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MINIMIZING ENVIRONMENTAL STRESS IN FIELD ESTABLISHMENT OF VEGETABLE CROPS IN THE SOUTHWESTERN U.S.

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Overcoming environmental stresses during seedling establishment is crucial to successful vegetable production. In the irrigated production areas of the southwestern United States, stress most often is related to unfavorable temperature, soil or water salinity, or poor soil structure; it is frequently difficult to separate the effects of these stresses, since they may all be present to some significant degree. Growers use a variety of techniques to ameliorate these conditions. The use of sprinkler irrigation for stand establishment has become a widespread practice; sprinkling moderates soil temperature, minimizes salinity in the zone of germination, and reduces soil crusting. By modifying bed configuration, growers have been able to increase soil temperature to stimulate germination. Various chemical and physical treatments have proven effective in reducing soil crusting. The use of transplants has expanded for many crops, both as a means to circumvent seedling establishment problems and as a technique to obtain earliness.

INFLUENCE OF PRODUCTION ENVIRONMENT ON SEED VIGOR

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The environment that seeds experience during development, storage, and planting significantly affects seed vigor. Yet, relatively few studies have focused on how environment during seed development affects seed vigor. Our objective was to compare vigor of seeds developed in summer vs. winter. Lettuce *(Lactuca sativa* L.) seeds from six cultivars were developed in summer and winter at Yuma, Ariz. Seed vigor of these seedlots was compared using field plantings and growth chambers (at 20,25,30, and 35C). Seed vigor was greater for seed produced during summer than for that produced during winter, based on greater field emergence, higher germination percentages, and longer roots. These seedlot differences in vigor were greatest at 35C. Another way to estimate seed vigor is by ion leakage from seeds. Fewer ions leaked from seeds produced in summer than from those produced in winter. Thus, lettuce seed is more vigorous when produced in summer than in winter, and ion leakage is a good indicator of that vigor.

PHYSIOLOGICAL APPROACH TO SEED ENHANCEMENT

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Purchasers of high-value seeds expect strong, uniform, and reliable germination and establishment, even under stress. Enhancement refers to postharvest processes applied to the seed to improve performance. Most enhancement methods involve controlled hydration. In moisturization, water activity is increased up to the 0.6 to 0.7 range, and the seed is not redried before marketing. Moisturization reduces rehydration stress when the seed is sown. Priming methods include a diverse set of procedures that increase water activity beyond -0.9, hydrating membranes and, to various extents, physiologically activating the seed. After priming, seeds are redried to water activities below 0.7 to prevent fungal growth. Various hypotheses about why priming works will be presented.

SEED PELLETING-HISTORY AND MODERN FUNDAMENTALS

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The use and improvement of pelleted seed technology has greatly expanded in the last 15 years. Vegetable and flower seeds are pelleted to improve the singulation and planting placement in the field and greenhouse. Improved planting placement increases final-stand establishment, crop uniformity, and decreases seed and production costs. The commercial history of pelleted seed in the U.S. started after WWII with the development of the clay pellet by Filtrol Inc. Seed tablets and seed tape technologies were also developed but faded from the industry with the advent of better pelleted products. Current technology consists of a "splitting" seed pellet that allows for improved oxygenation. Improved technology also allows for pellet weights that can be tailored to meet the planting requirements of different species and planting systems.

A FILM-COATED BROCCOLI SEED PRODUCT

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Sakata Seed America investigated the possibility of marketing a film-coated broccoli seed product. Film coating is the process of applying a colored polymer film material onto the seed surface that completely covers the seed and any seed pesticide. Film-coated seed has the benefit of providing uniform and precise pesticide placement, is dust free, safe to handle, can be highly visible in the soil, and has increased flowability in seed planters. The drawbacks arc the cost of the film-coating machinery and the film product as well as the slower application rate. The basic application procedure of film products to broccoli seed and the effects of film products on seed viability and seed storage will be discussed.

CONTROL OF SEPTORIA LEAF SPOT OF PISTACHIO *(PISTACIA VERA)*

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Studies were established in 1992 and 1993 in a mature commercial pistachio orchard to determine the effectiveness of several fungicides for control of septoria leaf spot *(Septoria pistaciurum)*. Fungicide treatments used in 1992 were Bravo 720F at 3.0 lbs./A (ai.) and 4.5 lbs./A a.i.; Kocide 101 50W at 8.0 lbs./A a.i. plus Benlate 50W at 1.0 lb./A a.i. Fungicide treatments in 1993 were Bravo 825 WDG at 3.0 and 4.5 lbs./A a.i. and Benlate 50W at 2.0 lbs./A a.i. Treatment replications consisted of two treated trees separated by nontreated trees within the row and nontreated tree rows dividing treated rows. At

crop maturity, disease severity was determined by counting the number of leaf spots caused by septoria on ten leaves collected at random from each of the two trees of each replicated plot. All treatments significantly reduced disease severity compared to trees receiving no fungicide treatments. Experimental plots were too small to detect any apparent effect of fungicide treatments on yield. Leaves around nut clusters not receiving fungicide treatments were senescent at crop maturity, while leaves on treated trees showed no sign of senescence.

EFFECT OF INSECTS AND INSECTICIDES ON ONION SEED AND BROCCOLI SEED PRODUCTION IN SOUTHWEST ARIZONA

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In 1991 and 1992, insecticide trials were conducted on onion and broccoli grown for seed, respectively, near Yuma, Ariz., to evaluate the effects of insects and insecticide treatments on seed production. Four insecticides (Agri-Mek, Ammo, Capture, Lorsban) were evaluated on onions where both western flower thrips *[Frankliniella occidentalis* (Pergande)] and onion thrips *(Thrips tabaci* Lindeman) were present. Visual differences between treatment resultant from onion thrips damage were evident within 10 days after treatments were applied at flower opening. Lorsban, Ammo, and Capture treatments provided control of onion thrips based on condition of seed heads. Ammo and Capture were the only treatments that increased seed yield, as the Lorsban treatment was thought to repel bees needed for pollination. Pyrethroid treatments yielded 40% more seed than the nontreated check, which yielded more than Lorsban and Agri-Mek treatments. Four insecticide treatments (Thiodan, CGA-215944, and two rates of RH7988) were evaluated on broccoli seed where green peach aphid *[Myzus persicae* (Sulzer)] was present. All treatments reduced aphid numbers compared to the nontreated check, with RH7988 providing most control. Seed yields (g/plant) were reduced in all insecticide-treated plots compared with the nontreated plots, although percentage of seed sized larger than 4.5/64" was apparently correlated with increased aphid control. Seed yield per plant was higher from the lower rate of RH7988 than the higher rate. Plants treated with RH7988 had almost 0.5 g/plant more seed sized 5.5/64" than other treatments.

COMPLEX SEGREGATION ANALYSIS (CSA) OF GERBERA FLOWER COLOR

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The frequency distribution of gerbera flower hue in the Davis population of gerbera appears continuous and bimodal. This suggests that a gene of large effect may be segregating in a background of polygenic variation. CSA is a statistical technique developed in genetic epidemiology for investigating such complex traits without the need of inbred lines. The REGC program of SAGE (Elston, LSU Medical Center, New Orleans) uses the regressive models of G. Bonney (1984) through pedigree analysis to provide estimates of major gene parameters and residual correlations among relatives. Pedigrees obtained from generations 14, 15, and 16 indicate that a major dominant gene for hue is segregating and accounting for -0.66 of the total variation. The genotypic means are 32 degrees and 71 degrees for the *aa* and *bb* genotypes, respectively. The a allele is dominant to the *b* allele and has a frequency of 0.55. The residual parent-offspring correlation estimate is 0.2 and measures the genetic contribution to the remainder of the variance.

STUDIES OF LIQUID FERTILIZATION OF ANTHURIUM

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Anthuriums appear to be very salt sensitive. Small plants of *Anthurium andraeunum* 'Marian Seefurth' were fertilized daily with 25, 50, 75, 100, and 125 ppm N of 12N-16P-30K + micros (75% nitrate-25% ammonium) liquid fertilizer corresponding to 0.50,0.74, 0.98, 1.22, 1.45, and 1.69 $mS \cdot cm^{-1}$ of electrical conductivity (EC). After 1 year, flower production was greatest [5.2 flowers per plant (fl/pl)] at 0.50 $mS.cm^{-1}$ (25 ppm N). Flower production decreased gradually with increasing EC to 3.9 fl/pl at 1.45 $mS \cdot cm^{-1}$ (125 ppm N), then dropped to 1.8 fl/pl at 1.69 $mS \cdot cm^{-1}$ (150 ppm N). Flower stem length and flower size followed the same pattern. With larger 'Ellison Onizuka' plants, the number of flowers, flower stem length, and flower size all peaked at 0.74 $mS \cdot cm^{-1}$ (75 ppm N). A drop was again observed at 1.69 $mS \cdot cm^{-1}$ (125 ppm N). Other workers recommend 0.60 to 0.80 $mS \cdot cm^{-1}$ for anthurium production. Our findings are in agreement. However, for smaller plants, 0.50 $mS \cdot cm^{-1}$ would produce better growth.

RESPONSE OF FIELD-GROWN NORWAY MAPLE AND GREEN ASH TREES TO WHITE AND BROWN TREESHELTERS

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We investigated microclimate, gas exchange, and growth of field-grown Norway maple *(Acer platanoides)* and green ash *(Fraxinus pennsylvanica)* trees in brown, white, or no treeshelters. Microclimate, tree growth, and gas exchange measurements were taken summer and winter. Treeshelter microclimate was greenhouse-like compared to ambient conditions, as short-wave radiation ($S\downarrow$) was lower, and midday air temperature and relative humidity were higher. In both species, this resulted in less trunk growth and greater specific leaf area, which are growth responses characteristic of shade acclimation. Treeshelter microclimate did, however, substantially increase shoot elongation and stomata1 conductance, but did not increase photosynthesis when compared to trees grown without shelters. White shelters allowed 25% more penetration of $S\downarrow$ than brown shelters, but tree growth and climatic variables did not differ with treeshelter color. Stomatal conductance, however, was higher for trees in white shelters. Treeshelters also appeared to have a negative effect on plant hardiness. New shoot growth in shelters was more winter-damaged, particularly in maple, than nonsheltered trees. This may be related to winter bark (T_b) and air temperature (T_a). Winter midday T_b on trees grown in shelters was up to 15C higher than T_b on trees outside shelters, while midday T_a inside treeshelters was up to 20C higher than T_a outside treeshelters.

VARIABLE URBAN IRRADIANCE AND SHADE ACCLIMATION IN NORWAY MAPLE STREET TREES

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Shade acclimation response of Emerald Queen Norway maple street trees to variable urban irradiance levels was investigated. Specific leaf area, trunk growth, and crown density were measured from trees in 13 sites ranging from urban canyons in the business core to open exposures in residential areas of Seattle, Wash. Percentage of potential seasonal input of global shortwave radiation for each site was modeled based on the azimuth and elevation angles of the surrounding horizon topography. Building height in the business core reduced estimated irradiance to a range of 27% to 90% of that for an unobstructed horizon topography, while those outside the business core had 90% to 95% irradiance. As estimated potential irradiance decreased, growth of these maple street trees exhibited responses characteristic of shade acclimation in a dose-response pattern. Specific leaf area increased and trunk growth and crown density decreased to acclimated levels at -70% of potential irradiance. These acclimation responses did not degrade the function of the trees in their urban-canyon locations. Their foliage was healthy, and reduced crown density was not apparent since there were no full-sun-grown trees for comparison.

ROADSIDE MONITORING OF Pb, Cd, Zn, Mn, AND Cu ACCUMULATION IN PLANTS AND SOIL AT ZION NATIONAL PARK, UTAH

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We conducted a preliminary field study that examines the accumulation of Pb, Cd, Zn, Mn, and Cu in plants and soil along a roadway in

Zion National Park. The study is designed to determine the effects of motor traffic on the accumulation of these heavy metals in various plant species and soil during 1 year and to determine if these accumulations decrease as you move away from the roadway. Preliminary results indicate that the amount of Pb, Cd, Zn, Mn, and Cu concentrations found are a function of the number of vehicles passing during a year and the distance from the roadway. Higher concentrations of these heavy metals are found in areas close to the road and in areas where traffic is moving slowly or even stopped. The heavy metal concentrations decreased as the distance from the roadway increased, and the speed of passing vehicles increased.

SEED ENHANCEMENT AND THE PUBLIC: A PARTNERSHIP PROPOSAL

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Agricultural biotechnology, in such areas as seed enhancement, is making significant progress in overcoming a variety of conceptual and practical problems. As a result, the near-term potential is tremendous for improving agricultural productivity and efficiency on marginal lands, for decreasing reliance on synthetic chemicals, and for enhancing environmental acceptability. However, a number of major challenges lie ahead, at least three of which require the development of a strategic plan, if the seed industry is to remain viable. The emergence of resistant viral strains and more aggressive insects, as well as herbicide-resistant weeds, requires access to a greater diversity of genetic resources. Then: too, with governmental oversight, there must be a credible, sound review process that is flexible and assures safety while facilitating technology development, transfer, and use. Third, the public must develop a far better understanding of the applications of biotechnology and the actual risks they may pose. This can be accomplished through a process that recognizes the tremendous potential benefits biotechnology offers, while also eliminating irrational fears, mistrust of recombinant DNA, and ill-founded aversion to genetically engineered products. The purpose of this paper is to address these challenges concerning seed enhancement by proposing and outlining a partnership strategy supportive of school-based community seedbank programs. Also explored in this presentation, because they can ensure the success of such initiatives, are the reciprocal, conceptual changes that society appears to require of the seed enhancement industry and, more generally, agricultural biotechnology. In such respects, the emphasis is on the conservation of plant genetic resources. This includes the germplasm of crop plants, their wild relatives, and other plant species possibly contributing important genetic characteristics and scientific understanding of their oligogenic nature.

PURPLE NUTSEDGE CONTROL IN FALL VEGETABLES WITH EPTC AND SUMMER FALLOW

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Purple nutsedge *(Cyperus rotundus)* has become increasingly widespread in vegetable crops planted from August to October in the low deserts. A herbicide that is both effective and safe to crops has not yet been found. Several tests were conducted in southwestern Arizona to evaluate the efficacy of EPTC combined with summer fallow for the control of purple nutsedge. Preirrigation applications of the emulsifiable concentrate and granular formulation of EPTC were ineffective. These same treatments, applied after irrigation, when the top 6 inches of soil were dry, were very effective (75% to 90%) in controlling the emergence of purple nutsedge shoots. These tests demonstrated the importance of proper application and cultural practices when using this treatment before planting fall vegetables.

IMPLEMENTATION OF A SUSTAINABLE SMALL FARM EDUCATIONAL PROGRAM IN THE GILA RIVER INDIAN COMMUNITY, ARIZONA-A BEGINNING

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An educational attempt to assist Gila River Indian Community members to return to a sustainable small-farm heritage has shown initial success after 1 year. The project uses horticultural technology to help tribal members overcome severe social concerns. The first phase addressed the needs of youth at risk through a 10-acre farm at the Gila River Indian Community Juvenile Rehabilitation and Detention Center in Sacaton, Ariz. During 1993, the farm operation leveled 10 acres of squash, corn, and watermelons; planted and cared for 200 deciduous fruit and citrus trees; and planted and cared for 150 commercial Christmas trees. Produce was either sold to community members or donated to community food centers at the schools or at homes for the elderly. The youth were led by 14 volunteers who completed an intensive training program and were certified as Master Gardeners by the Univ. of Arizona. They have donated -300 hours of time to the project. The project gave youth at risk an opportunity to learn new concepts and skills, gain exercise, and work off detention time. As tribal leadership observed the initial successes, they gave permission to address health and nutrition as well as other youth-at-risk targets within the community beginning in 1994.

EFFECTS OF WILTHIN ON BLOSSOM THINNING OF 'LOADEL' PEACHES

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Various rates of Wilthin were applied at full bloom to limbs carrying 150 to 250 flowers to study their activity on blossom thinning of 'Loadel' peaches. Wilthin applied at 0.75% and 1.0% significantly reduced fruit set to 29% and 30%, respectively, while the control produced 94%. The effectiveness of the 0.75% rate was dramatic, but it is interesting to note that the 1.0% rate did not lead to excessive thinning nor phytotoxicity on foliage or fruit. More extensive studies need to be done to fully determine the potential of this material. However, these results suggest that further testing of Wilthin on a larger scale is warranted.