horticulturist will place priority on projects having a reasonable chance of success.

3. *Do we (I) have the ability to perform?* This major priority item can be viewed from several standpoints, including a) individual capability, education, experience, and desire; b) facilities available to do the research, including laboratories, orchards, field plots, etc.; and c) the financial base required for the particular project. A true horticulturist should be content with doing excellent horticultural research and not try to become a "pure" biochemist.

4. *Is this the best use of the intended research resources?* Even though the ability to perform may be present, the intended research may not be the best use of resources for a particular individual or in a given area. Where possible, work with apples in an apple area and citrus in a citrus area.

5. *Does the intended research have the support of the administration and horticultural clientele?* Insofar as possible, every horticultural research project should conform to the overall research priorities and goals of the administering group and hopefully provide some service to the horticultural industries of the area. Research and researchers can be independent without being repugnant.

**Horticultural Research—Where do we go from Here?**

E. C. Maxie, University of California, Davis.

Changing priorities of a society becoming ever more urban will dictate the kinds of research the federal and state legislatures will support. Individually and organizationally, horticulturists must ask themselves "What, in the field of pomology (landscape architecture, vegetable crops, etc) are the problems of interest to the general public?" How we answer this question and what we do to meet the challenge it poses will determine our research goals and more critically, whether we shall have budgetary support. People-oriented programs must be given priority over industry-oriented programs. This support can then be turned into more radical changes in programs as the statement may suggest. It does mean that both researchers and industry must project a new image. Some ideas on the why and the how of needed change will be discussed.