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QUARTERLY Reports on Plant Growth Regulation and Activities of the PGRSA

Volume 32, No. 2
April - June 2004

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PGRSA membership is open to all persons interested in the regulation of plant growth and development. Inquiries regarding membership should be directed to...

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The Quarterly is open to papers of merit dealing with all aspects of plant growth regulation and plant growth regulators. Manuscripts will be reviewed by two or more reviewers. Membership in the Society is not required. Newsworthy items, viewpoints and abstracts of theses and dissertations are also published as space permits.

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**2004
PLANT GROWTH REGULATION SOCIETY OF AMERICA
ANNUAL MEETING**

**August 1-4, 2004
Charleston Riverview Hotel
Charleston, SC**

SCHEDULE SUMMARY

Saturday, July 31

1400 – 1700 Pre-Conference PGRSA Steering Committee Meeting
(Little David Room, #225)

Sunday, August 1

1245 – 1730 Optional Tour of Confederate Submarine, H.L. Hunley and Patriots Point
Bus pickup at the hotel entrance at 12:45 pm

1300 – 2000 Registration (Promenade A)
JoAnn Coviello and assistants

1900 – 2100 Opening Reception
(Rainbow Room and Adjoining Courtyard)

Monday, August 2

0700 – 1730 Registration (Promenade A)
JoAnn Coviello and assistants

0800 – 0810 Opening Remarks (Cotillion B)
Dr. Eric Curry, President PGRSA

0810 – 0830 Opening Address (Cotillion B)
Dr. R. Woodson

0830 – 1000 **SYMPOSIUM I:** (Cotillion B)
TRENDS AND USES OF PGRS IN ORNAMENTALS
AND GREENHOUSES
Moderators:
Dr. Brian Whipker and Dr. J. Raymond Kessler Jr.

1000 – 1030 Break (Cotillion A)

- 1030 – 1200 Session I - Contributed Papers (Cotillion B)
Moderator: *Dr. Carol Lovatt*
- 1200 – 1330 Lunch (Citadel A and B)
- 1330 – 1530 **SYMPOSIUM II:** (Cotillion B)
 WATER RELATIONS, PGRs AND PLANT GROWTH
Moderator: *Dr. Ed Stover*
- 1530 – 1600 Break (Cotillion A)
- 1600 - 1730 Session II - Contributed Papers (Cotillion B)
Moderator: *Dr. Thomas Chao*

Evening Free in Charleston

Tuesday, August 3

- 0700 – 0800 Sustaining Members and PGRSA Steering Committee Breakfast (Citadel A)
- 0800 – 1730 Registration (Promenade A)
JoAnn Coviello and assistants
- 0800 – 1000 **SYMPOSIUM III:** (Cotillion B)
 HORMONE DELIVERY SYSTEMS
Moderator: *Dr. Sonja Maki*
- 1000 – 1030 Break (Cotillion A)
- 1030 – 1200 Session III - Contributed Papers (Cotillion B)
Moderator: *Dr. Wayne MacKay*
- 1200 – 1330 Hosted Lunch (Citadel A & B)
- 1330 – 1530 **SYMPOSIUM IV:** (Cotillion B)
 TREE ARCHITECTURE
Moderator: *Dr. Hanne Rasmussen and Dr. Ron Smith*
- 1530 – 1600 Break (Cotillion A)

1600 – 1730 Session IV - Contributed Papers (Cotillion B)
Moderator: *Dr. Eric Curry*

1830 – 2030 Poster Session and Reception (Cotillion A)
Moderator: *Dr. Steve McArtney*

Wednesday, August 4

0800 – 1200 Registration (Promenade A)
JoAnn Coviello and assistants

0830 – 1000 Session IV - Contributed Papers (Cotillion B)
Moderator: *Dr. Ricardo Menendez*

1000 - 1030 Break (Cotillion A)

1030 – 1200 Industry Session (Cotillion B)
Moderator: *Dr. Jeff Norrie*

1230 – 1400 Hosted Business and Awards Luncheon (Citadel A & B)
for all attendees and accompanying registrants

1500 – 1800 PGRSA Steering Committee Meeting
(Little David #225)

1845 – 2130 Hosted Gala Colonial Reception at the Old Exchange
for all attendees and accompanying registrants

1830 Pickup at Hotel Entrance

2115 Departure from Old Exchange or use your CARTA pass to return later.

**31st ANNUAL MEETING
PLANT GROWTH REGULATION SOCIETY OF AMERICA**

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AND GREENHOUSES
Moderators: *Dr. Brian Whipker and Dr. J. Raymond Kessler Jr.*

0830 TRENDS AND USES OF PGRS ON HERBACEOUS PERENNIALS (1)
Dr. Joyce Latimer

0900 THE DEVELOPMENT OF PLANT GROWTH REGULATORS FOR
NURSERY AND GREENHOUSE CROPS (2)
Dr. James Barrett

0930 PLANT GROWTH REGULATORS IN FLORICULTURE (3)
Dr. Brian Whipker

- 1000 – 1030 Break (Cotillion A)
- 1030 – 1200 Session I - Contributed Papers (Cotillion B)
Moderator: *Dr. Carol Lovatt*
- 1030 CLONING *CITRUS SINENSIS* FLORAL TIMING AND MERISTEM IDENTITY GENES TO IDENTIFY PGRS TO REGULATE FLOWERING (4)
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- 1330 – 1530 **SYMPOSIUM II:** (Cotillion B)
 WATER RELATIONS, PGRs AND PLANT GROWTH
Moderator: *Dr. Ed Stover*
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Evening Free in Charleston
(Use your CARTA pass to enjoy Old Charleston by Night)

Tuesday, August 3

- 0700 – 0800 Sustaining Members and PGRSA Steering Committee
Breakfast (Citadel A)
- 0800 – 1730 Registration (Promenade A)
- 0800 – 1000 **SYMPOSIUM III:** (Cotillion B)
HORMONE DELIVERY SYSTEMS
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†*Graduate Student Presentation Award Candidate*

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Wednesday, August 4

0800 – 1200 Registration (Promenade A)

0830 – 1000 Session IV - Contributed Papers (Cotillion B)

Moderator: *Dr. Ricardo Menendez*

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1000 - 1030 Break (Cotillion A)

- 1030 – 1200 **Industry Session (Cotillion B)**
Moderator: *Dr. Jeff Norrie*
- 1030 – 1045 *Sherry Leclere*
 Stoller Enterprises, Inc.
- 1045 – 1100 *Gary Custis*
 PBI Gordon Corporation
- 1100 - 1115 *Ricardo Menendez*
 Valent Biosciences Corporation
- 1115 - 1130 *Jerry Mayuex*
 Plant Biotech Incorporated
- 1130 - 1145 *Jeff Norrie*
 Acadian Seaplants, Ltd.
- 1145 – 12:00 *Jeff Dobbs*
 Olympic Horticultural Products
- 1230 – 1400 Hosted Business and Awards Luncheon
 (Citadel A & B)
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ABSTRACTS

(1)

TRENDS AND USES OF PGRS ON HERBACEOUS PERENNIALS

Joyce G. Latimer

Department of Horticulture, Virginia Tech, 301 Saunders Hall, Blacksburg, Virginia 24061 USA

Controlling the growth of containerized herbaceous perennials is challenging due to the large variety of plant materials, which generally have received less attention from breeders than their annual counterparts. More potent compounds have made it possible to treat perennials economically and fueled more research into effective control measures. This talk will summarize the use of the currently available PGRs on a wide variety of perennials, with an emphasis on effective treatments for the most commonly produced plants, along with the results of trials using new products and application methods.

(2)

THE DEVELOPMENT OF PLANT GROWTH REGULATORS FOR NURSERY AND GREENHOUSE CROPS

J.E. Barrett*, C.A. Bartuska, J.B. Million, R.K. Schoellhorn, D.G. Clark and T.A. Nell

Environmental Horticulture Department, University of Florida, P.O. Box 110670, Gainesville, FL 32611

PGRs are an integral part of greenhouse crop production. However, other than rooting hormones, the nursery industry has not developed routine usage of other PGRs. This is changing with the use of height-control products in herbaceous perennial production. PGRs are used primarily to prevent or accelerate flowering, to delay flower or leaf senescence and to increase or decrease plant size. The most important chemicals are daminozide, paclobutrazol and ethephon. For chemical companies, supporting a product in this market is difficult due to the extremely large number of crops and varieties and the significance of genotype x chemical and chemical x environmental interactions. Commonly, the growers find new uses for products before the chemical company is aware of them.

(3)

PLANT GROWTH REGULATORS IN FLORICULTURE

Brian E. Whipker

Dept. of Hort. Sci., Box 7609, North Carolina State Univ., Raleigh, N.C. 27695-7609.

Greenhouse floriculture crop production involves a wide diversity of techniques utilizing plant growth regulators (PGRs). New techniques being used by the industry include liner soaks, bulb soaks, and late season-low concentration drenches. New chemistries are also being introduced which provide additional options for height control. Plant breeders are expanding the horizon of greenhouse floriculture by constantly releasing improved cultivars or an entirely new species. Some of these crops require PGRs to manage excessive growth. An update on the direction of where the industry is heading will be presented.

(4)

CLONING *CITRUS SINENSIS* FLORAL TIMING AND MERISTEM IDENTITY GENES TO IDENTIFY PGRs TO REGULATE FLOWERING

Lynn J. Pillitteri, Linda L. Walling and Carol J. Lovatt*

University of California, Riverside, Riverside, CA 92521

It is commercially valuable to be able to manipulate flowering in citrus. Citrus has a lengthy juvenile phase that limits traditional breeding programs. Annually, time of flowering and floral intensity impact yield and net income. Identifying the genes that regulate juvenility and floral development is key to manipulating citrus floral phenology. *TERMINAL FLOWER* is a key regulator of floral timing in arabidopsis. A homologue of this gene (*CsTFL*) was isolated from the 'Washington' navel orange (*Citrus sinensis* L. Osbeck). *CsTFL* had 65% amino acid identity to *AtTFL*. Wild-type arabidopsis plants ectopically expressing *CsTFL* showed the expected late-flowering phenotype. Homologues of *LEAFY* and *APETALA1*, meristem identity genes that regulate flower formation, were also isolated. *CsLFY* and *CsAPI* had 65% amino acid identity to their arabidopsis counterparts. Wild-type arabidopsis plants ectopically expressing *CsLFY* or *CsAPI* showed the expected early-flowering phenotypes. Results of real-time PCR demonstrated that juvenility in citrus was positively correlated with *CsTFL* transcript accumulation and negatively correlated with *CsLFY* and *CsAPI* RNA levels.

(5)

FLORIGENIC PROMOTER OF LYCHEE (*Litchi chinensis* Sonn) SYNTHESIZED IN LEAVES

T.L. Davenport*, Z. Ying

University of Florida, IFAS, Trop. Res. & Ed. Ctr., Homestead, FL. 33031

The florigenic promoter is synthesized in leaves of mango and in stem tips of citrus and is translocated to buds in the phloem of mango. Because lychee trees appear to have the same phenology as mango and regulated by similar environmental cues, we needed to determine the source of the putative florigenic promoter of this crop to further understand the flowering mechanisms. Replicate branches from five trees each of two cultivars, 'Brewster' and 'Mauritius' were isolated from the rest of the canopy by girdling. All of the stem terminals on each branch were tip pruned to stimulate uniform bud break during cool, floral inductive conditions. One branch on each tree was defoliated to remove the potential source of the floral promoter and another was left with the full complement of leaves. Another set of replicate branches was left undisturbed to document normal flowering behavior. Virtually 100% of the lateral shoots initiating in the branches with leaves formed flowering shoots. In contrast, branches in which all of the leaves were removed formed only vegetative shoots. This is the first evidence indicating that the florigenic promoter of lychee is synthesized in leaves. Other information on subsequent fruit set will also be discussed.

(6)

CHEMICAL REGULATION OF TIMING AND SYNCHRONY OF BUD BREAK AND FLOWERING IN DIFFERENT WOOD TYPES OF APPLE

S. McArtney^{1*}, J. Palmer², R. Diack², S. Ward²

¹Department of Horticultural Science, NSCU and ²HortResearch NZ Ltd.

Bud break and flowering of apples is protracted in New Zealand's maritime climate due to a more gradual increase in temperatures during early spring and a high propensity for development of floral buds on one-year old woody shoots, which typically develop later than on older spur wood. Various horticultural sprays (HiCane®, Waiken®, Erger G, Urea, Armobreak +KNO₃) were tested for their effects on the timing and synchrony of bud break and flowering of one-year old shoots and spur wood of apple cv. 'Royal Gala' in two regions and seasons. Hi-Cane® or Erger G treatments were without effect on the synchrony of bud break or bloom, but advanced them by up to 8 days. Armobreak + KNO₃ advanced bud break and bloom by only 3-4 days, but also reduced the flowering period within each wood type in one experiment. The impacts of these responses on horticultural practices such as chemical thinning and harvest management will be discussed.

(7)

COMPARISON OF MULTIPLE RATES OF APOGEE® AND PALISADE® FOR ‘CHEYENNE’ BERMUDAGRASS SEED PRODUCTION

M. D. Rethwisch*, R. Perez and M. Reay

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Usage of gibberellic acid inhibitors have been documented to increase seed harvest of grasses in the Pacific Northwest, but had not been evaluated for bermudagrass seed production in the low desert. Four rates of Palisade® (1-4 pts/acre) and three rates of Apogee® (7-29 oz) were applied to ‘Cheyenne’ bermudagrass (*Cynodon dactylon*) to evaluate their effects on seed production. Treatments were applied just prior to inflorescence appearance, while applications of lowest two rates of both chemistries included both single as well as two applications with second application approximately two weeks after experiment initiation. All Palisade® treatments significantly reduced plant heights and inflorescence heights, as did twice applied Apogee® treatments for plant heights. Most Palisade® treatments also significantly reduced total inflorescence length as well as opened ‘heads’. Data indicate that higher rates of both chemistries and especially Palisade® significantly reduced seeds per unit area.

(8)

DEVELOPMENT OF ALTERNATIVE METHODS FOR PLANT GROWTH REGULATION IN EUROPE.

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The intensive use of chemical growth retardants is of environmental concern. Restrictions on the use of chemical growth retardants have been introduced in Europe in the recent years, and reflect a need for developing efficient non-chemical methods for plant growth regulation. Experiments with a range of genetically and ecologically widely differing plant species have shown that chemical growth regulation can be significantly reduced by using a low P buffer technique or drought stress as single factors or in combinations. Reduced nutrient and water availability during production also improved the post-production quality by significantly reducing the number of senescent flower buds and delayed root dieback compared with chemically growth-regulated plants. The presentation will give you an update on new promising methods for plant growth regulation and what attempts were made in Europe to implement the results to the horticultural industry.

(9)

†EFFECTS OF PLANT GROWTH REGULATORS ON THE INCIDENCE OF POWDERY MILDEW ON RUDBECKIA AND PHLOX

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Actively growing *Rudbeckia hirta* 'Indian Summer' and *Phlox paniculata* 'Blue Boy' plants were sprayed with seven growth regulator treatments: 10,000 ppm B-Nine (daminozide) applied twice; 160 ppm Bonzi or Piccolo (paclobutrazol); 60 ppm Topflor (flurprimidol); 60 ppm Sumagic (uniconazole); 4000 ppm Cycocel (chlormequat) on *Phlox* only; two applications of a tank mix of B-Nine/Cycocel at a rate of 7500/1500 ppm; and an untreated control. Two weeks following the first treatment, plants were inoculated with powdery mildew and disease incidence was monitored using the Horsfall-Barratt Scale for assessing disease. At the termination of the experiment (7 wk after treatment), plants treated with Bonzi and Piccolo had significantly less disease than all other treatments on both crops. Cycocel, the tank mix, and Sumagic treatments resulted in significant height control compared to controls on *Phlox*. *Rudbeckia* heights were not significantly different from control.

(10)

CAN WE DELIVER ENHANCED WATER USE EFFICIENCY, SUSTAIN YIELDS AND ENHANCE YIELD QUALITIES BY EXPLOITING ROOT-TO SHOOT SIGNALLING MECHANISMS IN CROP PLANTS?

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Signals travelling from roots-to-shoots have been shown to communicate information regarding soil water status and control gas exchange and growth in the absence of any changes in plant water relations. This phenomenon is embodied in the theoretical basis to a novel deficit irrigation technique known as partial rootzone drying (PRD). While several examples are in existence to demonstrate the success PRD, little physiological evidence supporting the theoretical basis to the technique exists, with some notable exceptions. This paper presents a brief review of relevant recent literature, the research of the European Consortium tasked with developing this novel deficit irrigation technology in Mediterranean crops, and research by the authors to elucidate the physiological basis of a plants' response to soil water availability. The paper will conclude by considering a new experimental framework to scrutinize PRD.

†*Graduate Student Presentation Award Candidate*

(11)

EXPANSINS AND THEIR ROLES IN REGULATING PLANT GROWTH

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Expansins are a group of proteins that were initially isolated from cell walls of cucumber hypocotyls and were capable of inducing cell wall extension *in vitro*. Expansin proteins loosen cell walls in an unconventional way by weakening glucan-glucan interactions between wall polymers. Since cell wall loosening is one of the key factors that determine the rate of cell elongation and expansion, expansins are believed to be important for regulating plant growth. Expression of expansin genes in many plant species is closely associated with the cell elongation/expansion process. A molecular genetics approach has provided direct evidence that expansins are capable of controlling cell expansion and thus plant size. Increasing evidence has indicated that expansins are involved in other processes in plants presumably also through softening the cell walls. These functions include seed germination, pollination and fruit ripening. Potential application of using expansin proteins, such as increasing plant growth and controlling fruit quality, will be discussed.

(12)

TRANSLATING CHANGES IN WATER STATUS INTO COMMERCIAL BENEFIT: A REVIEW TO STIMULATE DISCUSSION

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Water relations play a key role in plant development and economic production. Thus, water may be considered a fundamental PGR. In managing water relations through irrigation, minimization of drought stress is the most frequent goal. However, inducing moderate stress can also be beneficial, such as in the practice of regulated deficit irrigation or the use of drought stress to stimulate flowering and increase fruit sugar. Data from some PGR applications and pruning practices suggest that their effects on water relations may be substantial and may sometimes even be the mechanism for achieving desired results. Can we increase effectiveness of crop management practices by recognizing this link? For example, recent experiments suggest that improved water relations through increased root:shoot ratio, may be the primary mechanism for increased citrus fruit size following mechanical hedging and topping of tree canopies. Other experiments suggest that citrus fruit thinning may be accomplished through appropriately timed, moderate drought stress, which may interact with chemical thinners. Other opportunities for extending this concept might include efforts to identify a threshold water status necessary to stimulate flushing which may permit improved management of vegetative/cropping balance. Other PGRs which influence water relations may provide additional opportunities for effectively manipulating water status and commercially significant aspects of plant growth and development.

(13)

MEPIQUAT PENTABORATE FOR USE IN COTTON CULTIVATION

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Mepiquat chloride (MQC) was commercially introduced under the trade name Pix[®] for vegetative growth control in cotton in the USA in 1980 and has since become a cornerstone in modern cotton production. In some countries, such as India and Australia, the related compound chlormequat chloride (CCC) is used for the same purpose. However, a number of reasons indicate that CCC is the inferior product due to acting too abruptly and intensively and affecting only the main stem. Another variant is mepiquat pentaborate (MQB) (trade name Pentia[®]), which has just been introduced in the USA. The pentaborate form of mepiquat is showing a superior performance under field conditions as compared to its chloride salt. Mepiquat is absorbed more rapidly in the presence of pentaborate. As a result, new shoot growth is inhibited more intensively but the effect is not as “sharp” as that after a CCC treatment. Another positive effect of faster uptake is improved rain-fastness. The anion pentaborate provides some boron, which, under boron deficiency, may be of nutritive value. Finally, MQB is a non-hygroscopic salt, which would allow for production of granular formulations.

(14)

†THE ROLE OF EXOGENOUSLY APPLIED JASMONIC ACID, SALICYLIC ACID AND ETHEPHON ON PARTHENOLIDE CONTENT IN CLONED FEVERFEW (*Tanacetum parthenium*) PLANTS

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Exogenous foliar spray combinations of 0.5mM and 1.0mM jasmonic acid (JA), salicylic acid (SA) and ethephon (ETH) solutions were applied to vegetatively propagated cloned feverfew (*Tanacetum parthenium*) plants to measure effects on parthenolide content. Cloned feverfew plants were grown in one gallon nursery containers. The containers were placed in an open field and spaced 30 meters apart in a randomized complete block design. Rates of 0.5mM and 1.0mM utilizing seven different chemical systems were exogenously foliar applied. Fresh and dry weights, chlorophyll content, tissue mineral content, and parthenolide content utilizing HPLC (Tricar, Inc. method) were measured.

†*Graduate Student Presentation Award Candidate*

(15)

TRINEXAPAC-ETHYL, PLANT POPULATION, NITROGEN FERTILITY, AND CROP PRODUCTION IN DRILL-SEEDED RICE

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Under intense management (higher than recommended seeding and nitrogen fertility rates), lodging resistant/tolerant rice varieties will lodge. Trinexapac-ethyl can decrease plant stature and reduce lodging in rice. Francis, a variety moderately susceptible to lodging, was grown with dense stands and high nitrogen fertility. Foliar treatments of trinexapac-ethyl (6 and 12 g/A) were applied during the initial stages of stem formation (internode elongation). Growth reduction was noted within 2 weeks after application. At maturity, trinexapac-ethyl reduced mature plant height between 5 and 10%, delayed heading (a measure of crop maturity) between 1 and 3 days and increased grain yield up to 5% in the first crop. Rice was most responsive to trinexapac-ethyl at either a high plant population or with supplemental nitrogen fertility. With combinations of high plant population and supplemental nitrogen, the response to trinexapac-ethyl was minimal. Lodging was absent in the first crop. The second or ratoon crop, which originated from the stubble of the first crop, was unaffected by trinexapac-ethyl.

(16)

EFFECT OF GROWTH REGULATORS ON YIELD AND FIBER QUALITY AND QUANTITY IN FLAX (*Linum usitatissimum* L.)

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Gibberellic acid (GA₃) at 125 and 250 ppm and indole-3-acetic acid (IAA) at 1.0 and 3.0 ppm were applied as sprays over the canopy to determine their influence on fine-fiber yield, stem length, stem diameter, and fiber elongation. GA₃ treatment increased fine fiber yield by 13-14% and improved fiber fineness by 12-16%. GA₃ decreased chlorophyll content, stem diameter, flowering and boll production. IAA increased fine fiber yield, chlorophyll content, and stem diameter, but decreased fiber strength, and fineness. This research showed that the application of PGRs such as GA₃ and IAA to flax could increase the yield and achieve finer, stronger fiber.

(17)

SCREENING OF ACC-DEAMINASE CONTAINING RHIZOBACTERIA FOR GROWTH PROMOTION IN *ZEA MAYS* UNDER AXENIC CONDITIONS.

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Any factor/stimulus that causes a change in the endogenous levels of ethylene in a plant results in modified growth and development. Nine rhizobacterial isolates containing ACC-deaminase activity were used to inoculate maize seedlings under axenic conditions. Results showed significant increase in root elongation, shoot length and seedling fresh weight, likely due to the ability of these ACC enriched rhizobacterial isolates to deaminate ACC, the immediate precursor of ethylene. ACC-deaminase activity per unit time of the rhizobacterial isolates correlated significantly to root elongation by inoculation of that isolate. It is highly likely that this ACC-deaminase trait could be effectively used for screening of plant growth promoting rhizobacteria for growth promotion in maize.

(18)

ROLE OF ACC-DEAMINASE CONTAINING PLANT GROWTH PROMOTING RHIZOBACTERIA ON NODULATION IN MUNG BEAN (*VIGNA RADIATA*)

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Inoculation of plants with ACC-deaminase containing plant growth promoting rhizobacteria (PGPR) may alter the endogenous levels of ethylene (C_2H_4), which subsequently leads to changes in the growth and development of inoculated plants. Endogenous C_2H_4 synthesis has been found to act as a potent negative regulator of nodulation, therefore, two effective ACC-deaminase containing strains, *Pseudomonas putida* and *Pseudomonas fluorescence*, were selected for co-inoculation with *Rhizobium japonicum* on *Vigna radiata* (mung bean). Co-inoculation with ACC-deaminase containing PGPR increased number of nodules, and fresh and dry weights of nodules significantly as compared to *Rhizobium* alone, most likely by decreased C_2H_4 levels in the plant roots during early stages of nodule development. It is highly likely that ACC-deaminase containing PGPR could be employed to increase nodulation in legumes.

(19)

A NEW GENERATION OF LIQUID CULTURE BIOREACTORS TO STUDY PGR'S DURING PLANT ORGAN DEVELOPMENT

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Plant tissue culture protocols largely involve adjusting ratios of synthetic auxins and cytokinins on semi-solid media to stimulate formation of callus, somatic embryos, shoots and roots. Liquid culture creates a more dynamic exchange interface between tissue and media, but requires active management of water and oxygen. A new generation of simple bioreactors, introduced over the last decade, allows relatively simple, reliable and cost-effective means for growth of higher plants in liquid media. Traditional vessel sizes ranging from 50 to 500 ml were generally increased to the 2 - 20 L in these newer systems. Altering size and shape of plant tissue by adjusting the cytokinins and introducing gibberellin-inhibitors (e.g. ancymidol, paclobutrazol) facilitates aseptic handling of plant materials. The rate of solute transfer to the plant, particularly sucrose, was enhanced in liquid systems. Storage organ development, such as micro-tubers, micro-corms, micro-rhizomes, etc., is often promoted by jasmonic acid. The interaction between ancymidol and the increased availability of sucrose has been important to develop efficient systems. Similarly, increased availability of sugars and cytokinins is effective to increase shoot bud division during micropropagation.

(20)

EARLY CONTROL OF SEEDLING GROWTH BY TREATING SEEDS WITH GROWTH REGULATORS

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Control of seedling growth is a challenge in plug production. The goal of the research was to evaluate applicability of seed treatments with triazole growth regulators for early height control of ornamental and agronomic crops, as well as determine growth regulator distribution in treated seeds. Verbena, salvia, pansy, dill, and cucumber seeds soaked in 50 mg·L⁻¹ paclobutrazol solutions for 5 min produced seedlings that were up to 43, 18, 30, 22, and 44% shorter than controls, respectively. For most crops, increasing triazole concentrations during seed soaking were associated with progressive decreases in seedling emergence. Preliminary results indicate that this was associated with reduced seed metabolic heat and respiration rates. Preliminary mass spectrometry data demonstrate undetectable levels of triazole in cucumber fruits grown from seeds soaked in 50-1000 mg·L⁻¹ paclobutrazol. Mass spectrometry might be a prospective method to characterize location of triazoles in seed tissues.

(21)

THE EMBRYO MADS-DOMAIN PROTEIN AGL15 DIRECTLY REGULATES EXPRESSION OF A GENE ENCODING A GIBBERELLIN 2-OXIDASE

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To better understand how the MADS domain transcriptional regulator AGAMOUS-Like 15 (AGL15) functions during and after seed development, a chromatin immunoprecipitation (ChIP) approach was used to identify directly regulated genes. *AtGA2ox6*, which encodes an enzyme involved in GA metabolism, was identified and confirmed as a direct downstream target of AGL15. Constitutive expression of *AGL15* and of *AtGA2ox6* altered endogenous GA amounts and caused GA-deficient phenotypes in Arabidopsis that could be at least partially rescued by application of biologically active GA. The phenotype of plants with decreased expression of *AtGA2ox6* was the converse of plants overexpressing *AtGA2ox6* in terms of seed germination attributes and effects on somatic embryo production.

(22)

EFFECTS OF A RANGE OF GIBBERELLIN STRUCTURES ON GROWTH OF *PISUM SATIVUM* GENOTYPES DIFFERING IN SHOOT ARCHITECTURE

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We have been studying the effects of applications of a range of differing gibberellin (GA) structures to pea genotypes whose shoots are GA deficient (*le*) and possess distinct shoot architectures. GA deficient determinate and indeterminate lines differing in the number of flowers produced on a reproductive branch (WT, *det*, *det multi* and *ultramulti*) were treated with 25 µg of GA₃, GA₁, GA₄ and two ring D-modified GAs (which are known to act as competitive inhibitors of GA 3 beta hydroxylation), 16,17-dicholoro-methano-dihydroGA₅ (DiC) or the exo-enriched isomer of 16,17-dihydroGA₅ (DiHGA5) and grown under long days (LD). Plant height and axillary branch number were most affected by GA treatment. Applications of GA₃, GA₄, DiC, GA₃ plus DiC and GA₄ plus DiC were also made to the *det multi* line and the *ultramulti* line grown under short days (SD). Axillary branching increased in all treatments under SD, but GAs significantly promoted growth of the additional axillaries under short days only in the *ultramulti* line. The effects of applications of the above GAs and ring D-modified GAs on architecture, flowering and yield of these four pea lines will be discussed. Supported by NSF 9977087.

(23)

INTERACTION OF COMPOUNDS WITH THE ETHYLENE BINDING SITE

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Burg and Burg (Plant Physiol. 42:144-152, 1967) found the ratio of concentrations of alkene needed for a ½ maximum ethylene response for pea growth inhibition was 1:130:140,000 for ethylene, propylene, and 1-butene. They concluded the ethylene binding site was a restricted site. In testing some 1-substituted cyclopropene inhibitors of the ethylene binding site, it was found (Sisler *et al.* Plant Growth Reg. 40:223-228, 2003) that as the molecular size increases, most were more effective than 1-methylcyclopropene. The concentration requirements for a series of 1-alkenes starting with ethylene and ending with the 10 carbon 1-decene were tested for ethylene action in pea growth. These same compounds were also tested as ethylene inhibitors. Ethylene, propylene and 1-butene were active agonists in pea growth. Longer chain alkenes were inactive as agonists. In pea growth, 1-butene, 1-pentene, 1-hexene, 1-octene, and 1-decene were active as ethylene antagonists. These results show the change from ethylene agonists to ethylene antagonists in a single series with 1-butene being a pivotal compound active as both an agonist and as an antagonist. Probably hydrophobic interaction is involved. These results suggest the ethylene binding site is not very restricted.

(24)

EVIDENCE OF GROWTH STIMULATION BY LOW CONCENTRATION OF GIBBERELLIN SYNTHESIS INHIBITORS

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There are several compounds used in ornamental production systems and in the care and maintenance of trees in urban landscapes because they are known to inhibit the synthesis of gibberellins via the isoprenoid pathway when applied at labeled rates. The consequence of this effect on plants is typically reduction of vegetative growth with a re-partitioning of assimilates to reproductive growth and fine root development. However, at low concentrations that may arise due to environmental degradation or misapplication of applied compounds, growth stimulation may occur. Examples of stimulation of growth in plants, trees, and cell cultures will be presented and possible explanations for this seemingly anomalous response related to energy production in mitochondria via the electron transport chain.

(25)

SENSITIVITY OF RADISH TO VOLATILE ORGANIC COMPOUNDS: TOLUENE, ETHANOL, AND ACETONE

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Manned spacecraft are designed to have extremely low leak rates which may contribute to the accumulation of anthropogenic (solvents, hygiene products, machinery) and biogenic (plant, animal, microbial) Volatile Organic Compounds (VOC's) in the atmosphere. NASA's Spacecraft Maximum Allowable Concentrations (SMAC's) establish astronaut exposure limits for VOC's, however the biogenic activity of those levels to plants systems has not been determined. The validity of the SMAC's to plant production systems was tested by exposing radish (*Raphanus sativus* L. cv. Sora, Cherry Belle and Cherry Bomb) to three common spacecraft VOC's (acetone, ethanol, and toluene) at the SMAC, 0.1 SMAC and control concentrations. The radishes were grown in controlled environment chambers at 23°C, 75% RH with 1,500 mmol mol⁻¹ CO₂. A 16 h light/ 8 h dark photoperiod under cool white fluorescent lamps at 300 mmol m⁻² s⁻¹ PPFD was provided. Phytotoxic responses to ethanol and toluene, but not acetone, were observed at the 0.1 SMAC concentrations. This suggests that additional research on biogenic effects of VOC's in plant systems is required.

(26)

Response of Blueberry Cultivars to the New Plant Growth Regulator, CPPU

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Field studies designed to determine effects of the plant growth regulator CPPU [N-(2-chloro-4-pyridyl)-N'-phenyl urea] on blueberries have been conducted since 1999. Responses of the cultivars were measured by recording data on fruit set, berry size, and yield of blueberries. Most research has been focused on rabbiteye varieties (*Vaccinium ashei* Reade) grown in the southern U. S.; however, a limited number of studies have been conducted on highbush (*Vaccinium corymbosum*). Test results with both species have shown a positive benefit with CPPU in terms of increasing fruit set and berry size. Fruit set has been increased as much as 3-fold in some varieties and berry weight increased more than 30%. The most optimum rate on rabbiteye cultivars appears to be 10 to 15 mg/L applied at 12-18 days after flowering. Slight delays in fruit ripening have been observed in CPPU treated plants. These results overall suggest that CPPU may be a useful tool in blueberry production.

(27)

Fortified *Ascophyllum* Marine Plant Extracts IMPROVE YIELD AND QUALITY OF TOMATOS AND PEPPERS

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Minor use fertilizers and biostimulants are increasingly finding their way into mainstream agricultural programs. Extracts from *Ascophyllum nodosum* are now being fortified with micronutrients in addition to one or more other organic compounds, to provoke specific or general beneficial responses within the plant. A prototype product currently in development by Acadian Seaplants examined a blend of *Ascophyllum* extract, boron, organic acids and quaternary ammonium compounds (QACs) on tomato and pepper production. Trials indicate that when used in foliar applications, overall effects on tomatoes ranged from significant increases in fruit number (60.3%) and sizing (general increase in 7 categories), to slight improvements in fruit firmness (23.0%). For peppers, similar increases in fruit number (77%) and size distribution were observed. Similar results were found in a second experiment on fresh market “salad” tomatoes. Economic return to the grower indicated a significant benefit to using the fortified *Ascophyllum* extract product on these crops.

(28)

5-AMINOLEVULINIC ACID EFFECTS ON SQUASH, CUCUMBER, AND BELL PEPPER YIELD

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Field experiments were conducted to determine the effect of 5-aminolevulinic acid hydrochloride (5-ALA) on the yield of bell pepper, summer squash, and cucumber. 5-ALA (0, 3, 6, 9, 12, 15 mg·L⁻¹) was sprayed on the crop canopies once (1 day after the beginning of flowering), two times (1 and 7 days after the beginning of flowering), or three times (1, 7, and 14 days after the beginning of flowering). Regardless of ALAN rate, one application did not affect yield in any of the crops, compared to non-treated controls. When 5-ALA was applied two or three times at 12-15 mg·L⁻¹, squash and cucumber yields were significantly greater than in control plants. In bell pepper, two applications of 5-ALA did not enhance yield, but three applications at 12-15 mg·L⁻¹ resulted in yields significantly greater than in control plants.

(29)

DISTRIBUTION OF CYTOKININS AND AUXIN IN THE CONIFER CROWN

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Long seasonal growth interruptions with the formation of buds are inherent in the woody life form. Both auxin and cytokinins influence axillary meristem initiation, outgrowth and interactions between meristems; a rapidly growing body of molecular evidence supports this classical notion. However, hypotheses based on annuals, seedlings, or tissue cultures are challenged when applied to branching patterns of trees, e.g., models that imply continuing signaling between top and root system appear inadequate in a tall tree. Vegetative buds in conifer trees are mainly preformed, and growth potential and time of release highly predictable according to position. Buds with comparable position and fate may be destructively analyzed over a range of time and treatments. Buds contain high concentrations of auxin and cytokinins in a pattern roughly consistent with their position and role. Distribution of iP, iPR, and iPR-mP suggests that cytokinins are synthesized in needles, buds and shoots, roots being only periodically important. Recent and new results will be reviewed in light of apical control and dominance phenomena.

(30)

A SIMPLE MATHEMATICAL MODEL TO INVESTIGATE SHOOT:ROOT PARTITIONING IN RESPONSE TO LIGHT AND NITROGEN

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A simple mathematical model has been developed to describe growth and partitioning in conifer seedlings in response to nitrogen fertility, daily light and ambient or elevated carbon dioxide levels. In order to do so, the activities of two PGR's – a cytokinin and an auxin – produced by the root and shoot, respectively, are invoked to control protein synthesis, carbohydrate transport and the formation of cellulose structure (the majority of the plant dry matter). The model equations are presented as phenomenological rather than mechanistic process descriptions. The model plant has only seven compartments or pools, and it is a goal-seeking model. As a growth resource (e.g., light, nitrogen) becomes more limiting, the proportioning of the new mass in the growing plant shifts to accumulate shoot or root mass in order to “acquire” more of the limiting resource. In this way partitioning is accomplished in response to environmental cues. Selected examples of model behavior will be presented.

(31)

CHARACTERISTICS AND MANAGEMENT OF PEACH AND APPLE TREE CROWNS

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Efficient, high density fruit orchards require size-controlled trees with crown structures that can support production of quality fruit. Vigorous and branched vegetative growth can create a dense, shaded environment in tree crowns that may increase pest populations and adversely affect fruit quality. To avoid adverse effects, fruit tree size and crown characteristics have been managed with genetic and cultural techniques such as size-controlling scion and rootstock and by pruning and training. Plant hormone relations may differ among size-controlling genotypes and the effects of cultural techniques on endogenous hormone concentrations and growth in different genotypes will be discussed.

(32)

CROWN MANAGEMENT IN CONIFER SEED ORCHARDS

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Crown architecture in northeastern conifers as it relates to the numbers and positioning of male and female cones along shoots is reviewed. The importance of understanding the natural patterns of cone production as a tool for effective crown management is emphasized. Results from crown management trials over the past 20 years are used to demonstrate that it is possible to maintain tree height at acceptable levels through regular 'topping' without severely reducing cone production. A general discussion on adopting 'topping' as part of a conifer seed orchard management system is also provided.

(33)

†ROOTSTOCK AND SHOOT PREFORMATION IN PISTACHIO AND THEIR INFLUENCE ON CANOPY ARCHITECTURE AND YIELD COMPONENTS

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Rootstock significantly alters the pattern of shoot growth of pistachio (*Pistacia vera*) cv. Kerman. Terminal buds of shoots from trees on three rootstocks were dissected during the dormant season to determine the number of preformed nodes. Data indicate that there are 8-9 preformed nodes in dormant buds regardless of rootstock or shoot carbohydrate status, suggesting genetic control. However, shoots from trees on two of the three rootstocks produce neofomed growth in addition to preformed growth, resulting in altered canopy architectures. Neofomed growth is dependent on current season photosynthates and has the potential to compete with reproductive sinks for available resources.

(34)

LONG DISTANCE NITROGEN SIGNALING VIA CYTOKININ IN POPLAR

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Nitrogen fertilization of certain clones of young hybrid poplar trees strongly enhances sylleptic branching. Although direct treatment of undeveloped sylleptic buds with ammonium nitrate has no promotive effect on bud outgrowth, the daily treatment of these buds with cytokinin (1 mM benzyladenine) results in the initiation of vigorous outgrowth. B. Forde has hypothesized that nitrate applied to the roots of herbaceous plants can be transduced via *ipt* enzymes to cytokinin which can then be transported up the xylem to the shoot with subsequent binding to a CRE1-type receptor and promotion of leaf outgrowth. Sakakibara has demonstrated in maize and in *Arabidopsis* that Type A response regulator genes in the shoot's receiver domain (triggering shoot growth) are inducible only by cytokinin and not by nitrate whereas nitrate can only be transduced to cytokinin in the roots and not in the shoots. The poplar data in the present study are consistent with the herbaceous model of nitrogen signaling of Forde and Sakakibara.

†*Graduate Student Presentation Award Candidate*

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PROHEXADIONE-CA AND CROP PROTECTION IN POME FRUIT TREES

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Prohexadione-Ca (ProCa - contained in the products Apogee® and Regalis®) is a new plant bioregulator for use in pome fruits. Trees pre-treated with ProCa are less affected by diseases such as fire blight and scab and by different types of insect pests although the compound is inactive as a bactericide, fungicide or insecticide. ProCa leads to growth reduction by blocking gibberellin biosynthesis. However, it can largely be ruled out that its effect on morphological or histological structures is of major direct relevance for disease and insect pest incidence. In treated shoots, ProCa causes also considerable changes in the spectrum of flavonoids. Convincing evidence is now available that ProCa triggers pathogen resistance by inducing the formation of 3-deoxyflavonoids, in particular luteoforol, with phytoalexin-like properties. Luteoliflavan, another flavonoid, is also found only after treatment with ProCa. This compound is known to be an inhibitor of insect growth, which may explain the observed effects on insect pests. Another advantage with regard to plant protection results from the fact that ProCa-treated trees have a more compact but open canopy, thereby enabling better spray penetration and coverage for fungicide or insecticide treatments.

(36)

RESPONSE OF SIX CITRUS GENOTYPES TO PROHEXADIONE-CA

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Control of vegetative growth is a significant problem in commercial production of Florida citrus. Citrus is now planted at higher densities to encourage higher early production, which increases the cost of containing vegetative growth as plantings mature. In many orchards, more aggressive pruning results in lower mature yields than were realized prior to containment pruning. In addition, competition between vegetative growth and fruit development may sometimes compromise fruit set in parthenocarpic cultivars. Several GA biosynthesis inhibitors have been evaluated for vegetative growth reduction. The compound Prohexadione-Ca (P-Ca) has been approved for use in several fruit species, and was examined for effects on six citrus genotypes (Duncan grapefruit, Sun Chu Sha mandarin, *C. macrophylla*, *C. aurantium*, Swingle citrumelo, and Smooth Flat Seville). In two greenhouse experiments, potted young trees were sprayed with 500 ppm P-Ca plus 0.05% Silwet with or without pH adjusted to 3.5. In experiment 1, either a single or double application of pH adjusted P-Ca decreased shoot growth across all genotypes within a month of the first treatment, but only a double application of P-Ca at 4-week intervals reduced shoot growth 3 months after application, with a 38% reduction in shoot length across all genotypes. In experiment 2, all P-Ca treatments reduced shoot growth in the first three months after treatment, with a 40% reduction across all genotypes from a double application of pH adjusted P-Ca at 4-week intervals.

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PARTHENOLIDE AND ABSCISIC ACID SYNTHESIS IN FEVERFEW ARE CONNECTED

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Feverfew plants under different environmental conditions and plants and cut flowers treated with chemical agents that affect abscisic acid (ABA) synthesis were evaluated for parthenolide (PRT) and ABA. PRT levels were highest during late afternoon whereas ABA was at its maximum level during morning hours. ABA was higher in water-stressed plants whereas PRT content was higher in plants recovered from dehydration. ABA inhibitors such as norflurazon and naproxen reduced PRT concentration in cut flowers and in two-month old plants. Application of 2,4-D, a promoter of ABA synthesis, to potted plants resulted in a 2.5 fold increase in PRT levels. Our results indicate that PRT synthesis in feverfew is connected to the ABA pathway.

(38)

POLLEN FLOW IN MANDARIN ORCHARDS AND CROSS-POLLINATION EFFECT ON SEED CONTENT AND FRUIT SIZE OF MANDARINS

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We used AFLP markers to determine the pollen parentages of mandarin seedlings from two orchards in California. We found that pollen of 'Minneola' tangelo was able to disperse across 94 rows of buffer trees at a distance of 521 meters to pollinate 'Afourer' mandarins in orchard near Madera, CA. We found that pollen of 'Afourer' mandarin was able to disperse up to a distance between 945 – 1,292 meters to pollinate 'Nules' Clementine mandarin in the orchard near Bakersfield, CA. The distance that compatible pollen was able to disperse, most likely by honeybees, within the mandarin orchards was much larger than anyone expected. There are different levels of compatibility among different mandarins and up to 40 seeds per fruit was found in crosses between Clementine mandarins x 'Afourer' mandarin. Cross-pollination between different mandarins also could significantly increase the fruit weight, fruit size and seed count per fruit. The implication of these findings for seedless mandarin production in California will be discussed.

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COMPARING PACLOBUTRAZOLS

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The paclobutrazols Bonzi and Piccolo were compared for their efficacy as foliar sprays on 'Majestic Giant Yellow Blotch' pansies (2.5 to 15 mg·L⁻¹) and 'Noblesse' geraniums (5 to 40 mg·L⁻¹) and as a substrate drench with 'Pacino' pot sunflowers (1 to 4 mg of active ingredient per pot). At similar concentrations, both paclobutrazols provided a similar degree of control of plant height and plant diameter. Based on results with these three plants, Bonzi and Piccolo were found to have a similar degree of activity.

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FLURPRIMIDOL FOLIAR SPRAYS CONTROL GROWTH OF FALL PANSIES

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Flurprimidol (0.38%; trademark Topflor) foliar sprays of 0 to 30 mg·L⁻¹ (year 1) and 0 to 15 mg·L⁻¹ (year 2) were applied to 'Majestic Giant Yellow Blotch' pansies for growth control. Flurprimidol has a high efficacy on pansies, with no further control of plant height at 22.7 mg·L⁻¹ or plant diameter at 16.1 mg·L⁻¹, based on linear-plateau analysis (year 1). A 5 mg·L⁻¹ flurprimidol application resulted in 28% shorter and 30% smaller diameter plants compared to the nontreated control (year 2). Because of the efficacy of flurprimidol on pansies, grower recommended concentrations would be between 2.5 and 7.5 mg·L⁻¹ for vigorous pansy cultivars such as 'Majestic Giant Yellow Blotch'.

(41)

POTENTIAL ADDITIVE GROWTH REGULATOR EFFECTS OF TRIAZOLE FUNGICIDES ON PGR-TREATED BEDDING PLANTS

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Fungicides such as triadimefon and propiconazole are chemically very similar to triazole growth regulators (PGRs) frequently used during bedding plant production. The possibility of additive or synergistic effects when fungicides and PGRs are both applied was investigated. Seedlings of *Viola ×wittrockiana* (pansy), *Petunia ×hybrida*, and *Catharanthus roseus* (annual vinca) were grown in a greenhouse and treated with the PGRs paclobutrazol or uniconazole. The fungicides triadimefon or propiconazole were applied as sprays in a factorial experiment. Both fungicides reduced plant width and root dry weight of petunia, and triadimefon reduced width and root dry weight of pansy. For annual vinca, a physiological leaf spot occurred on all plants treated with triadimefon, but with propiconazole, the leaf spot occurred only on plants also treated with a PGR.

(42)

GIBBERELIC ACID AND SUCROSE DELAY SENESCENCE OF CUT *LUPINUS DENSIFLORUS* BENTH FLOWERS

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The inflorescence of *L. densiflorus* consists of several tiers of attractive yellow flowers in a group of 6-7 per node. Unlike some other lupines, where both flower abscission and senescence affect vase life, in *L. densiflorus*, flower senescence is the key factor that influences postharvest quality and display life of cut inflorescences. This study was undertaken to optimize postharvest protocols for cut inflorescences of *L. densiflorus* and evaluates the role of gibberellic acid (GA) and sucrose on senescence of flowers. Two lines of *L. densiflorus* (light yellow or dark yellow flowers) served as the experimental material. Cut inflorescences were placed in vases containing GA (1-20 mg/l) and sucrose (1-4%) solutions at 22–25°C under illumination ($30 \mu\text{mol}\cdot\text{m}^{-2}\cdot\text{s}^{-1}$) for 12 hours per day. Sucrose in the holding solution effectively delayed the onset of flower senescence in both the light yellow and dark yellow flowered lines. As with sucrose, the presence of GA was also very effective in delaying flower senescence. Sucrose and GA, in combination, proved even more effective than either sucrose or GA individually.

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SALICYLIC ACID INCREASES THE BIOMASS ACCUMULATION OF
CHRYSANTHEMUM MORIFOLIUM

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Chrysanthemum morifolium Ramat. was cultivated in greenhouse conditions and the shoot was sprayed on four occasions with salicylic acid (SA) at 10^{-6} a 10^{-10} M concentrations in order to determine its effect on the flowering of the plant. The treatments were arranged in a totally random experimental design with 20 replicates per treatment. The results obtained showed that all the SA treatments increased significantly the number of flower primordia. The 10^{-6} M treatment increased the number 65% and 10^{-8} M increased 55% in comparison with the control. In a similar way, salicylic acid affects the pattern of flower exposition.

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STANDING CYPRESS: A POTENTIAL NEW SPECIALTY CUT FLOWER CROP

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Standing cypress (*Ipomopsis rubra* (L.) Wherry), a member of phlox family, is native to North America and grows up to West Texas. It produces a thyrse-like attractive panicle consisting of 1-3 flowered cymose inflorescences with scarlet–yellow-red flowers on a long axis with dark green pinnately parted leaves. Herein, we report our preliminary observations relating to postharvest performance of cut flowering stems of this plant. The flowers were found to be relatively more tolerant to ethylene than phlox and pretreatment with 1-MCP or STS prevented corolla abscission and slightly delayed flower senescence. Incorporation of sucrose in the vase solution dramatically promoted opening of new flower buds, delayed flower abscission and senescence, and greatly improved vase life and longevity. Plants grown from seeds collected from a wild population exhibited variation in their vigor, branching, length of flowering axis, flower size and color. Selection and breeding efforts are underway to further improve plant growth, flower quality and display life of cut flowering axis.

(45)

INFLUENCE OF FERTILIZER AND UNICONAZOLE ON GROWTH OF HERBACEOUS PERENNIALS

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Ascending fertilizer rates in conjunction with uniconazole were tested on rooted liners of *Artemisia arborescens* 'Powis Castle', *A. vulgaris* 'Oriental Limelight', *Astilbe chinensis* 'Pumila', *Filipendula rubra* 'Venusta' and *Perovskia atriplicifolia*. Controlled-release fertilizer (15N-3.9P-10K) was incorporated before potting at 2.4, 4.72, and 7.11 kg·m⁻³. Uniconazole at two spray rates that varied with plant species was applied 2 weeks after transplanting. Plant height and width were measured 2, 4, 6 and 8 weeks after treatment (WAT). Shoot dry weights were taken at 8 WAT. Analysis of variance indicated no interactions between fertilizer rate and PGR concentration for any of the variables measured. Main effects varied by species. Unusually heavy rainfall throughout the experiment resulted in very low soluble salts levels by 8 WAT, diminishing the fertilizer effects. All crops except *Filipendula* and *Artemisia* 'Powis Castle' were responsive to uniconazole.

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EFFECT OF LIGHT INTENSITY ON GROWTH, DEVELOPMENT, AND PIGMENTATION OF RED-LEAF AND RED ROMAINE LETTUCE

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Near-term space missions, such as the International Space Station (ISS) and early space exploration missions will be constrained in terms of available volume, mass, and power and the use of higher plants for bioregenerative life support functions may be limited. However the psychosocial aspects of including plants on these missions to provide a variety of fresh, nutritious, and colorful dietary supplements could be profound. A series of experiments were conducted to determine effects of light intensity on color development and productivity of red-leaf (cv. Red Sails) and Romaine (cv. Eruption and Outredgeous) lettuce cultivars. Experiments were performed in a controlled environment chamber (Model M-48, EGC) maintained at 25°C, 50% RH, 1,200 mmol mol⁻¹ CO₂, and 16-h light/ 8-h dark diurnal cycle. Light levels were maintained at 150, 300 or 450 mmol m⁻² s⁻¹ with VHO cool white fluorescent lamps. At 300 mmol m⁻² s⁻¹, there were significant differences in cultivar yield with Red Sails >Outredgeous> Eruption. The results show a strong response of incident light on edible yield of all three cultivars. There was also a strong correlation increasing light intensity and red leaf coloration in all cultivars.

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GREEN ONION YIELD AS AFFECTED BY GIBBERELIC ACID, ACETYLTHIOPROLINE, AND A MIXTURE OF AMINO ACIDS AND SHORT-CHAIN PEPTIDES

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Green onion sets were soaked for 14 hours in aqueous solutions of gibberellic acid 3 (GA; 5, 10, 20, 30 mg·L⁻¹), acetylthioprolin (AP; 100, 200, 300, and 400 mg·L⁻¹), and a glycine-rich commercial complex of amino acids and short-chain peptides (APC; 1, 2, 3, and 4 g·L⁻¹). The same AP, APC, and GA rates were sprayed on the resulting plants 15 and 30 days after sprouting. Compared to non-treated control plants, yield was significantly higher in green onion treated with GA, AP, and APC, regardless of rate. The highest yields were obtained with APC at the rate of 3 g·L⁻¹, AP at the rate of 300 mg·L⁻¹ and GA at the rates of 20-30 mg·L⁻¹.

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EFFECTS OF PRUNING ON AUXIN AND CYTOKININ LEVELS AND SUBSEQUENT SHOOT REGROWTH OF DIFFERENT GROWTH HABITS OF PEACH

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Peach tree (*Prunus persica*) growth habits that have vertical branches and narrow crowns (Pillar growth habit) are being developed for high density plantings. Previous research indicated that shoots of Pillar contained higher auxin concentrations than did Standard trees. High auxin levels may contribute to strong apical control of growth. In addition, lower cytokinin/auxin ratios in Pillar shoots may contribute to reduced sylleptic growth. It was hypothesized that pruning may differentially affect the hormonal and the branching patterns in these different growth habits. Current research on the effects of pruning on auxin and cytokinin concentrations in Pillar and Standard peach trees will be discussed.

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CORONATINE: A POTENTIAL ABSCISSION AGENT IN CITRUS

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Coronatine is a polyketide produced by *Pseudomonas syringae* that causes yellowing and growth regulator-like effects in plants. In both structural and functional views, it shares similarities with octadecanoid pathway metabolites involved in jasmonate responses, lipid signaling, and abscission. Our research focused on effects of coronatine foliar sprays on abscission in 'Hamlin' and 'Valencia' oranges. Branch applications performed on both cultivars demonstrated that 200 mg·L⁻¹ was the optimal concentration for significant reduction of fruit detachment force and low to moderate leaf abscission (below 20%). Coronatine at this concentration enhanced ethylene production in both mature fruit and leaves; no significant fruitlet or flower abscission was found as a result of the treatment. A similar response occurred when coronatine was applied to entire trees. However, reduced chlorophyll content and slight chlorosis developed during the weeks following the application. Coronatine did not induce chlorosis in new vegetative shoots that developed after compound application; the new leaves appeared green and healthy. Further, branch application studies showed differences in ethylene production between coronatine and other abscission agents such as methyl-jasmonate, 5-chloro-3-methyl-4-nitro-1H-pyrazole and ethephon. The results suggest that coronatine loosens mature fruits and has minimal effects on leaf abscission, making coronatine a viable candidate as a citrus abscission agent.

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†EFFECTIVENESS OF RETAIN® ON PISTILLATE FLOWER ABORTION AND ETHYLENE PRODUCTION OF WALNUT FLOWERS

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Pistillate flower abortion (PFA) of walnut (*Juglans regia*) is the loss of female flowers shortly after bloom, prior to fruit set. PFA is associated with high pollen load and can be especially severe in cv. Serr. Ethylene production following pollination is greater in cultivars that are more susceptible to PFA. A peak in ethylene production, associated with pollination, occurred approximately 18-24 hours after pollination in excised flowers. Ainoethoxy-vinylglycine, applied as ReTain® (Valent Biosciences), decreased ethylene production in both pollinated and non-pollinated flowers. The decrease was correlated to the concentration applied. In the field, early sprays of ReTain decreased PFA in 'Serr' walnut compared to the untreated control. Late applications of ReTain had no effect. PFA can greatly reduce yield in an orchard, but ethylene inhibitors may help alleviate the problem.

†*Graduate Student Presentation Award Candidate*

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†EFFECT OF DEFICIT IRRIGATION ON YIELD AND VEGETATIVE GROWTH IN ENGLISH WALNUTS.

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The project goal is to regulate vegetative growth by irrigation, without decreasing productivity. In 2002, three levels of stress, low, mild, and moderate, were imposed on two 'Chandler' orchards: a young 8th leaf hedge row, 30' by 18', and a mature, standard diamond 32' by 32' spacing. Grower cultural practices were maintained. Individual tree stress (midday SWP) was tracked by a pressure chamber to maintain target levels. After two years of treatment, the hedge row orchard has shown a decrease in yield and light interception in both the mild and moderate stress treatments. The standard spacing orchard showed no significant decrease in yield or light interception. In 2004, the hedge row orchard had fewer floral terminals and an increase in the total number of dead/non-growing terminals, per area, as stress increased. Apparent differences between the two orchards to similar levels of stress are currently being investigated.

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PROTEIN EXPRESSION OF FORCED SOFTWOOD GROWTH IN RELATION TO PLANT GROWTH REGULATORS IN FORCING SOLUTION

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Protein expression of forced softwood growth in relation to plant growth regulators (PGR) in forcing solution and pre-forcing treatments was studied. GA₃, BA and IBA increased amount of protein in forced shoots of privet and spirea. GA₃ at 100 mg/l still enhanced total protein expression although suppressed shoot elongation. No statistically significant difference was observed for protein expression between longer shoots (>2 cm) and shorter shoots (<1 cm) of privet. Pre-forcing soak treatments did not influence protein expression.

†*Graduate Student Presentation Award Candidate*

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BERMUDAGRASS GROWTH REGULATION AND PURPLE NUTSEdge CONTROL WITH TRINEXAPAC, IMAZAQUIN, AND HALOSULFURON

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Growth regulation and control of the weed purple nutsedge (*Cyperus rotundus*) are important components of Bermudagrass turf (BT) management in the Caribbean. Experiments were conducted in the Dominican Republic to evaluate the growth regulator trinexapac-ethyl (TE) and the herbicides imazaquin and halosulfuron in BT infested with purple nutsedge. The treatments were (1) control plots (no TE or herbicide application), (2) halosulfuron, (3) imazaquin, (4) TE without herbicides or (5) with halosulfuron or (6) imazaquin. Growth and appearance of BT, as well as purple nutsedge growth and survival, were measured every two weeks for eight months. Compared to control plots, BT and purple nutsedge growth were significantly lower in plots sprayed monthly with TE. When programs with halosulfuron or imazaquin were implemented, purple nutsedge survival was <5%, but BT growth was not significantly lower than in control plots. In terms of purple nutsedge control and BT appearance and growth suppression, programs combining TE and halosulfuron or imazaquin provided the best results.

(54)

BERMUDA TURFGRASS RESPONSE TO BENZYLADENINE AND PHOSPHORUS FERTILIZATION

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Experiments were conducted to determine the effects of benzyladenine (BA) and phosphorus (P_2O_5) fertilization rates on Bermuda turfgrass (BTG) growing on an ultisol. BA (0, 10, 20, 30 $mg\cdot L^{-1}$) and P_2O_5 (0.5, 1.0, 1.5, 2.0 $kg\cdot 100\ m^{-2}\cdot year^{-1}$) were applied every three months. BTG growth, color, and density were determined every 15 days for 12 months. Increasing BA and P_2O_5 rates tended to improve BTG growth, color, and density, enhancing BTG visual quality, especially during the summer months (average daytime temperatures ~29 C).

(55)

PROMOTING EFFECTS OF MEPIQUAT CHLORIDE ON LATERAL ROOT INITIATION OF COTTON SEEDLINGS

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Effects of mepiquat chloride (MC) on initiation and development of lateral roots of cotton seedling were studied using *Gossypium hirsutum* L. cv. Zms16 and Zms29, cultured on a glass board after soaking seeds with 400 mg/L MC for 12 hours. The number of lateral roots, root primordia, and the segment length of lateral roots and root primordia initiation were increased by MC. MC also promoted primordia initiation and lateral root development after removal all the megascopic lateral roots. Under the stress of low temperature, initiation of lateral roots was significantly promoted by MC also. Levels of IAA, Z and ZR in the middle segment of the primary root were all increased by MC, which might be the key reason for lateral root induction.

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THE SPATIAL AND TEMPORAL DISTRIBUTION OF AUXIN AND GIBBERELLINS IN SUNFLOWER (*Helianthus annuus* L.)

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Indole-3-acetic acid (IAA) and gibberellins (GA) are principal plant growth hormones. Early research gave important information on IAA and GA synthesis, degradation, physiological function and genetic determinism. Recently, the possible relationship between IAA and GA was discussed and it was demonstrated that IAA promotes GA biosynthesis. To define more accurately the temporal and spatial distribution of free IAA and GA₃ and their relationship during ontogenetic development, phytohormone levels in vegetative and generative organs were determined. The occurrence and dynamics of free IAA and GA₃ in different organs of *Helianthus annuus* were investigated at various developmental stages. The results demonstrated the spatial (roots, leaves, inflorescences, and flowers) and temporal distribution (diverse ontogenetic phases) of dominant centers (sink organs) in relation to IAA concentrations in sunflower. The highest IAA concentration was found in aerial organs, whereas its concentration in roots was much lower. In addition, genotypic variation was determined. The percentage of free IAA was higher in the roots, leaves, inflorescences, and flowers of the hybrid F₁ than in inbred lines. The data demonstrate a direct correlation between auxin and hybrid vigor.

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EGGPLANT YIELD ENHANCEMENT WITH SELECTED CROP STIMULANTS IN A LOW-PESTICIDE SYSTEM

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Transplanted eggplants grown with a reduced-pesticide system were sprayed with the biostimulant and/or plant growth regulator based-products Satisfy®, Stimplex®, Triggrr®, Ergostim®, Siapton®, Pentakeep V, and Biozyme®, as recommended by manufacturers (rates, frequencies, method) and variations of the recommendations. None of the products provided significant yield increase when applied once. Sequential application as recommended or in similar application programs resulted in marketable yield increase by 10-20%, depending on the product utilized.

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INFLUENCE OF WATERING REGIMES, A SEAWEED-DERIVED BIOSTIMULANT, AND *TRICHODERMA* SOIL AMENDMENTS ON ORNAMENTAL PEPPER GROWTH AND FRUIT PRODUCTION

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Ornamental pepper (OP) seedlings were treated with combinations of a seaweed (*Ascophyllum nodosum*) extract-based biostimulant (Stimplex®)(0 and 30 mg active ingredients per L) and the soil was treated with a *Trichoderma* spp. formulation (Promot-Plus®) (0 and 4 L per ha). OP was grown under various watering regimes. Compared to untreated OP, Stimplex® and Promot Plus® treatments improved overall growth and increased fruit number. The effect of Promot Plus® was more pronounced in OP grown with watering regimes that maintained high and relatively stable soil moisture content, but the opposite seemed to be true for Stimplex®.

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UNICONAZOLE AND PACLOBUTRAZOL APPLICATION TO ANNUALS AS A LINER DIP

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The liner dip application technique involves dipping the roots and media of seedlings and rooted cuttings in a PGR solution prior to transplanting into final container. Seedlings of petunia (*Petunia x hybrida* 'Madness Midnight') and marigold (*Tagetes patula* 'Janie Spry') and rooted cuttings of verbena (*Verbena anadensis* 'Aztec Pink') were treated (30 sec.) with uniconazole as a liner dip at concentrations of 0.25 to 4.0 mg L⁻¹. Concentrations producing final plant size approximately 50% of control plants were 1-2, 4 and 4 mg L⁻¹ for petunia, marigold and verbena, respectively. Paclobutrazol was applied as a liner dip to rooted cuttings of 'Priscilla' petunia (a vigorous cultivar) using concentrations of 1 to 16 mg L⁻¹. Paclobutrazol has less activity than uniconazole on petunia and the 16-mg L⁻¹ treatment did not reduce final plant size by 25%. However, paclobutrazol at 80 mg L⁻¹, as a media spray (sprayed on surface of media prior to transplanting) at 300 ml m⁻² produced a 25% reduction in final plant size.

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EFFECT OF CYTOKININS ON YIELD OF ICEBERG LETTUCE

Jorge M. Fonseca

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The effect of field applications of cytokinin solutions (5 ppm) on fresh weight and size of iceberg lettuce was investigated. A first trial included 6- benzylaminopurine (6-BAP) and kinetin applied three times after head formation or once two weeks prior to harvest. All four cytokinin treatments produced larger heads than the control. Lettuce treated with 6-BAP once two weeks before harvest and those treated with kinetin three times before harvest were heavier than the control. A second trial was conducted to evaluate the effect of HappyGro®, a commercial kinetin and vitamin formula, on weight and size of lettuce at harvest. Lettuce heads treated with HappyGro® three times before harvest were 6% heavier and 4% larger than the control. HappyGro® applied once before harvest also produced larger heads than the control. These results suggest that cytokinins may be a viable approach to increase yield of iceberg lettuce if the chemicals were approved for such use.

(61)

DELAYED RIPENING OF APPLE AND PEAR FRUIT USING POSTHARVEST DIPS OF AMINOETHOXYVINYLGLYCINE (AVG)

E.A. Curry

USDA, ARS, Tree Fruit Research Laboratory, 1104 Western Avenue, Wenatchee, WA 98801 USA

Regulation of fruit ripening allows more flexibility both in harvesting and marketing—usually with improved uniformity and retention of quality. Efficacy of pre-harvest foliar applications of AVG have been inconsistent because of 1) the long interval (3-5 weeks) between treatment and time of harvest, 2) inadequate coverage due to canopy interference and 3) differences in climatic conditions between seasons and among orchards. Postharvest dipping or drenching of fruit would increase efficacy, improve coverage uniformity, and reduce environmental residue. ‘Golden Delicious’ apples and ‘Bartlett’ pears were dipped for 2 min. in solutions of AVG from 0 to 400 mg·l⁻¹. Apples were kept at 20°C for 9 weeks and pears were kept at 1°C for 5 months. By measuring CO₂ and C₂H₄ daily, delay in ripening initiation for apples treated with 0, 100 and 200 mg·l⁻¹ was 7, 35 and 55 days, respectively. At 9 weeks, apples treated with 400 mg·l⁻¹ failed to ripen. After five months, pears dipped in [AVG] > 0 produced less ethylene out of storage than those dipped in water alone. Compared with a preharvest foliar spray at the same dosage, pears treated after harvest gained 4 weeks storage life.

(62)

EFFECT OF RETAIN® ON REDUCING PISTILLATE FLOWER ABORTION (PFA) IN SERR WALNUT USING SPEED SPRAYER APPLICATION

R.H. Beede

University of California Cooperative Extension, Kings County, 680 North Campus Dr., Suite A, Hanford, CA 93630 USA

Pistillate flower abortion (PFA) in walnut is the loss of female flowers early in the season, typically 2 to 3 weeks after bloom. It was first noted in the Serr cultivar soon after the earliest plantings came into production in the early 1970's. Serr is an important early maturing, high edible yield variety, which helps extend the harvest period and set marketing conditions. PFA can reduce dry, in-shell walnut yield 75%. In the 1980's, field-based research by Catlin et al. confirmed from detailed tagging of flowers that PFA is always associated with high numbers of pollen grains present on the receptors (stigmas) of female flowers. Polito showed that the large number of resulting pollen tubes growing down the style of the female flower produced excessive ethylene, most likely the cause of flower abortion. Polito also field tested non-commercial compounds which either promoted or inhibited ethylene production and observed corresponding increases and reductions in PFA. Single shoot testing by the author in 2003 of Retain®, a commercially available ethylene biosynthesis inhibitor, resulted in a four-fold increase in fruit set. In 2004, commercial speed sprayer applications at 62.5 and 125 ppm in two locations resulted in a 23% to 84% increase in fruit set, depending upon the amount of PFA in the control. Differences in percent set between pre-receptive and receptive flowers were less with the higher Retain® rate. Application at 40% bloom also appeared more effective than at 70%.

2,4-D Increases the yield of commercially valuable large size fruit of Clementine Mandarin

Chih-Cheng T. Chao^{1*}, Louise Ferguson² and Carol J. Lovatt¹Univ. of California, ¹Riverside, CA 92521 and ²Davis, CA 95616

Excessive fruit drop and small fruit size are two problems associated with the commercial production of seedless mandarins worldwide. These problems are solved in many mandarin-growing countries by one or more foliar-applications of GA₃ during flowering and fruit set. However, GA₃ has not proven to be a reliable strategy for increasing Clementine mandarin set or size in California. GA₃ (10 mg·L⁻¹) applied at full bloom and 30 d after petal fall or as a single application 30 d after petal fall had no effect on the 2-year cumulative yield of commercially valuable large size fruit (transverse diameters 50.81 to 76.20 mm) or total yield compared to untreated control trees. In contrast, 2,4-D at 24 mg·L⁻¹, but not 12 mg·L⁻¹, applied 30 d after petal fall significantly increased the 2-year cumulative yield of mandarin fruit with transverse diameters > 50.81 mm ($P < 0.0001$) and total yield ($P < 0.0001$) per tree compared to untreated control trees and all other PGR treatments tested. PGR treatments had no effect on fruit quality, except 2,4-D (24 mg·L⁻¹) significantly increased juice weight per fruit in year 1 ($P < 0.0001$). The reliability of 2,4-D as a tool for increasing the value of the commercial mandarin crop in California is still under investigation.

PLANT GROWTH REGULATION SOCIETY OF AMERICA
Winter Steering Committee Meeting Minutes
Newport Beach Radisson, Collins Room
Newport Beach, CA
December 6, 2003
9:00 a.m.- 6:00 p.m.

Attendees: Eric Curry (President), Richard Dunand (Business Manager), Louise Ferguson (1st Vice President), Wayne Mackay (Past President), Sonja Maki (2nd Vice President), Ricardo Menendez (MAL-2), Jeff Norrie (MAL-1), Ed Stover (Secretary).

Old Business

President Eric Curry brought the meeting to order at 9:00 AM.

Minutes of 2003 Annual Meeting, 1st and 2nd Steering Committee Meetings-

A motion was made to accept previously submitted meeting minutes as already discussed and adjusted. Seconded and unanimously approved.

2003 Meeting Discussions

1) Richard Dunand provide a brief overview of finances following 2003 meeting, all expenses have not been finalized, appears that we will be ~\$10,000 in the black for this meeting.

2) Eric Curry indicated that we had 124 participants in 2003 meeting: 68 from US/Canada, 42 from Japan, and 14 from other regions. Of participants from US/Canada, 55% were non-industry; 93% of Japanese participants were non-industry.

- Eric notes that these demographic figures emphasize the potential importance of coordinating PGRSA with ASPB (Plant Phys. Meetings). ASPB meets in Seattle in 2005 when PGRSA meets in California, and so may provide another opportunity for us to meet with Japanese colleagues.

- Richard Dunand notes that we should now begin discussions for our next meeting with JSCRIP. Proposed that we need to outline our meeting in Seattle and ASHA in Las Vegas, both weeks before scheduled PGRSA management. Proposed that Eric contact JSCRIP and mention opportunity for joint meeting in 2005.

3) In 2003, 50% of U.S. and Canadian participants were from industry. We need to continue to serve our industry participants by providing quality venues in desirable locations. The committee discussed other approaches to making the meeting attractive to industry.

- Noted that PGRSA is one of few professional societies that provides opportunity for industry people to speak to entire organizations.

- Proposed that we consider an invitation to all supporting companies (while soliciting support) to put up table displays or posters: previously we responded with OK when request was made.

- Louise notes that industry session has been near end of meeting, moving to 2nd day may give people an opportunity to later contact industry reps, could be achieved by exposure in opening reception.

- Ricardo suggests that some industry talks should receive more time for more technical presentation.

- Richard Dunand notes that rationale for industry section on last day has been to keep industry people at the meeting until end. Eric suggests an alternative would be to ensure that the third day have an extremely strong program, perhaps with a keynote speaker.
 - Concluded that future planners need to build opportunities for industry involvement, more time in industry session, longer times for some talk, industry exposure in initial social, invited opportunities for displays or posters, and high level of recognition for supporters.
 - Richard indicates that industry session could be improved by making talks more formal with research presentations: make opportunity for formal with detailed listing in program (1st half of industry) industry workshop, plus less formal talk with those who wish to talk about their products and interests.
 - Louise will schedule 3 hours for PGRSA industry section on last day, 1.5 hours for 20+ minute workshop sessions, 1.5 hours brief industry overviews.
- 4) Eric notes that our attendance would have been low in 2003 if not for people coming from outside North America. Conclude that we need to make extraordinary efforts to have attractive meeting sites and draw strongly on potential local participants.
- 5) The steering committee congratulated Eric on coordinating an excellent meeting in 2003.

Business Manager's Report

Richard Dunand requested that steering committee provide any updates on contact information. An end of 3rd quarter budget report was provided.

- Our net assets are somewhat greater than they have been at any other point in last 5 years, at \$142,514.
- Our bank account is somewhat higher than ideal, at \$49,790, and some will be moved into money market soon, but will maintain a minimum of \$10,000 to avoid service charges. It costs \$45-50,000 each year to run PGRSA and strategy has been to keep that amount in liquid funds, money market and bank accounts.
- With better returns, we continue to move maturing treasury strips into CDs.
- The society finances are very sound.

Richard presented the membership services budgets for last 5 years. All expenses excluding the meeting have exceeded dues and publication income.

- We will again have a membership budget \$5-6,000 in the red.
- The society budget continues to be kept in the black by "profits" from the annual meeting.
- Executive secretary expenses (ASG) will again be in the range of \$6-8,000.
- Changes in budget: reduced total dues income in last 2 years; also reduced income from previous proceedings and PGR handbook; greatly increases cost of checking account due to credit card fees (up from \$170 in 1999 to \$18,00 in 2002 and 2003).
- Membership has been stable for 5 years (150 to 169) and is now 161.

Richard discussed options for a PGRSA directory.

- ASG has proposed several options. Committee agreed to publish a PGRSA directory and send it to all members (\$350 total expenditure) as well as post it on the web within a year, with plans for future web only versions.
- PGRSA directory will be published as a 20-page staple-backed pamphlet.

Discussions on 2005 Meeting

The Steering Committee toured the facilities at the Radisson and discussed how each element would fit with the planned program. We unanimously agreed that it will be an excellent site for our 2004 meeting. A free shuttle is available from the hotel to the airport and within 5 miles of the hotel. Parking is free.

Thomas Chao of UC Riverside will serve as the local arrangements chair.

- He discussed opportunities for a tour. He indicated that there are many related agricultural features in Irvine. There are a few major ornamentals producers, the UC/South Coast Extension Center with Strawberry evaluations, avocado production, and other potential subjects for demonstration. The Irvine Company has many ag-related ventures recently focusing on vegetables.
- Thomas suggests that avocado production and ornamentals may be the most interesting.
- Louise suggests that Kirk Lawson at the South Coast Station could discuss how day-neutral strawberry breeding has taken the CA industry from 2 months of production to 11 months.
- The committee agrees that the Thursday tour would be a half day at South Coast Center (only 20 minutes from Radisson), and possibly related ag ventures, consider a catered lunch at South Coast, dinner on our own in Laguna Beach.
- For Sunday's tour should consider Huntington Library and Botanical Garden or Getty Museum or winery tour in Temecula. Noted that daylight continues until 9 pm in summer.
- Thomas and Sonja Maki will finalize tour arrangements for Wednesday excursion, consider a harbor cruise dinner, or catered dinner at Huntington Library south of Newport Beach.

Executive Officer's Report

Tom Tworowski was unable to attend but sent in an Executive Officer's Report. Eric Curry read report.

- **Contract Services:** We continue our contract with Association Services Group (ASG). Based on the agreement signed 8 November 2002, the contract renews automatically on October 1 each year and can be terminated by either party by giving 90 days written notice. Tom will contact ASG in January to request that they submit 1099 MISC Forms for 2003 to the IRS.
- **Hotel Contracts:** Tom has not received written confirmation from the Charleston Riverview Hotel acknowledging the 20% reduction in room obligations from 200 to 160 for the 2004 annual meeting. Louise Ferguson has contacted them and Tom requests she contact them again regarding this reduction in room obligations. Based upon the advice of Sonja Maki and the Steering Committee, Tom will review and sign a hotel contract for the 2005 annual meeting.
- **Annual Registration with the State of Missouri:** Tom registered PGRSA as a Nonprofit Corporation on 26 August 2003. We have a new registered agent in the state: S. Gary Custis, PBI Gordon Corp., 1217 W. 12 St., Kansas City, MO 64101 (816-460-6215).

- **Taxes:** Tom would like to complete the taxes in March this year to allow time to resolve potential discrepancies between end-of-year assets reported to IRS and funds in bank, Prudential and Vanguard accounts.
- To facilitate the change in the *Quarterly* to an electronic-based publication we must identify potential problems and the approach for the transition. Can we integrate the electronic *Quarterly* into the existing web page? Do we need a professional to help design the system? Can we identify someone who would investigate issues and the likely costs for this transition and report recommendations to the Steering Committee in early 2004, possibly by email?
- The logo for the International Allelopathy Society was still on the cover of the *Quarterly* in the second issue for 2003. As per their request we should remove the logo as soon as possible. When we've transitioned to an electronic *Quarterly*, PGRSA might consider inviting submissions from members of the Japanese Society for the Chemical Regulation of Plants.
- Tom requests that the Steering Committee authorize one person to develop a plan that establishes the goals, format, editorial committee (contributors), and resource requirements (software and secretarial support – i.e. a budget) for the new edition of the PGR Handbook. The individual should present this plan and a target timeline to the Steering Committee at the 2004 annual meeting for discussion and implementation. This person can be, but does not have to be, the editor-in-chief of the Handbook. I recommend Ricardo Menendez but if Ricardo would prefer to defer, I recommend Hank Cutler. Other potential candidates can also be identified.
- We must continue efforts to attract and include new members. The membership brochure and our awards should be advertised as early as possible to maximize effectiveness.

Editor's Report

Caula Beyl also was unable to attend but sent in a report which was read by Eric Curry. Report sent in by Caula Beyl, read by Eric Curry.

- Sharon Omahen sent Caula the file for Issue #3 of the *Quarterly* for correction and Caula expects to send it to the printer by Friday (December 12, 2003).
- Issue #4 is expected to have one publication in it, but it has not been received from the author.
- Caula asks that Louise send her the meeting preannouncement for Issue #4. She asks that pictures be included.
- Caula indicates that one manuscript has been received and will go out for review, and has been promised two from another author.
- As always, we still need manuscripts.

Discussions on 2004 Meeting

Louise Ferguson led discussion on the 2004 meeting plans.

- Jim Rushing is local arrangements chair.
- Four students from Clemson will run projectors in exchange for waived registration.
- The meeting will include 4 symposia at 1.5-2 hours each.
- Louise argues that symposia would be improved if we could offer an honorarium of \$200-\$250 to 2 speakers in each session. For about \$2000 we might broaden ability to attract top flight speakers who aren't associated with PGRSA.
- Total 14 invited papers in symposia, 24 contributed papers and 6 presentations for industry section. Details were discussed.
- Louise proposes Eduardo Blumwald for keynote speaker.
- Tour of the Confederate ship Hunley and Patriots Point is scheduled for the Sunday before the opening reception, cost includes a bus but requires minimum of 20 people.
- Because of distance to other restaurants, cost of most meals will be included in registration (except Monday dinner).
- Final reception on Wednesday will be held at Old Exchange. Details of reception were discussed, considering charging members ~\$20-25 (about 1/3 of actual cost, with remainder in registration cost) to participate. Unsure as to how many of the attendees will stay for final reception. We will have to pay for a minimum of 60 people.
- Still no post-conference tours: Louise is still looking, but few good ag-related options in the area, and summer weather may be uncomfortable for many participants..
- There may be an "official" Thursday tour.
- Official room nights have been adjusted down to 160, we only need 120 to meet contract. Room rate will be \$109.00.
- The Charleston Riverview has been acquired by the SJ Group and some renovation will be occurring.
- Louise discussed menu.
- We will bring our own LCD projectors and laptops.
- The 2004 meeting will be advertised by sending information to numerous societies and regional universities; information has been posted on the website and will be updated.
- Two \$500 graduate student travel awards and 1 young scientist award will be offered, with waiver of registration fee. It was suggested that industry sponsors of travel awards could be recognized by name as the XYZ Student travel award but should be in addition to sustaining membership. After continuing discussion, decided that would be PGRSA Travel Award sponsored by Company XYZ.
- The committee discussed advantages of including annual membership with the registration.
- Details of funding invited speakers were discussed. In the past \$5-6000 have been earmarked for funding invited speakers (registration, rooms, and occasional flight costs). Committee agreed that bringing in top quality speakers is key for the society, fundamental policy should be to invite speakers to make the best session, and offer support only to the degree necessary.
- Louise went over budget for 2004 meeting; registration will include almost all meals. Inflows and outflows are expected to balance. She indicated that efforts to get industry sponsorship and mail-outs on abstracts etc. are forthcoming; also contacts with local universities. Companies will be invited to put up posters at both receptions.

Publicity Committee Report

Sonja Maki provided information on PGRSA publicity.

- Posted on Web site: 2004 Membership and publication order form, pictures from 2003 meeting, 2004 meeting information, 2004 meeting flyer; latest news.
- Sonja also provided an extensive list of organizations and universities that will receive publicity concerning the 2004 meeting. Several additional recipients were suggested.
- Sonja is also finalizing the membership brochure.

Nominations Committee Report

Ricardo Menendez led discussion on developing a slate of candidates.

- Committee members suggested following as potential PGRSA officer candidates: Brian Whipker, Steve McCartney (NC State) in Dick Unrath's position, Pablo Morales, Don Elfving, Ron Smith, Steve Miller, Thomas Chao, Greg Reighardt, Harry Klee, Dennis Shepard, and Deidre Holcroft.
- Nominating committee deliberated as follows:
 - Ricardo Menendez will contact Bob Belding to determine whether he can serve as MAL-Z.
 - Jeff Norrie will run for VP1 possibly unopposed
 - Ed Stover willing to run for Secretary, willing to serve even though will be VP of American Pomological Society for next two years and then President; proposed that nominating committee consider whether opportunity to bring in new leadership may make it desirable to run 2 new members, especially since Secretary is a position which does not require extensive experience with the operations of PGRSA
 - Dennis Shepard, Brian Whipker will run for MAL-1
 - Consider running or appointing Ron Smith or Thomas Chao as MAL-2 (requires considerable knowledge of PGRSA), since transition of Jeff Norrie to VP will disrupt normal transition from MAL-1 to MAL-2 to MAL-3
 - Ricardo Menendez agrees to serve as MAL-3 for a 2nd year
 - Will investigate whether we could appoint Thomas Chao MAL-2 to fill an open position if Bob Belding cannot serve.
 - Mechanisms of nominations process were discussed. Could send out email requesting nominations. President could request nominations during business meeting. Eric suggests that final nomination state be finalized via email.

Sustaining Membership Committee Report

Wayne Mackay provided the sustaining membership committee report. Compton Uniroyal will renew their sustaining membership after a 1 year lapse, and indicated surprise that they had missed a year. LT Biosyn is uncertain whether they will become sustaining members, Jerry Mayhem of Plant Biotech is not sure. Stover will send contract information to Wayne for Eden Bio Sciences.

Manual of Operating Procedures Update

Eric informed the committee that there are no new issues concerning the manual of operating procedures. It will be put on the web.

New Business

Discussions on 2006 Meeting

Jeff Norrie presented the site selection committee report for the 2006 meeting.

- The Steering Committee unanimously agreed to meet in Quebec City, July 8-13, 2006. Hotel rooms will be somewhat more expensive than our usual venues, but we feel that attractiveness of location and concurrence with Quebec Summer Festival makes it worth the modest risk.
- The airport is 35 minutes away and only taxis serve.
- Jeff will visit Holiday Inn (CA \$175) and Hilton (CA \$209). Either Ricardo or Richard will join Jeff in looking for facilities.
- Jeff will ask Joanne Chaney to arrange sample contracts for Holiday Inn and Hilton.
- Eric will contact JSCRIP to see if they would prefer to meet in 2005 in Newport Beach, 2006 in Quebec City, or 2007 in W. Coast. If they prefer 2007, Eric will consider asking if they have a preferred location for the meeting.

PGR Handbook Update

The committee discussed various aspects of updating the handbook.

- Ricardo estimates that 28% of current version needs updating, but all data must be collected to verify accuracy.
- Ricardo indicated that while he is willing to play a significant role in updating the handbook, he will need considerable help, and that someone else should probably oversee the entire effort. Ricardo proposes that 4-8 people divide up the PGR list and request updates from the companies marketing them.
- Wayne Mackay suggests that we consider Narendra Sankhla, who has written several recent books on PGRs, as a person to write some portions of the updated handbook.
- Committee agreed to ask Tom Tworowski to contact Hank Cutler to see if he will spearhead revision of the handbook either himself or by heading up a committee.

Archived PGRSA Publication

Eric has scanned all of the proceedings and converted to searchable PDF. He proposes making all tables of contacts as opening pages and then link to articles.

Publishing the Program and Proceedings of the Annual Meeting

Eric Curry provided information on his findings and led committee discussion on this subject.

- Eric notes that even with detailed instruction, only 10% of abstracts are consistent with specified format, and therefore requiring a lot of editing. Eric has developed an MS Word table with locked format and purposes that this format could be downloaded to generate uniform abstracts.
- Eric has investigated other options and found that the company X-CD Online Abstract and Paper Management Company can provide on-line uniform abstracts at \$400 each year for all of our abstracts and \$600 each year for all papers. They would publish a CD with the papers for only \$3 each copy.
- Omni-Press, our current publisher for the proceedings, would perform a similar service for \$1000-\$2000 per year. They would send draft finished product each year for final comments.
- Eric will send details of options via email, to finalize a committee decision. Current paper proceedings publication costs \$2000-\$2500 each year so that the savings will be modest but the committee agrees that the CDs will be far more valuable.
- Eric will explore the cost for ASG or the publishers to print on-demand a paper copy as a comb-binder publication or some other form. There will be no cost of storing archived publications and will simply print-on-demand. Richard indicates that 95% of request for proceedings are for current year.

Web Management and Publishing of the *Quarterly*

Caula has 3rd volume of 2003 Quarterly ready to go on-line.

- Steering Committee thanked Sonja Maki for the fantastic job she has done getting our Web site updated, but propose that we need to move to a professional web manager because of time required.
- Sonja will explore various options. Wayne Mackay suggests Invitro Biology Web site (SIVB.org) as an example of a site we might want to emulate. Perhaps we should determine who has designed their site. Sonja suggests that American Phytopathological Society web page as another example to explore as a model.
- Jeff Norrie notes needs to have links to sustaining member companies with 200 word summaries of product lines and interest.
- Committee members suggested that web format should permit access to sustaining members, Quarterlies, archived proceedings, current events, and permit publication of any submitted refereed papers.
- Cost of web management will be determined and discussed, before final decision.

Jeff Norrie suggests that we promote the PGRSA meeting at the Western PGR Society meeting. Richard indicates that we have routinely been doing this at their annual business meeting.

President Eric Curry adjourned the meeting at 5:25 pm.

2004 PGRSA

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MEMBERSHIP**	COST*
Membership for 2004	
U.S./Canada/Mexico	40.00
International	55.00
Student	15.00
Sustaining	500.00
 PUBLICATIONS	
Current Proceedings	
U.S./Canada/Mexico	40.00
International	55.00
Back Issues (1979-2001) Indicate Year _____	30.00
 Plant Growth Regulator Handbook - 1990	30.00
 Chemical Vegetation Management - 1988	40.00
 Bioassay Handbook - 1986	20.00
 PGRSA Membership Directory - 1999	16.00
 PGRSA Quarterly Back Issues	18.00

*All prices include shipping

**All memberships include *PGRSA Quarterly*; Proceedings available at an additional charge. Please make payments in U.S. currency drawn on a U.S. bank. Make checks payable to Plant Growth Regulation Society of America. Send check and this invoice to the address shown above. AmEx, MC and VISA accepted.

PGRSA STEERING COMMITTEE 2003-04

[Http://www.griffin.peachnet.edu/pgrsa/comite.htm](http://www.griffin.peachnet.edu/pgrsa/comite.htm)

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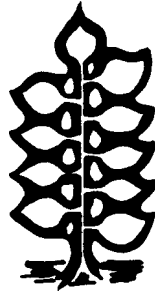
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Acadian Seaplants Limited - Jeffrey Norrie
Amvac Chemical Corporation - John Immaraju
BAL Planning Co., Ltd. - Yasuo Kamuro
Crompton/Uniroyal Chemical Corporation – Tom Harger
Dormex Co. USA, LLC - Maurice DeBenedetto
Fine Agrochemicals Ltd. - Steve Wilson
Nufarm Americas Inc. - James Spadafora
PBI/Gordon Corp. - Gary Custis
Plant Biotech Incorporated – Jerry Mayeux
SePro Corporation - Michelle Bell
Stoller Enterprises, Inc. - Jerry Stoller
Syngenta Professional Products - Dennis Shepard
Valent BioSciences Corporation - Prem Warrior

2004 PGRSA ANNUAL MEETING SPONSORS

Acadian Seaplants, Ltd. - Jeffrey Norrie
BASF – John Harden
Dormex Co. USA, LLC - Maurice DeBenedetto
Olympic Horticultural Products - Jeff Dobbs
Syngenta Professional Products - Dennis Shepard
Valent BioSciences Corporation - Ricardo Menendez



Till We Meet Again

July 10 - 15 2004

The 7th International Plant Cold Hardiness Seminar
Hokkaido University, Sapporo, Japan
<http://news7a1.atm.iwate-u.ac.jp/~ipchs/index.htm>

July 17 - 20, 2004

American Society for Horticultural Science 101st Annual International Conference
Renaissance Hotel, Austin, TX
<http://www.ashs.org/annualmeeting/index.html>

July 24 - 28, 2004

American Society of Plant Biologists Annual Meeting
Disney's Coronado Springs Resort & Convention Center
Lake Buena Vista (near Orlando), Florida
www.aspb.org/meetings/pb-2004/

July 31 - August 4, 2004

31st Annual Meeting of the Plant Growth Regulation Society of America
Charleston, South Carolina
www.griffin.peachnet.edu/pgrsa/events.html

July 31 - August 4, 2004

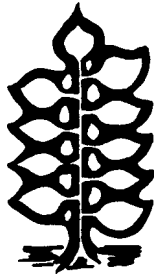
American Phytopathological Society Annual Meeting
Anaheim Convention Center, Anaheim, CA
www.apsnet.org/meetings

August 28 - 31, 2004

17th Annual Lettuce and Leafy Vegetable Conference
Hotel Sandman (Longueuil), Quebec, Canada
www.cshs.ca/ILLVC2004

September 20 - 24, 2004

18th International Conference on Plant Growth Substances
Canberra, Australia
www.conlog.com.au/ipgsa2004



Down the Road

July 10 -15, 2005

Xth International Turfgrass Research Conference

Llandudno, North Wales, UK

www.aber.ac.uk/itrc2005

June 26 - 30, 2005

10th International Symposium on Plant Bioregulators in Fruit Production

Saltillo, Mexico

www.salttillo2005.org