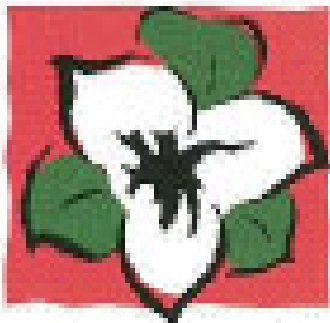
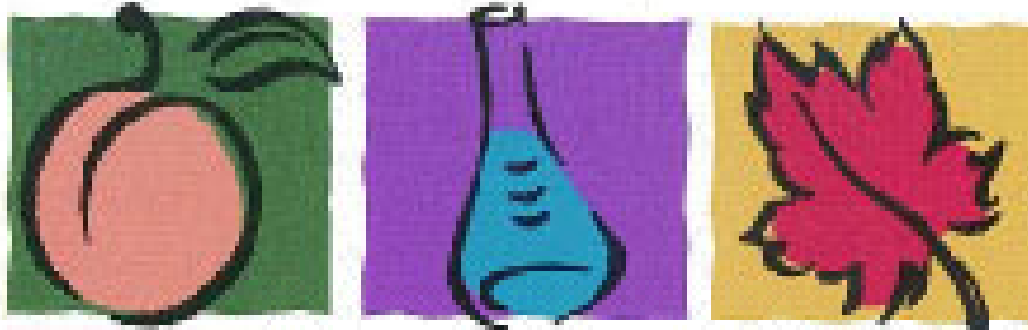


Program Supplement



HORTICULTURE
Art & Science for Life
TORONTO 2002

XXVIth International Horticultural Congress

XXVI International Horticultural Congress

August 11 to 17, 2002,

Toronto, Canada



Dear Colleagues:

At last count the Program for the XXVIth International Horticultural Congress contains over 2300 titles distributed over 23 symposia, a Knowledge and Scholarship Forum and a cross-commodity poster session featuring Special Topics in Horticulture. You will appreciate the considerable amount of preparation involved in publishing this volume of information and the fact that it had to be compiled in early May.

Predictably, numerous program changes have occurred during the intervening period. Some papers have been withdrawn, others have been added. Modifications to titles, text and author lists have been requested, and presentation times have changed. This Supplemental Program lists all changes up to and including July 8, 2002. The book is arranged by event (i.e., symposium and workshop); new papers are listed first followed by notes on changes to the original information. Please use the book in conjunction with the main Program Book and check carefully for any changes to the sessions that you will be attending.

Enjoy the Congress!

Best regards,

Norman Looney, President of the Congress

Peter Hicklenton, Chair Printing and Publications Task Force

Yves Desjardins, Chair Scientific Program Task Force

Abstracts and Changes

Contributed Papers (Poster and Oral)

XVI International Horticultural congress

Toronto, Canada

August 11-17, 2002

SYMPOSIA TIMETABLES

Each symposium has been allotted time after 16:20 on Monday, Tuesday and Thursday. For many symposia the oral session (20 minute presentations) ends at that time. There will generally follow a period reserved for poster discussion (short presentations by poster authors) or general discussion until 17:20. In a few cases additional 20 minute oral presentations have been scheduled between 16:20 and 17:20.

Please note that, contrary to the indication in the program, the last paper of the morning session for most symposia is scheduled for 10:20 on Friday, August 16. The 10:20 to 10:40 time period is provided for discussion, to present the student poster award for the symposium and/or to conduct working group business. The break begins at 10:40.

The IHC organizing committee extends sincere thanks to the nearly 50 conveners and their International Scientific Committees who have compiled the symposium programs.

Symposium 1 (S1): Biotechnology of Horticultural Crop Improvement: Achievements, Opportunities and Limitations

Location: Crowne Plaza Hotel, Ballroom A

Thursday · August 15

S01-P-117A

PROTOPLAST ISOLATION AND SOMATIC HYBRIDIZATION BETWEEN EGYPTIAN AND CHINESE GARLIC

Abdel-Hamid A. Ali*

Genetic Department, Faculty of Agriculture, Tanta Univ., Kafr El-Sheikh, Egypt.

The study was conducted to describe protoplast isolation and fusion and subsequent plant regeneration in garlic (*Allium sativum* L.). Protoplast were enzymatically isolated from the youngest etiolated leaves of both garlic cultivars (Egyptian and Chinese cultivars), using an enzyme solution (2% cellulase "

Onozuka" "RS, 0.5% Dirselaase, 0.1 % Pectolayase Y23, 0.6Mmannitol and 10 mM CaCl₂). Two ml of each purified protoplast cultivars suspension was mixed together. The mixture was mixed again in petri dishes with an equal volume of agarose culture medium containing B5 medium supplemented with 1 mg/l NAA, 1mg/BAP, 0.5M Mannitol, 0.1% casin hydrolysate and 1.2%w/v agarose low melting point. The microcalli that formed after about five weeks were transferred to solid B5 medium. For plant regeneration the derived microcalli from fused protoplasts were transferred to MS salts and B5 vitamins medium. Several organized compact green structure at their surface after about four weeks. Regeneration of complete plantlets with shoot and root took about additional 4-6 weeks. Cytological analysis for the root tips of regenerants showed different levels of ploidy. And the electrophoretic analysis confirmed that fusing both types of protoplasts produces some regenerants.

Changes to the program of S1

Paper number S01-P-54 (original contribution number 2150) 'ROOT AND SHOOT ANATOMY OF IN VITRO FRUIT TREE ROOTSTOCKS: INVESTIGATIONS BY LOW TEMPERATURE SCANNING ELECTRON MICROSCOPY' by Luca Sebastiani, Antonio Minnocci, and Claudio Vitagliano has been withdrawn.

Paper number S01-P-66 'SOMATIC EMBRYOGENESIS FROM MATURE TISSUES OF LETTUCE *LATTUCA SATIVA*' by J.E.A. Seabrook*, and L.K. Douglass will now be given as oral paper number S01-O-77 from 16:40 to 17:00 on Tuesday, August 13.

Paper number S01-O-122 TRANSFORMATION OF WATERMELON VIA COPPER INDUCIBLE **CONSTRUCTS OF GUS AND ISOPENTENYL TRANSFERASE (IPT)** by Fahrettin Goktepe*, Harrison Hughes has been withdrawn. In its place paper **S01-P-83 PRODUCTION OF TRANSGENIC TOBACCO WITH ENGINEERED RESISTANCE TO INHIBITORS OF PLANT PEPTIDE DEFORMYLASE** by Mark A. Williams*, Lynnette M.A. Dirk, Robert L. Houtz will be presented from 16:20 to 16:40.

Paper number S01-P-130 'PHOSPHINOTHRICIN AND CROWN GALL RESISTANT TRANSGENIC PLANTS OF GRAPEVINE' by Myroslava Rubtsova, Boris Levenko* will now be given as oral paper number S01-

O-137 from 15:20 to 15:40 on Friday, August 16

Paper number S01-P-138 'AGROBACTERIUM-MEDIATED TRANSFORMATION OF PLUM (*PRUNUS DOMESTICA* L.) WITH PRUNE DWARF, PRUNUS NECROTIC RINGSPOT, AND TOMATO RINGSPOT VIRUS COAT PROTEIN GENES' by Isabel Padilla, Kevin Webb, and Ralph Scorza has been withdrawn. It will be replaced by 'IN VITRO BIOASSAY OF THE INSECTICIDAL ACTIVITY OF A CRY1A(C) TRANSGENE IN CALLUS DERIVED FROM A REGENERATION-RECALCITRANT CROP PLANT' by Benjamin Steinitz*, Yedidya Gafni, Yael Cohen, Yona Tabib, Shlomit Levski and Amos Navon (current Program number S01-P-127)

ISHS Biotechnology Commission

The business meeting of the ISHS Biotechnology Commission will take place in the Symposium 1 home room - Crown Plaza Hotel Ballroom A on Thursday, August 15, 2002 between 1900 and 2100.

Symposium 2 (S2): Toward Ecologically Sound Fertilization Strategies for Field Vegetable

Location: MTCC Room 103B

Thursday · August 15

S02-P-21

MANAGEMENT STRATEGIES FOR CAPTURING THE BENEFITS OF MYCORRHIZAS IN THE PRODUCTION OF FIELD-GROWN VEGETABLES

J.N. Sorensen*¹, J. Larsen¹, I. Jakobsen²

¹Danish Institute of Agricultural Sciences, Department of Horticulture, P.O. Box 102, DK-5792 Aarslev, Denmark

²Risoe National Laboratory, Plant Research Department, P.O. Box 49, DK-4000 Roskilde, Denmark

The mycorrhizal symbiosis between plants and fungi is a natural biological resource, which enhances the uptake of several plant nutrients. An improved use of this biological resource may increase the sustainability in plant production. Two approaches were investigated: 1) The use of previous mycorrhizal main crops or pre-established mycorrhizal cover crops, which enhance the rate of mycorrhiza formation in young seedlings and 2) the use of transplants, which were pre-colonized by mycorrhizal fungi selected for high nutrient uptake efficiency.

Results from field experiments showed that colonization, P uptake and growth of leeks increased if the previous crop was leek or onion compared to cabbage. A cover crop of black medick, established the previous autumn, increased the colonization of leek roots and also increased the plant P concentration and growth. These measurements were, however, not significantly influenced by the date of incorporation or the tillage depth. Results showed that a well-prepared soil bed at sowing or planting is of crucial importance for plant growth. Differences in colonization, P uptake and plant growth diminished during the growing period and nearly disappeared at the final harvest date of the leeks. Leek transplants inoculated with *Glomus intraradices*, *G. fistulosum*, *G. mosseae* or a field population of mycorrhiza increased the colonization, P uptake and growth of field-grown leeks, compared to non-inoculated transplants. Regarding the concentration of P, Zn and Cu, especially the leek roots were influenced by inoculation, compared to the leaves.

As for the experiments on previous crops and cover crops, differences between treatments nearly disappeared at the final harvest date. Although, plants were grown in soil low in P, an explanation for this lack of response could be due to a sufficient supply of soil P or other nutrients low in mobility.

S02-P-27A

INFLUENCE OF ZINC AND SULPHUR APPLICATION ON THE CHANGES IN DIFFERENT PARAMETERS IN RELATION TO QUALITY OF ONION

P.S.Munsi*¹, Mukesh Kumar¹, D.K.Das², T.K.Chottopadhyay²

¹Institute of Agriculture, Visva-Bharati University, W.B, India

²Bidhan Ch. Agril. Univ, Mohanpu, W.B, India

Onion (*Allium Cepa* L) is an important commercial bulbous vegetable crop grown in South-East Asian countries. According to FAO, onion is second only to tomato in terms of annual world production, improved varieties and crop production techniques are expected to raise economic yields of this crop. Application NPK fertilizers for onion cultivation is an easy and popular means for improving the yield, but it does not care for quality as well as for its storability. In addition to these inputs like NPK fertilizers, both zinc and sulphur have assumed a considerable importance for increasing yield of onion and improvement of quality. A field experiment in randomized block design was conducted at the Kalyani farm of Bidhan Chandra Agril. University, India (22057/ North latitude and 880 20/ East longitude at 7.8 m above MSL) during 1994-95 and 1995-96 to assess the yield and quality of onion bulbs (Cv.N-53) Treatments consisted of three levels each of zinc (0, 10,20 kg ha⁻¹ in chelated form) and sulphur (0,30,60 kg ha⁻¹ as elemental form) along with generally recommended NPK fertilizers as soil application, each treatment being replicated three times. Results showed application of Zn-EDTA @ 10kg ha⁻¹ increased the average yield of onion (18.02 t ha⁻¹) and improved the amount of total soluble solids, ascorbic acid content, concentration of total sugar (reducing and non reducing) also ash content of onion bulb whereas the moisture content of the same was decreased with the application of zinc. However, the application of sulphur alone particularly at higher level or in combination with both levels of zinc (10 and 20 kg ha⁻¹) showed significant decrease in the amount of the same parameters mentioned above. The same treatments of sulphur significantly increased the moisture content of bulbs resulting in poor storability. The study suggests that application of zinc @ 10kg ha⁻¹ is likely to result in higher yield of onion along and healthy bulbs with better keeping quality.

S02-P-27B

EFFECT OF FYM AND VERMICOMPOST ON TOMATO (LYCOPERSICON ESCULANTUM MILL VAR.SEL-7)

Narender Pal*, T.P. Malik, J.L. Mangal

Dept. of Veg.Crops, CCSHAU, Hisar of Veg.Crops, CCSHAU, Hisar-125004

Tomato is one of most popular vegetable crops in world. It is widely grown in India. The present experiment was conducted at Experimental Farm of Department of Vegetable crops, CCSHAU, Hisar. To study the impact of Vermicompost and FYM along with NPK (inorganic fertilizers) on yield and yield attributing characters of tomato. Flowering was delayed more with the treatment 100% of recommended dose of NPK + 15 tones of Vermicompost as compared to control i.e 32.67 and 29.30 Days After Transplanting (DAT) respectively. Similarly in case of fruiting the fruiting period was prolonged to 40(DAT). The no of fruits per plant were highest with 100% of recommended dose+ 15 t vermicompost The yield of tomato was highest in case of 100% of recommended dose NPK +15 tones of Vermicompost (353q/ha) as compared to control(270q/ha) whereas the optimum fruit yield of 351q/ha was obtained with 100% of recommended dose of Vermicompost.

S02-P-27C**RESPONSE TO NITROGEN FERTIGATION OF DIFFERENT ONION CULTIVARS IN ARGENTINA**

V. M. Lipinski¹, S. Gaviola, C.C. Martínez, A. Alaria, M. Maza,
¹Estación experimental Agropecuaria La Consulta, Instituto Nacional de Tecnología Agropecuaria. CC 8, 5567 La Consulta, Mendoza, Argentina

The onion crop is of great importance in Argentina with around 22,000 ha, for fresh market and dehydration industries. Six onion cultivars (*Allium cepa* L.) were evaluated for their response to nitrogen fertigation (Navideña INTA, Antartica INTA, Refinta INTA, Cobriza INTA, Valcatorce INTA and Valuno INTA). Five levels of N were used (0, 75, 150, 225 and 300 kg N·ha⁻¹) in a split plot design with 3 replications in a block arrangement. The plants were grown under drip irrigation using a high density of 400,000 plants·ha⁻¹. During the growing season, leaf quick N tests* (sap) were performed and soil NO₃⁻ were determined in soil extracts with merck-o-quant strip, to fix critical levels. There were significant differences between cultivars and N levels. Also there was a significant cultivar x N interaction. Linear response and plateau models were adjusted to all cultivars. The breakpoint level in Antartica INTA, Valuno INTA, Refinta INTA and Cobriza INTA was 150 kg of N·ha⁻¹, in Navideña was 166 and in Valcatorce was 133. Sap nitrate test was not useful for controlling N fertigation. Soil NO₃⁻ quick test can be used as a tool to control N fertigation.

S02-P-27D**INFLUENCE OF ZINC AND SULPHUR APPLICATION ON THE CHANGES IN DIFFERENT PARAMETERS IN RELATION TO QUALITY OF ONION**

P.S.Munsi*¹, Mukesh Kumar¹, D.K.Das², T.K.Chottopadhyay²

¹Institute of Agriculture, Visva-Bharati University, W.B, India

²Bidhan Ch. Agril. Univ, Mohanpu, W.B, India

Onion (*Allium Cepa* L) is an important commercial bulbous vegetable crop grown in South-East Asian countries. According to FAO, onion is second only to tomato in terms of annual world production, improved varieties and crop production techniques are expected to raise economic yields of this crop. Application NPK fertilizers for onion cultivation is an easy and popular means for improving the yield, but it does not does care for quality as well as for its storability. In addition to these inputs like NPK fertilizers, both zinc and sulphur have assumed a considerable importance for increasing yield of onion and improvement of quality. A field experiment in randomized block design was conducted at the Kalyani farm of Bidhan Chandra Agril. University, India (22057/ North latitude and 880 20/ East longitude at 7.8 m above MSL) during 1994-95 and 1995-96 to assess the yield and quality of onion bulbs (Cv.N-53) Treatments consisted of three levels each of zinc (0, 10, 20kg ha⁻¹ in chelated form) and sulphur (0, 30, 60kg ha⁻¹ as elemental form) along with generally recommended NPK fertilizers as soil application, each treatment being replicated three times. Results showed application of Zn-EDTA @ 10kg ha⁻¹ increased the average yield of onion (18.02t ha⁻¹) and improved the amount of total soluble solids, ascorbic acid content, concentration of total sugar (reducing and non reducing) also ash content of onion bulb whereas the moisture content of the same was decreased with the application of zinc. However, the application of sulphur alone particularly at higher level or in combination with both levels of zinc (10 and 20 kg ha⁻¹) showed significant decrease in the amount of the same parameters mentioned above. The same treatments of sulphur significantly increased the moisture content of bulbs resulting in poor storability. The study suggests that application of zinc @ 10kg ha⁻¹ is likely to result in higher yield of onion along and healthy bulbs with better keeping quality.

Friday · August 16

800-900**S02-P-55A****THE EFFECTS OF DIFFERENT IRRIGATION PROGRAMS AND NITROGEN LEVELS ON THE YIELD AND QUALITY OF GREEN BEAN UNDER GREENHOUSE CONDITIONS**

Serap Soyergin¹, Riza Kanber², Atef Hamdy³

¹Ataturk Central Horticultural Research Institute Yalova/Turkey

²Cukurova University, Agricultural Faculty, Adana/TURKEY

³Mediterranean Agronomic Institute, Bari/ITALY

The experiment was carried out in 1999 at the Ataturk Horticultural Central Research Institute in Yalova, Turkey. The experimental design was strip plot with three replications. Three nitrogen levels (N1:15, N2:30, and N3:45 kg/da) and three irrigation intervals (I1:2, I2:4, and I3:6 days) were investigated. Free water surface evaporation was used to determine irrigation water amount. According to the results, the interaction between nitrogen doses and irrigation intervals was found to be statistically significant. The maximum pod yield and pod number per plant were obtained from treatments of I2N2. The dry matter of pods reduced by increasing amount of water applied. On the other hand the nitrate content of pod increased with increasing the nitrogen doses. Protein content of pods was also affected by the irrigation interval and nitrogen interaction. Water use efficiency was greater with four day irrigation interval as compared to the others.

Symposium 3 (S3): Potatoes-Healthy Food for Humanity: International Development in Breeding, Production, Protection & Utilization

Location: MTCC Room 201CD

Changes to the program of S3

The paper S03-P-15 'CLOSING IN ON LATE BLIGHT RESISTANCE' by S. Kristine Maess is withdrawn

The paper S03-P-81 'EFFECT OF PHYSIOLOGICAL AGE OF SEED TUBERS AND PLANTING DATES ON EMERGENCE CHARACTERISTICS AND YIELD OF POTATO VARIETIES IN OMAN' by I.A. Khan is withdrawn and has been incorporated in S03-P-80 (same author).

Posters originally schedule for the poster session of Friday 16 August have been moved to the Thursday session. The following papers have been renumbered accordingly:

#1655 is changed to S03-P-91A

#1696 is changed to S03-P-91B

#1737 is changed to S03-P-91C

#1802 is changed to S03-P-91D

#2033 is changed to S03-P-91E

2121 is changed to S03-P-91F

#2184 is changed to S03-P-91G

#2233 is changed to S03-P-91H

#2650 is changed to S03-P-91I

#2806 is changed to S03-P-91J

Symposium 4 (S4):Environmental Stress & Horticultural Crops

Location: MTCC Room 202AB

Thursday · August 15

S04-P-114A

EFFECTS OF WATER STATUS AND FRUIT LOAD ON FRUIT-SHOOT PARTITIONING OF PHOTOASSIMILATES IN JAPANESE PERSIMMON

K.Morinaga*¹, K.Moriguchi², Y.Koshita-Mitani¹, Y.Tsuchida¹

¹National Institute of Fruit Tree Science, NARO, Dep. Grape and Persimmon Research, Akitsu, Hiroshima 729-2494 Japan

²Ehime Prefectural Station of Fruit Tree, Matsuyama, Ehime 791-0112 Japan

Photoassimilates partitioning between fruit and shoot in response to drought stress was investigated using stable isotope ¹³C in different fruit loaded glasshouse-grown 3-year-old Japanese persimmon (*Diospyros kaki* L.). After 6 d of controlling water supply, predawn leaf water potential in the heavy fruit load trees (HFL) decreased to a range from -1.0 to -1.2MPa, and that of the medium fruit load tree (MFL) ranged from -0.9 to -1.1MPa. Net photosynthesis of leaves and water content in fruit and shoot were measured, and 3-year-old branch with bearing shoot of HFL and MFL were fed with ¹³CO₂ on the 6th day of water stress treatment. Net photosynthetic rates of leaves of both HFL and MFL were reduced to 20% of that of well-watered condition trees. Water content of leaves of both HFL and MFL was most severely reduced compared to fruit and bearing shoot. Percentages of fruit enlargement of both HFL and MFL were lower than those of the well-watered tree on the 6th day of water stress treatment. However, percentage of shoot enlargement of HFL was earlier reduced than that of MFL. ¹³C-Photoassimilates partitioning percentage of fruit of HFL was higher than that of MFL under well-watered condition. However, the partitioning percentages of fruit of HFL were lower than that of MFL under drought stress condition. These findings indicate that sink potential of persimmon fruit might be changed in response to not only water status but also fruit load of trees.

Changes to the program of S4

The paper S04-P-99 'INFRARED AND ULTRAVIOLET LIGHT INJURY OF APPLE FRUITS' by Lotfali Naseri is withdrawn

The paper number S04-P-30 (shown in the 13:40 to 14:40 poster session on Tuesday, August 13) 'ULTRASTRUCTURE OF NODULES FROM *ALNUS MARRITIMA*' by H.A. Kratsch*, W.R. Graves is being presented in symposium 18 in the 13:40 to 14:40 poster session on Thursday, August 15 as paper number S18-P-42

Change of author: Paper number S04-O-60 'MECHANISM OF INJURY BY AND ACCLIMATION TO ENVIRONMENTAL STRESSES IN TENDER PLANTS: STRATEGIES FOR IMPROVING STRESS RESISTANCE' is by Jiwan P. Palta

The paper number S04-P-12 is a duplicate of S04-P-103. The latter will be presented in the poster session from 13:40 to 14:40 on Thursday, August 15. S04-P-

12 will not be presented as indicated in the program.

The paper number S04-P-101 entitled 'PHOTOSYNTHETIC PERFORMANCE OF WILD TYPE STRAWBERRY ECOTYPES (*FRAGARIA* SP) DIFFERING IN SALT SENSITIVITY' is replacing the presentation S04-O-118 on the Thursday 15 August from 1600 to 1620.

The authors of paper S04-O-24 are Jeff Kuehny*, Melyssa Kay Davis Vige and James E. Board (LSU Dept. of Agronomy, 108 Mb Sturgis, Baton Rouge, LA 70803-2120)

The new title on paper S04-P-109 is 'Monitoring drought stress in raspberry plants (*Rubus idaeus* L.) using hyperspectral and thermal infrared remote sensing, leaf gas exchange, chlorophyll fluorescence and soil moisture sensors'

Paper **S04-O-118 'WATER USE EFFICIENCY IN STONE FRUITS'** by Cristos Xiloyannis has been withdrawn. It will be replaced (as an oral presentation from 16:00 to 16:20) by **S04-P-101 'PHOTOSYNTHETIC PERFORMANCE OF WILD TYPE STRAWBERRY ECOTYPES (*FRAGARIA* SP)DIFFERING IN SALT SENSITIVITY'** by Adriana, Nikoloudi*, and James A., Flore

Paper number S04-O-124 'INVESTIGATION OF THE EFFECTS OF THE LIGHT AND THE RAIN ON THE OVERCOMING OF DORMANCY IN SOME APPLE CULTIVARS' by Guiliano A.Finetto has been withdrawn.

Symposium 5 (S5):Viticulture & Oenology:Living With Limitations

Location: MTCC Room 202CD

Monday · August 12

S05-P-13A

ALTERNATIVE SOIL MANAGEMENT FOR SANDY VINEYARDS LASZLO, NEMETHY

Nemethy Laszlo*

Hungarian Institute of Agricultural Engineering 2100 Godollo, Tessedik, S. ut 4. HUNGARY

In many vineyards sited on sandy soils, intensive mechanization during the past decade has led to biological, soil texture, and environmental problems. The objective of this work was to develop soil cultivation systems that were non-traditional and in strict accordance with the environmental protection regulations. Under this project, treatments involving straw mulch and cover crops were tested. Instead of herbicides, remote control row cultivating equipment with advanced technology was tested. Both soil moisture and bulk density were measured. The main observations are as follows: 1. Each year the highest soil moisture was associated with straw-covered treatments; 2. Among cover crop and soil cultivating treatments, the most soil moisture was observed under Digitaria, followed by rye, fallow, and mowed weeds; 3. The highest soil moisture was achieved at a stubble height of 12-15 cm and the lowest was at a stubble height of 20-23 cm. A stubble height of ca. 5 cm resulted in an intermediate soil moisture level; 4. Among all cover crop and soil cultivating

treatments, the mean soil resistance (kp/cm²) was 1.2-1.5 times higher than that of the mean value tested in the untreated portion of the field, however the value in the path of the tractor wheel was 2.1-3.8 times more.

Tuesday · August 13

S05-P-30A

THE INFLUENCE OF NPK, PHOSPHORUS SOURCE AND POTASSIUM FOLIAR APPLICATION ON GROWTH AND FRUIT QUALITY OF THOMPSON SEEDLESS GRAPE-VINES

A.T.Salem*, A.E.Kilany, G.S.Shaker

Faculty of Agriculture, Cairo University, Giza, Egypt

A study was conducted in a drip irrigated vineyard to investigate the response of 11 year old Thompson Seedless grapevines to various NPK fertilizer treatments, consisting of two nitrogen rates (60 and 80 kg/feddan (fed)), two sources of phosphorus (monoammonium phosphate and phosphoric acid) and foliar potassium (potassium thiosulfate, 2 mL/L) during the veraison to harvest period. Within each N rate, six NPK ratios were achieved. Using nitrogen at 80 kg/ha improved vine growth and fruit composition more than 60 kg/fed. However, improvements in vine productivity and cluster quality were related to NPK ratio, with an optimum of 1:1:3 NPK. Monoammonium phosphate resulted in higher yields with better fruit composition than phosphoric acid. Spraying K at weekly intervals during the veraison to harvest stage improved the fruit composition, so additional foliar K is recommended to sustain the advantages achieved by high NPK soil applications. [Editor's note: a feddan is 4200 sq. m or 0.42 ha].

Thursday · August 15

S05-O-57

EFFECT OF HOT-WATER ON REST TERMINATION AND RESISTANCE OF VITIS VINIFERA BUDS

Rasul Jalili*, Lotfali Naseri

Department of Horticulture, College of Agriculture, Urmia University, P. O. Box 165, Urmieh, West Azarbayjan, IRAN

Laboratory experiments were conducted to determine the effect of hot water temperature and exposure time on rest termination and bud survival of three grape cultivars (Safidebidaneh, Ghiziluzum, and Rishbaba). A completely randomized design within a factorial treatment arrangement with three replications was used. In November, dormant cuttings were submerged in hot water at six different constant temperatures [0 (as control), 40, 45, 50, 55 and 60C] in combination with three exposure periods (10, 20 and 30 min.). Bud break was recorded over a period of 5 weeks. The interaction of temperature and exposure time was significant with respect to bud break. The rate of bud break increased initially with increasing temperatures and/or the exposure until it reached an optimum value, and thereafter decreased. Most buds broke for all three cultivars during the first 2 weeks following a regime of 55C for a period of 20 minutes. At 60C an inhibiting effect on bud break was observed, and all buds were injured. In control cuttings, no bud break occurred throughout the experimental period as a result of endodormancy.

Changes to the program of S5

Additions:

Monday, August 12

Paper number S05-P-53 'EVALUATION FOR PIERCE'S DISEASE AMONG MUSCUDINE GRAPES' by Jian Lu and Zhongho Ren will be presented orally from 15:00 to 15:20

Paper number S05-P-11 'SELECTIVE FILTRATION OF SOLAR RADIATION BY COLORED SHADE NETS CAN IMPROVE THE YIELD AND QUALITY OF TABLE GRAPES' by Shahak et al. will be presented orally from 15:40 to 16:00

Paper number S05-P-10 'SEASONAL PHOTOSYNTHETIC RESPONSE TO LIGHT INTENSITY IN FIELD GROWN SANGIOVESE AND MONTEPULCIANO VINES (VITIS VINIFERA L.)' will be presented orally from 16:20 to 16:40.

Paper number S05-P-13 'EFFECTS OF COVER CROPS ON GROWTH CHARACTERISTICS AND UNDERGROUND ENVIRONMENT OF VINEYARDS' by G.C. Song et al will be presented orally from 16:40 to 17:00.

Paper number S05-P-28 'EFFECTS OF MACRO- AND MICRONUTRIENTS ON FRUITFULNESS AND SOME QUANTITATIVE AND QUALITATIVE TRAITS OF SULTANA GRAPES' by M.A. Nejatian will be presented orally from 17:00 to 17:10

Time from 16:20 to 17:20 will be occupied by a series of short presentations featuring the following papers:

S05-P-29 'GRAPE LEAF DIAGNOSIS STANDARDS IN COMPARISON TO PEDOLOGICAL FACTORS' by Jolanta Ciesielska Jolanta et al.

S05-P-28 'EFFECTS OF MACRO AND MICRONUTRIENTS ON FRUITFULNESS AND SOME QUANTITATIVE AND QUALITATIVE TRAITS OF SULTANA GRAPES' by Mohammad Ali Nejatian

Tuesday, August 13

Paper S05-O-31 will not be presented at 14:40. It has been moved to Friday at 09:40. The following papers (S05-O-32, S05-O-33, S05-O-34 and S05-O35) will advance by 20 minutes.

Paper S05-P-26 'EFFECT OF NON-CONVENTIONAL GROUND COVERS ON GROWTH OF CONTAINERIZED SEYVAL BLANC GRAPEVINES' by N. Krohn et al. will be presented orally from 16:00 to 16:20.

Paper S05-P-30 'IN-ROW VINE SPACING EFFECTS VINE YIELD INDEPENDENT OF BUD LOAD FOR FIVE WINE CULTIVARS OF V. VINIFERA L.' by K.H. Fisher and B. Piott will be presented orally from 16:20 to 16:40

Paper S05-P-55 'FERTILITY AND PRODUCTIVITY CHARACTERIZATION OF THE BEARING UNITS OF THE VERDEJO VARIETY TO IMPROVE PRUNING STRATEGIES' by S. Lopez-Miranda et al. will be pre-

sented orally from 16:40 to 17:00.

Thursday, August 15

Paper S05-P-12 'STUDY OF MECHANISM OF PHLOEM SUGAR UNLOADING IN DEVELOPING GRAPE BERRY' by Guo-Hai Xia*, Da-Peng Zhang and Fan-Shi Kong will be presented orally from 16:00 to 16:20.

Paper S05-P-43 'VARIABILITY IN THE AUTOCHTHONOUS VINE VARIETY KRATOSIJA' by V. Mara, M. Milutinovi and, L. Pejovi will be presented orally from 16:20 to 16:40

Time from 16:20 to 17:20 will be occupied by a series of short presentations featuring the following papers:

S05-P-51 'TISSUE CULTURE IMPROVES THE PROPAGATION OF NORTON GRAPEVINE (VITIS AESTIVALIS)' by B.B. Bigger and P.E. Read

S05-P-52 'EFFECT OF MALE PARENT AND APPLICATION OF BORIC ACID ON EMBRYO RESCUE IN SOME SEEDLESS GRAPEVINE (VITIS VINIFERA) CULTIVARS' by A. Ebadi et al.

S05-P-45 'CYTOGENETIC STUDY OF INTERSPECIFIC HYBRIDS BETWEEN VITIS ROTUNDIFOLIA AND V. VINIFERA' by X., Xu and J. Lu.

S05-P-54 'RELATIONSHIPS AMONG QUALITATIVE AND QUANTITATIVE CHARACTERS IN 90 GRAPEVINE (VITIS VINIFERA) CULTIVARS' by M. Reza Fatahi Moghadan et al.

S05-P-44 'IN VITRO GROWTH OF GRAPES AS AFFECTED BY INTERACTION BETWEEN LIGHT AND CYTOKININS' by Seon-Kyu Kim et al.

Change of authors: Paper number S05-P-25 'THE USE OF A FREEZING BUD TECHNIQUE TO DETERMINE THE HARDINESS OF 20 GRAPE GENOTYPES' by Djamila Rekika, Johanne Cousineau, Audrey Levasseur, Claude Richer, Helen Fisher and Shahrokh Khanizadeh

Paper S05-O-60 'FRUITSET AND POLLINATION REQUIREMENTS IN WINEGRAPES' by Sandy Lang*, Georgina Milne, Marc Greven, Sue Neal, Steve McCartney, Stefan Henton has been withdrawn

Paper S05-O-73 'INFLUENCE OF ROOTSTOCKS ON THE PERFORMANCE OF PINOT NOIR CLONE 10/5 IN A COOL CLIMATE' by Tom Crossen*, Glen L. Creasy, Gilbert Wells, Gwyn Williams, Michael C. Trought has been withdrawn.

Friday, August 16

Paper S05-O-73 'INFLUENCE OF ROOTSTOCKS ON

THE PERFORMANCE OF PINOT NOIR CLONE 10/5 IN A COOL CLIMATE' by T. Crossen et al. has been withdrawn. In its place paper S05-O-31 'PHLOEM UNLOADING IN THE DEVELOPING GRAPE BERRY: AN IN VIVO TECHNIQUE FOR THE STUDY OF PHLOEM SUGAR UNLOADING AND AN UNLOADING MECHANISM' by Guo-Hai Xia et al. will be presented

Symposium 6 (S6): The Future for Medicinal & Aromatic Plants

Location: MTCC Room 104A

Monday · August 12

S06-P-13A IN VITRO ACTIVITY OF RHEUM RIBES EXTRACTS AGAINST CLINICAL ISOLATES OF GRAM-NEGATIVE PATHOGENS

B.S. Fazly Bazzaz*¹, M. Khajehkaramadin², H.R. Shokoheizadeh¹

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²Ghaem Hospital, Mashhad University of Medical Sciences, Mashhad, Iran.

Rheum ribes is one of the Polygonaceae family which is endemic to Iran and a few neighbors. In this investigation, antimicrobial effects of root, stem and leaf extracts of *Rh. ribes* on a few common gram negative microorganisms were investigated using hole-plate and paper disc methods. Gram negative microorganisms were *Escherichia coli*, *Klebsiella pneumoniae*, *Proteus* spp., *Pseudomonas aeruginosa* and *Neisseria gonorrhoeae*. In examination of pathogenic microorganisms in hole-plate method, methanolic extracts of different organs of the plant in concentrations of 0.5 and 5 mg/ml and in paper disc method, 250 and 500 micrograms of extracts per disc were used. Results showed that *E. coli* is the most sensitive and *N. gonorrhoeae* is the less sensitive organism towards stem extract. However *P. aeruginosa* is the most sensitive and *Proteus* spp. is the less sensitive organism towards leaf extract. Also discs had an effect equal to Streptomycin and Tetracycline discs. The results suggested that extracts of *Rheum ribes* could

S06-P-13B CORNELIAN CHERRY: A PERSPECTIVE SOURCE FOR PHYTOMEDICINE

Nazim Mamedov*

University of Massachusetts at Amherst. Laboratories for Natural Products, Medicinal and Aromatic Plants. 990 North Pleasant St., Apt.H-10

Cornelian cherry (*Cornus mas* L., Cornaceae) is a tall deciduous shrub or small tree from 5 to 8 m high. It is chiefly found in Southern Europe and northern limit being in the southern Belgium, Luxembourg, central Germany, Italy, Spain, Portugal, Greece, Albania, Bulgaria, Ukraine, Caucasus, Central Asia, Turkey, Iran, Afghanistan and South America.

Cornelian cherry has been cultivated in Caucasus and Central Asia for centuries as food and medicine (Asadov et al., 1990; Kuritz et al., 2001). Part used is the mature fruit. The life expectancy is up to 250 years. The fruits have a sweet-sour, slightly

astrigent taste and are used to make preserves, compotes, sauce and vine. The bark and leaves contain tannins and used in tanning. The fruit contains tannins 10 percent, sugar 9.5 percent, pectin 5.0 percent, malic acid 2.5 percent, amberic acid 1.5 percent and ascorbic acid 0.6 percent. The fruit contains 85 percent of juice. The bark contains tannins 7 percent and up, glycosides and pigments. The leaves contain from 8 to 18 percent of tannins. The drupes contain 34 - 35 percent of fatty oils. In traditional medicine galenicals from leaves and powder from drupes are widely used against diarrhea and hemorrhoids (Damirov et al., 1983; Asadov et al., 1990). The juice from fruit used against diabetes (Damirov et al., 1983). Galenicals from bark and evaporated juice are used to treat skin wounds and furunculosis. Galenicals from leaves, flowers, fruit are used against sore throat, digestion problem, measles, chickenpox, anemia, rickets, liver and kidney diseases in traditional and conventional medicine as well (Damirov et al., 1983, Sokolov and Zamotayev, 1984, Asadov et al., 1990).

Tuesday · August 13

S06-P-30A

IS MEDICAL CONTROL OF TEA CONSUMPTION NECESSARY?

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Heavy metal accumulations in higher concentration may inhibit enzyme activity, influence the acute phase protein synthesis and gene expression as well as the prooxidant and antioxidant forms of scavenger molecules. Beiqishen Tea was studied in an in vitro complex test system. Phytochemical screening and trace element analysis were carried out as well as the detection of antioxidant properties. Characteristic constituents were determined by chromatographic (capillar gaschromatography, ion trappi mass spectrometry, TLC) and spectrometric (UV, UV-VIS) methods. Element concentrations were determined by ICP-OES. Antioxidant capacity was studied by spectrophotometric and luminometric techniques using a Berthold Lumat 9501 luminometer. H-donating activity, reducing power property and total scavenger capacity were measured. Total polyphenol content was $20.773 \pm 0.523\text{g}/100\text{g}$ drug, total flavonoid content: $0.485 \pm 0.036\text{g}/100\text{g}$ drug, and tannins: $9.063 \pm 0.783\text{g}/100\text{g}$ drug. The predominant compound was caffeine. β -carotene was detected in traces. Essential oils: p-cymol (5%), + limonene (50%), ocymen (2%), methylchavicol (3%) thymol (2%) were identified by TIC (total ion current) chromatography. Metallic ion analysis showed significantly high concentration of Al, As, Ba, Cr, Cu, Fe, Mn, Ni, Ti. Antioxidant or scavenger properties were identified depending on the concentration. Based of the above results the tea infusion contains trace elements and caffeine in addition to polyphenols and tannins in high concentration, the attention of patients suffering from gastrointestinal disorders, renal- and cardiovascular diseases, should be called to the fact that consumption of the tea without control involves risks.

S06-P-30B

COMPARATIVE STUDY OF STRUCTURAL, ANATOMICAL AND DEVELOPMENTAL CHARACTERISTICS OF TWO SPECIES OF DATURA; AND DETECTING THEIR ANTIMICROBIAL EFFECTS

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Morphological characteristics, anatomical structures and developmental stages of vegetative and reproductive organs and some antimicrobial effects were studied and compared in two species of Datura: *D. stramonium* L. and *D. innoxica* Miller. Developmental stages of meristem and flower in both of the species were the same, and there were no significant differences in their morphological characteristics. Studying the anatomical characteristics of the primary structures of roots showed the presence of two bonds of xylem and phloem vessels. In the secondary structure of the main roots, phloem was visible inside the xylem. Secretory and non-secretory trichomes existed on the epiderm of leaf and stem in *Datura innoxica* Miller but did not in *Datura stramonium* L. In both species, flower developmental stages were the same. Two carpels aroused with delay, compare with petals and stamens, in the middle of floral meristem after it had been flattened. Anthers had plasmodial tapetum cells. Tetrahedral tetrads by synchronic separation were made at the same time. Pollen grains were tri pored. Studying of developmental stages of the ovule made in clear that there were ovules with subepidermal archaespore, with a developed tegument and an eight-cell embryonic sac. Internal secretory cells (Idioblasts) were studied using Draggendorff reagents. The studies showed that idioblasts were present in parenchyma of stems, petioles and veins. The antimicrobial effects of ethanol 80% extract of roots, stems, leaves, flowers and fruits in different developmental stages were studied and compared in both species. In the vegetative stages, it showed that only leaves' extracts in both of the species had antibacterial effects on the bacteria studied (*Bacillus subtilis* and *Xanthomonas campestris*).

Thursday · August 15

S06-P-83A

EFFECTS OF IRRIGATION REGIMES AND PLANT DENSITY ON YIELD AND AGRONOMIC CHARACTERISTICS OF SABGOL (*PLANTAGO OVATA*)

Parviz Rezvani Moghaddam

Ferdowsi university of mashhad.college of agriculture department of Agronomy. Mashhad. IRAN

In order to understand more clearly the effects of irrigation regimes and plant density on yield and agronomic characteristics of Isabgol (*plantago ovata*), a field experiment was conducted at research station, college of agriculture, Ferdowsi university of Mashhad, during the years 2000 and 2001. A split plot design based on completely randomized block design with three replications was used. The treatments comprised four irrigation regimes 7, 14, 21 and 28 interval days allocated in the main plots and four plant densities 8, 10, 14 and 20 in the first year and 20, 60, 100 and 140 plants/m² in the second year allocated in sub plots. In order to having uniform emergence, before studying the irrigation treatments, all plots were two and three times irrigated in the first and second year respectively. Results showed that the irrigation regimes in each of 2 years had significant effects on plant height, number of spikes per plant, dry matter and seed yield. Decreasing the irrigation intervals had a positive effect on these characteristics. The seven irrigation interval days had the highest seed yield. Plant density had no significant effects on spike length, plant height and 1000 seeds weight in 2

years. The effect of plant density on number of seeds per spike was significant only in the first year of study. In the first year, plant density had no significant effect on number of spikes per plant, but in the second year with increasing in the densities, the number of spikes decreased. The lowest number of spikes was shown in the highest density (140 plants/ m²). With increasing plant density, dry matter yield and seed yield were increased significantly in both years. The highest seed yield was obtained at the highest density (140 plants/m²), but there was no significant difference between 140 and 100 plants/m² density.

S06-P-83B

EVALUATION AND CHARACTERIZATION OF SAGE AND OREGANO CLONES OBTAINED IN VITRO

Fortunato Morone*¹, N Cicco², V. Lattanzio¹, Ruta C¹, A Tagarelli¹

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Sage (*Salvia officinalis*) and Oregano (*Origanum vulgare*) are two species of the Labiatae family traditionally used by the food industry because of their aromatic and antioxidant properties linked to the phenolic metabolites. Nowadays, dietary phenolic ingredients from aromatic plants are being investigated for their antimicrobial and antioxidant properties for uses such as food preservatives and disease prevention. In addition, in vitro culture, with consistent phenolic phytochemical profiles are also investigated. The high degree of heterozygosity verifiable easy in the plants, caused by natural cross-pollination, produces variability in the level of compounds of essential oils. The quantity-quality identification and evaluation of autochthonous ecotypes of this species allow the preservation of the local genetic resource and represents a valid cultural alternative to a sustainable agriculture.

Therefore, the aim of this study was to obtain several clones starting from a heterogeneous seed of autochthonous ecotypes by micropropagation and then to individuate and characterized antioxidant natural compounds. Tissue culture technique, moreover, could produce homogeneous clones selected by their precious characters to destine for the industry.

Each clonal line originated from a different heterozygous seed of two species were evaluated for essential oils and the individuation and characterization of antioxidant natural compounds.

Friday · August 16

S06-P-100A

THE QUANTITATIVE/QUALITATIVE ANALYSIS OF THUYA ORIENTALIS ESSENTIAL OIL

S.Parhami-Gh. Amin, B. Nik-Avar
Department of Pharmacognosy, College of Pharmacy, University of Tehran, Tehran, IRAN

This study was fulfilled because of widespread growing of thuya orientalis in Iran and necessity of accomplishment of scientific study concerning the quantitative/qualitative analysis of its essential oil.

- Genus and species of collected samples be came distinguished as Thuya orientalis.

- The essential oil extracted from leaves and fruits were examined by TLC method and then after the essential oils were analysed by GC/MS for identification of their chemical constituents. The oil of fruit has been found to contain 28 components (Alpha-pinene 52, 38%, Delta-3-Carene 14.24%, Beta-Phelandrene 5.06%, Cedrol 6.45%) and the oil of leaves has contained 48 components (Alpha-Pinene 21.92%, Delta-3-carene

10.53%, Limonene 7-16%, cedrol 20.27%)

S06-P-100B

ARBORETUM OF MEDICINAL AND AROMATIC PLANTS IN THE JNANABHARATHI CAMPUS, BANGALORE UNIVERSITY

A.N. YELLAPPA REDDY*¹, S. NARAYANA SWAMY², K. SIDDAPPA³

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An attempt is made by the Bangalore University to bring large area under the Ex-situ Conservation of medicinal plants which are under threat of extinction. Prior to planting of plants, the land, climate, soil profile and the status of water resources have been thoroughly studied. Water conservation measures such as watershed approach and rainwater harvesting have been implemented. Contour trenching and crescent shaped soil basins have been opened up to conserve as much rainwater

as possible. An area of 100 acres has been planted with these saplings with well conceived strategy. The strategy involves a three-tier method of planting i.e. tall trees; medium canopy trees and low growing as well soil conserving creepers which are planted in such a way that they do not compete each other for sun light, ventilation and ground water. The tall trees are widely spaced and have been given enough open space. The medium and small plants are planted closely. Attention is also paid to individual plants, which are nurtured well. Climbers and creepers are planted close to the tall trees so that they could climb upon

them and take their support. The arboretum of medicinal plants is first of its kind in south India and it has already become self-sustaining one. All the plants have established well and have developed their own habitats.

Changes to the program of S6

Paper S06-P-6. Please note that the presenting author will be C. Gerardi in place of F. Blando.

Paper by P.M. De Magalhães, V. Pereira, and A Sartoratto entitled YIELDS OF ANTIMALARIAL SPECIES *ARTEMISIA ANNUA* L. will be presented on Thursday's poster session but will be displayed in S25-P-22.

Paper by Jasmim*, J. M., Prado, M. A., Silva, J. C. C. Nitrogen Fertilization effect on *Alpinia zerumbet* (Pers.) Burt & Smith, will be presented on Thursday's poster session but will be displayed in S25-P-24.

Symposium 7 (S7): Expanding Roles for Horticulture in Improving Human Health & Life Quality

Location: Crowne Plaza Hotel, The Caledon Room

Thursday · August 15

S07-P-33A

PSYCHOLOGICAL EFFECTS OF INTERIOR FLOWERS ON GENDER, SPECIALTIES AND DEGREES OF PRIVATE INTEREST IN PLANTS AND FLOWERS IN UNIVERSITY STUDENTS

Megumi Adachi*

Relationship Laboratory, Horticultural Science Course, Department of Agriculture, Tokyo University of Agriculture, Tokyo

Flowers have been used for interior decorations since ancient times, however, the psychological effects of interior flowers have not been well researched. This research aim is to investigate psychological effects of different cut flowers as a table decoration in a university restaurant. Live, artificial and dried red cut roses were decorated on tables in a university restaurant. About 200 university students as experimental subjects psychologically evaluated the environmental conditions in the restaurant when the different roses were decorated. Semantic Differential (SD) method was used for the evaluation, since unconscious effectiveness of the decorated flowers on the whole environmental condition could be compared. We also checked the gender, specialties and degrees of private interest in plants and flowers in the all experimental subjects and compared psychological differences between them. For it has been regarded as the most important to consider differences of profiles such as gender, nationalities, positions and ages in experimental subjects when psychological and physiological effects of plants were researched.

Changes to the program of S7

Paper number S07-P-24 'EFFECTS OF INTERIOR HORTICULTURAL ACTIVITY USING POTTED HERBS ON HUMAN PHYSIOLOGICAL STATES AND EMOTION' by Hideo Kakuta, Etsuko Yano, Tomoo Maeda, Tomoaki Yoshida has been withdrawn.

Paper number S07-P-41 'THE ESSENCE OF A GARDENER: MOTIVATIONS AND CONSTRAINTS INVOLVED IN GARDENING' by Tammy Kohlleppel*, Dennis McConnell, Steve Jacob has been withdrawn.

Paper S07-P-51 Please note the change in authors: 'RESEARCH ON THE DROUGHT RESISTANCE OF 47 LIANES' Jiangli Lei, Yiyan Xu, Ruiying Liu, Xia Chen, Yuzhen Yao, and Guojing Liu

Paper S07-O-63. Please note the addition of Juddith Ridd to the list of authors. The authors on this paper are I. Innis and J. Ridd from Massey University.

Paper **S07-O-64** 'HORTICULTURAL PRODUCTION IN DEVELOPING CITIES AND PUBLIC HEALTH' by Gebhard B. Luilo, Edith F. Mwijage has been withdrawn. In its place paper **S07-P-49** 'FRESH PRODUCE FOOD SAFETY TRAINING PROGRAM FOR THE SOUTH-

EASTERN US' by Dennis J. Osborne, Douglas C. Sanders*, Donn R. Ward, James R. Rushing and William Hurst will be presented from 14:20 to 14:40.

Symposium 8 (S8): Managing Soil-Borne Pathogens: A Sound Rhizosphere to Improve Production

Location: MTCC Room 206C

Tuesday · August 13

S08-P-19A

THE INFLUENCE OF SOME MICROBIAL PRODUCTS ON CUCUMBER GROWING AND FRUCTIFICATION

Popescu Victor *, Viorica Luchian, Stefania Jurcoane, N. Dobrescu, Gh. Bogdan

University of Agricultural Sciences and Medicine Veterinary, 59 Marasti Blvd. Bucharest - 71331, Romania,

As more as knowledge about soil microorganisms, the major factors which achieve the principal processes implied in fertility and in protection have been accumulated, it was look for to solve some problems concerning the soil microbial activity and the stimulation of its activity, to multiplied some useful microorganisms (bacteria and fungus) without soil, then to introduce them into the soil at an intentional density, place and moment. The purpose of this research is represented by the test of the product which contain *Bacillus subtilis* BSV- *Bacillus subtilis* BSU + the fungus *Trichoderma autoviride*, regarding the influence on cucumber plants growing and fructification as well as the positive effect to control some diseases. There were organized the following experimental variants: V1- control; V2- 1.0g product/ 50 ml water; V3 - 1.5 g/50 ml water; V4 - 2g product / 50 ml water.

To carry out this experience 1 g cucumber seeds it was weighed for each variants and it was treated with 5 ml solution. Seeds had been maintained 2 h into the solution, then there were sowing one seed/pot. The treatment has a positive influence on plants number, on emergence percent - 91.6% at V2, total yield and their quality. The highest yield has been registered at V3.

The test concerning the biological activity against some fungus species have been performed in vitro and in greenhouse by cucumber seeds treatment. The obtained results emphasized that the tested product is active to control Fusarium sp. and Phytium debarianum fungus. The acute toxicity DL50 determination was carried out on small laboratory animals, the product being total lack of toxicity and there were not registered mortality.

S08-P-41A

EVALUATION OF STREPTOMYCES ISOLATES FOR BIOLOGICAL CONTROL OF CHARCOAL ROT

Hassan Reza Etebarian*

Abourayhan Campus Tehran University P.O.Box 4117, Tehran, Iran

Charcoal rot and stem rot of melon is one of the most important diseases of this crop. Yield losses of 100% was observed in Garmsar area of Iran. Biological control of causal pathogen (*Macrophomina phaseoli*) was investigated by four isolates of *Streptomyces*. Dual culture and cellophane overlay technique

were used in vitro assay. All antagonist -host combination were carried in 4 replicates. Colony diameter was recorded daily, compared with controls and percentage of growth inhibition was calculated. Glasshouse studies were performed to test the ability of Streptomyces to control charcoal stem rot of melon. Seeds of Garmsar melon cultivar were surface sterilized and planted in pasteurized soil infested with *M. Phaseoli*. Colonized wheat barn with Streptomyces isolates were incorporated to the soil before pathogen inoculation. In the other experiment seeds of melon were soaked in Streptomyces suspension and planted in infested soil with pathogen. Streptomyces isolates inhibited mycelial growth of *M. Phaseoli* in dual culture. Streptomyces isolates STL, A20 and A15 inhibited growth of the pathogen by 88.16-89.3% and mycelial growth of *M. Phaseoli* was reduced by 69.99% by Streptomyces isolate 22. Cell free metabolite by 4 isolates of Streptomyces reduced colony area by 80.14-99.6%. The results of glasshouse experiments when soil of pots infested with pathogen and Streptomyces or seed treated with Streptomyces indicated that, survival of seedling in plants inoculated with the pathogen alone was significantly less than in treatments pathogen +Streptomyces and Streptomyces alone. There were no significant differences between Streptomyces alone and *M. Phaseoli*+Streptomyces ($P<0.5$).

Friday · August 16

S08-O-42

BIOLOGICAL CONTROL OF SOILBORNE DISEASES

Eric B. Nelson*

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The rhizosphere is a biochemically and microbiologically rich habitat where dynamic changes in plant, pathogen, and microbial development have major impacts on soilborne plant pathogens. A key to understanding biological control processes as well as the basis for success or failure of introduced or resident microbial agents is dependent on a greater knowledge the plant and microbial associated factors that influence pathogenesis in this habitat. This presentation will focus on our understanding of the plant, microbial, and pathogen factors that regulate microbial interactions with pathogens in the rhizosphere. Rapid developmental responses of pathogen propagules to subterranean plant parts reveal important clues as to the nature of initial events in pathogenesis, the regulation of these responses by the plant and the pathogen, as well as the microbial processes that may contribute to disease control. Studies with pathogen responses to seeds have served as a useful model for understanding these complex interrelationships and have revealed an important regulatory role for seed exudates molecules in regulating biological control processes. These insights are leading to improved abilities to predict the performance of introduced biological control organisms as well as to understand the mechanisms underlying disease control. The implications of such studies with practical aspects of soilborne disease control will be discussed.

Changes to the program of S8

Paper number S08-P-41 'TREHALOSE ACCUMULATION IN CARROT PLANTS THROUGH ARBUSCULAR MYCORRHIZAL FUNGUS SYMBIOSIS' by Y. Matsubara*, K. Hasuo, H. Fukui has been withdrawn.

Symposium 9 (S9): Issues & Advances in Postharvest Horticulture

Location: MTCC Room 105

Monday · August 12

S09-P-20A

ACCELERATED UNIFORM RIPENING IN GRAPES WITH A NATURAL LIPID LYSOPHATIDYLETHANOLAMINE (LPE)

Lalit Arya, Matt Rademacher, John Towse, Tim Peoples, Jiwan Palta*

Nutra-Park, Inc, 3230 Deming Way, Madison, WI. 53562

LPE is a natural lipid present in the membranes of all cells. Commercially LPE is derived from egg yolk and soy lecithins. Recent research demonstrates that a pre-harvest application of LPE can accelerate the ripening of fruits while prolonging their shelf life. We investigated the potential use of LPE to accelerate ripening in table grapes. Preharvest applications of LPE were made to red table grapes (var. Seedless Flames) on a commercial field near Bakersfield, California. The treatments included 200 ppm LPE mixed with 0.03% Li-700 (a surfactant), applied 1, 2, and 3 times at weekly intervals. Treatments were replicated six times, and each replicate was a full row consisting of 90 vines. First treatment was applied when 10 to 15 % of the grape berries exhibited color. Applications were made using a commercial spray rig that allowed complete coverage of a row. Fruits were harvested three times over a period of a month, starting three days after the third, final application. LPE applied three times at weekly intervals resulted in about a 50% increase in harvest amount for the first harvest. As expected, subsequent harvest amounts decreased proportionately. By comparison, control harvest amounts exhibited a rise in later harvests – evidence of delayed ripening. Results demonstrate significant efficacy of LPE in accelerating ripening in grapes, when applied in proper amounts.

The following paper has been added (16:20 to 16:40 replacing **S09-O-26** which was withdrawn). Timetable for the remainder of the afternoon reverts to that shown in the main program book

TECHNIQUES FOR POSTHARVEST INSECT CONTROL IN DEVELOPING COUNTRIES

E.J. Mitcham, Department of Pomology, University of California, Davis, CA 95616

Control of insect pests to achieve quarantine security for export shipments of horticultural commodities and to prevent damage to commodities in storage is important. Methyl bromide is one of the most common techniques currently used for insect control because it has been inexpensive, easy to use and broadly effective. With the impending phase out of methyl bromide in 2005 in developed countries and 2025 in developing countries, alternative techniques are needed. While methyl bromide may remain available for quarantine uses due to an exemption in the Montreal Protocol (a United Nation's Treaty), it is expected that the cost of methyl bromide will continue to increase and the availability will decrease. There is no single alternative to replace methyl bromide, and there are few alternatives that are readily available to replace even some uses of methyl bromide at this time. Irradiation treatment has the greatest potential to provide a quarantine security for a broad range of commodities and insect pests; however, the capital investment required for an irradiation facility could be prohibitive. If grower cooperatives are formed with a common packing and irradiation facility,

the cost could be shared and the facility could be used for a greater percentage of the year, thereby lowering the cost of use. A number of alternative fumigants are under investigation for insect control in horticultural crops including sulfuryl fluoride, propylene oxide, phosphine with carbon dioxide, carbonyl sulfide, acetaldehyde and ethyl formate. Registration and commodity tolerance are the main obstacles to adoption, but these materials would be easy to apply, requiring little sophisticated technology. Fumigation with carbon dioxide and/or reduced oxygen atmospheres has potential for insect control, especially for products that can safely be stored at elevated temperatures. Inexpensive tent structures are available to provide a sealed area around the product for either chemical fumigation or atmosphere containment. Relatively inexpensive carbon dioxide and oxygen sensors are available to monitor atmospheres, but there must be a source of liquid or gaseous carbon dioxide or nitrogen. Cold treatment protocols are available for control of some insect pests, but are not well tolerated by tropical commodities. Either reliable cold storage facilities or the ability to conduct the cold treatment in a marine container during transit is necessary. Heat treatments using hot water or hot air have been developed for insect control, especially for subtropical and tropical fruits and fruit flies, and additional treatments are under development. These treatments require a modest capital investment and a reliable electrical source is necessary. Recent research on radio frequency heating shows promise, but the capital investment is much higher and equipment would need to be shared by a cooperative, as with irradiation. Unfortunately, there is no single alternative to methyl bromide and alternatives must often be developed on a commodity and insect pest basis.

Tuesday · August 13

S09-P-115A

AMINOETHOXYVINYLGLYCINE (AVG) AFFECTS APPLE'S MATURATION AND POST-HARVEST QUALITY

J.L. Petri*, G.B. Leite, M.M. Spengler

EPAGRI-Estação Experimental de Caçador, C.P. 591 - 89500-000 - Caçador, SC, Brasil,

Apple growing in Brazil is characterized by orchards with more than 50 ha per grower, although some growers may have more than 1,000 ha. The cultivars 'Gala' and 'Fuji' account for more than 90% of the production in these orchards. This fact delays harvest resulting in fruit picked out of the ideal date. 'Gala' has a short maturation, concentrating the ideal harvest period. Aminoethoxyvinylglycine (AVG) is an ethylene synthesis inhibitor that delays fruit maturity and reduces pre-harvest drop, improving orchard management. The field experiments were carried out at Caçador Experimental Station, Santa Catarina State, Brazil, during four years, using the apple cultivars Gala and Fuji. The treatments applied were control plus AVG concentrations of 62.5, 125 and 250 g ha⁻¹, sprayed at 2, 4 and 6 weeks before commercial harvest time. The objectives were to evaluate the effect of AVG on pre-harvest fruit drop, commercial harvest time and fruit quality in pre and post-harvest, after 90 days of cold storage. The application of AVG significantly reduced pre-harvest fruit drop in cv. Gala, but had no effect in cv. Fuji. Harvesting was delayed 15 to 25 days in cv. Gala and in a lesser extent period in cv. Fuji when compared to the control. Comparing fruits at the same date, AVG treated fruits had significantly poorer skin and bottom color than those from the control. After attaining maturity at the right harvest point, they developed the same red color of those from the control. AVG delayed starch degradation, increased fruit firmness at harvest and after 90 days of storage, but did not affect the brix in relation to the control. The results showed that AVG was more efficient on 'Gala' than on 'Fuji'. The best results were obtained spraying AVG at 125 g ha

1 from 4 to 5 weeks before the predicted harvest time.

S09-P-115B

FRESH-CUT TOMATO FRUIT QUALITY AFFECTED BY MATURITY AND CONTROLLED ATMOSPHERE STORAGE

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Tomato fruit at pink or light-red stages of ripening were cut into slices, rinsed with water containing 50 µL L⁻¹ sodium hypochlorite and drained. They were stored in perforated polyethylene package at 1°C in air or controlled atmosphere (2.5% O₂ and 5% CO₂) for five and ten days. Weight loss, chlorophyll and lycopene contents, seed discoloration, fungal infection, total soluble solids content, titratable acidity, sugar/acid ratio, pH, flavor and taste, firmness, ascorbic acid content, rate of respiration and ethylene production, and electrolyte leakage were evaluated after each storage period. The overall quality of controlled atmosphere-stored slices was better than that of air stored slices. Slices from light-red fruit had lower weight loss, minimum seed discoloration, lower chlorophyll degradation, higher total soluble solids and ascorbic acid content, better taste and flavor, and lower rates of respiration and ethylene production, lower titratable acidity content, and higher electrolyte leakage than slices from pink fruit. Prolong storage resulted in increased weight loss, seed discoloration, pH, titratable acidity, rate of respiration and off-flavor, less chlorophyll and lycopene content, and less total soluble solids, sugar/acid ratio, and ascorbic acid content.

S09-P-115C

RESPONSE TO CONCENTRATION OF 1-METHYLCYCLOPROPENE (MCP) IN THREE SUMMER APPLE CULTIVARS WHEN TREATED AND STORED AT 20C AND 1C.

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Summer ripening cultivars 'Sunrise', 'Silken' and 'Ginger Gold' apples have a limited post-harvest life. These cultivars are generally not stored for a long time and many are marketed very quickly. In the case where they are marketed at fruit stands, the cooling step in the handling protocol adds to cost of handling. This test was conducted to see if a reasonable shelf life could be attained without the use of refrigeration. Fruit were treated for 12 hours with 0.1, 0.25, 0.5 or 1.0 ppm 1-methylcyclopropene (1-MCP) at 1C or 20C. Following treatment, fruits were subsequently held at the treatment temperature for three weeks in air and then were held an additional seven days 20C to simulate a shelf handling. 1-MCP treated apples of all three cultivars maintained significantly better firmness and titratable acidity levels than control (untreated) fruit when held at 20C. The treatment resulted in a 5-pound advantage in flesh firmness and 0.2 % advantage in titratable acidity retention. 1-MCP treated apples also exhibited less ground color change. A concentration of 0.1 ppm 1-MCP was sufficient to provide maximal inhibition of ripening when treatment was applied at 20C. In 'Sunrise' apples 1-MCP effects at the 1C treatment temperature were greatly reduced in comparison with effects seen at the 20C treatment. A one-pound firmness advantage was found for fruit treated with 1.0 ppm 1-MCP at 1C and stored three weeks at 1C. The results suggest that four weeks shelf life can be achieved at 20C with 1-MCP treatment for 'Sunrise', 'Silken', and 'Ginger Gold'. These cultivars may be subject to chilling injury and hence the effectiveness of 1-MCP treatment is impaired at the lower treatment and storage temperature.

S09-P-115D**SUGAR COMPOSITION CHANGES IN 'AUTUMN SEEDLESS' TABLE GRAPE DURING LONG TERM COLD STORAGE**

F ARTÉS, F. ARTÉS-HDEZ. A. Allende*

Postharvest and Refrigeration Group. Food Engineering Department. Technical University of Cartagena. Paseo Alfonso XIII, 48. 30203 Cartagena. Murcia. Spain

During two consecutive years 'Autumn seedless' table grape cv growing in the South East of Spain was hand harvested at commercial maturity stage by the end of July. Selected clusters freedom from defects were packed in polypropylene baskets and then wrapped with macroperforated polypropylene film to obtain a near saturated air atmosphere around berries. According to commercial need, grapes were stored at 0°C for 51 days the first season and for 42 days (in order to reduce losses) in the second season. After cold storage a shelf life of 7 days at 15°C was applied. In the present work changes in sugar composition are reported. At harvest and at the end of both storage periods sugar composition was analysed by HPLC. Total sugar content at harvest was 201.6 g/L and 213.2 g/L in the first and second season respectively. No differences in total sugar content between at harvest and after both storage periods in the first season were found. However in the second season a slight decrease between level at harvest and after cold storage (198.8 g/L) and shelf life (195.2 g/L) was found. Sucrose content was higher during the first season (5.3.1 g/L at harvest) than in the second one on which only was detected at harvest (0.4-0.2 g/L). Glucose/Fructose ratio at harvest was 0.98 and 1.05 for the first and second season respectively. This ratio slightly increased up to 1.02 after cold storage and 1.03 after shelf life in the first season, while in the second season a slight increase up to 1.07 after cold storage was followed by a decrease up to 1.0 after shelf life. As far as we know, postharvest changes in sugar composition of 'Autumn seedless' cv. is firstly reported here.

Thursday · August 15**S09-P-178A****EFFECT OF HIGH OXYGEN ATMOSPHERES ON BLUEBERRY ANTIOXIDANT CAPACITY, PHENOLICS AND ANTHOCYANINS**

Yonghua Zheng*, Chien Y. Wang

U. S. Department of Agriculture, Produce Quality and Safety Laboratory, Bg. 002, BARC-W, 10300 Baltimore Ave., Beltsville, MD 20705-2350, U. S. A.

The influence of high oxygen concentrations on antioxidant capacity (measured as oxygen radical absorbance capacity, ORAC), total phenolic and total anthocyanin contents in blueberry fruit (*Vaccinium corymbosum* L. cv. Duke) was investigated. Freshly harvested highbush blueberries were placed in jars ventilated continuously with air or with 40, 60, 80, or 100 kPa O₂ at 5 °C for up to 35 days. Samples were taken initially and at 7-day intervals during storage. Treatments with 60-100 kPa oxygen increased fruit antioxidant capacity as compared with air treatment during the 35 days of storage. Elevated oxygen also promoted the increases in total phenolic and anthocyanin contents. Fruit treated with oxygen concentrations at 60 kPa or higher also exhibited less decay. Data obtained suggest that high oxygen treatments may protect the antioxidant capacity of blueberry fruit and this antioxidant capacity may be associated with total phenolic and anthocyanin contents.

Friday · August 16**S09-P-211A****MAINTAINING QUALITY OF FRESH-CUT KIWIFRUIT WITH VOLATILE COMPOUNDS**

Chien Y. Wang*, J. George Buta, David W. Spaulding

U. S. Department of Agriculture, Produce Quality and Safety Laboratory, Bg. 002, BARC-W, 10300 Baltimore Ave., Beltsville, MD 20705, U. S. A.

Kiwifruit (*Actinidia deliciosa*) were cut into 5-mm slices and placed in polystyrene trays. Various volatile compounds were introduced inside the trays before the lids were covered. The development of decay and the shelf life of the slices were evaluated during storage at 10C. Kiwifruit slices treated with 2.24, 11.2, or 22.4 microliter/liter methyl jasmonate maintained good quality after 3 weeks at 10C. Comparable results were obtained with absolute ethyl alcohol (300 microliter/liter) or isopropyl alcohol (300 microliter/liter). However, 1-propanol was less effective and methyl alcohol was not effective in maintaining the quality of kiwifruit slices. Methods of application affected the efficacy of the volatile compounds. In general, spotting the volatile compounds onto hanging filter paper strips yielded better results compared to putting the volatile compounds into small beakers placed inside the trays. In addition to having less decay, kiwifruit slices treated with methyl jasmonate also maintained higher levels of sugars and organic acids compared to the untreated slices. Measurement of oxygen and carbon dioxide concentrations in the trays revealed that oxygen had never dropped below 19.5 percent and carbon dioxide had stayed around 0.8 percent in all of the treatments during the three weeks at 10C. No differences in respiration rates were detected among the treatments. Ethylene production increased during the first 7 days and then decreased gradually in all of the treatments. However, no differences in ethylene production were found among the treatments.

Changes to the program of S9

The paper S09-O-25 'DEVELOPMENT OF A LARGE CAPACITY EVAPORATIVE COOL STORAGE CHAMBER FOR CITRUS AND OTHER PERISHABLES WITH SPECIAL REFERENCE TO MANDARIN FRUIT (*CITRUS RETICULATA* BLANCO) by M.S. Ladaniya has been withdrawn. The remaining papers in this afternoon session will be advanced by 20 minutes.

Paper number S09-P-67 'EFFECT OF HARVEST DATE AND POST HARVEST CALCIUM CHLORIDE TREATMENT ON STORAGE LIFE AND QUALITY OF PEARS(CV. SHAHMIVEH)' by M. Basirat, A. Talaei and M.J. Malakouti has been withdrawn.

Paper number S09-O-26 entitled 'SWEET POTATO PRODUCTS' by M.R. Premalatha, M. Ilamaram has been withdrawn. The next two presentations S09-O-27 and 28 are moved up in the program, at 1620 and 1640 respectively.

Paper S9-P-219, A. Allende will be the presenting author. The authors on this paper are: A. Allende, E. Padilla, F. Artés-Hdez, F. Artés.

Please note the following change in the text of paper S09-P-174: Delete the words 'ascorbate free radical reductase' in the 4th sentence.

Symposium 10 (S10): Issues in Sustainability ;
Stewardship of Resources, Alternative Production
Systems, Climatic Change, Other Global Issues
Affecting Economic Sustainability

Location: MTCC Room 104C

Monday · August 12

The Introduction to Symposium 10 will take place between
11:00 and 11:20 on Monday, August 12.

WHY A SUSTAINABILITY SYMPOSIUM?

L. Bertschinger*

Swiss Federal Research Station for Fruit Growing
Viticulture and Horticulture
Wädenswil, Switzerland

The symposium will take the form of a think tank to stimulate sustainable development of horticultural systems around the world - a stimulus to interdisciplinary and transdisciplinary horticultural research. The participants are scientists, experts and research managers in horticulture, who wish to learn from case studies and disciplines not necessarily directly related to their own expertise. The information will provide for adaptive thinking and new know-how in the diverse systems they work with, contributing to the development of horticultural systems growing fruits, vegetables, flowers and healthy products for further generations.

Tuesday · August 13

S10-P-56A

TREE - COVER CROP COMPETITION IN NURSERY

K. Hänninen*¹, R. Strömmer²

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²Department of Ecological and Environmental Sciences, University of Helsinki, FIN-15140 Lahti, Finland

Vegetative ground covers have been studied e.g. in nurseries and orchards for developing environmentally sound production systems in horticulture. As cover crops compete with trees below- and above ground restricting growth, it is important to find less competitive species and management systems which lessen competition. Also it is important to understand, how plants are competing with each other and which kind of role microorganisms might have in using soil resources.

We evaluated 1) seven clovers (*Trifolium sp.*) and a grass (*Festuca rubra*) as cover crops with red birch (*Betula pubescens* Ehrh. f. *rubra* Ulvinen f. *nova*) seedlings in nursery field experiments and 2) the role of water supply in tree - clover/grass competition in a pot experiment in a greenhouse.

Tree growth, nutrient status of tree and soil, resource allocation of plants and competitive intensity were determined, as well biomass and respiration activity of microorganisms.

Annual clovers provided about the same growth and nutrient status in birch as did the control without cover crops. Perennial clovers and grass were strong competitors with tree reducing growth and nutrient status considerably. Microbial biomass and basal respiration were highest in perennial clover and *Festuca* plots, supporting idea that microorganisms may contribute to the nutrient competition with birch. Neither annual nor perennial clovers did generally improve soil nutrient status. In higher water sup-

ply the competitive ability of birch was better than in situation where water supply was restricted.

S10-P-56B

PROSPECT OF USING VEMICOMPOST FOR INTEGRATED NUTRIENT MANAGEMENT IN FLORICULTURE

P.S. Munsir*, S. Giri, P.S. Saha, G.N.Chottopadhyay

Institute of Agriculture, Visva-Bharati University, Sriniketan, West Bengal, India.

In view of the increasing significance of commercial floriculture throughout the world, it is imperative to improve flower production from limited land resources thorough optimum utilization of the productivity of soils. Owing to some problems associated with intensive use of mineral fertilizers on sustained crop production, emphasis is now being given on Integrated Plant Nutrition System at global levels. Since vermicomposting technology provides an effective means of recycling different organic wastes along with production of nutrient rich compost, its effect on integrated nutrient management in floriculture has been assessed in this study using African Marigold (*Tagetes erecta* L.) as the test crop. Field experiments were carried out at the University horticultural farm, Sriniketan (latitude 23°39' North and longitude 87°42' East at 58.9m above MSL) during 1998-2000 in two phases. In the first phase, efficiency of vermicompost as a component of total integrated nutrient management was studied. In view of encouraging results from the study and also high nitrogen requirement of such low fertile soils, the efficiency of vermicompost in supplying nitrogen to the crop was investigated in the second phase. The results of the first phase showed maximum flower yield (18.82 t ha⁻¹) with vermicompost +50% of recommended dose of NPK to be significantly higher than the yield (13.01t ha⁻¹) obtained with equal dose of farm yard manure along with 100% recommended fertilization. Similar was the observation during the second phase of the study where vermicompost was observed to compensate 150 kg of nitrogen application ha⁻¹ area and yet result in significantly higher yield of flower. Yield attributes, other associated characters and changes in soil properties also indicated use of vermicompost to be an effective proposition for adoption of integrated nutrient management for Marigold cultivation not only for improving the economic yields but also for reducing the use of inorganic fertilizers.

S10-P-56C

COCONUT FIBER AS AN ALTERNATIVE PLANT SUPPORT AND SUBSTRATE

J. M. Jasmim*, N. A. Souza

UENF/CCTA, Av. Alberto Lamego, 2000 - Horto - Campos dos Goytacazes - Rio de Janeiro - Brazil

Coconut green shells collected after milk consumption were chopped and pressed for manufacturing plant stakes similar to the fern tree ones, whose large use for staking ornamental plants as well as substrate has brought the fern tree to the list of endangered species. The coconut fiber supports manufactured were tested for staking an ornamental plant (*Syngonium podophyllum*) throughout its growth using either a mixture of coconut fiber and a commercial substrate (Plantmax), or Plantmax solely, as potting media. The experiment was a factorial with two factors (substrate, stakes) and two levels (Plantmax, Plantmax:coconut fiber; coconut fiber stake, tree fern stake), as follows: 1- Plantmax and tree fern stake; 2- Plantmax and coconut fiber stake; 3- Plantmax:coconut fiber and tree fern stake; 4- Plantmax:coconut fiber and coconut fiber stake. The experiment was carried out in a greenhouse environment, in a completely randomized block design with six replicates and three pots (two plants each) per plot. The plant lengths (heights), number of internodes, number of leaves and leaf areas were recorded. The potting mixture Plantmax:coconut fiber was as good or even

superior to Plantmax alone, except when it was combined with fern tree stakes, in which case the plants presented lower height and leaf chlorosis. The coconut fiber stakes supported plant growth very well and showed a marked influence on plant length (height). The total nutrient content analysis showed higher levels of K, Cl and Na for the coconut fiber as compared to the tree fern fiber.

Thursday · August 15

S10-P-73A

GRAFT-INDUCED CMV RESISTANCE WITH MORPHOLOGICAL AND MOLECULAR TRAITS IN THE GRAFTING BETWEEN CAPSICUM ANNUUM AND WILD C.BACCATUM

Yanju Zhang*, Yutaka Hirata

Laboratory of Plant Genetics and Biotechnology, Tokyo University of Agriculture and Technology

We have been studied on graft-induced genetic changes in several crops. During our study, the possibility of gene transfer was found, indicating the existence of graft transformation in grafting system. We further study to make clear the mechanism and application of graft transformation to breed virus-resistant material. In the present study, we conducted the interspecific grafting between graft hybrid line d45-6 (*Capsicum annuum*) and the wild CMV resistant line LS1205 (*C. baccatum*) in attempt to introduce CMV resistance to the susceptible scion d45-6. Interestingly, some graft-induced changes, such as the shape and direction of fruits have been observed in the grafted scions and first G1 progenies, which derived from selfing of the grafted scion. Furthermore, the peroxidase isozyme band specific to the stock presented in the grafted scion and the G1 progenies. DNA polymorphism by PCR was also detected among scion, stock and their graft progenies. RAPD analysis using primer A04 showed that both the stock and scion presented different banding pattern. Most of the scion bands were shared by G1, and one of the stock bands also appeared in the graft progenies, and four unique band types were found in the G1 progenies. These results suggested that some graft-induced changes and graft transformation occurred in the grafted scion and some were heritable to the progenies.

Mechanical inoculation test with CMV (yellow strain) showed that the percentage of disease and disease index of G1 progenies were significantly decreased, similar to that of the resistant stock material. Thus, CMV resistance of the stock must have been efficiently introduced to the scion and transferred to the G1 progenies. In parallel, we also confirmed that in both homografting and interspecific grafting, CMV could migrate from the inoculated stock to the scion via the graft-union, vice versa.

Friday · August 16

S10-P-88A

COSTS OF CONVENTIONAL VERSUS LOW INPUT PEACH PRODUCTION IN THE EASTERN UNITED STATES

R.G. Brumfield* and L.S.Martin

Rutgers University, 55 Dudley Road, New Brunswick, NJ 08903-8520

Peaches in the eastern U.S. are a high value crop encompassing 32,800 bearing ha, or 52% of the national total (fresh and processing). The 1999 eastern peach crop was valued at \$191 million U.S. Eastern peach production is centered in three main areas: the upper mid-West (MI), the mid-Atlantic (NJ, PA)

and the Southeast (GA, NC, SC). Peaches constitute a major component in the diets of infants and children. Implementation of the Food Quality Protection Act of 1996 has and will continue to limit reliance on organophosphorous insecticides, which have been the foundation of pest management programs for the past forty years. The project evaluated the cost of pest management systems based on reduced-risk tactics that previous research and experience indicated will be effective, sustainable, economically viable, and led to enhanced biological control. Studies in New Jersey of the costs and returns of mature peach orchards going to the fresh market found that pesticide costs for conventional methods were 12 percent of total costs. The use of risk management systems could reduce cost of pesticides to 9 percent of total costs

Changes to the program of S10

Paper **S10-O-3 'A CASE STUDY OF A POTENTIAL SOLUTION FOR CHALLENGED SYSTEMS' SUSTAINABILITY: APPLICATION OF PRECISION FARMING IN TREE CROP PRODUCTION'** is co-authored by Patrick Brown and Kelly Morgan. Kelly Morgan will present the talk.

Paper number S10-P-5 'GIAS AS A TOOL TO AGROCLIMATOLOGICAL ZONING OF AZARBAIJAN PROVINCE FOR DRYLAND FARMING OF ALMOND' by H. Yazdanpanah, A. Khalili, S. Ahajam and A. Vezvai has been withdrawn

Paper number S10-P-36 'BREEDING RYE (*SECALE CEREALE* L.) FOR USE AS A COVER CROP IN NO-TILL VEGETABLE PRODUCTION' by S. Chris Reberg-Horton*, Nancy Creamer, Jim Burton, Paul Murphy, Noah Ranells has been withdrawn.

The authors on paper **S10-P-51** are shown incorrectly in the Program. Authors are Filippo Adamo-Domenico Rombolá*, Giovambattista Mazzanti and Bruno Marangoni

Paper number S10-P-84 'SMALLHOLDER AGROFORESTRY FRUIT PRODUCTION IN LAMPUNG, INDONESIA: HORTICULTURAL STRATEGIES FOR SMALLHOLDER LIVELIHOOD ENHANCEMENT' by James M. Roshetko*, Pratiknyo Purnomosidhi, Yuliyanti has been withdrawn.

Paper S10-O-74 'RESEARCH NETWORKING TO EVALUATE THE SUSTAINABILITY OF HORTICULTURAL PRODUCTIONS SYSTEMS' is a 20 minute presentation (10:00 to 10:20 on Thursday, August 15), not 40 minutes as indicated. Other papers in this session will advance 20 minutes from the times indicated. A Discussion period will follow the oral presentations at 16:00.

Paper S10-O-64 'SUSTAINABILITY OF STONE-FRUIT PRODUCTION SYSTEMS' by Michael Raviv, Miriam Zilberstaine, Kamel Khatib, Nery Itzhaky, Shaul Ben Yehuda has been withdrawn.

Paper S10-O-65 'BOTTLENECKS AND NEW APPROACHES IN DISEASE AND PEST ORGANIC SYSTEMS OF PRODUCTION BRING NEW HORIZONS TO TRADITIONAL CROP PHYSIOLOGY' by J.W.Palmer, and J.N.Wünsche will be presented on Friday, August 16 from 14:00 to 14:40 instead of 12:00

to 12:20 on Thursday as shown.

Paper S10-P-67 'ORGANIC FRUIT AND VEGETABLE PERFORMANCE IN MIDWESTERN U.S.' by K. Delate and H. Friedrich will be presented orally from 12:00 to 12:20 on Thursday, August 15 and not as a poster as shown.

Paper S10-O-93 'SUSTAINABLE AGRICULTURE THROUGH ECOLOGICALLY-BASED, "BUILT-IN" SOLUTIONS' has been withdrawn.

Paper S10-O-92 'NEED FOR LOW-PRODUCTION COST ALTERNATIVE SYSTEMS FOR FUTURE SUSTAINABILITY OF THE VEGETABLE GROWERS IN THE UNITED STATES' by Aref A. Abdul-Baki, Lidia M. Carrera, John R. Teasdale, Pamela K. Rice will be presented from 10:20 to 10:40 on Friday, August 16 instead of 14:00 to 14:20

Paper S10-O-94 'UNVEILING BASIC PRINCIPLES IN NATURAL TOLERANCE TO MICROBIAL PATHOGENS IN COVER CROP GROWN VEGETABLES' by Autar Mattoo will be presented from 14:40 to 15:20 on Friday, August 16.

The last paper of the Friday August 16 oral session (S10-O-94) will last only 20 minutes. The final 20 minutes of the Program (15:20 to 16:00) will be dedicated to a discussion on the formation of an organic fruit-growing working group.

Symposium 11 (S11): Asian Plants with Unique Hort. Potential: Genetic Resources...

Location: MTCC Room 205CD

Monday · August 12

S11-P-10

EFFECT OF GRANULAR SILICATE APPLICATION ON THE QUALITY AND SHELF LIFE OF TOMATO GROWN BY PERLITE CULTURE.

Young-Chul Kim*, Kwang-Yong Kim, Kuen-Woo Park, Hyung-Kweon Yun, Tae-Cheol Seo, Ji-Won Lee, Sang-Gyu Lee
Veg. Culti. Div., Nat'l. Hort. Res. Inst., RDA, Suwon, Kyonggido, Korea, 440-706

This research was conducted to evaluate the effects of four different amounts of granular silicate (0, 1, 2, and 4 tons/ha⁻¹ of granular silicate) on the quality and shelf life of tomato grown in perlite media, which is the most commonly used for hydroponics of fruit vegetables in Korea. The soluble solid contents of tomato increased by the higher granular silicate application. However, titratable acidity of the fruits was not affected by the amounts of different granular silicate application. Glucose contents of fruits at 41 and 48 days after anthesis were relatively higher in 2 and 4 tons/ha⁻¹ treatments than in control. Fructose content also showed the same tendency as glucose. The change of fruit color from pink-red to red stage was accelerated 25% more in 2 and 4 tons/ha⁻¹ treatments than in control. Lycopene content of fruits was 2.74 times higher in 4 tons/ha⁻¹ treatment than in control. The fruits with more soluble silicon had the higher lycopene content. Shelf life of harvested fruits was 4 days in

room temperature. Evolved CO₂ was the most in the first day after harvest. C₂H₄ was evolved in two days after harvest. Among granular silicate treatments, the fruits cultivated in 4 tons/ha⁻¹ treatment showed the lowest CO₂ evolution and the highest firmness.

S11-P-30A

POINTED GOURD (*TRICHOSANTHES DIOICA*): A CHOICE VEGETABLE OF INDIA CAN BE GROWN SUCCESSFULLY IN THE SOUTHERN UNITED STATES

Bharat P. Singh*, Wayne F. Whitehead

Agricultural Research Station, Fort Valley State University, Fort Valley, Georgia 31030-4313,

The presence of a substantial immigrant population of Indians and Bangladeshis has created a niche market for the pointed gourd (*Trichosanthes dioica* Roxb.) in the United States. The high cash value but labor intensive nature of production make pointed gourd an ideal alternate crop for small farmers. It is also a crop of much interest for home gardeners from Indian subcontinent. A successful production of pointed gourd in the United States will depend on the ability of this perennial crop to survive the temperate climate of the United States during winter and regenerate year after year to produce optimal fruit yield. The development of optimal cultural practices for producing the crop in the United States will also be needed. We initiated a study to achieve the above objectives during 1994. A small number of male and female pointed gourd vines were initially procured from India, multiplied in the greenhouse under mist, and transplanted in the field during spring 1995. Proper irrigation and fertilization produced vigorous vines starting from the first year. Fence wire provided sufficient support to train the vines. The pointed gourd successfully overwintered by cutting vines to the ground level before frost and covering the root with thick straw layer. Fresh vines sprouted from overwintered roots during subsequent springs. Full scale fruiting on female plants started in the second year of transplanting. The plants fruited between 15-17 weeks per year and needed harvesting twice a week to prevent fruits from over maturing and developing hard seeds. The fruit number and yield over the season ranged from 614,840 to 1,191,548/ha and 16.2 to 26.2 mt/ha, respectively. The yield level obtained was comparable to those reported in the literature. It was concluded from the study that pointed gourd can be successfully cultivated in the southern United States.

S11-P-30B

GENETIC DIVERSITY OF IRANIAN MELON GERMPLASM

Jahangir Abbas Kohpayegani*¹, A. Vezvaei², A. Kashi¹, J. Mozafari³,

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³Seed and Plant Improvement Institute, National Plant Genebank of Iran, Mahadasht, Ave., Karaj/ IRAN

Genetic diversity of 110 Iranian melon landraces from the National Plant Gene bank of Iran were characterized based on 40 agro-morphological traits. Diversity was analyzed using correlation, cluster, factor analysis. Factor analysis have shown that 7 factors were identified which together explained 0.5 % of the variation. To select the relevant characters, those correlation values 0.5 were considered as relevant for that factor. The variation to select the factor. The first factor explained 18.4 % of the variation and is associated with fruit characters such as fruit shape, fruit length, fruit width, flesh thickness, fruit cavity diameter, amount of placental tissue, fruit skin hardness, fruit skin thickness, color of cavity, internal aroma, soluble solids, flesh

moisture, fruit skin texture. The second factor which accounts for 7.2% of the variation and is associated with seed character such as seed color, seed length, seed width. The third factor explained 6.9 % of the variation and is associated with fruit characters such as fruit skin main color, fruit skin secondary color. The fourth factor explained 5 % of the variation and is associated with leaf characters such as leaf pubescence density. The fifth factor explained 4.8 % of the variation and is associated with flower such as type of flower. The melon germplasm was grouped into six clusters. Correlation among some pair characters were significant.

S11-P-30C

COMPARISON OF CPPU EFFECT ON FRUIT DEVELOPMENT AMONG ACTINIDIA SPECIES

Youn Seop Jo¹, Hye Sung Cho¹, Moon Young Park¹, Tae Dong Park¹, Wol Soo Kim^{*2}

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There exist about 61 species of Actinidia species around world and most are originated from China. Among them, 3 species, which are *A. deliciosa*, *A. chinensis* and *A. arguta*, are commercially cultivated, even though *A. arguta* is minor. Except *A. deliciosa* and *A. chinensis*, most Actinidia fruits are relatively small but some have very impressive horticultural advantages to be commercialized, with high vitamin content, excellent flavor, sweetness, etc.

Several CPPU related reports are published recently, however, they are all focused on *A. deliciosa* var. 'Hayward'. We investigated several Actinidia species for their CPPU sensitivity to improve their fruit size during fruit development. *A. kolomikta* fruits were not affected by CPPU 16ppm and the fruits of *A. macrosperma* were only affected on cross sectional expansion, not with longitudinal. Other species seem they are sensitive to CPPU. More details are discussed on differences of fruit development, fruit quality, etc.

S11-O-34

STUDIES ON EVALUATION OF GERmplasm RESOURCES AND BREEDING OF FLAT PEACH

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Institute of Horticulture, Jiangsu Academy of Agricultural Science, Nanjing, 210014

Flat peach (*Prunus persica* Batsch. var. *compressa* Bean.) is a mutation of peach (*P. persica* Batsch.). It is native to China with a long history of more than two-thousand years. It has saucer shape and excellent flavor, but with few germplasm resources. In 1978, Xinjiang flat peach (*P. ferganensis* Var. *compressa* Bean) and Nectarine-flat peach (*P. persica* Var. *compressa* Bean) was found in Gansu province northwest China. In the early 1980's, a breeding program was set up by Department of Agriculture to systematically breed new flat peach cultivars, and now some varieties have been published.

This paper studied the bloom date, bloom type, pollen fertility, fruit development period, fruit traits and productivity of traditional flat peach cultivars preserved in National Peach Germplasm Repository in Nanjing, evaluated the parents and main characters of newly-bred flat peach varieties.

1. Flat peach bloom earlier than other peach. All the varieties were showy flowers with pistle lower than stamen. Most varieties had fertile pollen except Roupantao and Wanpantao.

2. 71.4 percent of the flat peach varieties' soluble solids were between 12.0 and 14.0 percent. 61.9 percent of the flat peach varieties' soluble sugar were between 9.01 and 10.69 percent. 52.4 percent of the flat peach varieties' titratable acid-

ity were between 0.20 and 0.30 percent. Most varieties taste sweet.

3. The flesh of flat peach from north china was non-melting and hard-melting, while those from south china was soft-melting. With the exception of Huangjinpantao and Huangroupantao, all the other varieties were white-fleshed. Most varieties ripen between 106 and 115 days, 121 and 130 days after full bloom.

4. Fenghuapantao and Sahuahongpantao have good yielding ability.

5. Newly-bred varieties have good quality, ripening from 62 days to 134 days after full bloom with weight from 95 grams to 220 grams. Sahuahongpantao, Wanshudapantao, 124pantao are good germplasm for breeding new variety.

Thursday · August 15

S11-P-113A

INFLUENCE OF SEEDLING QUALITY ON GROWTH AND YIELD IN SUMMER-GROWN TOMATO(CV. MOMOTARO YOKU)

Young Hah Choi*, Han Cheol Rhee, Joon Kook Kwon, Dong Kum Park, Jae Han Lee

Busan Hort. Experiment Station, NYAES, RDA. Busan 618-300, Korea.

This study was carried out to clarify the effects of the type of seedling container and the duration of seedling raising on seedling quality, growth, and yield in summer tomato. The seedling quality at transplanting time was better in polyethylene pot (9cm dia.) nursery than in plug tray (72 cells) nursery. The harvest initiation stage for the 1st fruit cluster was earlier in PE pot-nursed seedlings and in old-aged seedlings than in plug tray (72 cells)-nursed seedlings and in young-aged seedlings, respectively. The total yield harvested for 4 months, especially early yield for initial 2 months was higher in PE pot-nursed seedlings compared with in plug tray-nursed seedlings. This high early yield in PE pot-nursed seedlings proved to be due to the advanced harvest time and the increased numbers of fruit-set in lower cluster. In PE pot-nursery the yield for initial 2 months was lowest in 25 day-old seedlings but it showed no significant difference between 35 day-old and 45 day-old seedlings. However, the cumulative yield since the third month after harvest initiation did not show any difference among seedling ages. In plug tray nursery the cumulative yield for initial 3 months was highest in 35 day-old seedlings followed by 25 day-old seedlings and 45 day-old seedlings but there were no significant differences among seedling ages in the total yield. The differences in early yield among seedling ages were found to result from the difference in initial root establishment after transplanting, the different numbers of fruit-set affected by root establishment, the diameter of main stem near the soil surface, and root weight.

S11-P-113B

BARBERRY GROWING IN IRAN

A. Tehranifar*

Ferdowsi University of Mashad, Faculty of Agriculture, Department of Horticulture, P O Box 91775-1163, Mashad, Iran.

In Iran more than 5000 tonnes of barberries are produced each year. Khorasan is the main region of production with about 6,000 hectares. Khorasan is located in north east of the country. With more than 4500 tonnes production per year it is the largest of the barberry production areas in Iran. Barberry cultivation in Khorasan is concentrated in the south of the province especially around Birjand and Ghayen. Where environmental condition (hot weather, low relative humidity, water shortage and soil condition) makes difficult of growing of other horticultural crops. Mean yearly precipitation are 190.3 and 173.5 mm in

Ghayen and Birjand respectively. Minimum and maximum temperature are (-38, +41) in Ghayen and (-15, +44) in Birjand. More than 85 present of production is in Ghayen and more than 15 present in Birjand. According to evidence the cultivation of seedless barberry in south of province back to two hundred years ago. The paper gives more information about Cultivation, Taxonomy, propagation, utilization and processing of seedless barberry cultivated in south of the Khorasan.

Changes to the program of S11

The paper S11-P-118 'EFFECT OF CO₂ AND TEMPERATURE ON THE PRODUCTION OF HIGH QUALITY SEEDLING IN TOMATO (*LYCOPERSICON ESCULENTUM* MILL. CV. MOMOTARO 8) SEEDLING' by C. K. Ahn, Y. W. Choi, J. S. Kang, will be presented in the 13:40 to 14:40 poster session on Thursday, August 15, not from 08:00 to 09:00 on Friday, August 16 as shown in the program.

Symposium 12 (S12): Breeding, Genetics, & Cultivar Development of Tree Fruits & Nuts

Location: MTCC Room 203 BD

Tuesday · August 13

S12-P-39A

RAPD ANALYSIS ON THE CULTIVARS, STRAINS, AND RELATED SPECIES OF CHINESE JUJUBE

Liu Mengjun*, Zhao Jin

Research Center of Chinese Jujube, Agricultural University of Hebei, Baoding 071001

Chinese jujube (*Ziziphus jujuba* Mill.) is a native fruit tree of China and has been introduced to more than 20 countries. It is becoming increasingly important for its wide adaptation, easy management, early bearing, rich nutrition, and multi-use. The genetic relationships between 27 cultivars, strains, and related species (*Z. acidojuba* C.Y. Cheng et M.J. Liu. and *Z. mauritiana* Lam.) of Chinese jujube were studied by using RAPD (random amplified polymorphic DNA) technique. 15 primers were screened from 80 arbitrary 10-mer primers, and a total of 92 DNA bands were amplified, 77 of which (83.69%) were polymorphic. A tree diagram was constructed by AVERAGE method. The Chinese jujube samples surveyed were classified into 6 groups at molecular level. The genetic relationships of some cultivars were also discussed in comparison with earlier results using morphological characters, utilization or distribution. In addition, RAPD fingerprints of 11 excellent strains of Zanhuangdazao (a leading cultivar of Chinese jujube) were established using 5 primers. The S154-780bp band was regarded as a molecular marker linked to the stone-less character.

Changes to the program of S12

Paper number S12-P-82 'BIOAGRONOMIC CHARACTERISTICS OF 'SUNCREST' PEACH GRAFTED ON NINE ROOTSTOCKS IN THE TUSCANY COASTAL AREA OF ITALY' by Filiberto Loreti*, Rossano Massai, and Carlo Fei has been withdrawn.

Paper number S12-P-80 'FIRE BLIGHT RESISTANCE OF NEW PEAR ROOTSTOCK CLONES' by R.L. Bell has been withdrawn.

Paper number S12-P-51 'RESISTANCE TO PEAR PSYLLA NYMPHAL FEEDING OF GERMPLASM FROM CENTRAL EUROPE' by R.L. Bell has been withdrawn.

Papers S12-P-9, S12-P-18, S12-P-19, S12-P-20, S12-P-34, S12-P-35, S12-P-37, S12-P-38, S12-P-90, S12-P-92 have been withdrawn.

Susan Gardiner will be the presenting author for paper S12-O-9 and -25 in place of Nnadozie Oraguzie.

Nubuhro Kotoda will be the presenting author for paper S12-O-99 in place of Nnadozie Oraguzie.

Symposium 13 (S13): Key Processes in the Growth & Cropping of Deciduous Fruit & Nut Trees

Location: Crowne Plaza Hotel, Ballroom B

Monday · August 12

S13-P-47A

SHOOT ARCHITECTURE OF THE OLIVE TREE (*OLEA EUROPAEA* L.): EFFECT OF CULTIVAR ON THE DISTRIBUTION OF VEGETATIVE AND REPRODUCTIVE ORGANS ON BRANCHES.

Nathalie Moutie, Gilbert Garcia, Pierre-Eric Lauri*

INRA, UMR BDPPC, Equipe AFEF, 2 place Viala, 34 060 Montpellier Cedex, FRANCE

The olive tree is currently developing in France through the impetus of the Varietal Renewal Plan. An initiative is being developed to deepen knowledge concerning the varieties cultivated in France. In this traditional cultural system, knowledge of plant growth morphology is very limited. Pruning is the same for all varieties. World-wide, few studies have been carried out on the architectural development of the olive tree, whereas many experiments have been conducted on other fruit species.

As part of an ongoing research project on olive tree characterisation, an experiment has been carried out to compare shoot architecture of 6 cultivars. The aims of this trial were first to develop descriptors to study lateral organs distribution on branches, and second to analyse the variability existing between genotypes for this distribution.

The position of the lateral branches, flowers and fruits has been described and correlated to some vegetative characteristics of the bearing branch such as basal angle. We have found

differences between varieties leading to a proposed qualitative typology based on the lateral organs distribution on the branch. Results are discussed in relation to both tree training and cultivar characterisation.

S13-P-47B

THE REGULATION OF ROOT PRUNING AND SOIL WATER CONTENT TO APPLE LEAF WATER USE EFFICIENCY

Yuling Jie*, Hong-Qiang Yang, Lianzhong Zhang, Xinshu Luo
College of Horticulture in Shandong Agriculture University, Taian, 271018, China

It was studied that the effect of root pruning and soil water content on leaf water use efficiency (WUE) in pot-cultured tree-year old apple (*Malus pumila* Mill/ *Malus hupehensis* Rhed) trees. The results showed that root pruning increased WUE obviously and the WUE went up step by step from second day to 42th day after treatment. In the mean time, transpiration rate (Tr) and stomatal conductance (Gs) decreased obviously, but net photosynthetic rate (Pn) and carboxylation efficiency (CE) recovered rapidly and was higher than control after seventh day of treatment; the total number and the concentration of zeatin riboside (ZR) in leaf come back to the control level after 28th day of treatment. Those changes had close relationship to the continuous elevation of WUE. The WUE got highest when soil water relative content (SWC) reached 52.0%. The change of stomatal conductance was the main reason that caused WUE to increase when SWC decreased from 77.2% to 52.0%. The declination of carboxylation efficiency resulted in the declination of WUE when SWC decreased from 52.0% to 20.1%. The WUE rose again after rewatering, but it could not reach the level of control within seven days. The WUE decreased at the day of waterlogging, it rose again and reached the control level on the third day after waterlogging. After the third day, the WUE decreased gradually with the extending of waterlogging time. At the sixth day of waterlogging, the carboxylation efficiency decreased.

S13-P-47C

THE DIURNAL CHANGE OF FRUIT TREE'S LEAF WATER USE EFFICIENCY

Yuling Jie*, Hong-Qiang Yang, Lianzhong Zhang, Xinshu Luo
College of Horticulture in Shandong Agriculture University, Taian, 271018, China

It was studied that the diurnal change of leaf water use efficiency (WUE) by LCA-4 photosynthesis and transpiration instrument in several fruit trees (sweet cherry (*P. Avium*), Chinese cherry (*P. pseudocerasus*), apricot (*P. armeniaca*), peach (*P. persia*), plum (*P. salisine*) and apple (*Malus pumila* Mill)). It was found that the diurnal change of WUE in Summer and Autumn showed the same tendency that WUE was the highest at 7:00—8:00, the lowest at noon, and recovered little at 16:00-17:00. WUE in autumn was higher than in summer at a same time. The pattern of apple WUE diurnal change looked like upward crescent moon in the two seasons. Apricot WUE in summer drew a wave line but declined smoothly in autumn. The diurnal change of Chinese cherry WUE had two peaks in Summer at 7:00 and 15:00 respectively, but in autumn it had one peak at 7:00, declined to a low level at 9:00 and kept on the same level later. Sweet cherry WUE in a day changed like upward crescent moon in the two seasons. Plum WUE was highest at 7:00, lowest at 11:00 and recovered little at 17:00 in summer, and it was highest at 7:00 and 17:00, and lowest at noon in autumn. The leaf WUE in the shoot without fruits declined from the maximum at 7:00-8:00 and recovered at 14:00, but it did not recover in the shoot with fruits. Path analysis showed that leaf temperature among external factors and net photosynthetic rate among internal factors was the most important factor that affected WUE directly. VPD affected WUE indirectly by leaf temperature, air humidity and net photosynthetic rate.

S13-P-47D

DETERMINATE OF RELATIVE SALT TOLERANCE OF PISTACHIO ROOTSTOCKS ACCORDING TO GROWTH INDEXES AND IONS ACCUMULATION

A. MOHAMMADKHANI*, H. LESANI

Dept. of Horticulture, Faculty of Agriculture, Tehran University, Karaj, Iran

The salt tolerance of four pistachio rootstocks including Badami, Qazvini, Sarakhs (*P. vera*) and *P. mutica* evaluated under four levels of NaCl (0, 20, 40, and 60 mM) in a greenhouse experiment. The elements analyzed in leaf, stem and root tissues included Na, Cl, K and Ca. Data showed that with increasing sodium chloride concentration of irrigated water the content of Na and Cl of tissues was increased but the accumulation of K and Ca was decreased. The rootstocks showed difference concerning in the absorption and transportation ions. Sarakhs and *P. mutica* rootstocks absorbed more Na and Cl in comparison with Badami and Qazvini cultivars. Sodium chloride treatment had different effects on water potential of different rootstocks. Sarakhs rootstock showed a water potential more negative than the other rootstocks which probably was due to more accumulation of sodium in leaf tissue. Size and density of stomata determined 12 weeks after salt treatment. Increasing levels of salinity decreased size of stomata while increased number of stomata per unite area in the leaf surface. The effect of salinity on changes of stomata was different among rootstocks. Significant differences were observed for leaf, stem and root dry weights, damaged leaves and stem elongation, in response to increasing concentrations of NaCl. A linear relationship was found between dry weight and NaCl concentration for all tissues. Based on the results of dry weight, stem length, leaf number and damaged leaves, we concluded that the Badami and Qazvini rootstocks were more salt tolerable cultivars than Sarakhs and *P. mutica*.

S13-P-47E

PREVENTATION OF LIME INDUCED CHLOROSIS IN PEACH TREES BY SOIL AND LEAF TREATMENTS

Serap Soyergin, Itidal Moltay, Gurkan Sarlar

Ataturk Central Horticultural Research Institute, Yalova/Turkey

This research was implemented in order to determine the effects of various iron fertilisers and doses applied from soil or leaf in recovering of lime induced iron chlorosis indicating peach trees in Marmara region.

The experiment consisted of 18 different iron treatments. As iron fertilisers, acid peat (1 litre), acid peat+FeSO₄ (10 g and 20 g FeSO₄), tobacco waste (0.5 and 1 litre), Sequestren-138 Fe (5 g) per container were given to the soils before planting, and % 0.05 and % 0.10 Fe-EDDHA, % 0.1 and % 0.2 Fe-EDTA, % 1 Fetrilon (%13 Fe-EDTA) and % 0.5 FeSO₄ were applied three times with 15 daily intervals from the leaves. According to the results 1 % Fe-flavanoid and 1 % Fetrilon (% 13 Fe-EDTA) applied three times with 15 daily intervals in spring were the most effective treatments. Leaf active iron contents were markedly increased in that treatments. There were significantly negative correlations between active iron contents and K/Top.Fe, P/Top.Fe, Zn/Top.Fe, Mn/Top.Fe and Ca/Top.Fe ratios.

The following paper (presented in the S25 section in the 13:40 to 14:40 poster session) is associated with Symposium 13

S25-P-30

EARLY FIELD PERFORMANCE OF «HONEYCRIP» ON M26 IN NOVA SCOTIA

Charles G. Embree, Dale J. Hebb, Allison Grant

Agriculture and Agri-Food Canada Atlantic Food and Horticulture Research Centre 32 Main St., Kentville, Kings County, Kentville, Nova Scotia, Canada, B4N 1J5

Two commercial plantings of «Honeycrisp» have been monitored as part of production management study since 1996. Growth and yield data illustrate the unique and dramatic shift to an apparent mature production phase in just over two years. Annual increases in trunk area of 70% were observed while crop loads were low (under 0.35kg/cm²). The onset of the production phase brought high crop loads (as much 2.6 kg/cm²) and reduced the annual increase in tree growth to about 28%. The record crop loads in year four of over 2kg/cm² were surprisingly accompanied by large fruit which ranged from 205 to 240g. Followup data indicates this rapid shift to the mature production phase leads to much lower crops or bienniality. «Honeycrisp» in these conditions favor fruit production, over tree growth. Added inputs of irrigation and/or mulch did not significantly impact performance even though soil moisture levels increased. Even though, «Honeycrisp» was precocious, productive and of high quality, in the cool, short season, maritime climate of the Annapolis Valley, problems of slow tree growth and biennial cropping are identified and discussed.

Tuesday · August 13

S13-P-89A

PHYSIOLOGY AND EFFICACY OF APPLE TREES TREATED WITH PROHEXADIONE-CALCIUM IN THREE CANADIAN PROVINCES

Jean-Pierre Privé¹, John Cline², Charlie Embree³, Erica Fava¹, Doug Nichols³

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Experiments were conducted to investigate the physiological effects of the growth retardant, prohexadione-calcium, on shoot growth and fruit production for McIntosh, Cortland, Empire, and Golden Russet in New Brunswick; Empire and Delicious in Ontario and Northern Spy in Nova Scotia. This product is registered in Europe and the US (Apogee[®]) but not in Canada. The experiments evaluated the effect of rate (75 and 125 mg/l), number of applications (0, 2, 4) and spray concentrations (1 to 7X based on tree-row volume) of prohexadione-calcium on shoot growth in both bearing and non-bearing mature apple trees but also included fruit set and yield for the bearing trees.

Shoot growth responses to prohexadione-calcium were similar in all three provinces. This product significantly reduced shoot growth regardless of rate, number of applications, cultivar or location and that this suppression was due mostly to a reduction in internode length rather than node number. Interestingly, the majority of this suppression always occurred within the first two weeks after application and that the low rate (75mg/l) applied twice was as efficient in restraining shoot growth as the high rate (125 mg/l) applied four times. Although the product

was applied at different concentrations, this had no apparent effect on the results. The prohexadione-calcium did however have an indirect effect on yield and fruit quality by reducing the efficacy of the chemical thinner (carbaryl) in NB and ON. As the total amount of product applied increased, a greater proportion of fruit was retained on the tree producing a greater proportion of small unmarketable fruit. The best compromise between suppressing shoot growth while minimizing heavy crop loads was obtained with the 75 mg/l rate applied twice. Although not as significant as shoot growth, there was an increase in light interception within the lower tree canopy with increasing rates and number of prohexadione-calcium applications. This in turn produced redder fruit in the lower canopy of the treated trees similar to summer pruning. However, no further results on fruit quality can be made in this study because of the confounding effects that prohexadione-calcium had on reducing the efficiency of the chemical thinner, thus increasing crop loads.

S13-P-89B

EFFECT OF ROOTSTOCKS ON FLORAL AND POLLINATION BIOLOGICAL TYPES OF APPLE CULTIVARS

Erika Nagy Toth^{*1}, Zsuzsanna Orosz-Kovacs²

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Perfect dichogamy could be observed only in some of the studied apple cultivars; delayed homogamy and homogamy were much more frequent. In protogynous apple flowers nectar secretion may start in the balloon stage (Starkrimson M.4, M.9) or in the open flower. The pollination biological type can be wind- and/or insect-pollination both in balloon stage and open flower. Protogyny was observed mostly in flowers of trees on M.26. Since protogynous flowers were characterised by the worst fruit set, among the studied cultivars Jonnee, Gloster, Jonagold and Summerred on M.26 set less fruit than on other rootstocks, suggesting the natural fruit thinning effect of this rootstock. Delayed homogamy always began with protogyny. At anther dehiscence the stigma has not become brown yet, thus stigma activity and pollen shedding were partly overlapping. Fruit set of delayed homogamous flowers varied, being good in some cultivars (Idared MM.106, Gloster M.26), but weak in others. Trees having various flower types (both protogynous and delayed homogamous) were more advantageous than those having only protogynous flowers, mostly pollinated by wind, since the former were also visited by insects at the time of pollen shedding. In 1998 Starkrimson on M.4 had 3 types of flowers: protogynous, delayed homogamous and homogamous. In this "multi-strategic" type the various floral biological types increase the chance of the stigma receiving pollen, thus increasing certainty of yield, too. In homogamous flowers with synchronous activity, secretion may start in the balloon stage, but insect attraction is characteristic rather in the open flower. Concerning the relation between rootstock and floral biological type, the flowers of trees on M.9 were either protogynous (Mutsu, Jonagold) or delayed homogamous (Gloster, Jonnee, Idared); whereas the flowers on M.4, M.26 and MM.106 were of all three types (protogyny, delayed homogamy and homogamy).

Thursday · August 15

S13-P-130A

SUNBURN ON APPLES - CAUSES AND COSMETIC CURES

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On the basis of our results so far (Wünsche et al., 2000, *Acta Horticulturae*, 557:349-356), sunburn is probably caused by overheating of the fruit surface due to excessive levels of incoming solar radiation in combination with high ambient air temperatures. The complexity of the underlying physiological mechanisms of this skin blemish is, however, not fully understood. It has been hypothesised that sunburn damage may be an expression of plant defense mechanisms involved in the response to oxidative stress. The sensitivity of apple cultivars to sunburn may be partly related to the physiochemical properties of the fruit skin. The homogeneity, thickness and composition of the epicuticular wax layer, the amount of hair on the skin surface, and the concentration and quantity of skin pigments could offer some protection against sunburn by increased reflection of visible and particularly infrared light accompanied by decreased fruit temperature. Our research has shown that chlorophyll a and b concentrations in the skin decreased considerably from healthy to sunburned skin tissue, probably resulting from photobleaching of the chlorophyll. Pigments with substantial radical scavenging ability such as β -carotene and chlorogenic acid concentrations increased substantially with greater sunburn damage. Heat shock proteins (hsps) are believed to confer tolerance to heat by protecting proteins from irreversible denaturation and breakdown. Northern blot analysis of apple tissue RNA from heat exposure treatments has shown that hsp 17 and hsp 70 gene expression were associated with high fruit temperature. It has yet to be identified how soon gene expression occurs and whether hsp transcripts are translated to high protein levels, following high temperature exposure of apple fruit. To avoid sudden exposure of fruit to intense heat and solar radiation, overhead sprinkling and coating the tree with a reflective kaolin particle film were effective orchard practices for reducing incidence and severity of sunburn. More work is needed to identify the sunburn sensitivity of apple at different stages of fruit development and to understand the time response between sun injury and visible sunburn symptoms on a range of cultivars.

The following paper is an addition to Symposium 13 and will be presented in the 13:40 to 14:40 poster session. It can be found on poster board S13-P-144. The organizers sincerely apologize to the authors for the omission of the abstract from the Program Book

S13-P-144

CHEMICAL BLOOM THINNERS FOR CONVENTIONAL AND ORGANIC APPLE ORCHARDS

Jim McFerson, Tory Schmidt, and Leonardo Lombardini

Washington Tree Fruit Research Commission, 1719 Springwater Avenue, Wenatchee, WA 98801

Apple growers, especially those in organic systems, have limited options to chemically thin fruits in their crop load management programs to encourage annual bearing and enhance harvest fruit size and quality. In the U.S.A., registered materials are inconsistent and/or costly. Post bloom thinners are routinely employed in conventional orchards, but expensive green fruitlet hand thinning is usually employed. From 1998 - 2001 we conducted 65 replicated trials on nine cultivars in commercial and organic orchards throughout Washington. Treatments were applied at 20% and 80% full bloom with either a grower-operated airblast or our own low volume tower sprayer. Response variables included: 1) initial bloom clusters per sampling unit (branch, tree, trellis section) and cross sectional area; 2) post-

treatment number of clusters with zero (blank), one, two, three, or more than four fruitlets; 3) time required to hand thin sampling units; 4) return bloom on sampling units (measured in subsequent season); and, 5) harvest fruit quality parameters (size, L/D ratio, soluble solids, titratable acids, starch index, firmness, fruit finish). Our most effective treatments were ammonium thio-sulfate and a 2% vol:vol tank mix of Crocker's Fish Oil and lime sulfur. Other combinations of lime sulfur with various oil-based products (e.g. JMS Stylet oil, Omni Supreme, Safe-T-Side, and a cottonseed vegetable oil emulsion) were promising, as were high rates (6-10% vol:vol) of lime sulfur. Our best treatments routinely reduce initial crop load >50%. Cluster composition was significantly skewed towards blanks, singles, and doubles. Hand thinning time was reduced from 25-50%. Return bloom was significantly enhanced vs. control treatments. Harvest fruit size was regularly increased. Our greenhouse trials on crabapple (cv Snowdrift) yielded parallel results, suggesting it is a reasonable model system.

The following paper is an addition to Symposium 13 and will be presented in the 13:40 to 14:40 poster session. It can be found on poster board **S25-P-32**.

S25-P-32

SUNBURN ON APPLES - CAUSES AND COSMETIC CURES

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development and to understand the time response between sun injury and visible sunburn symptoms on a range of cultivars.

Friday · August 16

S13-P-154-A

THE EFFECTIVENESS OF DIFFERENT APPLICATION METHODS OF ZINC SULFATE ON NUTRITIONAL CONDITIONS OF APPLE IN CALCAREOUS SOILS OF IRAN

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To evaluate the effectiveness of the different application methods of zinc sulfate in apples, an investigation was carried out in one of the orchards of West Azerbaijan province in 2000 growing season. The treatments with five replications were tested: T1; control, T2; balanced fertilization based on soil test except zinc application, T3; T1+trunk injection of zinc (1.0%), T4; T2+trunk injection of zinc, T5; T1+zinc broadcast, T6; T2+zinc broadcast, T7; T1+zinc spray (0.5 %), T8; T2+zinc spray, T9; T1+deep placement of zinc and T10; T2+deep placement of zinc.

Analysis of soil tests from 0-30 cm and 31-60 cm depths indicated that the level of soil fertility was low, and the concentration of several nutrients were about or below the critical level. The zinc concentration from both soil layers were 0.2 mg/kg, indicating a severe deficiency of this element resulting from its continuous uptake without supplementing it. The analysis of the irrigation water showed high levels of bicarbonates. The results demonstrated that the greatest leaf area, chlorophyll index of leaves resulted from deep placement and spray treatments. Also the effect of zinc on the levels of the current year's growth of branches was significant and spray of zinc appeared to be the most effective method in this respect. The zinc concentration in the samples from the control plants were low (15mg/kg), and it was below the critical level so that trees showed severe deficiency symptoms. The foliar application of zinc sulfate resulted in high levels of zinc in the leaves, but a great percentage of this supplement remained in the leaf epidermis as well as in the dead spaces between the leaf cells instead of being carried to other plant tissues. The concentration of P, Ca, were low in the samples from spray treatments, most probably due to antagonistic reactions between zinc and these elements. The effects of these fertilizer treatments on the concentration of N, K, Mg, Fe, Mn, Cu and B were statistically insignificant. The chemical analysis of the fruits showed high levels of N from spray treatments, which were correlated with high levels of zinc in the same samples due to direct spraying of fruits. The Ca levels of sprayed fruits were low. Other quality factors such as TSS, acidity level, sugar content and pH of the fruit juice were not affected by zinc sulfate. However, balanced fertilizer treatments especially deep placement along with spray application of zinc sulfate, resulted in improvements in apple quality indices. Considering soil condition (calcareous), and the obtained results, it appeared that the placement of zinc sulfate in the holes along with manure was the best method of zinc application in apple orchards.

Changes to the program of S13

Paper number S13-P-102 'NPA, SEED SET AND XYLEM DEVELOPMENT IN APPLE STALKS' by S. Lang, L. Drazeta, C. Cappellini, R. Volz, and P.E. Jamison

has been withdrawn.

Please note the change in authors on paper number S13-P-104 'THE POSITIVE INFLUENCE OF YEAR-ROUND REFLECTIVE MULCH ON APPLE YIELD AND QUALITY IN COMMERCIAL ORCHARDS' by Brian Grout, Clive Beale and Timothy Johnson*. Timothy Johnson will present.

Paper number S13-P-129 'Fruit yield, tree growth and crop evapotranspiration as INFLUENCED BY VARIOUS IRRIGATION METHODS APPLIED TO THE GOLDEN DELICIOUS APPLE CULTIVAR PLANTED WITHIN THE HILLY REGION OF PITESTI-MARACINENI IN ROMANIA' by N. Tanasescu, and C. Paltineanu has been withdrawn

Paper number S13-O-132 'Xylem dysfunction and fruit mineral nutrition in time and space' by Sandy Lang, Lazar Drazeta, Bartolo Dichio, Damiano Remorini, and Richard Volz has been withdrawn. It will be replaced by S13-P-122 entitled 'Effects of leaf area removal on sweet cherry vegetative growth and fruit quality' by M. Whiting and G. Lang.

Paper **S13-P-99** will be presented in the 13:40 to 14:40 poster session as shown. The association of this paper 'APPLICATION OF POLYPLOIDY TO CRANBERRY BREEDING AND BIOTECHNOLOGY' by Eric Zeldin and BrenMcCown has been changed to S14.

Paper **S13-P-126**: A.B. Woolf is deleted from the author list.

Paper S13-P-144 DEVELOPING APPLE YIELD MODELS: A STATISTICAL APPROACH by Faye Propsom, Emily Hoover, Frank Forcella and Dennis Cook has been withdrawn. In its place paper **S13-P-144 CHEMICAL BLOOM THINNERS FOR CONVENTIONAL AND ORGANIC APPLE ORCHARDS** by Jim McFerson, Tory Schmidt, and Leonardo Lombardini will be posted (included in Thursday poster session)

Symposium 14 (S14): Berry Crop Breeding, Production and Utilization for a New Century

Location:MTCC Room201 EF

Tuesday · August 13

S14-P-36A

RECENT PROGRESS IN Highbush BLUEBERRY BREEDING FOR ROMANIA'S GROWING CONDITIONS

Paulina Mladin*, Gh. Mladin

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For extending highbush blueberry in the climatic favourable areas but less favourable soil conditions a breeding programme has been started since 1982. The main goal was to obtain new cultivars with better adaptability to podzolic soils, poorer in acidity and organic matter. To induce the variability, intraspecific and interspecific crosses and open pollination methods were employed. American and some European cultivars with complex genetic origin (*Vaccinium australe* Small, *V. corymbosum*

L., *V. lamarckii* Camp) as well as some diploid wild species as *V. angustifolium* L., *V. uliginosum* L., *V. myrtillus* L. as genitors were used. Over 20,000 seedlings were evaluated by the following traits: growth habit, fruiting precocity, fruit load on bush, berry quality, simultaneity of berry ripening on strig and bush. The selected individuals were propagated by green cuttings under mist, at the end of June - early July. Up to now in micro-trials plots with 3-10 plants have been studied over 270 selections and in the comparative ones, with 16 plants per 4 replications and 82 elites. Also, in the hybrid selection field some heritability aspects (regarding quantitative characters as: vigour, fruit precocity, fruit size and colour, ripening season) have been investigated, the most important work being done to selecting and evaluation of the valuable genotypes. So, in the last 5 years the first new cultivars were released: Azur, Safir and Augusta, followed by the most recently ones: Simultan and Delicia cvs.

Azur and Augusta cvs. are originated of Berkeley x Bluecrop cross, Safir of Pemberton x Blueray and Simultan and Delicia of open pollination of Spartan cv.. besides high productivity and quality, other traits there are added to the evaluation balance, such as: good vigour of Azur cv., earliness, pretty simultaneous ripening of Safir cv., lateness and vigour of Augusta cv., aroma and good habit of Delicia and simultaneous ripening of Simultan cv.

Friday · August 16

S14-P-76B

GERMPLASM RESOURCES AND GOOD VARIETIES OF ACTINIDIA CHINENSIS PLANCH IN CHINA

Shande Chen

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China is the original producer country of Actinidia (named Kiwifruit). Two varieties have primary economic significance (*A. chinensis* var. *chinensis* and *A. chinensis* var. *delicosa*), both selections of *A. chinensis* Planch. Wild germplasm resources exist primarily in the Yangtse River Valley in about 10 provinces. This paper discusses 15 new cultivars of *A. deliciosa* and *A. chinensis* that have been bred in the Region in recent years. The primary 4 cultivars are:

1. Jin Kui, selected and bred by Hubei Provincial Research Institute of Pomology, Hubei province.
2. Miliang No. 1 selected by Jishao University Hunan province in the year of 1982-1984, in (west Hunan province).
3. Xuxiang selected and bred by Xuzhou Orchard Jiangsu Province, from c.v. Hayward seedlings in 1975.
4. Qinmei It is discovered earlier by Shanxi Provincial Research Institute of Pomology from the investigation of wild resources.

Others promising cultivars are:

5. Xuguang with an average weight of 100g per fruit.
6. Zhouyu No.1. It is the one of a new discovered first class cultivars in Shanxi Province, China.
7. Qincui; a late-maturing, productive, cultivar suitable for processing.
8. 93-01; one of the Hayward bud mutation series.
9. Quimi; a medium maturing, large-fruited, earlier bearing, productive, cultivar from central and south China
10. Zaoxian; an early ripening cultivar.
11. Suxiang; an early bearing, productive, cultivar with good storage potential.
12. Qionglu; a cultivar that grows well at high soil pH.
13. Quanyang; an early bearing, high yielding cultivar suitable for fresh market and processing.
14. Red Sun; a new cultivar with red flesh.

15. Yixiang; a cultivar resistant to drought and high temperatures.

Changes to the program of S14

Poster discussion presentations will take place in the S14 home room:

Monday August 12

- 16:20 to 16:30 'Antioxidants in Ohio Berries' by Richard C. Funt*
- 16:30 to 16:40 'Preharvest Temperature Affects Antioxidant Capacity in Strawberry' by Shioh Y. Wang*, and W. Zheng
- 16:40 to 16:50 'AC-Sainte-Pierre' Strawberry' by Shahrokh Khanizadeh*, Johanne Cousineau, Martine Deschênes, Audrey Levasseur, Odile Carisse, Jennifer DeEil, Louis Gauthier and Alan Sullivan.
- 16:50 to 17:00 'Discrimination of Rubus Cultivars Using Rapid Markers and Pedigree Analysis' by Eric T. Stafne*, John R. Clark, Matthew C. Peltó
- 17:00 to 17:10 'Comparison of Strawberry Plugs from Dormant Plants to Canadian Tip Cuttings' by Peter R. Probasco* and Stephen A. Garrison
- 17:10 to 17:20 'Manipulating Transplant Morphology to Advance and Enhance Fruit Yield in Strawberry' by Julia Reekie, Peter Hicklenton, John Duval, Craig Chandler and Paul Struik.

Tuesday August 13

- 16:20 to 16:30 'Out-of-season Strawberry Production in the Eastern United States' by Fumiomi Takeda*
- 16:30 to 16:40 'Out of Season Production of Strawberries: the Effect of a Short-day Treatment in Summer' by Atsushi Yamasaki*, Takayoshi Yano and Hidekazu Sasaki
- 16:40 to 16:50 'Manual Harvesting of Blackberries Is Faster on Single-sided Shift-trellis than Static-I Trellis' by H.D. Stiles*
- 16:50 to 17:00 'An Economic Assessment of the Returns to Irrigation Investment for Wild Blueberries' by Timothy J. Dalton, Andrew Files and David E. Yarborough*
- 17:00 to 17:10 'Regional, Spatial and Temporal Variability of Cranberry Soil pH' by Joan R. Davenport*, Carolyn J. DeMoranville, Saratha Kumudini, Teryl R. Roper, Art Poole and John Hart
- 17:10 to 17:20 'Can Lowbush Blueberry Soil Ph Be Too Low?' by J.M. Smagula* and W. Litten

Thursday, August 15

- 16:40 to 16:50 'Pre-plant Winter Cover Crops for Weed Suppression in a Low-input Strawberry Production System' by B.L. Black*, J.M. Enns and H.J. Swartz
- 16:50 to 17:00 'Increasing Winter-strawberry Production in North-central Florida Using Passive Ventilated Greenhouses and High Plant Densities' Ashwin Paranjpe*, Daniel J. Cantliffe, Elizabeth M. Lamb, Peter J. Stoffella and Charles Powell
- 17:00 to 17:10 'Changes in Freezing Tolerance and Protein Constituent of *Lonicera caerulea* During Cold Acclimation' by H. Imanishi*, K. Takada, K. Masuda, T. Suzuki and T. Harada

Paper S14-P-25 'DEVELOPMENT OF *CHAETISIPHON*

FRAGEFOLII ON DIFFERENT STRAWBERRY GENOTYPES' by Milojub Stanisavljevic and Slobodan Milenkovic has been withdrawn

Paper number S14-P-29 'Comparison of strawberry plugs from dor ant plants to Canadian tip cuttings' by Peter R Probasco and Stephen A. Garrison will be presented in the 13:40 to 14:40 poster session on Thursday, August 15, not on Tuesday, August 15 as indicated.

Paper S14-P-36 'THE INDUCTION AND REGENERATION OF RABBITEYE BLUEBERRY BUDS' by Yadong Li, Shuying Liu, Zhidong Zhang and Lin Wu has been withdrawn

Symposium15 (S15): Horticultural Science in Emerging Economies: Issues & Constraints

Location: MTCC Room 103B

Monday · August 12

S15-P-8A

EXTENDING THE SHELF LIFE OF EGGPLANT FRUITS WITH DIFFERENT POSTHARVEST TREATMENTS

Celso Luiz Moretti*¹, Leonora M. Mattos², Joesse M. A. Teixeira¹, Waldir A. Marouelli¹, Washington L.C. Silva¹

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Extending the shelf life of eggplant (*Solanum melongena* L.) fruits is a great challenge for Brazilian growers planning to export their product to other countries in the MERCOSUL. The present work was carried out to investigate different postharvest treatments to extend the shelf life of eggplant fruit. Eggplant fruit, cultivar CiÁa, were harvested in the optimum maturity stage at commercial fields in Brasilia, DF, Brazil. After harvest, fruit with no external blemishes were graded for size (20±2cm) and diameter (8±0.5cm) and hydrocooled with chlorinated water (100 mg.kg⁻¹ NaClO; 10°C). Fruit were then treated with calcium chloride (2%), 1- methylcyclopropene (500 mg.kg⁻¹), modified atmosphere (coextruded polyolephin), calcium chloride (2%) + modified atmosphere storage (coextruded polyolephin), calcium chloride (2%) + 1- methylcyclopropene (500 mg.kg⁻¹), and control. Fruit were stored for 10 days under refrigerated conditions (12±0.5°C / RH 90-95%) and every two days were analyzed for total soluble solids, weight loss, firmness, and color (L*a*b*). Fruit increased their weight loss during the experiment. Eggplant fruit stored under modified atmosphere conditions, with or without application of calcium chloride, lost around 3% of their initial weight. Firmness was reduced in all treatments during the storage period. At the tenth day, fruits treated with calcium chloride + modified atmosphere storage were 2.5 times firmer than control fruits. "L" value for fruits stored under modified atmosphere were significantly higher than other treatments. Soluble solids content was not statistically affected by the different postharvest treatments. It is suggested that eggplant fruit stored under refrigerated conditions, wrapped in plastic films (coextruded polyolephin), and treated with calcium chloride (2%) can be successfully exported from Brazil to any other country in MERCOSUL.

Tuesday · August 13

S15-P-20

PRIORITIES FOR HORTICULTURAL RESEARCH IN PAPUA NEW GUINEA.

Geoff Wiles

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The horticultural industry in Papua New Guinea (PNG) comprises two distinct sectors. There is substantial subsistence oriented production of fruit and vegetables, characterised by low input smallholder farming techniques. There is also an important and growing market-oriented production of fruit and vegetables, primarily for the domestic market, and spice crops, notably vanilla, destined for the export market. NARI has focused considerable effort on identifying research priorities, so as best to use the scarce human and financial resources. In the case of PNG industry lobby groups and grower organisations are weak and it has been necessary for NARI to undertake a proactive consultation process in order to determine research needs. This process has comprised specialist workshops, visits to provinces to gather firsthand information on research needs in different parts of the country, and a National Consultative Workshop on Research Priorities. The outcomes of this consultation process are now being refined to identify research areas and research projects worthy of support. For horticultural crops the priorities identified so far cover vegetable crops, fruits and nuts and spices. For vegetable crops priorities identified are: improved understanding of market demand and marketing costs; reliable information on production costs; identification of the best varieties for different agro-ecological conditions; reduction of crop losses due to pests and diseases; addressing soil fertility issues; developing production packages for specialty crops; and reducing post-harvest losses. In the case of fruit and nut crops priorities are similar, but also include research on propagation techniques and domestication of indigenous species such as galip nut. For spice crops the major research focus is on vanilla, as a result of rapid farmer-led expansion in production. There is a need to adapt production practices and processing techniques used in other countries to PNG conditions and identify the best environments for vanilla production within PNG.

Changes to the program of S15

Paper number S15-O-16 'SOCIO-ECONOMIC AND ECOLOGICAL DETERMINANTS OF PRODUCTION OF HORTICULTURE CROPS - A CASE STUDY OF HIGH INPUT REGION IN INDIA' by Parveen K. Sardana, and Ramesh Goyal has been withdrawn

Please note the full names and addresses of conveners for Symposium 15: Dr. George Wilson, North Carolina State Univ., USA; Dr. Nico DeGroot, Agricultural Economics Research Institute, The Netherlands

Symposium 16 (S16): Protected Cultivation 2002: In Search of Structures, Systems, & Plant Materials for Sustainable Production of Greenhouses

Location: MTCC Room 104D

Monday · August 12

S16-P-27

STRENGTHS AND WEAKNESSES OF THE GREENHOUSE INDUSTRY IN NEW JERSEY

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The green industry is usually divided into the floriculture (greenhouse) sector and the environmental horticulture (nursery) sector. The floriculture sector includes cut flowers, cut cultivated greens, potted flowering plants, potted foliage plants, and bedding and garden plants. The environmental horticulture sector includes crops usually grown outdoors and used primarily for landscaping purposes, such as trees, shrubs, ground covers, turfgrass or sod, bulbs, and planting stock. The green industry is the fastest growing sector of U.S. agriculture, representing 11 percent of gross cash farm crop receipts in 1997. New Jersey ranks 11th in floriculture and environmental horticulture cash receipts, and is a key player in the green industry. Despite its lower rank, the green industry in New Jersey benefits from a high income and a highly educated population. However, New Jersey also has certain weaknesses. These include climate, cost of production, and labor shortages. The growth of the mass market has reduced costs and resulted in consolidation, but the shift from a production-driven to market-driven economy has also resulted in numerous niche markets which can be exploited by local producers. This project was conducted to explore the drivers of the greenhouse industry in New Jersey: its strengths, weaknesses, opportunities, and threats. Questionnaires were mailed in the spring of 2001. Questionnaires were returned by 185 currently active producers. Greenhouse firms ranged in age from one to 148 years with an average age of 29 years old. Fifty-eight percent of the firms were legal corporations. Retail sales accounted for 47% of the revenue. The average greenhouse was 45,858 square feet in size.

Tuesday · August 13

S16-P-52A

DEVELOPMENT OF A NEW ENVIRONMENTAL SUBSTRATE FOR GREENHOUSE TOMATO PRODUCTION

M.C. Desbiens¹, J., Caron*¹, M. Dorais², S.E. Allaire¹,

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²Agriculture and Agrifood Canada, Harrow, Ontario, Canada

Environmental concerns about the pollution associated with greenhouse production and the use of industrial waste products justify the interest in developing new substrates for greenhouse tomato production. Indeed, rockwool presents recycling problems and its replacement by more environmental friendly substrates is a worldwide target. Sawdust, peat and composted barks-based substrates have been developed and compared during a six months incubation in the laboratory. Measurements of physical (aeration and water retention) and chemical (immobilization) properties have been performed to identify growing

media of interest as an alternative to rockwool. Two substrates have been selected from this group and compared with rockwool in greenhouse essays. Air, water and fertilisation management were adjusted according to incubation results for these trials. Yield and plant growth results will be presented.

S16-P-52B

RETENTION AND MIGRATION PROCESS OF POTASSIUM IN A ORGANIC SUBSTRATUM FOR HORTICULTURE

R.M. Madjar*, V.E. Davidescu

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Potassium is an essential element for plant growth, present in the soil in water- soluble, exchangeable, and no exchangeable forms. It is important to understand the retention and migration processes of potassium from plant nutrient and soil fertility standpoints.

The paper presents the potassium quantities retained in different forms in a natural substratum composed of equal parts of forestry compost and peat. The substrate was realized for pot trials with different ornamental species.

The research of retention and migration processes of K was investigated using glass columns, uniformly packed with equal parts of forestry compost and peat. The columns have been percolated with solution with increasing concentration of K. In the collected percolate, K was analysed. After percolation, in the substratum dried in air K extractable in NH₄OAc 1n, pH=7.0 (Schollenberger-Dreibelbis-Cernescu) was obtained. Potassium was measured in all extracts by flame emission spectrophotometry. This study was conducted to determinate the specific equation of the retention and migration of potassium in a natural substratum and to find a relationship between organic matter content of substratum and potassium retention.

Thursday · August 15

S16-P-81A

REDUCING THE NITRATE CONTENT OF PROTECTED LETTUCE CROPS

C. M. T. Byrne*¹, M. J. Hennerty², M. Maher¹

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²UCD, Department of Crop Science, Horticulture and Forestry, University College Dublin, Dublin 4.

Research was carried out on nutritional strategies to reduce the nitrate content of protected lettuce crops. EU legislation imposes limits on nitrate content of lettuce, 3,500 mg kg⁻¹ fresh weight in summer and 4,500 in winter. An experiment to study the effects of N fertiliser type and rate was set up. Five rates of N to supply 25, 50, 100, 200 and 400 mg Nl⁻¹ and two fertiliser types, calcium ammonium nitrate and calcium cyanamide were included. Lettuce was grown in both soil and peat filled containers. These treatments were combined in a 5 x 2 x 2 factorial design with four replications. This summer crop was grown under glass at a spacing of 22cm. Both fertiliser type and rate had very significant effects on the nitrate content (P < 0.001) with calcium cyanamide yielding a lower average nitrate content of 878 mg kg⁻¹ than CAN, which gave 1456 mg kg⁻¹, s.e. 88.2. Nitrate content increased with increasing rates of fertiliser application. Levels of 348, 384, 981, 1770 and 2354 mg kg⁻¹ nitrate were obtained at application rates of 25, 50, 100, 200 and 400 mg Nl⁻¹ respectively. The growing medium had no effect on the nitrate content. Fertiliser type, fertiliser rate and the growing medium all significantly affected the lettuce head weight. Head weights with calcium cyanamide were lower, 229 g compared

to 262 g with CAN, s.e. 6.9. There was an interaction between fertiliser rate and growing medium. Increasing fertiliser rate producing greater head weights when the plants were grown in peat (220, 278, 361, 412, 340 g at the five rates of N) in contrast to soil (123, 153, 192, 194 and 179 g), s.e. 15.4. It is concluded that consideration of fertiliser type and nutritional strategies that carefully manage N availability will reduce the nitrate content of lettuce.

S16-P-81B

DYNAMICS OF DRY MATTER AND MINERAL NUTRIENTS ACCUMULATION BY A GLASSHOUSE CUCUMBER CROP

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Glasshouse experiments were carried out in Southern Spain (Cartagena) to determine growth parameters associated with dry biomass and main macronutrients (N, P, K, Ca, Mg) accumulation from two cucumber (*Cucumis sativus* L. cv *Trópico* F1) growth cycles (winter crop and spring crop). Data analysis indicated that growth variables taken into account were fairly described by an exponential function. When using thermal time (base temperature = 10 °C), the dynamics of dry biomass and nutrient content of the two growth cycles were quite similar. The results suggested that (i) dry matter and nutrient accumulation follow identical growth patterns and (ii) can be quite well predicted with thermal units assuming an exponential growth function.

The following paper is an addition to Symposium 16 and will be presented in the 13:40 to 14:40 poster session. It can be found on poster board **S25-P-29**

S25-P-29

CHANGES IN DRY MASS PARTITIONING AND CARBOHYDRATE CONCENTRATION IN LETTUCE STEMS DURING GROWTH

O New LEE*, Nobuo Sugiyama

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Lettuce plants (*Lactuca sativum*) belong to Asteraceae and accumulate fructans. Lettuce plants tend to bolt when they are grown at temperatures higher than 20°C and at daylengths longer than 14h. Enhanced stem elongation is accompanied by an increase in dry matter partitioning to the stem, but it has not been studied whether fructans continue to accumulate in elongating stems. The purpose of this study was (a) to determine the changes of dry mass allocation between stems and leaves, and (b) to determine the changes of carbohydrate contents in stems during the growth. Seeds of the crisphead lettuce 'Tel-me' were sown on May 2, 2001 and grown in naturally-lit greenhouse, maintained 25/20°C and 15h photoperiod. Destructive measurement of stem diameter and length was carried out on five plants at three-day intervals. Leaves and stems were divided by each 8-nodes, and were freeze-dried and weighted. The dried samples were analyzed carbohydrate concentration by HPLC. Stems elongated exponentially with times. The plots of the log-transformed data on dry mass of stems and that of leaves were linear before inflorescence initiation. The relationship was deviated from linearity thereafter. Stems contained mainly sucrose, and the level of fructose and glucose remained low. The concentration of sucrose and fructans increased during stem growth. The degree of polymerization of fructans increased throughout stem development. Fructans were stored in the lower stem base, and rarely found in rapidly elongated stem nodes. These results showed that (a) dry mass partitioning between stems and leaves

changed after inflorescence initiation, and (b) carbohydrate concentrations increased continuously during stem elongation. Fructans in the lettuce stems may be hydrolyzed and used as substrates for seed development.

Friday · August 16

S16-P-99A

CUTTING WITH LATERAL SHOOTS OF CHERRY TOMATO FOR EARLY HARVEST AND HIGHER YIELDS

Seung K. Yang*, Kyeong J. Choe

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Lateral shoots, which must be removed as soon as possible, could be used for cutting materials instead of seeding for nursery plants of cherry tomato. The cutting propagation directly into cutting media was effective to reduce seedling periods. Rooting and growing of nursery plants were required about 10 days in cutting-bed, and 15 to 20 days to transplant them after cutting. One hundred percentages rooting and enough root growth were observed in all media of carbonized rice hull (CRH), perlite, rock wool, NFT, CRH+perlite, CRH+peat moss, perlite+peat moss. Top and root growth were promoted by both the standard and higher ionic strength as much as two times of Yamajaki nutrient solution. Higher rooting and root growth were resulted at 20 to 25°C in root zone temperature. In size of separated cutting media, the pot volume of 30 to 300 mL were proper, although root growth was gradually limited in small media volume. The cutting plants showed more fruit numbers and higher yields than that of seedlings of 'Pepe' cherry tomato. Especially early harvested tomatoes markedly higher in cutting plants than that of seedling.

S16-P-99B

SNAPDRAGON PRODUCTIVITY AND PHOTOSYNTHESIS UNDER LOW LIGHT CONDITIONS

Jorge-A Gutierrez-E*, Bernard Grodzinski

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Limiting light levels are present in most agricultural settings and especially during winter time production of greenhouse crops. Currently, no crops have been selected for low light tolerance (LLT). One ornamental crop, snapdragons (*Antirrhinum majus* L.) may provide important physiological and genetic clues to modifying a wide range of other important greenhouse and field crops. We are trying to determine whether different cultivars recommended for winter production grow better at low light (LL) because LLT genes are expressed. Taken together our data show that the reallocation of carbon reserves from reproductive and flower development towards increased vegetative development (i.e., increased leaf area and stem growth) occurred in all snapdragon lines acclimated to LL conditions. However, the extent to which reallocation of reserves occurs can be very different in lines recommended for low-light, winter production. Both whole plant and leaf gas exchange rates appear to be altered so that photosynthesis occurs at lower light levels (LCP) than in more vigorous lines traditionally grown in full sun, summer conditions (HL). These data demonstrate that genes controlling leaf photosynthetic C-fixation and /or dark respiration at LL are involved as well as those controlling whole plant architecture (i.e., leaf area development). In summary under LL conditions plants change: a) the pattern of C allocation to sinks, b) chloroplast metabolism leading to lower LCP, and c) the daytime leaf Pn

and export patterns.

S16-P-99C

EFFECTS OF NITROGEN, POTASSIUM, CALCIUM CONCENTRATIONS AND SOLUTION TEMPERATURES ON THE GROWTH AND YIELD OF STRAWBERRY (CV. REDGAUNTLET) IN A NUTRIENT FILM (NFT) HYDROPONIC SYSTEM

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The effects of different concentrations of nitrate-nitrogen, potassium, and calcium, nutrient solution temperatures and root media on the growth and yield of strawberry (cv. Redgauntlet) in a nutrient film (NFT) hydroponic system were assessed over a 106 day period. Plants grown in nutrient solutions containing high (14.9 N: 8.5 K: 4.2 Ca mM) and low (7.1 N: 4.6 K: 2.3 Ca mM) concentrations of these elements showed similar growth and yield. Nutrient uptake was not affected by either solution or the 50C difference in solution temperature. Berry production was dependent on plant size, truss number and root medium. Calcium deficiency in young leaves was associated with high solution temperatures and not the levels of Calcium in the nutrient solution.

S16-P-99D

ROCKET (*ERUCA SATIVA* MILL.) AND CORN SALAD (*VALERIANELLA OLITORIA* L.): PRODUCTION OF TWO LEAFY VEGETABLES GROWN IN A SOILLESS CULTURE SYSTEM

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The soilless culture system (SCS) can be adopted as a standardized growing technique for ready-to-eat or ready-to-cook products, which may enhance food quality and conservation. The SCS avoids soil parts to reach the leaves, allowing the production of clean material at harvest, and consequently the reduction of many washing treatments. A SCS was implemented for the Leafy Vegetable Production (LVP) of rocket (*Eruca sativa* Mill.) and corn salad (*Valerianella olitoria* L.). The two species were grown in styrofoam containerized cell-trays (40 or 160 cells, with 8 and 2 seeds per cell, respectively), using different growing media (100% rockwool or 75% peat and 25% perlite, in volume), and different nitrogen concentrations in the nutrient solution (30 e 120 mmol L⁻¹ N). Rocket and corn salad were respectively sown on 7 and 3 June 1999, and harvested on 21 and 23 July 1999. Plants were irrigated throughout the experiments according to their needs and fertigated weekly by an ebb-and-flow system, with an hour of tray floating. At sampling, leaves were cut and weighed, and leaf area of the samples was measured. Leaves were attributed a Quality Index (QI: 100%, 75%, 50%, 25% and 0%, according to a leaf visual evaluation), to determine their marketable values. For both the considered species, the best LVP in terms of mass, leaf area and quality was achieved by plants grown in 40-cell trays filled with peat and perlite and fertilized with 30 mmol L⁻¹ of N. The research carried out indicated that high quality ready-to-eat rocket and corn salad can be produced with a SCS by using the ebb-and-flow irrigation system.

S16-P-99E

DISTRIBUTION OF IAA, ABA, CKS AND GAS WITHIN SEEDLESS FRUITS OF PARTHENO-CARPIC TOMATO

Kiyohide Kojima*, Yuichi Tamura

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Levels of indole-acetic acid (IAA), abscisic acid (ABA), cytokinins (CKs) and gibberellic acids (GAs) in seedless fruits of parthenocarpic tomato (*Lycopersicon esculentum* Mill. cv. Rarkuna First) were analyzed. CKs included trans-zeatin (Z) and trans-zeatin riboside (ZR), and GAs included GA1 and GA4. Fruits were sampled at young stage (6 cm in a diameter) and mature green stage (8 cm in a diameter). Sampled fruits were sliced from equatorial region in 20% thickness of fruit diameter, and sliced disks were separated into pericarps, partitions and locule tissues (included placenta). The pericarps and partitions tissues were centrifuged for collection of apoplast solution (AP; sap out of a cell membrane). Thereafter the tissues were frozen, thawed and recentrifuged for collection of symplast solution (SP; sap within a cell). The locule tissues were homogenated and filtrated. At extraction, 13C6-IAA, 2H6-ABA, 2H5-Z, 2H5-ZR, 2H2-GA1 and 2H2-GA4 as internal standards were added. After purification, IAA, ABA, CKs and GAs were fractionated with HPLC and determined with liquid chromatography-mass spectrometry (LC-MS). IAA concentration was generally higher in young stage than in mature green stage. ABA concentration was higher in locules. CKs concentrations were higher in partitions and locules tissues of young fruits (especially Z was 4.6 pmol/g fresh weight in SP of partition tissues and ZR was 55 in locule tissues). The concentrations of plant hormones in divided parts changed differently. Thus, precise determination of the hormone concentrations of the component tissues needs to assign specific roles in specific tissues. These results suggest that specific plant hormone status in the specific part may be involved in fruit growth potential of tomato.

S16-P-99F

SOLUTION ELECTRICAL CONDUCTIVITY AND RATIO OF NITRATE TO OTHER NUTRIENTS AFFECT ACCUMULATION OF NITRATE IN HYDROPONIC LETTUCE

Martin P.N. Gent

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What effect does solution electrical conductivity (EC) and the supply of nitrate in proportion to other elements (nitrate supply ratio) have on lettuce was grown in hydroponics? Low-N treatments were compared to high-N treatments in a series of successive plantings in a greenhouse in the northeast USA. In 1996, the low and high-N treatments differed in EC, 0.65 and 0.9 dS m⁻¹, respectively, but not in nitrate supply ratio. Leaf tissue had more nitrate and total reduced-N and lettuce grew faster in the solution with higher EC. In 1997 and 1998, the nitrate supply ratio of the low-N treatment was only 60% of that for the high-N treatment, and EC was varied from 1.2 to 2.0 dS m⁻¹ in four series of plantings. In 1997 and 1998, tissue nitrate was lower in the low-N treatment only when EC was less than in the high-N treatment. However, under irradiance greater than 10 MJ m⁻² d⁻¹, the lower EC also slowed growth. The ratio of elements in the recirculating solution differed from the ratio in which they were supplied. Under low irradiance in a solution with EC greater than 1.5, nitrate in solution accumulated to a concentration greater than expected from simple dilution of the concentrates. Regression over data from all experiments showed leaf nitrate was a linear function of solution nitrate. Nitrate in leaf tissue increased by 0.08 to 0.09 mg g⁻¹ dry weight per 1 mg L⁻¹ increase in solution nitrate. Accumulation of nitrate in the nutrient solution was one cause of the high concentration of nitrate in lettuce grown under low irradiance.

Special characters in the following paper were incorrectly transcribed in the program. The paper should appear as follows:

DEVELOPMENT OF GROWTH AND NUTRIENT UPTAKE MODELS FOR HYDROPONICALLY-GROWN WATER DROPWORT (*OENANTHE STOLONIFERA* DC.) USING DAILY INTEGRATED IRRADIANCE AND AVERAGE TEMPERATURE

B.H. Mun* and B.Y. Lee

Models were developed for predicting growth and nutrient uptake of water dropwort based on daily integrated photosynthetic photon flux density (PPFD) and average daily temperature (ADT). Various growth parameters were examined to correlate with the fresh weight (FW). Dry weight and leaf area index (LAI) up to linear growth phase were highly and allometrically correlated with FW, each with $r^2 > 0.96$. Using the radiation extinction coefficient (K) of 0.29 in the equation of $(1 - e^{-KLA})$, the maximum radiation use efficiency (maximum RUE, RUE_{max}) was found to be $0.0388 \text{ kg} \cdot \text{mol}^{-1}$ for the FW of water dropwort. Since RUE value was affected by ADT, the function of RUE_{ADT} followed beta distribution ($\text{RUE}_{\text{ADT}} = 0.0422[(39.0 - \text{ADT}) / 15.0]^{15.0} / [(\text{ADT} - 7.5) / 16.5]^{15.0} + 1$) comprising minimum, optimum, and maximum temperature of 7.5, 24.0, and 39.0°C, respectively. The FW was well predicted with the function of $\text{FW} = 0.0388 \cdot \text{RUE}_{\text{ADT}} \cdot (1 - e^{-KLA})$ PPFD (bias = -0.195 and RMSE = 0.543). However, different nutrient uptake patterns were observed at 3 levels of PPFD or at 5 regimes of ADT. The amounts of K^+ and $\text{PO}_4\text{-P}$ uptake were highly correlated only with the FW ($r^2 > 0.96$). However, the amounts of Ca^{2+} and Mg^{2+} uptake were correlated with PPFD as well as FW. Without compensating based on the nutrient uptake model, the nutrients, K^+ and $\text{PO}_4\text{-P}$ in the nutrient solution were greatly depleted at harvest, but Ca^{2+} and Mg^{2+} accumulated. When the nutrients were compensated based on the nutrient uptake model, however, the FW could be increased at a rate of approximately 6.6%.

The following paper is an addition to Symposium 16 and will be presented in the 08:00 to 09:00 poster session. It can be found on poster board **S25-P-28**

S25-P-28

YEAR-ROUND VEGETABLE PRODUCTION UNDER SIMPLE PLASTIC RAIN SHELTERS IN THE LOWLAND TROPICS

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Vegetable production in the lowland tropics is constrained by biotic and abiotic stresses. The adverse effects of high temperature, rainfall, wind and incidence of pest and diseases are serious during the wet season. Improved technologies such as protective structures have been developed to overcome the effects of environmental stresses. Studies at the Asian Vegetables Research and Development Center (AVRDC) in Taiwan were conducted in 2000 to 2001 to evaluate the benefits of plastic rain shelters in minimizing the effects of biotic and abiotic stresses in year-round vegetable production. Vegetables were grown in plastic rain shelters 5 m long, 2.4 m wide high structures with an arched top. Cropping system consisted of tomato planted during the hot wet season (July), followed by

okra and yardlong bean planted in the dry season (December). All crops were planted in plots consisting of single 30 cm high raised beds arranged in a randomized complete block design with three replications. Survival rate of tomatoes grafted onto EG203 eggplant rootstock was higher than non-grafted plants and those grafted onto H7996 tomato rootstock under rain shelters. Yields were low under open field and differences between grafted and non-grafted treatments were not significant ($P > 0.05$). Under rain shelters, yields from tomatoes grafted onto EG203 were significantly ($P < 0.05$) higher than non-grafted or those grafted to H7996. Differences in yield of okra and yardlong bean grown in rain shelters and open field were not significant, but yields were slightly higher in plants grown under rain shelters compared to open field. Studies suggest that the combined benefits of rain shelters and grafting were evident in tomato production during the hot wet season. Dry season crops such as okra and yardlong bean may no longer benefit from rain shelters.

Changes to the program of S16

Paper by Kazuhiro Fujiwara*, Takuya Fujii . EFFECTS OF SPRAYING OZONATED WATER ON THE SEVERITY OF POWDERY MILDEW INFECTION ON CUCUMBER LEAVES. will be presented on Thursday's poster session but will be displayed in S25-P-23.

The paper **S16-P-6 'UTILIZATION OF COMPOSTS AND COVER CROPS IN HIGH TUNNEL CROPPING SYSTEMS: OPPORTUNITIES AND CHALLENGES'** by E.P. Burkhart and W. J. Lamont has been withdrawn

Symposium17 (S17): Advances in Vegetable Crops Breeding & Seed Production

Location: MTCC Room 205AB

Monday · August 12

S17-P-24A

GENETIC VARIATION AND ASSOCIATION ANALYSIS AMONG POD YIELD AND QUALITY CHARACTERS IN INDIAN HIMALAYAN COLLECTION OF BROAD BEAN (*VICIA FABA* L.)

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Broad bean is an important minor legume vegetable crop, owing to its high protein content, ability to fix atmospheric nitrogen and capability of growing even on marginal lands. It can be effectively utilized to fight human malnutrition in the developing countries. Based on these considerations, a systematic breeding programme was initiated in the mid-hills of North-Western Himalayas with the variability and interrelationship studies among twenty four divergent genotypes. Significant differences amongst these revealed presence of sufficient variability for pod yield and quality characters, which was also confirmed by their broad range. The differences between GCV and PCV for pod yield, ascorbic acid and protein content were little or nearly equal, suggesting thereby that these characters were less influenced by the environment. High heritability estimates ($h^2_{bs}:97\%$) along with high genetic advance ($GA:125.93\%$) for pod yield indicated

the role of additive gene action for its inheritance. However, the quality parameters appear to be governed by non-additive genetic system.

The genotypic correlations were higher in most cases than the corresponding phenotypic ones, indicating existence of inherent association among such traits. Maximum direct contribution was made by ascorbic acid, protein and per cent dry matter, whereas harvest index exhibited negative direct effect suggesting utilization of these traits in broad bean breeding programme.

Tuesday · August 13

S17-P-57A

INHERITANCE OF SELF-INCOMPATIBILITY AND S-ALLELE INTERACTIONS IN INDIAN GENOTYPES OF GREEN SPROUTING BROCCOLI (*BRASSICA OLERACEA* L. *ITALICA* PENCK.)

P. Kalia*, S.M. Yadav

Department of Vegetable Science, College of Agriculture, Himachal Pradesh Agricultural University, Palampur(HP)-176 062, India

Sporophytic self-incompatibility, controlled by a series of multiple S-alleles at single S-locus, is an important genetic tool in Brassica Oleracea used to breed F1 hybrids. It is, therefore, imperative to know the inheritance of self-incompatibility and interaction amongst S-alleles, which facilitate development of appropriate S-allele lines for hybrid production. With this view point, three possible phenotypic groups were identified from the present investigation among progenies of fourteen self-incompatible plants belonging to four diverse Indian genotypes of green sprouting broccoli. Type IV S-allele interaction was observed in progenies of twelve self-incompatible plants, indicating their utilization for the production of three- or four way cross hybrids. The type II and III S-allele relationships are quite rare in occurrence and were found only in one progeny each of a single genotype. The S-allele plants isolated from indigenous cultivars might be useful as potential parental inbred lines in hybrid broccoli breeding programme.

S17-O-62

PREDICTION OF GROWTH STAGE USING DAYS AND HEAT UNITS IN FOUR CULTIGENS OF CUCUMBER

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Cucumber (*Cucumis sativus*) is a major vegetable crop worldwide. Computer growth models have been developed to help researchers, growers, and processors predict plant development. The objective was to study growth and development of cucumber using both days after planting and cumulative heat units (HU) to determine their value in prediction of harvest date for pickling cucumbers grown in North Carolina. The experiment was a split-plot treatment arrangement in a randomized complete block design with three replications. Plantings were made every week for 10 weeks (30 April through 2 July). Cultigens were chosen to represent inbreds vs. hybrids, new vs. old releases, anthracnose resistant vs. susceptible, and early vs. late maturity. Data on plant growth stage and weather conditions were collected daily. Main growth stages were planting (direct seeding), emergence, vine tip-over, flowering (50% of plants with 2 or more open flowers), and fruit harvest. Harvest stage was further divided into 5, 25, 50, and 75% fruit yield from six harvests. Heat units were calculated from weather data using the method of Perry, Wehner and Johnson, which uses the daily maximum air temperature, a base temperature of 15.5°C, and a

reducing ceiling of 32°C. Of the four cultigens, 'Calypso' was the earliest (450 HU), M 21 and Wis. SMR 18 were intermediate (500 HU), and WI 2757 was the latest (520 HU). Plantings made early in the season required 53% more days to reach 5% fruiting stage than those made later (49 for Calypso at planting date 1 vs. 32 at planting date 10). However, plantings made early in the season required only 12% more heat units to reach 5% fruiting stage than those made later (474 HU for Calypso at planting date 1 vs. 425 HU at planting date 8). Therefore, heat units were more stable over planting dates than days after planting.

The following paper (presented in the S25 section in the 13:40 to 14:40 poster session) is associated with Symposium 17

S25-P-27

INFLUENCE OF PARENTAL GERMLASM ON YIELD COMPONENTS OF PEPPER (*CAPUSICUM ANNUUM* L.) EVALUATED IN F1, F2, AND F3 GENERATIONS

Bogoljub Zecevic*, Radisa Djordjevic, Mirjana Mijatovic, Milan Damjanovic, Dejan Cvikic

Centre for Vegetable Crops, Centre for Vegetable Crops, Smederevska Palanka, Serbia, Yugoslavia, 11420

The goal of this research was to determine genetic values for the yield components fruit number and fruit weight based on F1 and F2 generations from a diallel cross of pepper genotypes. Another objective was to estimate the effects of applying pedigree and bulk methods of selection in F3 hybrid populations. The hybrid populations were formed by crossing divergent genotypes, represented by different cultivars of *Capsicum annuum* L. Investigation of parental lines and the F1 generation was performed during three years, the experiments with F2 generations endured two years, while the analysis of results for hybrid populations of the F3 generation was based on data of a one year trial. Considering all combinations of crossing, it was estimated that levels of heterosis in the F1 generation for analyzed traits was very low. The genetic analysis of the F2 generation showed that for investigated traits the mode of inheritance was partial dominance. In the F3 generation, yield components for hybrid populations formed by the pedigree method of selection appeared to be higher than for populations from the modified bulk method

Thursday · August 15

S17-P-69

A QTL LOCATED ON CHROMOSOME 2 IN *LYCOPERSICON HIRSUTUM* CONTROLS ASPECTS OF VASCULAR MORPHOLOGY AND DEVELOPMENT.

Gitta Coaker*, David Francis

1680 Madison Ave, Wooster OH 44691

Although the horticulture and genetics of the cultivated tomato, *Lycopersicon esculentum* Mill., are well understood, there are few reports available concerning anatomical studies. We investigated the difference in the vascular root/shoot transition zone between *L. esculentum* and *L. hirsutum*. Stem sections were taken between the cotyledons and the first vegetative node and between the first and second vegetative nodes in an inbred backcross (IBC) population having *L. esculentum* as the recurrent parent and *L. hirsutum* as the donor parent. Segregation for vascular morphology was observed in individual IBC lines containing a chromosome 2 donor segment from *L. hirsutum*. An F2 population of 150 individuals segregating for vascular

morphology was developed by crossing an IBC line to *L. esculentum*. Stem sections were taken from tomato seedlings in the F2:3 population and the overall shape of the vascular system, length and width of primary vascular bundles, and thickness of the secondary xylem was recorded. Six molecular markers located on the distal portion of chromosome 2 were placed onto the F2 population and the phenotypic data obtained from F2:3 families was regressed onto the F2 molecular marker data for marker-trait analysis. The results of the marker-trait analysis for vascular structure showed a highly significant ($P < 0.0001$) association between the two most distal chromosome 2 markers (CT059 and CT094) and primary vascular bundle length. Significant associations between marker TG091 and the secondary xylem thickness as well as the overall vascular shape ($P < 0.04$ and $P < 0.05$) were observed. F2:3 families with *L. hirsutum* DNA for the above molecular markers had longer primary vascular bundles, a thicker secondary xylem, and a triangular vascular shape. The results of the marker-trait analysis suggest that a QTL from *L. hirsutum* located on the distal portion of chromosome 2 controls aspects of vascular morphology and development.

S17-P-101A

DEVELOPMENT OF RAPD MARKERS LINKED TO THE MALE STERILITY ALLELE, MS-3, IN CUCUMIS MELO (ITALICS) L.

Kevin M. Crosby*, Soon O. Park

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The popularity of hybrid varieties for commercial production of western shipper melons can be associated with increased vigor and earliness compared to open-pollinated lines. The production of hybrids requires laborious emasculation of seed parents and leads to expensive seed. Genic male sterility, conditioned by the single recessive allele, *ms-3*, is a potentially stable and effective means to generate larger quantities of hybrid seed with less contamination and much less labor. Several families were developed at the Weslaco Experiment Station using sterile (*ms-3/ms-3*) plants as seed parents and mildew resistant western shipper lines as pollen parents. The goal was to employ backcrossing to introgress the *ms-3* allele into several, high quality inbred western shipper lines. These lines could then be used as parents to produce hybrid seed in field plots. One F₂ (subscript) family of the cross *ms-3/ms-3* x 'Dulce' was utilized to develop RAPD molecular markers linked to the sterility allele. All F₂(subscript) plants were grown in plastic pots in a greenhouse. Each individual plant was phenotyped for sterility and DNA was extracted from young leaf tissue. All fertile plants were selfed and F₃(subscript) progenies were planted in the greenhouse to confirm the homozygous or heterozygous nature of the F₂(subscript) plants. Bulked segregant analysis was performed with 7-10 plants of both homozygous fertile and sterile genotypes. Several markers were identified as linked to the *ms-3* allele and several linked to the fertility (*MS-3*) allele. These should be useful in the process of marker-assisted selection to expedite the inbreeding of lines carrying the *ms-3* allele. Expansion of the number of RAPDs screened and addition of AFLP markers have been undertaken as well.

Changes to the program of S17

Paper number S17-P-6 'UNEXPECTED SUSCEPTIBILITY OF NOVEL BREEDING LINES OF EUROPEAN RHUBARB [RHEUM RHAPONTICUM] TO LEAF AND PETIOLE SPOT DISEASES by Yipeng Zhao, Brian Grout and Peter Crisp will be presented by Yipeng Zhao.

Paper number S17-P-94 'AFLP ANALYSIS IN TOMATO GENOTYPES THAT DIFFER IN FRUIT SHELF LIFE' by G.M. Pratta, R. Zorzoli, L.A. Picardi, W.M. Yalle has been withdrawn.

Symposium19 (S19):Elegant Science in Floriculture

Location: MTCC Room 206AB

Monday · August 12

S19-P-21A

INFLUENCE OF INDUCED DORMANCY AND BULB STORAGE TEMPERATURE ON FLOWERING OF VELTHEIMIA BRACTEATA 'LEMON FLAME'

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Veltheimia bracteata is a bulbous indigenous South African plant. Under natural growing conditions in South Africa it is evergreen and dormancy has to be induced in order to possibly manipulate the flowering date. In the Netherlands, where it is grown as a dormant bulb, dormancy and flowering was influenced by storage temperature during dormancy.

Plants of the yellow flowered cultivar 'Lemon Flame' were lifted, defoliated, dried off for three weeks under greenhouse conditions, then stored at constant temperatures of 15°C, 20°C and 25°C as well as under greenhouse conditions for eight weeks, after which the bulbs were planted and grown under greenhouse conditions. Other treatments were the removal of the previous peduncle and defoliation. The dates of first emergence of new vegetative growth, first emergence of the inflorescence and opening of the first flower were recorded. Non-temperature treatments and storage at 20°C retarded emergence of the inflorescence by about three weeks compared to the control, while storage at 15°C and 25°C retarded emergence further, with the biggest delay of nine weeks observed after storage at 15°C. All the treatments involving lifting of the bulbs showed a 30 to 70 percent inhibition of formation of inflorescences. There was a significant relationship between bulb mass and flowering irrespective of the storage treatment, with the smaller bulbs tending not to flower. There was no significant delay in the date of opening of the first flowers of the inflorescences between the different treatments and the control. Peduncle length and number of florets per inflorescence were reduced by all treatments except the 20°C and 25°C storage treatments. These results differ significantly from those obtained in the Netherlands and indicate that this cultivar reacts poorly to induced dormancy by lifting and drying off before storage at different temperatures.

S19-P-21B

ESTIMATION OF DELAYED POLLINATION IN PRODUCTION OF SEEDS IN SELF-POLLINATED LILIAM SPP.

Hyun-Jung Kim*, Yoshiji Niimi

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We studied the relation between floral stage at the time of pollination and seed production in self-pollination of five *Lilium* spp and discussed influence of floral stages at pollination on the rate of pollen tube growth, behavior of pollen tubes in ovary and number of seeds formed. All pollinated pistils of *L. rubellum* developed into capsules with seeds, and the pistils pollinated at

day 0 formed the highest number of seeds (95 seeds per capsule). On the other hand, no pistils of *L. longiflorum* 'Georgia' formed capsules with seeds and only pistils of *L. speciosum* 'Uchida' pollinated at day +5 formed a few seeds. In Asiatic hybrid lily, 'Enchantment' and 'Connecticut King', pistils pollinated before and after anthesis formed more seeds than did those pollinated at anthesis. All pollen tubes in pistil pollinated at day +5 grew faster than those at anthesis (day 0) in each of compatible and incompatible combinations. A bundle of pollen tubes growing straight between two rows of ovules on the placental tissue was observed in *L. rubellum*, whereas meanderingly growing pollen tubes were observed in the ovaries of 'Enchantment' and 'Connecticut King'. In these growth rates of pollen tubes were faster in pistil pollinated at day +5 than at day 0. These results suggested that delay pollination is an effective way to produce viable seeds in self-incompatible *Lilium* spp.

Tuesday · August 13

S19-P-86A

A MECHANISTIC STUDY ON THE EFFECTS OF ARTIFICIAL LIGHTING TIME ON FLOWERING TIME AND FLOWER QUALITY OF 'HUNTING SONG' GLADIOLUS

Jinquan Feng¹, Qixiang Zhang²

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Three artificial lighting regimes: day lighting (7 am-9 am and 3 pm-6 pm, photoperiod 11 h/day), continuous lighting (5 pm-10 pm, photoperiod 14 h/day) and midnight lighting (0 am-5 am, photoperiod 14 h/day) were applied on gladiolus (*Gladiolus hortulanus* L. H. Bailey cv. *Hunting Song*) during winter flower forcing. Spike length was measured every 10-20 days until anthesis. Flower quality (spike length and flower number per spike), leaf chlorophyll content, photosynthesis rate, dry weight and mineral (N, P, K, Ca, and Mg) contents of root, bulb, leaf and flower spike were measured at anthesis and the distribution rates of dry matter and minerals among different organs of the plant calculated. Day lighting and continuous lighting resulted in lower chlorophyll content, higher photosynthesis rate, higher dry weight and N, P, Ca and Mg contents per plant compared to the midnight lighting. Higher proportions of dry matter and minerals were distributed to spike under day lighting and continuous lighting than that under the midnight lighting. Day lighting and continuous lighting resulted in longer spike and more flowers per spike than midnight lighting. Anthesis under day lighting was 4.4 and 6.4 days earlier than that under the continuous lighting and midnight lighting respectively.

S19-P-88A

PREDICTION OF DEVELOPMENTAL EVENTS ON SPATHYPHILLUM FLORIBUNDUM CV. PETITE BASED ON AIR THERMAL UNITS AND PHOTON FLUX DENSITY.

Carlos Luis Boschi¹, Adalberto Di Benedetto¹, Claudio Pasion²
¹Cátedra de Floricultura. Facultad de Agronomía Universidad de Buenos Aires

²Department of Horticulture, College of Food, Agricultural and Environmental Sciences, Ohio State University

Developmental events of *Spathyphillum floribundum* cv. *Petite* were observed on clonal propagated plants under a wide range of air temperature and light conditions. The dates of occurrence of "Tiller development", unfolding of each leaf, occurrence of "visible spathe" for the principal shoot and the first tiller, were observed for 210 whole plants. Half hourly averages

of air temperature and photosynthetic photon flux density (PPFD) were recorder. Temperature affected rate of tiller and flowering development, but the integrated PPFD did not. The base temperature was found to be 12 °C. Thermal units were computed and found to be suitable for tracking most phases of spathyphillum crop development; it were 360 ± 34, 185 ± 25, 186 ± 23, 1820 ± 270, and 1840 ± 210 °C. Day for the "first tiller development", "second tiller development", "third tiller development", occurrence of visible first plant inflorescence", and "occurrence of visible first tiller inflorescence" respectively. Errors of prediction for all phases and occurrence of "unfolding of each leaf" were also calculated.

Friday · August 16

S19-P-136A

MANAGING WESTERN FLOWER THRIPS USING A COMBINATION OF IMPATIENS WITH NATURAL RESISTANCE AND REDUCED RISK INSECTICIDES

Daniel Warnock*, Raymond Cloyd, Rebecca Loughner, Robert Elshire,

University of Illinois, Department of Natural Resources and Environmental Sciences, Urbana, Illinois

Western flower thrips (WFT) routinely infest impatiens crops during production. Crop losses due to physical damage and impatiens necrotic spot virus can be extensive. Minimizing crop loss is dependent on controlling the insect that causes the physical damage and vectors the virus. Current control measures are based on the application of insecticides, some to which thrips have developed resistance. To reduce bedding plant losses during production; researchers must supply alternative strategies to the grower's arsenal against this insect. Host plant resistance can lower thrips population levels in some crops. Synergistic effects between resistant plants and insecticides may exist. To determine if synergistic effects existed between resistant impatiens and commercial insecticides at reduced rates, two experiments were conducted. Using a randomized block design, several impatiens cultivars inoculated with WFT were exposed to two insecticides, Mesuro and Conserve, at varying rates. Thrips feeding damage was determined using a 1 to 9 visual scale and quantified with an image analysis system. Thrips populations were determined through extraction and counts. Results from Experiment 1 indicated that impatiens cultivars varied in feeding damage expressed and the number of insects on plants. *Cajun Carmine* appeared to negatively impact thrips fitness. Results from Experiment 2 indicate that host plant resistance combined with reduced rates of insecticides effectively controls WFT feeding damage and population levels comparable to controls. Impatiens cultivars varied in resistance to WFT feeding damage. Synergistic effects are present when resistant cultivars are combined with reduced rates of insecticides. Decreasing the number of insecticide applications and decreasing the volume of insecticides applied will minimize worker exposure, reduce phytotoxicity on plants, minimize environmental impact, and slow the development of resistance in insect populations.

Changes to the program of S19

The moderator of the Monday, August 12 morning session "Where do they come from? Issues in germplasm, biodiversity, and new floral crops" will be Dr. Richard Criley

Symposium 20 (S20): Citrus & Other Subtropical & Tropical Fruit Crops: Issues, Advances & Opportunities

Location: MTCC Room 206EF

Monday · August 12

S20-P-22A

CITRUS IMPROVEMENT BY HIBRIDIZATION IN CUBA: BEHAVIOR OF SELECTIONS.

Luis Bello, Giselle Sosa, Miguel Aranguren_Gonzalez* and Ildemaro Martínez

Estaci3n Experimental de C3tricos, Jag,ey Grande, Matanzas, Cuba
The agronomic behavior of seven hybrids obtained by directed crossing of 'Clementina' were selected for the characteristics of their fruits. These selections from seedlings were planted in a comparative trial, on a deep red ferrallitic soil, at a distance of 4 x 6 m. The hybrids studied were: 'Valentina' (Clementina x early Valencia), 'Clemelina' (Clementina x Hamlin), 'Maribel' (Clementina x Shamouti), selections 16/73, 16/10 and 16/49 (obtained from seeds of open pollinated Clementina) and the selection 17/6 (Clementina x early Valencia). Of the seven selections, five had better characteristics. 'Maribel', although it is a tangor, had mandarin-type fruit that were large and easy peeling, maturation was early and the trees were the most productive; 'Clemelina' has a spherical form similar to an orange, it peels with ease, matures in September and reaches an orange coloration. It is as productive as 'Maribel'. The tangor 'Valentina' has fruit of excellent quality, its maturation is mid-season, but it is less productive than the previously described selections. The selection 16/73 is also productive, fruit are oblate, smooth skinned with pale yellow coloration. It is difficult to peel. The selection 16/10 produces mandarin-type fruit of large size, tender segments, very good flavor, light orange coloration, but with shine, which gives a very good aspect.

Tuesday · August 13

The following paper will be presented orally in the 11:40 to 12:00 time slot:

S20-O-35

RESTRICTIONS ON THE EXOGENOUS CONTROL OF FLOWERING IN CITRUS

Amparo Martinez-Fuentes*, Carlos Mesejo, Mariano Juan, Vicente Almela, Manuel Agusti Instituto Agroforestal Mediterráneo, Universidad Polit3cnica.Valencia. Spain, 46022

In some partenocarpic citrus cultivars, both oranges and mandarins, the yield has been inversely related with flowering intensity. The effect has been explained through a competition process for carbohydrates among fruitlets that reduces their ability to set. The application of gibberellic acid during the rest period, significantly reduces flowering and, in turn, increases set and yield. On the other hand, there are some other varieties, especially seedy varieties, which after a period of heavy crop dramatically reduce flowering and the following yield, and lead the tree into an alternate bearing process. In these cases, the application of paclobutrazol to the soil during the rest period of the on-year, significantly increases forthcoming flowering and the following yield. Although it can be taken as a general rule, in some cases of both very high and very low flowering inten-

sity, the response to gibberellic acid and paclobutrazol, respectively, is practically non-existent. In this paper we'll present several illustrative cases and we'll propound a hypothesis.

S20-O-35

DIFFERENT MEDIA EFFECTS ON MASS PROPAGATION AND INITIATION OF BULBIL-LIKE STRUCTURES IN BANANA

Ahmad Majd*, F. Frahani, R. Zarghami

Azad Islamic University, North Branch of Tehran, No. 6.1 Toupchi street, Sohrevardi avenue, Tehran 15588, Iran.

Shoot cultures from explants of banana, cultivar Dwarf Cavendish, were established on Murashig and Skoog medium with 8 mg/l Benzylaminopurine. Different types of media, such as shake liquid and aerated liquid were assessed for their ability to support shoot multiplication and initiation of bulbil-like structures. Liquid aerated media on the jar semicontinuous reactor were found better for shoot multiplication and minimize the formation of adventitious budding.

For maximum plantlet production, growing in aerated liquid media followed by a brief culture on semisolid medium has been suggested.

S20-P-44A

EFFECTS OF VIROID INOCULATIONS IN 'PERSIAN LIME' (CITRUS LATIFOLIA TAN.) ON CITRUS MACROPHYLLA WEST. UNDER CUBAN CONDITIONS. I: PERIOD OF EARLY TREE DEVELOPMENT.

Romualdo Pérez, Nivardo del Valle, Ernesto Correa, Douglas Rodríguez, María E García* Karella Velázquez and J. Pérez Estaci3n Experimental de C3tricos "F3lix Duque Guelmes", Matanzas, Cuba

Persian lime SRA-58' (Citrus latifolia Tan.) trees grafted on Citrus macrophylla Wester. were inoculated one year after planting with field sources of citrus viroids to evaluate their effects on growth, production and productive efficiency. Three viroid sources containing Cachexia disease (CCaVd) alone or in a complex with exocortis disease (CEVd) significantly affected the growth and production of inoculated plants through the fifth year after planting. Severe Cachexia sources had a lethal effect in 80% of plants from the fourth to fifth years of age, which confirms the high susceptibility of this rootstock to the pathogen under Cuban conditions

S20-P-44B

PLANTING DISTANCES FOR CITRUS IN RED FERRAL3TIC SOILS OF JAG, EY GRANDE, MATANZAS, CUBA

Rodrigo Rodríguez, Nivardo del Valle, Romualdo Pérez, María E García*, Katia Rodríguez and Jenny Rodríguez

Estaci3n Experimental de C3tricos, Jag,ey Grande, Matanzas, Cuba

The growth, production, yield and quality of the fruit were evaluated in several experiments concerning planting distances for orange (Citrus sinensis (L.) Osb.), grapefruit (Citrus paradisi Macf.), lime (Citrus latifolia So.) and lemon trees (Citrus lemon (L.) Burm) planted in red ferrallitic soil of the Jag,ey Grande citrus region in Cuba. The growth and the production per tree were significantly smaller as the planting distances decreased. The yield in t/ha in the first crops was increased proportionally to the increase of the plantation density. The quality of the fruit was not affected significantly by the spacing of the trees.

S20-P-50A

CHANGES IN YIELD COMPONENTS INDUCED IN PERSIAN LIMES TREES BY VIROIDS ISOLATES

Miguel Aranguren_Gonzalez*, Romualdo PÉrez_Castillo, Douglas Rodríguez Martínez

EstaciÓn Experimental de CÍtricos, Torriente, Jag,ey Grande, Matanzas,. Cuba

Persian lime, SRA-58' trees (*Citrus latifolia* Tan.) grafted on *Citrus macrophylla* West. and inoculated with four isolates of viroids were evaluated after seven years of age for effects on vegetative and reproductive growth. Tree size, yields and the quality of the fruit were determined. The trees with the viroid CVd-IIb forming a complex with CVd-III or with CEVd were smaller in diameter, height and volume of the tree canopy compared to the healthy plants. The flowering, the number and size of leaves, and the total foliage area decreased. However, the productive efficiency was slightly higher for the inoculated plants, but was not significantly different from the healthy ones. The viroids CVd-III and CEVd inoculated alone, reduced the tree development, but they were not as aggressive as when combined with the CVd-lib isolate. The contents of juice and the number of fruit larger than 50 mm were higher in the healthy plants.

S20-P-56A

EFFECT OF FOLIAR AND SOIL APPLICATION OF UREA ON DRY MATTER PRODUCTION, CHLOROPHYLL CONTENT AND NPK STATUS OF CITRUS NURSERY PLANTS

T. Kannan, S.N. Singh, Harinder S. Rattanpal*, H.S. Dhaliwal
Department of Horticulture, Punjab Agricultural University, Ludhiana-141004, INDIA

The present study was undertaken at the College Orchard, Department of Horticulture, Punjab Agricultural University, Ludhiana from March to December, 1999. The urea was applied at monthly interval to Jatti Khatti (*Citrus jambhiri*) seedlings at the rate of 0.5, 1.0 & 1.5 per cent as foliar sprays and 217, 434 & 651 kg ha⁻¹ as soil application. The soil application provided 100, 200 and 300 kg nitrogen ha⁻¹. The highest increase in leaf dry weight, stem dry weight and total dry weight were recorded with 434 kg urea ha⁻¹ soil application. The 1.0 per cent urea foliar spray resulted in maximum increase in root dry weight, whereas, maximum chlorophyll content and nitrogen content of leaves were observed with urea @ 1.5 per cent foliar spray.

S20-P-56B

EFFECT OF FOLIAR AND SOIL APPLICATION OF UREA ON VEGETATIVE GROWTH AND BUDDING SUCCESS OF CITRUS NURSERY

T. Kannan, S.N. Singh*, H.S. Rattanpal, H.S. Dhaliwal
Department of Horticulture, Punjab Agricultural University, Ludhiana-141004. INDIA

Urea was applied at monthly interval from March to December to Jatti Khatti (*Citrus jambhiri* Lush) seedlings at the rate of 0.5, 1.0 & 1.5 per cent as foliar sprays and 217, 434 & 651 kg ha⁻¹ as soil application. The urea at the rate of 1.5 per cent foliar spray resulted in maximum increase in stem diameter, leaf number, leaf length with maximum plants attaining earlier buddable stage, highest budding success and maximum bud sprouting length. However, plants attained maximum height with 651 kg ha⁻¹ soil application and maximum root length was observed in 434 kg urea ha⁻¹ soil application. The results clearly indicated that for raising citrus nursery, 1.5 per cent urea foliar spray at monthly interval (i.e. from March to December) was the best.

S20-P-56C

EVALUATION OF DATE PALM MALES USING POLLEN VIABILITY AND ULTRASTRUCTURE

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Faculty of Meteorology, Environment and Arid Land Agriculture, King Abdulaziz University, Jeddah, Saudi Arabia

The main objective of this study was to develop a method to identify highly potent male palms for breeding purposes. Pollen grains from 61 date palm males grown in the Central Region of Saudi Arabia were thus evaluated using viability and ultrastructure measuring techniques.

The amount of pollen grains produced per spathe varied greatly from one male to another (0.02 – 82.92 gm/spathe). The viability testing showed that the pollen grains ranged from 44.6 to 100% using the acetocarmine method, whereas it ranged from 6.00 to 93.00% when using the germination method.

This investigations showed that pollen grains from all the investigated date palm males were monad, elliptical-peroblate with one deep germinal furrow across the surface. In all the encountered types of pollen grains, the exine pattern was reticulate with irregular and semicircular shaped pores. The ultrastructure investigations revealed that date palm males differed in their pores frequency, size, exine and porosity of pollen grains. Hence, using viability coupled with ultrastructure could be a valid method in the evaluation of male potency in date palm.

S20-P-56D

INDIGENOUS MIOMBO FRUIT TREES ADAPTABILITY, MANAGEMENT AND ADOPTABILITY BY SMALLHOLDER FARMERS IN SOUTHERN AFRICA

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⁵ICRAF Zimbabwe, Department of Research and Specialist Services, Causeway, PO Box CY 550, Harare, Zimbabwe; ICRAF Regional Office, Southern Africa Programme, c/o CIMMYT, PO Box 163, Mt Pleasant Harare; ICRAF, Headquarters, Nairobi Kenya; ICRAF, Headquarters, Nairobi Kenya; and Zambia/ICRAF Agroforestry Project, PO Box 510089, Chipata, Zambia

The Southern Africa region faces increasing food and nutritional crisis. As the Miombo forests recede, more rural people live under chronic and perpetual hunger and health hazards, while infants and children suffer from malnutrition. The deficiency of vital micronutrients and vitamins in the dietary systems of rural inhabitants could be addressed through increased availability of fruits and fruit products. More than 75 wild fruit tree species are eaten and sold from the Miombo woodlands of southern Africa. These under-exploited fruits are rich in sugars, essential vitamins, minerals, proteins, oils and fiber. The cultivation of these trees by farmers is hampered by limited knowledge of their biology, propagation and on farm management. The objective of this study was to assess the growth and potential adaptability of priority indigenous fruit trees in the prevailing farming systems, with a view to providing insight to how farmers manage IFTs on-farm, compared to other tree species. Assessments of tree growth and survival were made with 223 farmers in Malawi, 100 farmers each in Zambia and Zimbabwe, using semi-structured questionnaires. Extensive data were gathered

on socioeconomic characteristics, land-use practices, species management, species preference, and other factors. Eighty six percent of the IFTs were planted in homesteads. Tree growth was generally low compared to researcher-managed trees. Survival of trees declined with tree age, especially for *Uapaca kirkiana* and *Strychnos cocculoides*, while *Ziziphus mauritiana* and *Sclerocarya birrea* were better adapted. Farmers, 87% of which took no control measure, identified pests and diseases (48% of respondents) as probable causes of tree mortality and other causes were suggested.

Thursday · August 15

S20-O-63A

PRIORITY FOR DOMESTICATING MIOMBO INDIGENOUS FRUIT TREES AS A PROMISING LIVELIHOOD INTERVENTION FOR PEASANT FARMERS IN SOUTHERN AFRICA

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³ICRAF, Headquarters, Nairobi Kenya

There is increasing awareness of the economic importance of indigenous miombo tree fruits and their contribution to the household nutrition in southern Africa. Limited understanding of the biology, propagation and field management conditions of indigenous fruit trees, market potentials and farmers' preferences hampers the cultivation of these wild fruit trees. Ethnobotanical surveys indicated that over 75 indigenous fruit trees (IFTs) are eaten and sold in Malawi, Tanzania, Zambia and Zimbabwe. This paper puts ICRAF's tree domestication strategies in southern Africa into perspective by identifying knowledge gaps and opportunities, seeking to stimulate debate and interest on the improvement and domestication of these wild fruit trees. The paper identifies the deficiencies of the applicability of conventional approaches to tree domestication, and thus serves as a flexible pace-setting mechanism for strategy development. Several action workshops, surveys and participatory approaches were undertaken in order to understand users' and stakeholders' preferences, constraints and technological opportunities. IFTs were ranked by farmers, marketers, consumers and other stakeholders for improvement and domestication potential. IFTs included *Uapaca kirkiana*, *Strychnos cocculoides*, *Parinari curatellifolia* and *Sclerocarya birrea*. Extensive collections of *Uapaca kirkiana* and *Sclerocarya birrea* germplasm were made in 5 to 8 SADC countries, while evaluations in multilocal provenance/progeny trials were established on-station and on-farm, in four countries. More than 5000 farmers in the pilot project areas are planting IFTs to evaluate farm management and dissemination pathways. Studies on nursery production, vegetative propagation and farmers' adoption of these indigenous fruit trees species, their management and perceptions will be detailed. Using vegetative propagation tools, a participatory cloning approach has been developed for *Uapaca kirkiana*, as a spearhead species for Malawi. It is envisaged that improved cultivars with acceptable precocity and desirable fruit traits will create the necessary incentive for cultivating indigenous miombo fruit trees. Market research, economics of production, product development and farmer empowerment in fruit processing are being simultaneously undertaken as important components of the overall strategy.

S20-O-66

FRUIT POTENTIAL OF BRAZILIAN EUGENIA MYRTACEAE

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Brazilian Myrtaceae comprises several genus of trees and shrubs used for ornamental and fruit production. Out the well known guava, pitanga and jaboticaba, other species could be used for fruitculture, due the value and quality of their fruits and adaptation to some climate conditions mainly the subtropical one. Nine species of *Eugenia* were evaluated at Jaboticabal, located at 48° W and 21° S in São Paulo state in a germplasm bank. The average rain by year is 1431 mm and the temperature 22,2°C, in an altitude of 575 m. The species are *Eugenia klozschiana* Berg. (pera-do-cerrado), *Eugenia stipitata* Mc Vaugh (araça-boi), *E. tomentosa* Camb. (cabeludinha), *E. dysenterica* DC. (cagaita), *E. brasiliensis* Berg. (grumixama), *E. pitanga* (pitanga-anã), *E. luchsathiana* Berg. (pitomba), *E. uvalha* Camb. (uvaia) and *E. involucrata* DC. (cereja-do-rio grande). The evaluations comprises tree development, fruit quality and morphological leaf and flower studies. The main results are: the trees of pera-do-cerrado and pitanga-anã are small shrubs with 1 to 2 m height, araça-boi and cabeludinha small trees, whit 3 to 5 m and the other species tall trees, with more than 5 m 10 m height. The species adapted well at the subtropical conditions, out the araça-boi, native at Amazonian region, which production is severely affected by fungus disease. In relation to fruit quality all the species present edible fruit, some sweet and juice one, as cabeludinha, grumixama, pitomba, cereja-do-rio grande and pitanga-anã. Acidity is presented by araça-boi, pera-do-cerrado, cagaita and uvaia, being their fruits more suited for processing. Typical single leaf is presented by all species, with different size and shape, useful for comparative differentiation, added by color, smell and other characteristics. Flower components and structure are commented.

S20-P-79A

COMPARISON BETWEEN ORGANIC AND CONVENTIONAL MANAGED CITRUS ORCHARDS

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During the last years, in Mediterranean basin organic farming on citrus crop management has been assuming more prominence, especially due to consumers' interest. In order to optimise organic fertilization on citrus cultivation, a study on soil fertility and plants-yield nutritional status in organic and conventional managed citrus orchards was carried out, by using a field survey approach. The work was conducted in Southern Italy (Basilicata, Calabria and Sicily regions), on Navelinaí and Taroccoí orange [*Citrus sinensis* (L.) Osbeck] and Comuneí clementine (*Citrus reticulata* Blanco). Ninety conventionally and organically managed farms, similar for environmental-cultural conditions and site characteristics (such as age, cultivar and rootstock), were chosen in order to reduce the effects not directly linked to the different fertilisation management. Results obtained from the survey, in relation to soil fertility and quality, allowed to put in evidence changes in some chemical and biochemical parameters between organic and conventional managed systems. The organic matter and the total nitrogen, being

representative of soil long-term fertility, had higher values in orange organic groves. Furthermore biochemical parameters, tested to evaluate soil fertility, evidenced a more efficient soil microbial metabolism in organic farming systems. Referring to the nutritional status of citrus trees, in relation to different management, the nutrients concentration remained in an optimal range. Only slight differences were found for some elements (P, K, Fe) in foliar nutritional level, which could be due to the different type of organic fertilisation. As far as the yield is concerned, it is possible to affirm that there were no significant differences between organic and conventional managed farms. Among all parameters considered for fruit quality evaluation, we found significant differences in vitamin C content, that was higher in organic 'Navelina' orange. On the contrary, anthocyanins content was lower in organic Tarocco' orange. Other two important parameters analysed were the content of synephrine (which is an aromatic component of citrus, that has stimulant effect, like caffeine and ephedrine) and the isotope N15/N14 ratio. In conclusion, there were not prominent differences in agronomic parameters between the differently managed systems, even if it was found higher content of some nutrients (mostly N) in organic citrus systems. This finding is of great importance, since an increase of soil nutrients and energy storage could determine positive effects both on soil quality and on crop production on long time.

S20-O-83

GROWTH RESPONSE OF DATE PALM TREE TO PLANT GROWTH RETARDANTS.

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Various concentrations of paclobutrazol and uniconazole (0,1000 ppm x1,1000 ppm x2,1000 ppm x3 and 1000 ppm x4) were applied sequentially to Tafert date palm trees, at 30 days intervals. The results of this study indicate that, four applications of both paclobutrazol and uniconazole at 1000 mg/l at 30 days intervals produce long lasting retard effects on shoot growth and enhanced the fruit cluster formation. The height and trunk length of the tree and the length of leaves were significantly retarded by paclobutrazol and uniconazole. However, the number of offshoots and fruit cluster production were significantly increased by both growth regulators, whereas no significant effects were observed on the leaf and leaflets number. In general there was no significant difference between the effects of paclobutrazol and uniconazole treatments on these parameters.

Friday · August 16

S20-P-98A

LOSS OF PAPAYA FRUIT DURING COMMERCIALIZATION IN BRASILIA.

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Papaya (*Carica papaya* L.) produced in Luis Eduardo Magalhães, Bahia State, and commercialized in Brasília, Federal District, located 550 km from the producing area was used to evaluate the loss produced during the commercialization process - from shipment to consumer - all year round. Loss of papaya fruit from Solo and Formosa group in 4 wholesaler (2 specialized in papaya and 2 no specialized) and 5 retailers (3 supermarkets and 2 groceries) located in Brasília city were evaluated monthly from October 2000 to September 2001. Losses and storage period in the wholesale and retail markets, as well

as the origin of losses were collected monthly. The annual average loss in the wholesale (WM) and retail (RM) markets was, respectively, 1.46% and 5.08% for Solo group and 3.02% and 5.20% for Formosa one. In WM, bruising triggered 62.6% and 86.6% of fruit loss followed by inadequate maturity with 33.6% and 10.6% in Solo and Formosa, respectively. In RM, 63.1% and 58.0% of loss was observed in the rack during the exposition of the fruits followed by inadequate storage. The average storage time in the WM and RM was, respectively, 1.56 and 1.20 days for Solo and 1.45 and 1.45 days for Formosa

S20-P-98B

EVALUATION OF ALTERNATIVE TREATMENTS TO CONTROL GREEN MOLD IN CITRUS FRUIT

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The most common and serious disease which occurs in Italy during storage and marketing of citrus fruit is incited by *Penicillium digitatum* Sacc. Current decay control procedures have always relied on the application of synthetic chemical fungicides. Despite their fundamental role in postharvest disease control, chemical treatments are confronted by several problems that threaten their future potential. These treatments, which may leave a residue on fruit and in the environment, are questionable in terms of public acceptance. This perception has resulted in a trend to restrict or ban the use of synthetic fungicides already carefully tested for side effects, and tightly regulated. Therefore there is an emerging interest to develop alternative non-chemical means of decay control. This paper addresses the effectiveness of some of the novel approaches emerging as possible alternatives to synthetic fungicides with special emphasis on our Institute's findings. The enhancement of host defense mechanisms at the wound site, holding fruit at temperatures and humidity conducive to wound healing and detrimental to the pathogen development (curing), the potential of biological control measures, the utilization of heated solution of free-residue compounds (soda ash, ethanol) alone or as part of an integrated pest management (IPM) system, and hot water treatments (hot water dipping and short hot water brushing) has been evaluated on lemon and orange fruits holding incipient (24 hours) *P. digitatum* infections. These treatments were compared with an effective-fungicide standard treatment (Imazalil) applied at 1g a.i./L and an untreated control. Green mold incidence was assessed after 1 and 2 weeks of storage at 23°C. All treatments were evaluated for peel injuries and quality parameters.

The following paper will be presented from 09:40 to 10:00

S20-O-100

POLYAMINES AND SALICYLIC ACID METABOLISM DURING CITRUS FRUIT MATURATION AND THEIR EFFECTS ON FRUIT STORAGE

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Seven-year-old Ponkan trees (*Citrus reticulata*) on trifoliolate rootstocks (*Poncirus triflorata*) were used to monitor the changes of endogenous polyamines (PAs) and salicylic acid (SA) during fruit maturation, and to study their effects on postharvest storage life. The results showed that endogenous levels of free PAs and SA peaked in October at a maximum amount of 1,223 nmol g⁻¹ FW and 2,150 ng g⁻¹ FW, respectively. However, their contents started to drop gradually during fruit ripening. Fruits harvested in December were dipped with solutions of 100 mg L⁻¹ putrescine (Put), spermidine (Spd), spermine (Spm), and 400

mg L⁻¹ SA for 2-3 min, and then stored for a period of 3 months. It was shown that external application of above PAs and SA elevated endogenous levels of free PAs and SA, and the postharvest storage life was improved for Ponkan fruits. Except Put, all treatments resulted in the higher levels of endogenous PAs and SA in the storage fruits compared to the control. Analysis showed that treated fruits only had 2.0-6.4% decay during 3 months storage, 2.0% for SA, 3.5% for Spm, 4.0% for Spd, and 6.4% for Put treatment, respectively. Weight loss for the treated fruits were 3.0-5.2%, 3.0% for Spm, 3.5% for SA and Spd, and 5.2% for Put treatment, respectively. As a comparison, control fruit showed 13.5% decay and 11.0% weight loss during 3 months period of storage. Therefore, study has demonstrated that application of external PAs and SA could effectively elevate endogenous PAs and SA level, which has led to the improvement of fruit storage life. Among all treatments, SA and Spm treatments were shown the best, followed by the Spd and Put treatment.

Changes to the program of S20

Thursday

Many changes have occurred in the S20 program. The following are in chronological sequence and should be considered in conjunction with the main program and supplemental program books.

Paper **S20-O-63** (note there is a numerical conflict with a paper of bearing this number in the supplemental program book) by Agusti et al. will appear in the scheduled time slot (11:00 to 11:20)

Paper **S20-O-63A** (currently scheduled from 11:20 to 11:40) will be presented on Friday from 14:40 to 15:00. The next two papers in this mornings session (**S20-O-64** and **S20-O-65**) will be advanced by 20 minutes.

Paper **S20-O-66** will be presented on Friday from 15:00 to 15:20. Paper **S20-O-80** will be presented from 12:00 to 12:20

Paper **S20-P-73** will now be presented orally from 12:20 to 12:40

Afternoon Session

Paper **S20-O-83** (see supplemental program book) will be presented from 14:40 to 15:00

Papers **S20-P-56D** and **S20-O-63** (supplemental Program book) by F.K. Akinnifesi et al. will be combined into a single oral presentation to be given from 15:00 to 15:40. Paper **S20-O-81** (originally scheduled for 20 minutes of this time slot will be presented on Friday from 15:20 to 15:40

Paper **S20-O-82** will be presented from 15:40 to 16:00

Paper **S20-O-66** (as shown in the supplemental Program Book '**FRUIT POTENTIAL OF BRAZILIAN EUGENIA MYRTACEAE**' by L.C. Donadio and F.V. Moro) will be presented from 16:00 to 16:20

Paper **S20-P-68** and **S20-P-69** will be presented orally between 16:20 and 17:00.

The paper **S20-O-64** Evolution of Markets, Production technologies and certification systems for organically produced tropical fruit by A. Hodder has been withdrawn

Paper **S20-P-98 'BREEDING PAPAYA FOR RESISTANCE TO RINGSPOT VIRUS DISEASE IN MALAYSIA'** by Y.K. Chan will be presented orally from 11:40 to 12:00

Symposium21 (S21): Plant Genetic Resources: The Fabric of Horticulture's Future

Location: MTCC Room 104B

Friday · August 16

S21-P47

GENETIC RESOURCES OF UNDER-UTILIZED FRUITS IN PUNJAB SUBTROPICS

J.S.Bal, G.S.Aulakh, J.S. Cherry

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India holds a rich genepool of many less known and minor fruit crops, in different in agroclimatic regions but are under the threat of genetic erosion. With the drastic increase in world population, there is a strong need to conserve the existing resources. Keeping this in view, the genetic diversity of some under-utilized fruit crops, namely bael (*Eagle Marmelos* (L.) Corr. Serr.), Jaman (*Syzygium cumini* skeels), jack fruit (*Artocarpus heterophyllus* Lam.), dhaeu (*Artocarpus lacucha* Roxb.) and caronda (*Carissa carandus* L.) was explored in Punjab-the Indian subtropics, during 1994-2001 in order to identify and conserve the superior genotypes. Exploration were made to collect the variability from public and private gardens/ orchards, religious places, farm lands etc. A wide range of variability in physico-chemical characters, maturity period and yield components was recorded in the collected germplasm of different fruit crops. Based on these informations some desirable elite genotypes have been isolated and conservation. The paper assesses the importance of utilization of these resources in *ĕ*Ayurvedaĭ the indigenous therapy for curing human ailments. It lays emphasis on exploiting the potential usefulness of such a valuable resources, in combating the challenges of food and nutritional security to the ever increasing population and diverse measures for their conservation.

S21-O-59

MALUS-GERMPLASM FROM ASIA AND ITS EVALUATION AT THE GERMAN FRUIT GENE BANK

Martin Geibel*, Beate Hohlfeld

Institute of Plant Genetics and Crop Plant Research, Fruit Genebank, Bergweg 23, D 01326 Dresden-Pillnitz

The German Fruit Genebank at Dresden-Pillnitz has one of the largest ex-situ collections of *Malus*-wildspecies in the world hosting about 350 accessions of nearly all *Malus* species. In recent years the work was focused on new material from different collection trips. More than 1000 seedlings from 35 offspring of *Malus sieversii* collected by FORSLINE et al. during several trips to Kazakstan in the last decade are broadly characterized by morphological (plant growth, leaves, fruits) and phenological characters as well as evaluated for resistance to

Venturia inaequalis and Podosphaeria leucotricha. The material shows a broad diversity not only between different offsprings but also within several offsprings of open pollinated trees. The combination of resistance and interesting fruit characters offers new germplasm for the future fruit breeding. Evaluation-results of this material will be presented.

About 7000 seeds from 55 accessions as well as 163 scions from 28 accession of *M. hupehensis*, *M. kansuensis*, *M. prattii*, *M. sieboldii*, *M. transitoria* and *M. toringoides* were collected in 2001 during a German-Chinese Malus expedition (GEIBEL, FRITSCH, ZHOU, CHENG, DENG) to 6 sites of the Chinese provinces Sichuan and Chongqing. The diversity as seen in the original populations as well as in the first seedlings will be presented.

Changes to the program of S21

The paper **S21-O-16 'EVOLUTION OF GENE BANKS IN THE LIGHT OF MODERN MOLECULAR GENETICS'** by C. de Vicente has been withdrawn. In its place the following paper will be presented: **'GIS-ASSISTED EXPLORATION FOR CAPSICUM GENETIC RESOURCES IN PARAGUAY'** by D.E. Williams¹, A. Jarvis, K.A. Williams and L.Guarino ¹IPGRI Regional Office for the Americas c/o CIAT, A.A. 6713, Cali, Columbia.

Paper number S21-O-58 'CHARACTERIZATION OF SWEETPOTATO GERMPLASM THROUGH GENETICALLY INHERITED BIOCHEMICAL RESISTANCE COMPOUND' by Janice R. Bohac*, J.K. Peterson, D.M. Jackson, H.F. Harrison, M.E. Snook has been withdrawn. In its place (09:40 to 10:00 on Friday, August 16) the following paper will be presented: S21-P-47 'Lack of Association Between Genetic and Geographic Origin Characteristics for the Wild Potato Solanum Sucrense Hawkes' by Alfonso H. del Rio*, John B. Bamberg,

Paper number S21-O-59 'UTILIZATION OF APPLE GERMPLASM COLLECTIONS VIA RECURRENT SELECTION' by N.C. Oraguzie, A. Alspach, C. Morgan, J. Fraser, C. Whitworth has been withdrawn. In its place (10:00 to 10:20 on Friday, August 16) see paper by Geibel above.

The following poster paper has been added in the 08:00 to 09:00 session on Friday, August 16: 'GENETIC RESOURCES OF UNDER-UTILIZED FRUITS IN PUNJAB SUBTROPICS' by J.S. Bal, G.S. Aulakh, and J.S. Cherry,

Symposium 22 (S22): 4th International Symp. on Taxonomy & Nomenclature of Cultivated Plants

Location: MTCC Room 103A

Changes to the program of S22

Meetings associated with Symposium 22 will be held as follows:

Sunday, August 11: ISHS Commission on Registration and Nomenclature. 12:00noon to 2:00 pm. Crowne

Plaza Hotel - Wentworth Room. Presiding: PiersTrehane

Tuesday, August 14: IACPT Executive Committee Meeting. 7:00 am to 10:00 am Crowne Plaza Hotel, Niagara Room.

Symposium 22 will be holding various evening workshop in the Symposium 22 Home Room (MTCC 103A) on Monday, August 12 (Naming); Tuesday, August 13 (Standards); and Thursday, August 15 (General Meeting of the IACPT); and on Friday afternoon (Open Meeting on Code). Please see Piers Trehane in the S22 home room for further details.

Saturday, August 17 and Sunday, August 18. IUBS Commission on the Code of Nomenclature. Location to be announced (Please see Piers Trehane for further details)

Paper number S08-P-41 'THICKENING AND SUGAR ACCUMULATION AT THE STEM ABOVE GRAFT UNION OF TOMATO PLANTS GRAFTED ONTO SOLANUM ROOTSTOCKS' by M. Oda, M. Kawaguchi, H. Ikeda, H. Furukawa has been withdrawn from the program of S22. It is a duplicate of the same paper presented in S23.

The paper **S21-O-16 'EVOLUTION OF GENE BANKS IN THE LIGHT OF MODERN MOLECULAR GENETICS'** by C. de Vicente has been withdrawn. In its place the following paper will be presented: **'GIS-ASSISTED EXPLORATION FOR CAPSICUM GENETIC RESOURCES IN PARAGUAY'** by D.E. Williams¹, A. Jarvis, K.A. Williams and L.Guarino ¹IPGRI Regional Office for the Americas c/o CIAT, A.A. 6713, Cali, Columbia.

Symposium 23 (S23): Issues & Advances in Transplant Production, Stand Establishment and Seed Research

Location: MTCC Room 201AB

Monday · August 12

S23-P-15A

PRELIMINARY RESULTS OF SOLID MATRIC PRIMING OF ARTICHOKE ACHENS

Giovanni Damato*, Nicola Calabrese

Dipartimento di Scienze delle Produzioni Vegetali, Istituto di Scienze delle Produzioni Alimentari -CNR V.le Einaudi, 51 70125 - BARI - ITALY

Artichoke (*Cynara scolimus* L.) is a member of Asteraceae family. Seed of this specie display wide variation in emergence rate which reduce the uniformity of seedling stands, specially when the temperature is higher than 25-30 °C. In previous research the use of polyethylene glycol lightened a negative effect on germination percentage and germination rate (Damato, in printing). This study was undertaken to individuate the water potential and matric priming duration on artichoke seed germination characteristics. Seed of artichoke, cultivar O44, were mixed with vermiculite #5 at seed : vermiculite : water ratio of 2.4 : 1 :

2.4 (-0.4 MPa) or 2.4 : 1 : 1.2 (-1.2 MPa) and primed at 15 °C for 4, 6 and 8 days. Non-primed seed were included in the germination test as control. Germination test was conducted at 30/20 °C immediately after treatments and 30 days later.

The less negative water potential (-0.4 MPa) and the priming duration of 6 and 8 days led to germination of seed during priming (15 and 40 %, respectively). In the first test of germination final germination percentage (FGP) was not influenced by priming treatments and T50 was longer in the control compared to treated seed. After priming treatment, with shortest priming duration and more negative water potential, FGP was similar to that of control, but germination value (Diavanshir and Pourbeik, 1976) was higher and T25 was shorter. Good result for matric priming of artichoke seed can be obtained with a priming duration of 4 days and a water potential of 1.2 MPa.

S23-P-15B

IMPROVEMENT OF CAPPARIS SPINOSA L. AND C. OVATA DESF. SEED GERMINATION BY DIFFERENT SOWING DATES IN TRAYS.

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Germination of caper seed is poor and erratic. Some researchers registered a germination percentage of 5-15 % within 2-3 months of seeding. In this paper we report the results of two experiments on the effects of different sowing dates in trays on germination characteristics in *Capparis* spp. seed. Experiment 1. Seed of different ages (7, 19, 31 and 43 months) of a strain of *C. spinosa* L. (Locale di Veglie) and *C. ovata* Desf. (Calabrese) was sown in flats with cell volume of 3.5 cm³ on January 18, February 20 and March 23, 1999. After sowing containers were transferred in a cold greenhouse. Emergence percentage (EP) was higher in *C. spinosa* (26 vs. 11 %). In *C. spinosa* EP was higher for seed 7 and 31 months hold (34%) while in *C. ovata* was higher for seed 31 months hold (18 %) and lower for seed 43 months hold (7 %). EP decreased linearly delaying the seeding date (from 48 to 2 % for *C. spinosa* and from 26 to 1 % for *C. ovata*). Experiment 2. Seed of two strains of *C. spinosa* (Locale di Veglie and Locale di Leverano) obtained in the summer of 1998 were sown in three different dates and conditions as the experiment 1. The span of germination was shorter in Locale di Leverano (48 vs. 58 d) but EP was higher in Locale di Veglie (34 vs. 17 %). EP decreased linearly delaying sowing date (from 52 to 3 %). Interaction effects are discussed.

S23-P-15C

A TWO-YEAR/TWO-CULTIVAR STUDY OF THE EFFECT OF PLANT DENSITY ON PUMPKIN YIELD

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Pumpkin cultivars Aspen and Howden Biggie were grown in northern Mississippi during the summers of 2000 and 2001 to investigate the effect of plant density on yield. Four plant densities of 'Aspen' were tested: 7578, 5051, 3362, and 2243 plants/ha (3068, 2045, 1361, and 908 plants/ac). These densities were equivalent to 1.3, 2.0, 3.0, and 4.5 m²/plant (14, 21, 32, and 48 ft²/plant), respectively. In a separate experiment, four plant densities of 'Howden Biggie' were also tested: 5051, 3362, 2243, and 1494 plants/ha (2045, 1361, 908 and 605 plants/ac). These densities were equivalent to 2.0, 3.0, 4.5, and 6.7 m²/plant (21, 32, 48, and 72 ft²/plant), respectively. Experiments were direct

seeded by hand 7 July 2000 and 1 Aug 2001. Plantings were drip irrigated and fertilized, and pests controlled, according to recommended procedures for the region. Weather during 2000 was unusually hot and dry and pumpkins matured quickly before fall. Weather during 2001 was unusually cloudy, rainy, and cool in late summer and early fall and pumpkins matured slowly. There were significant linear and quadratic relationships (P=0.05) among treatments and yield categories in 2000. A combined analysis of results from 2000 and 2001 will be presented.

S23-P-15D

PREMERGENCE WEED CONTROL IN CONTAINER-GROWN HERBACEOUS PERENNIALS.

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²Department of Horticulture and L. A., Colorado State University, Grand Junction, CO 81502

During the 2001 season, preemergent herbicides were applied to container grown herbaceous perennials and woody plants at both Fort Collins and Grand Junction and evaluated for weed control, phytotoxicity, and effect on plant growth. The herbicides and rates were: Oxyfluorfen + Pendimethalin (Scotts Ornamental Herbicide II) 3 and 6 lbs ai/A, Oryzalin (Surflan) 2 and 4 lbs ai/A, Oxadiazon (Ronstar) 4 and 8 lbs ai/A, Oxyfluorfen + Oryzalin (Rout) 3 and 12 lb ai/A, Prodiamine (Barricade) 0.65 and 1.3 lbs ai/A, Pendimethalin (Scotts Ornamental Weedgrass Control) 2 and 4 lbs ai/A, Benefin + Trifluralin (Team) 2 and 4 lbs ai/A. Herbicides were applied to *Rhamnus smithii*, *Buddleja alternifolia* 'Argentea', *Epilobium fleischeri*, *Fallugia paradoxa*, and *Othonna capensis*. All plant and herbicide combinations did not result in any significant decline in plant growth due to phytotoxicity. In several occasions, Rout and Ronstar resulted in significantly better weed control than other herbicide treatments.

S23-P-15E

ANATOMICAL ABNORMALITIES IN CABBAGE SEEDLINGS INDUCED BY THE HERBICIDE PENDIMETHALIN

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²Dept. of Horticulture, Cornell University, Plant Sciences Bld., Ithaca, NY 14853

Potted seedlings of cabbage were either mist-sprayed with carrier only (controls—Ctr) or with carrier plus 1.1 kg per ha (1.0 lb per acre) active ingredient pendimethalin (Pdm) at each of three seedling stages: 2–3 leaf, 5–6 leaf, and 6–7 leaf. Five seedlings each of Ctr and Pdm were harvested for histological study when sprays dried and at 1, 2, and 3 weeks thereafter. All Ctr plants were normal in development and grew more and larger leaves than did Pdm plants, which had modified structure. Extreme malformation occurred when 2–3 leaf plants were treated with Pdm, with decreasing effects seen in later sprayed, older seedlings. Features of seedlings sprayed at the 2–3 leaf stage included severely reduced leaf production, reduced leaf area, increased lamina and petiole thickness, leaf crinkling, loss of leaf and stem stiffness, leaf reflection, and reduced plant height. All tissues of Pdm plants showed reduction or lack of cytokinesis during cell division; thus, giant vacuolated, polynucleate cells resulted. In Pdm plants the shoot apex had only one tunica layer and a few-celled corpus of giant vacuolated cells, while that of Ctr plants had a 2-layered tunica and a corpus having small non-vacuolate cells. At initiation, a leaf primordium in Pdm plants had few, but giant cells, with precocious cell enlargement; this accelerated midrib and lamina thickening, but caused poor dif-

ferentiation of mesophyll and vascular tissues. Primary xylem in leaf and stem was especially affected: metaxylem initials became extremely large, multi-nucleate, and they failed to produce a thickened lignified secondary wall. Lack of wall lignification also occurred in the sclerenchyma of secondary xylem. Xylem conductivity and biomechanical support were thus compromised; yet, phloem cells appeared relatively unaffected. Teratological effects persisted at least six weeks in the 2-3 leaf seedlings, but effects dissipated in the growth of the 6-7 leaf seedlings over that time period.

S23-P-16A
THE EFFECT OF AUXIGRO ON THE YIELD OF SNAP BEAN AND BELL PEPPER

Alejandro Ching*

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Two cultivars of snap beans, 'Tendergreen' and 'Bluelake Bush' and three cultivars of peppers, 'Enterprise', 'California Wonder' and 'Jalapeno M' were grown on a Sharpsburg silty clay loam soil (fine montomorillonitic mesic Typic Arguidolls) at the Alternative Crop Experiment Station. These experiments were performed to determine the effect of Auxigro on the yield of snapbean and bell pepper.

The snap beans and peppers were grown under natural rainfall conditions and supplemented with sprinkler irrigation when soil moisture capacity reached 50%. Auxigro was applied when the crops reached their first wave of flowering at a rate of 0 kg/ha and 0.38 kg/ha. Auxigro was mixed with two drops of 90% silicon based surfactant and applied with a hand held spray applicator. These experiments were established utilizing a completely randomized block design with four replications.

The data indicated that the response of snap bean on the increased number of large sized pods showed significant differences at the P-0.05 level. No significant difference was detected on the average length of the different pod sizes. The cultivar 'Tendergreen' treated with Auxigro at a rate of 0.38 kg/ha exhibited an increase in yield for small sized bean pods between cultivars, and among treatments within each cultivar, and among cultivars. Significant difference at P=0.05 was detected in the yield of large sized bean pods. The increased yield response of snap bean to Auxigro appears to be cultivar dependent.

There were significant differences at P=0.05 level in the pepper experiment, among auxigro treatments between cultivars, and within cultivars x Auxigro interaction. It was evident that three applications of Auxigro at a rate of 0.38 kg/ha with each application increased yield by 41% over the control in the 'Jalapeno M' cultivar. For the three cultivars, the response to Auxigro on pepper yields seems to be cultivar dependent.

Symposium 25 (S25): Special topics in Plant Protection

Location: MTCC Hall B

Monday · August 12

S25-P-18
THE MANAGEMENT AND CONTROLLING DISEASES ON UNDER-TREE TURFGRASS

Guilin Cheng*, Chunying Wang, Dawei Li, Weizhang Liu

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The investigation has been carried out for management method and controlling diseases on under-tree turfgrass. The results indicated that there were significantly difference effects under difference kind tree on difference turfgrass. Effects included growth of turfgrass, diseases and their degrees. Moreover, the maintenance and controlling diseases method on under-tree turfgrass were suggested.

S25-P-19
STUDY ON THE GOSSYPOL STERILANT TO CONTROL RESISTANCE COTTON BOLLWORM(HELICOVERPA ARMIGERA)

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The cotton bollworm (*Helicoverpa armigera*) (CBW) can damage over 200 species plants that included many horticultural plants, such as *Tulipa gesneriana* L., *Dendranthema morifolium* (Ramat) Tzvel, *Rosa chinensis* Jacq., *Rosa multiflora* Thunb. etc., vegetables, corns and so on. But cotton is the most serious damaged by CBW and economic benefits are enormous. Moreover, we carried out controlling CBW in cotton fields. So far all single chemical insecticides and most of mixture insecticides have presented high resistance by CBW in north cotton areas of China. It is an effectively method to control resistance CBW with hereditary control tactics, for example, sterilitant. It is not only significantly decreasing density of field pest population but also is supplement for TPM. During 1983-1997, we carried out the gossypol that have been used prophylactic in 1970's in laboratory and field. The results indicated that sterility effect was rather good using gossypol to control CBW, *Phalera flavescens* Bremer et Grey, *Melalopha anachoreta* Fabricius, *Dioryctria rubella* Hampson, *Leucania separata* Walker etc. Before CBW mating, we fed adult with over 800 ppm gossypol in the laboratory, the efficacy was 100%. From 1995 to 1997, we applied mixtures including 3000 ppm gossypol, male sex allure and attractant to control 2nd, 3rd, 4th generation CBW at 333-1000 hectare cotton acreage. The results showed that gossypols were applied from 2.25 to 6.75g per hectare could decrease eggs 52.6-72.8%, mean 63.3%; decrease larvae 34.2-60.8%, mean 45.7% and increase 7.8-15.0%, mean 10.9% cotton yield as well as reduce 7 times chemical pesticide control per year. According to the data retrieval, it is first reported to use directly sterilitant and need not artificial rear, fly sterility male insect to control field pest in the world.

Symposium 25 (S25): Special topics in Plant Production

Location: MTCC Hall B

Monday · August 12

S25-P-20
APPLICATION OF PAPER MILL BIOSOLIDS TO ORCHARDS AND VINEYARDS

Debbie Norton, Robert Cline*,

Department of Plant Agriculture University of Guelph, Vineland

In Ontario the pulp and paper industry generates amounts of organic waste which requires landfilling; both expensive and hazardous. Land application of this material as a soil conditioner provides a disposal alternative. Because continuous cul-

tivation removes soil organic matter and reduces soil fertility, horticultural soils require added organic matter to assure nutrient availability and overall soil health. Traditionally, animal manures were used as a source of organic matter. As they become more scarce and costly other biodegradable byproducts are being used. Between 1991 and 1996, three research experiments were conducted to determine the effects of paper mill biosolids (PMB) on selected soil characteristics in orchards and vineyards. In the first experiment, starting in 1991 PMB at a rate 30 tonnes per hectare or cattle manure at a rate 40 tonnes per hectare (maximum allowable rates in Ontario) were applied for five consecutive years to apple, cherry and peach orchards growing on sandy loam soil. The control plots were left unamended. In 1996 the cumulative effects of the treatments were evaluated by measuring soil pH, percent organic matter, and concentration of nitrates and salts. Addition of PMB resulted in increased soil pH and increased percent of organic matter when compared to cattle manure or no amendment. The concentration of nitrates was the highest in plots with cattle manure followed by PMB. Data obtained from measuring concentrations of soil salts was variable and inconclusive. In the second experiment, starting also in 1991 two sources of PMB (Noranda or Quno) were applied at rates 30 tonnes per hectare for five consecutive years to two vineyards planted on sandy loam or clay loam soils. The control plots were left unamended. Between 1991 and 1995 soils were sampled annually and analyzed for percent organic matter. In general, application of Noranda or Quno PMB resulted in the increase of organic matter. However, the increase was greater in sandy loam soil (between 40-50%) than it was in clay loam soil (between 5% to 22%). In addition, Quno PMB had significantly greater impact on the percent organic matter in sandy loam soil than did Noranda PMB, while in clay loam soil the impact of both Quno or Noranda PMB was similar. In the third experiment, 'Concord' grape vineyard growing on clay loam soil was amended with Quno PMB at rates 0, 30, or 60 tonnes per hectare between years 1991 and 1996. Soil organic matter and grape yield were evaluated annually. In general, there was no significant effect of PMB on the percent of soil organic matter. However, grape yields were higher in 1993, 1995 and 1996 in plots treated with PMB at 60 tonnes per hectare. PMB like other organic amendments are not consistent in their physical and chemical characteristics. Although research has demonstrated their advantageous impact on soil and crops, long term research, comparing various sludge rates, soil types and crop species is still needed to better understand the long term implications. Then, more site specific guidelines for the use of PMB can be developed.

Symposium 25 (S25): Special topics in Vegetable Production

Location: MTCC Hall B

Monday · August 12

S25-P-21

GRAFT-INDUCED CMV RESISTANCE WITH MORPHOLOGICAL AND MOLECULAR TRAITS IN THE GRAFTING BETWEEN CAPSICUM ANNUUM AND WILD C.BACCATUM

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We have been studied on graft-induced genetic changes in

several crops. During our study, the possibility of gene transfer was found, indicating the existence of graft transformation in grafting system. We further study to make clear the mechanism and application of graft transformation to breed virus-resistant material. In the present study, we conducted the interspecific grafting between graft hybrid line d45-6 (*Capsicum annuum*) and the wild CMV resistant line LS1205 (*C. baccatum*) in attempt to introduce CMV resistance to the susceptible scion d45-6. Interestingly, some graft-induced changes, such as the shape and direction of fruits have been observed in the grafted scions and first G1 progenies, which derived from selfing of the grafted scion. Furthermore, the peroxidase isozyme band specific to the stock presented in the grafted scion and the G1 progenies. DNA polymorphism by PCR was also detected among scion, stock and their graft progenies. RAPD analysis using primer A04 showed that both the stock and scion presented different banding pattern. Most of the scion bands were shared by G1, and one of the stock bands also appeared in the graft progenies, and four unique band types were found in the G1 progenies. These results suggested that some graft-induced changes and graft transformation occurred in the grafted scion and some were heritable to the progenies.

Mechanical inoculation test with CMV (yellow strain) showed that the percentage of disease and disease index of G1 progenies were significantly decreased, similar to that of the resistant stock material. Thus, CMV resistance of the stock must have been efficiently introduced to the scion and transferred to the G1 progenies. In parallel, we also confirmed that in both homografting and interspecific grafting, CMV could migrate from the inoculated stock to the scion via the graft-union, vice versa.

S25-P-22

YIELDS OF ANTIMALARIAL SPECIES ARTEMISIA ANNUA L.

P.M. De Magalhães*, B. Pereira, A. Sartoratto

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Since the selection program of *Artemisia annua* L. species reached hybrid lines for high artemisinin content and improvement agricultural aspects (1,2), the program in CPQBA-UNICAMP has been evaluating, annually, on the behavior of new populations cultivated, considering: biomass yields, rates between leaves and stem, artemisinin content and essential oil (composition and yields). The genotypes were evaluated during the period from November / 2000 to March of 2001 in CPQBA-UNICAMP, in Campinas-SP, Brazil. They presented artemisinin range from 1.69 to 2.01 g/m². The essential oil yields from a population cultivated in large scale, as well as its composition, suffered variations according to phenologic stage of culture: at blooming, 0.40%, in the middle of flowering, 0.30% and close to senescence stage, 0.21%. In the same phenologic stages some majorities representatives compounds of essential oil varied respectively: (1,8 cineol) = 17.06; 21.88 and 28.76%; and (Canphur) = 28.44; 14.89 and 30.87%. The results provide parameters to standardize row matter with anti malarial subject as well as characterize the essential oils obtained from large-scale cultivation. 1. Delabays, N. (1997) "Biologie de la reproduction chez L'Artemisia annua L. et Genetique de la production en artemisinine. Thèse de Doctorat. Université de Lausanne. 2. Magalhães, P, Delabays, N., Sartoratto, A. (1997) "New hybrid lines of the antimalarial species Artemisia annua L. guarantee its growth in Brazil" *Ciência e Cultura Journal of the Brazilian Association for the advancement of science.* 49(5/6):413-415.

S25-P-23

EFFECTS OF SPRAYING OZONATED WATER ON THE SEVERITY OF POWDERY MILDEW INFECTION ON CUCUMBER LEAVES

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To assess whether ozonated water could be a possible alternative to chemical fungicides, the effects of spraying ozonated water (OW), containing 4 mg L⁻¹ dissolved ozone, on the severity of powdery mildew (*Sphaerotheca fuliginea* Pollacci) infection (PMI) and occurrence of visible disorder or injury on leaves of cucumber (*Cucumis sativus* L. cv. Sharp 7) grown in a glasshouse were investigated. Net photosynthetic rate of a cucumber leaf was measured before and after spraying the ozonated water to investigate the existence of a possible negative effect on photosynthesis. Distilled water (DW) treatment and non-treated control were also examined. For each type of water, 150 mL water per plant was sprayed on all expanded leaves once every 3rd or 4th day, 4 times in total. The severity of PMI in the OW treatment was contained to almost the same level as that before the first spraying, while PMI steadily increased in the control and DW treatment. The severity of PMI after the third spraying was significantly lower in the OW treatment than in the control and DW treatment. Spraying the OW did not cause any visible disorder or injury on the leaves. For both the OW and DW, there was no large difference in net photosynthetic rate of a cucumber leaf at photosynthetic photon flux densities of 300 and 500 mmol m⁻² s⁻¹ between 1 h before and 2 h after spraying. The results indicate that ozonated water can be at least a partial alternative to chemical fungicides for powdery mildew on cucumber leaves with no negative effects on leaf visual appearance and net photosynthetic rate.

S25-P-24

NITROGEN FERTILIZATION EFFECT ON *ALPINIA ZERUMBET* (PERS.) BURTT & SMITH

Jasmim*, J. M., Prado, M. A., Silva, J. C. C.

UENF/CCTA Av. Alberto Lamego.2000 Horto, Campos dos Goytacazes - RJ – BRAZIL, 28015-620

Alpinia zerumbet, rhizomes twenty centimeters in diameter and bearing three buds each were planted in the field, spaced 1,0 x 1,0 m, under three levels of nitrogen fertilization: 0, 20, 30 and 40 g N per plant; with four replicates and four plants per plot in a randomized block design. The number of leaves, suckers, and plant height, number of days until flowering and leaf nutrient contents were recorded at different times throughout plant development. In sixty days all rhizomes planted presented at least one fully developed leaf in all treatments. Plant height, number of leaves and suckers showed a steady increment as a function of time, whereas only leaf height was influenced by the increasing nitrogen levels. At six months no significant essential oil yield was observed. Inflorescence emergence was affected by nitrogen treatments and was recorded when plants were ten to eleven months old. Under the experiment environmental conditions thinning should be recommended for the plants too vigorous growth in all treatments.

S25-P-25

INTRA-INDUSTRY TRADE AND TRADE DIVERSIFICATION IN FRUIT AND VEGETABLES: THE CASE OF SLOVENIA

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This paper investigates trade geography, degree and level of external integration, quantitative and qualitative structures and patterns in Slovenian trade in fruit and vegetables. Slovenian trade deficit in fruits and vegetables is the most important in

agricultural and food trade deficit. Between 1992 and 1999, trade deficit in fruits and vegetables increased further as exports declined and imports increased. The trade deficit is the greatest with the European Union (EU) countries. The distinction is made between intra-industry trade (IIT) and inter-industry trade, degree and level of IIT, and IIT is separated on vertical IIT and horizontal IIT. The degree of matched two-way trade declined from 17.4% in 1992 to 11.3% in 1999 and hence the Slovenian trade in fruits and vegetables is largely inter-industry type suggesting a relatively low degree of external integration. The level of IIT declined indicating an absence of trade creation in two-way matched trade flows. Trade diversion from the former Yugoslavian markets to trade creation towards the EU-15 markets was the most pronounced. In 1992, about 66% of two-way matched trade occurred with the former Yugoslavian republics, while in 1999 it was less than 30%. On the contrary, the share of two-way matched trade flows with the EU increased from 29% to 66% during the same time. The export-to-import unit values declined slightly, but remained greater than one in trade with the EU and the former Yugoslavian republics. The diversification in trade structures was not supported as the number of traded product categories declined by almost 30% in the period 1992-1997, and recovered slightly after then. More than two-thirds of IIT is vertical IIT with either very high or very low export-to-import unit values. However, the proportion of vertical IIT declined over time, particularly in the value terms. The initial large spread in the export-to import unit values in the two-way matched trade flows declined closer to one as a reflection of a gradual trade liberalization, price competitiveness and quality alignment towards less substantial qualitative differences in exports vis-à-vis imports.

S25-P-31

INFLUENCE OF ONCE IN ALL OR GRADUAL REDUCTION OF OVERLAPPING APPLE TREE CANOPIES ON THE GROWTH AND FRUITING IN 17-YEAR-OLD 'FUJI'/MM.106/MALUS PRUNIFOLIA SEEDLINGS

Yong-Koo Kim*, Hyun-Hee Han, Chang-Ho Lee

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Overcrowded canopies in Korean commercial apple orchard are considered to be the major causes for the poor productivity and quality of the products. To investigate some practical remedies for the overcrowded canopy problems, opening of a 2m space between the south-north alleyway was put into trial with treatments of one-year-opening, two-year-opening, no opening with branch tying down, no opening without branch tying down treatments. One-year opening of 2m gab between adjacent tree canopies demonstrated larger amount of pruned branches, larger amount of sunrays during the growing season, larger amount of flower bud number per meter of branch, but with shorter length of overlapping canopies and eventually shorter canopy width from east to west of the canopy. One-year-opening produced larger amount of best colored fruits and larger amount of early harvested fruits. Additionally, one-year-opening of a 2m gab between the trees refilled the basal part of limbs in a tree with fruiting branches. Therefore, it is expected that opening 2m gab between the trees once in all would be best remedy for the overcrowded apple orchard.

Changes to the program of Special topics in vegetable production

Paper number S25-P-7 'DORMANCY OF BULB ONIONS CONTROLLED BY GROWING TECHNIQUE' by Sorensen, J.N. has been withdrawn.

Workshops

Changes to the program of Workshop 6

Workshop 6 'Particle Films: A new Paradigm for Modifying Fruit Tree Microclimate, Physiology, Horticultural Characteristics, and Pest and Disease Management.'

Panel Discussion participants are:

Dr. Matt Ciomperlik, USDA-APHIS, Fresno, CA., USA
Dr. Amnon Erez, ARO, Bet Dagan, Israel
Dr. Mike Glenn, USDA-ARS, Kearneysville, WV, USA
Dr. John Jifon, Texas A&M University, Weslaco, TX, USA
Dr. Jim McFerson, Washington Tree Fruit Research Commission, Wenatchee, WA, USA
Dr. Ernesto Prado, INIA, Santiago, Chile
Dr. Gary Puterka, USDA-ARS, Kearneysville, WV, USA
Dr. George Saour, Biotechnology Department, Atomic Energy Commission, Syria
Dr. James Schupp, Cornell University, Highland, NY, USA
Dr. Andrew Thomas, University of Missouri, Mount Vernon, MO, USA
Dr. Jens Wunsche, HortResearch, Havelock North, New Zealand

Changes to the program of Workshop 8

Please note the following additions to this workshop:
Convener Walter De Jong, Department of of Plant Breeding Cornell University

Speakers: George Tai (Agriculture and Agri-Food Canada, Fredericton, NB, Canada) Stephen Love (University of Idaho, Aberdeen, ID, USA) Robert Graveland (HZPC Holland BV, The Netherlands)

Changes to the program of Workshop 10

For presentation 'Developments in High Density Cherries in Germany' the authors are Martin Balmer, Michael Blanke* and S.L.V. A., Ahrweiler.