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fruits for a healthy world

3rd INTERNATIONAL SYMPOSIUM ON TROPICAL AND SUBTROPICAL FRUITS

September 12th to 17th, 2004 Fortaleza - Ceará - Brazil

PROGRAM AND ABSTRACTS

Promotion

International Society for Horticultural Science

Brazilian Society for Fruit Crop

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Universidade de Brasília

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Vegetables
Tropical Agroindustry
Genetic Resources & Biotechnology

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3rd International Symposium of Tropical and Subtropical Fruits

FRUITS FOR A HEALTHY WORLD

12 – 17 September 2004
Fortaleza, CE, Brazil

PROGRAM AND ABSTRACTS

Fortaleza, CE, Brazil
2004

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This publication can be purchased in the following address:

Embrapa Agroindústria Tropical
Rua Dra. Sara Mesquita, 2270 – Planalto Pici
Caixa Postal 3761
60511-110 Fortaleza, CE – Brazil
Fone: (55-85) 299-1800
Fax: (55-85) 299-1833
www.cnpat.embrapa.br
E-mail: sac@cnpat.embrapa.br

Editor:
Fernando Antonio Souza de Aragão and Ricardo Elesbão Alves

Scientific Committee (in alphabetic order):
Celso Valdevino Pommer, Fernando Antonio Souza de Aragão, Heloisa Almeida Cunha Filgueiras, João Batista Salmito Alves de Almeida, Márcio Cleber de Medeiros Corrêa, Maria do Socorro Moura Rufino, Maria Raquel A. de Miranda, Ricardo Elesbão Alves, Osvaldo Kiyoshi Yamanishi, Saul Dussan Sorria

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PRESENTATION

The Organizing Committee welcomes you to the 3rd International Symposium on Tropical and Subtropical Fruits. This conference is an established symposium held every 4 years. The first edition held in Kuala Lumpur – Malaysia, 1996, and the second in Cairns – Australia , 2000.

The aims of the symposium are to facilitate the exchange of scientific and technical information and to promote international cooperation in all aspects of tropical and subtropical fruits, including discussion of both fundamental and applied aspects of research, teaching and training, production, packaging and processing, extension, and marketing.

The third symposium will be held in Fortaleza, at the Ceara State Convention Center, simultaneously to the 11th International Week on Fruit, Flower and Agroindustry (11th FRUTAL). Frutal is well known in Brazil as the most important fruit business gathering with more than 35.000 participants in the last event. This is a great opportunity to make business deals, update information, and get to know new technologies.

Brazil

The largest country in Latin America and the fifth largest in the world, is best known internationally for its carnival at Rio de Janeiro. Throughout the country, carnival puts on different styles. Within a culturally rich environment, the mixture of Europeans, native Indians and Africans forged Brazilian society. That combination produced unique forms of artistic expressions and of dance, such as capoeira, which is also a form of martial art.

Brazil has a rich environment with more than 8.000 kilometers of coast and holds the largest part of the Amazon – the biggest rainforest in the world. An exuberant biodiversity is also found in the Pantanal of Mato Grosso – the world's biggest wetland, the Semi-Arid and the Cerrados (savannas) at the rural Brazil. These ecosystems are truly natural reserves of genetic resources yet to be discovered.

Until the 50's Brazilian economy was predominantly agricultural and soybean by-products of are still very important today. After industrialization, however, most of the economy output is based on manufactured goods, including cars, engines and generators, furniture, chemical products, iron and steel laminates, textiles and footwear. At the present, jet airplanes are the main single type of product among the country's exports.

The country has so diverse in its many regions that some people use to say that there is more than one Brazil. United by the language and by an easygoing culture, perhaps Brazilians recognize their identity by accepting that people are simply … different.

Located in Northeast Brazil, Ceará is one of the most progressive states in Brazil. The state's growth rate has been well above the national average for the last few years. Ceará's infrastructure has continuously improved with modernization of its roads, airport, and agribusiness and tourism sectors. The favorable climate and investments in irrigated horticulture have strengthened the state's agribusiness.

The state's capital town, Fortaleza, has 2.1 million people. The average temperature is 26.6ºC and there is sunshine throughout the year, along with a pleasant ocean breeze. Along Ceará's 573 Km coastline there is diverse landscape and endless potential for tourism. Walkways, bike paths, kiosks with all kinds of food, and playgrounds for children, besides craft and souvenir stands produced by local artists stretch along the tourist areas.

The Convention Center is one of the most complete and well equipped in Brazil. The center has 15 thousand square meters of under roof, auditorium, conference rooms, mini-auditoria and air conditioned pavilion for expositions, parking areas and a food court offers conditions to host all events.

Welcome to Fortaleza!

Sincerely,

ORGANIZING COMMITTEE

GENERAL INDEX

PROGRAM

Date	Time (h)	Event
12/09 Sunday	14:00 - 18:00	Registration* (Seara Praia Hotel)
	19:30 - 21:00	Symposium Opening Ceremony
	21:00 - 23:00	Welcome Cocktail
01/09 Monday	08:00 - 10:00	Session 1 – Conservation / Genetics / Breeding
	10:00 - 10:30	Coffee Break
	10:30 - 12:00	Oral Session 1
	12:00 - 13:30	Lunch Break
	13:30 - 15:30	Session 2 – Biotechnology / Genomics
	15:30 - 16:00	Coffee Break
	16:00 - 18:00	Oral Session 2
	19:30 - 21:30	Opening Ceremony of the 11th Frutal / AgriFlor Brazil 2004
02/09 Tuesday	08:00 - 10:30	Session 3 – Integrated Fruit Production – IFP
	10:30 - 11:00	Coffee Break
	11:00 - 12:00	Oral Session 3
	12:00 - 13:30	Lunch Break
	13:30 - 15:30	Poster Session 1
	15:30 - 16:00	Coffee Break
	16:00 - 18:00	Session 4 – Crop Manageent
	18:30 - 21:00	Workshop 1
	18:30 - 21:00	Workshop 2
	18:30 - 21:00	Workshop 3
03/09 Wednesday	08:00 - 10:00	Session 5 – Pest and Disease Manageent
	10:00 - 10:30	Coffee Break
	10:30 - 12:00	Oral Session 4
	12:00 - 13:30	Lunch Break
	13:30 - 15:30	Session 6 – Postharvest Technology
	15:30 - 16:00	Coffee Break
	16:00 - 18:00	Oral Session 5
	18:30 - 19:30	ISHS Meeting
	21:00 - 24:00	Gala Dinner
04/09 Thursday	08:30 - 10:00	Session 7 – Food Safety & Traceability
	10:00 - 10:30	Coffee Break
	10:30 - 12:00	Oral Session 6
	12:00 - 13:30	Lunch Break
	13:30 - 15:30	Poster Session 2
	15:30 - 16:00	Coffee Break
	16:00 - 18:00	Session 8 – Econoics and Market
	18:30 - 21:00	Workshop 4
	18:30 - 21:00	Workshop 5
	18:30 - 21:00	Workshop 6
	21:00 - 21:30	Closing Cereony
05/09 Friday	06:00 - 20:00	Technical Tours

* Continues on Monday (13/09) at the Convention Center

CONFERENCES

13/09/2004 - Monday

08:00 - 10:00
Session I: Conservation / Genetics / Breeding
Coordinators
Dr. Alberto Carlos de Queiroz Pinto (Embrapa Cerrados, Planaltina-DF, Brazil)
Dr. Ying-Kwok Chan (Malaysian Agricultural Research and Development Institute (MARDI), Kuala Lumpur, Malaysia)

13:30 - 15:30
Session II: Biotechnology / Genomics
Coordinators
Prof. Dr. Robert E. Paull (University of Hawaii at Manoa, Honolulu, Hawaii, USA)
Prof. Dr. Keizo Yonemori (Kyoto University, Kyoto, Japan)

14/09/2004 - Tuesday

08:00 - 10:30
Session III: Integrated Fruit Production – IFP
Coordinators
Prof. Dr. José Carlos Fachinello (Coordinator of Peach - IPF, Federal University of Pelotas, Pelotas-RS, Brazil)
Dr. Moacyr Saraiva Fernandes (President of Brazilian Fruit Institute - IBRAF, São Paulo-SP, Brazil)

16:00 - 18:00
Session IV: Crop Management
Coordinators
Dr. Levi de Moura Barros (Embrapa Agroindústria Tropical, Fortaleza-CE, Brazil)
Prof. Dr. Sisir Mitra (Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, West Bengal, India)

15/09/2004 - Wednesday

08:00 - 10:00
Session V: Pest and Disease Management
Coordinators
Dr. Guy de Capdeville (Embrapa Cenargen, Brasília-DF, Brazil)
Prof. Dr. Richard Ian Samuels (Universidade Estadual do Norte Fluminense, Campos dos Goytacazes-RJ, Brazil)

13:30 - 15:30
Session VI: Postharvest Technology
Coordinators
Dr. Heloisa Almeida Cunha Filgueiras (Embrapa Agroindústria Tropical, Fortaleza-CE, Brazil)
Prof. Dr. Fabio Mencarelli (Università della Tuscia, Viterbo, Italy)

16/09/2004 - Thursday

08:30 - 10:00
Session VII: Food Safety & Traceability
Coordinators
Prof. Dr. Carlos F. Demerutis Peña (The University of Earth, San José, Costa Rica)
Dr. Reginaldo Baez Sañudo (CIAD, Hermosillo, Sonora, Mexico)

16:00 - 18:00pm
Session VIII: Economics and Market
Coordinators
Prof. Dr. Flávio Borges Botelho Filho (Brazilia University, Brazilia-DF, Brazil)
Dr. Roedhy Poerwanto (Directorate of Fruit Crops and Directorate General of Horticulture, Ministry of Agriculture, Jakarta, Indonesia)

WORKSHOPS

14/09/2004 – Tuesday
(18:30 - 21:00 h)

Workshp I: Fresh fruits and the prevention of degenerative diseases
Coordinator
Dr. Heloisa Almeida Cunha Filgueiras (Embrapa Agroindústria Tropical, Fortaleza-CE, Brazil)

Workshp II: Particle film technology: a non-chemical alternative for pest management and fruit quality improvement by modifying tree canopy microclimate and physiology
Coordinator
Prof. Dr. Luiz Eduardo Bassay Blum (Brazilia University, Brazilia-DF, Brazil)

Workshp III: Tropical fruit breeding - Where we are now, and where we are going
Coordinator
Prof. Dr. Celso Valdevino Pommer (Brazilia University, Brazilia-DF, Brazil)

16/09/2004 – Thursday
(18:30 - 21:00 h)

Workshp IV: Challenges of irradiated fruits
Coordinator
Dr. José Maria Monteiro Sigrist (ITAL-FRUTHOTEC, Campinas-SP, Brazil)

ORAL PRESENTATIONS

13/09/2004 - Monday

Oral Session 1 (10:30 - 12:00 h) - Conservation / Genetics / Breeding

Coordinators

Prof. Dr. Luiz Carlos Donadio (Bebedouro Citrus Experimental, Bebedouro-SP, Brazil)

Dr. Aart Louw (Agricultural Research Council, Nelspruit, South Africa)

Oral Session 2 (16:00 - 18:00 h) - Biotechnology / Genomics

Coordinators

Dr. Jose Inaki Hormaza (Estación Experimental la Mayorca - CSIC, Algarrobo, Spain)

Prof. Dr. Rod Drew (Griffith University, Brisbane, Australia)

14/09/2003 - Tuesday

Oral Session 3 (11:00 - 12:00 h) - Crop Management

Coordinators

Dr. José de Arimateia Duarte de Freitas (Coordinator of Melon - IPF, Embrapa Agroindústria Tropical, Fortaleza-CE, Brazil)

Dr. Wojciech Janisiewicz (AFRS/ARS/USDA, Kearneysville, West Virginia, USA)

14/09/2003 - Wednesday

Oral Session 4 (10:30 - 12:00 h) - Crop Management

Coordinators

Prof. Dr. Luiz Eduardo Bassay Blum (Brazilia University, Brazilia-DF, Brazil)

Prof. Dr. Juan L. Silva (Mississipi State University, Starkville, Mississipi, USA)

Oral Session 5 (16:00 - 18:00 h) - Postharvest Technology

Coordinators

Prof. Dr. Zora Singh (Curtin University, Perth, West Australia, Australia)

Prof. Dr. Takayoshi Akinaga (University of the Ryukyus, Okinawa, Japan)

14/09/2003 - Wednesday

Oral Session 6 (10:30 - 12:00 h) - Postharvest Technology / Marketing

Coordinators

Prof. Dr. Raimundo Wilane de Figueiredo (Federal University of Ceará, Fortaleza-CE, Brazil)

Prof. Dr. Zen-hong Shu (National Pingtung University, Taiwan)

POSTERS

Tuesday and Thursday
(13:30 - 15:30 h)

General and Economic View

Genetics and Molecular Biology

Fruit Development

Pest and Disease Management

Food Science and Technology

CONFERENCES

C01

Conservation through genebanks of tropical and subtropical fruits in Brazil

Francisco Ricardo Ferreira[1], *Alberto Carlos de Queiroz Pinto*[2]
[1]Embrapa Genetic Resources and Biotechnology Research Center, PqEB P.O. Box 02372, CEP 70.770-900, Brasilia-DF, Brazil, fricardo@cenargen.embrapa.br
[2]Embrapa Cerrados, Km 18 BR 020, P.O. Box 08223, CEP 73.310-970 Planaltina-DF, Brazil

Fruit crop is an important industry in Brazil, being one of the first in fruit production in the world. Brazil is also one of the most important centers of genetic diversity for several important tropical fruits. The Brazilian plant genetic resources conservation model is composed by Embrapa Cenargen-Genetic Resources and Biotechnology and a network of genebanks spread out over the Country's Research Units, Universities and State Institutions. At Embrapa, the conservation of tropical and subtropical fruits genetic resources comprises 24 field genebanks. Along with several other germplasm collections this system has about 300 species and more than 10000 accessions under conservation, including duplications. All materials are maintained in the field, except a small collection of banana germplasm which is maintained "in vitro". Brazil has a strong collecting program for native species, such as pineapple, cashew and passion-fruit, and for exotic species, such as banana, mango and citrus a good exchange program is maintained. Morphological and molecular characterization and evaluation of the most important tropical and subtropical fruit germplasm is in progress in the active genebanks at Embrapa Genetic Resources and Biotecnology Research Center. The germplasm documentation has been updated through a national information system named Brazilian Genetic Resources Information System - SIBRARGEN. In this paper, the number of accessions per species, and the location where the collections are maintained are presented as well as other important data on conservation of tropical and subtropical fruits are discussed.

C02

The impact of breeding on fruit production in warm climates of Brazil

Celso Valdevino Pommer[1], *Wilson Barbosa*[2]
[1]Universidade de Brasília, Brasília, DF, Brazil, pommer@unb.br
[2]Instituto Agronômico (IAC), Campinas, SP, Brazil

The Brazilian fruit industry, the third largest in the world and with important participation on the agricultural GDP, can increase its international market competitiveness with investments in the search for new products. Certainly, the genetic improvement is the viable approach to reach such purpose, based on the progresses verified in Brazil in the last 50 years. Spectacular results were obtained with the improvement of temperate fruit cultivars for exploitation in subtropical-tropical climate, under low chilling. It is the case of the IAC Aurora and Tropical peaches, cultivated at places with warm and dry winter, in latitudes below 20ºS. Outstanding example in the subtropical fruits are the guava cvs 'Paluma', 'Rica' and 'Século XXI', dominant in the São Paulo State, being the first of them planted in more than 3,200 hectares. In the tropical fruits, the first Brazilian cultivars of passion fruit were released about 5 years ago and they already allow ambitious projects as the one of a fruit processing company whose harvest, in Mato Grosso State, yielded 54 $t.ha^{-1}$ (IAC 275 'Maravilha') and presented TSS of 18°Brix, turning the initial forecast of cultivation of 100 hectares to 250ha, with all the production exported to Italy. Other relevant results with pineapple, acerola, banana, orange, tangerine, cashew, Asian pear and grape breeding are, equally, reasons of success for the fruit production in the Brazilian agribusiness.

C03

The germplasm resources of tropical and subtropical fruits in China

Chen Houbin
Tropical & Subtropical Fruit Research Laboratory, South China Agricultural University, Guangzhou 510642, China

An area of approximately a half million square kilometers of the Chinese territory is with tropical and subtropical climates, about 5% of the country. They cover the whole Hainan and Taiwan islands, southern Guangdong, Guangxi, Yunnan and Fujian provinces, and the small isolated parts of Sichuan and Guizhou provinces. One hundred and fifty million people of 36 minorities live in the region and a large part of rely on fruits for their incomes. Tropical and subtropical fruits in China belong to 51 families, 125 genera and 275 species. Among them, litchi, longan, bananas, loquat, red hayberry, mandarin, orange were native, while mango, pineapple, coconut, jackfruit, papaya, guava, custard apple, sapodilla, cashew nut, macadamia, avocado and so on, were introduced. Litchi, an attractive red fruit species, is the most important for its export market, whereas bananas are one of the most profitable species in domestic market. There are 208 cultivars of litchis and 29 cultivars of bananas being recorded. Attempts for breeding of very early and very late varieties in litchi, and fusarium wilt resistant or tolerant bananas (Cavendish) cultivars are highly encouraged. In order to protect new cultivars of litchis (*Litchi chinensis* Sonn.) and bananas (*Musa* AAA Group, Cavendish), the guidelines for testing the distinctness, uniformity and stability (DUS) of new variety have been edited after extensive and long-term investigation. This paper briefly introduces the distribution, production, research and utilization of tropical and subtropical fruit species in China.

C04

Transgenic fruit crops – state of art and perspectives

Manoel Teixeira Souza Júnior
Embrapa Recursos Genéticos e Biotecnologia, Parque Estação Biológica, Final Av. W5 Norte, CP 02372, Brasília-DF, CEP 70.770-900, Brazil. msouza@cenargen.embrapa.br

In 1983 research groups in US and Belgium reported at scientific meetings in Florida and California the production of the first transgenic plants in laboratory. Eleven years latter, the first transgenic plant variety, a tomato with long shelf life, was released commercially. Just 20 years after the initial reports on transgenic plants done at the Miami and Los Angeles conferences, the global area of transgenic crops reached 67.7 hectares, grown by seven million farmers in 18 countries, with the global market value of genetic modified (GM) crops estimated to be between U$ 4.50 and 4.75 Billion(James, C. 2003). On May 1st. 1998, the 'Rainbow' papaya became the first transgenic fruit crop released commercially. This GM papaya, resistant to a Papaya ringspot virus, have controlled this virus in Hawaii and accordingly to recent figures out of the USDA's statistical service, it presently makes up 47% of the Big Island's approximately 780 papaya hectares. Although this GM papaya is still the only GM fruit crop available in the market, several different species of fruit crops were already successfully transformed in dozens of laboratories around the World, and some of them will certainly arrive on the market shelves in the near future. In this presentation the state of art on genetic transformation in Brazil and in the World is presented and discussed. A special attention is given to the 15 most important fruit crops in Brazil. Aspects related to biosafety of GM fruit crops, as well as the concept of integrated precision transformation system, are also discussed in na attempt to evaluate their role eliminating or reducing the limitations of the current methods of gene transfer, and setting the stage for the production of GM fruits with higher possibilities of getting to the market.

C05

CITEST: integration of genetic breeding, functional and comparative genomics of citrus

Astua-Monge, G., Targon, M.L.P.N., Takita, M.A., Freitas-Astua, J., Kishi, L., Souza, A.A., Coletta Filho, H.D., Amaral, A.M., Cristofani, Marcos Antônio Machado
Biotechnology Lab., Centro APTA Citros 'Sylvio Moreira', Cordeirópolis, SP- Brasil 13490-970. Embrapa Milho e Sorgo and Embrapa Recursos Genéticos e Biotecnologia. E-mail: marcos@centrodecitricultura.br
Financial support: Millennium Institute / CNPq

With the purpose of integrating all the knowledge accumulated so far on genetic mapping with new data on functional and comparative genomics of *Citrus* species and related genera, a large EST sequencing project has been initiated focusing on the response of citrus to different biotic and abiotic limiting factors. A total of 52 cDNA libraries will be constructed from mRNA of citrus plants obtained from different tissues inoculated with several important pathogens or exposed to stress conditions. So far, we have sequenced more than 152,000 clones, producing over 47,000 unique clusters. Our objective is to sequence a total of 270,000 ESTs from *Citrus sinensis*, *Citrus reticulata*, and *Poncirus trifoliate*. The scope of the project also includes the development of molecular markers such as SSRs and SNPs based on EST data, the establishment of an experimental field network for testing hybrids of sweet orange and mandarins in order to validate the genetic maps and the inheritance studies, and the integration of the functional genomic studies of citrus pathogens whose genomes have been fully sequenced (CTV, *Xylella fastidiosa* and (*Xanthomonas axonopodis* pv. citri) into the whole scenario of host-pathogen interactions. A bioinformatics facility has also been set up with the objective of automating the analysis of EST sequences and data mining.

C06

Papaya as a model tropical fruit species for development of conservation and breeding technologies

Rod A Drew, S. E. Ashmor, M. Azimi
School of Biomolecular and Biomedical Science, Griffith University, Nathan Q4111, Australia, R.Drew@griffith.edu.au

Papaya (*Carica papaya* L.) has been used in our laboratory to compare a range of technologies for ex situ conservation of important germplasm, before application to other tropical fruit species. It represents a good model species as it is not straightforward in terms of seed desiccation tolerance and it has been the subject of a major research effort in tissue culture and biotechnology. We have investigated seed storage behavior via: desiccation curves based on accurate water activity measurements; and, a range of storage environments from liquid nitrogen to 15ºC/15%RH. Treatments have been optimized to break dormancy and ensure germination after seed storage. Twenty years of accumulated experience in papaya cell and tissue culture has facilitated our investigation of cryopreservation protocols including vitrification based techniques, encapsulation and slow freezing, on a range of in vitro tissues from shoot tips to somatic embryos. Efficient molecular markers have been employed to assess genetic diversity within and between papaya genotypes and related *Vasconcella* species. Plants that were recovered post-cryopreservation have been screened for changes in genomic DNA and DNA methylation using the Polymerase Chain Reaction (PCR) based Randomly Amplified DNA Fingerprinting (RAF) and Amplified DNA Methylation Polymorphism (AMP) techniques; and are being evaluated in field plantings. This research has lead to the development of optimum protocols for ex situ conservation of papaya germplasm, both as seed and vegetative tissue and has application to other tropical fruit species.

C07

Integrated production: a reality in fruit growing

José Rozalvo Andrigueto[1], *Adilson Reinaldo Kososki*[2]
[1]Fruit Production Development Program - MAPA and Coordinator of PROFRUTA email jrozalvo@agricultura.gov.br
[2]Member of de Management Group for the Fruit Production Development Program e-mail adilsonkososki@agricultura.gov.br

The Integrated Production of Fruits – PIF – is based on productive basis organization, process sustainability, system monitoring and information (data). The Ministry of Agriculture, Livestock, and Food Supply – MAPA – is responsible for this project. It comprises 5 Universities, 6 State Institutions of Research and Technical Assistance and 9 Research Centers of Embrapa. It also comprises 15 fruit species (apples, grapes, mangoes, papaya, citrus, cashew, coconut, bananas, melon, peaches/nectarines, guavas, persimmons, passion fruit, fig and pineapple). The Conformity Evaluation Patterns now being introduced in Brazil, demands basically organized processes of all productive system. It presents the Legal Marks for the PIF development process. Such institutional, technical and operational process is formed by the general guidelines and general technical official norms of a number of documents and other important components. Such document is the result of the partnership between MAPA, Inmetro and CNPq. All operational process, its attendance and monitoring are based on the voluntary adhesion of the growers and packing companies registered by Inmetro. The system regulation assures that the registration of the interested ones is a pre-requisite necessary to be followed. The specific technical norms – NTE – for each fruit present: NTE (15 thematic areas), Agro-chemical charts for each agro-ecological regions, Field and Post-Harvest Notebooks and Checking Lists (Field and Packing Houses).

C08

Integrated production of mango and grape in the San Francisco Valley, Brazil

Paulo Roberto Coelho Lopes
Project Coordinator, Embrapa Semi-Árido Researcher proberto@cpatsa.embrapa.br

Brazil started to use the Integrated Fruit Production (PIF) as the official system of fruit certification to guarantee the alimentary security and traceability. The Integrated Fruit Production Program for Mango and Grape in the Valley of the San Francisco, was initiated by means of the producers demand in the region, worried in taking care of the European market requirements, which could impose restrictions to the importations of mangoes produced in the region. The Production System had been implanted in commercial orchards, following the adopted standards world-wide, since that the import countries belong to the European Union, of which the English and German markets are the most demanding in environmental questions. Today, it has the participation of 96 mango companies (6,065 ha) and 67 table grapes companies (2,977 ha), and an estimate of 30% increase of adhesions per year. Amongst the economic advantages emerged with the PIF, it is cited reduction of the arisen costs of production because of the rationalization in the use of agricultural products in the order of 40% and 35%, respectively, for the mango and grape culture. Despite the PIF being a proposal of sustainable agriculture under the ecological, economic and social points of view, we have faced some problems, as for example, the lack of a roll of registered agrochemicals that allow the conclusion of the process of Evaluation of the System Conformity.

C09

Marketing tendencies of tropical fruits and integrated fruit production in Brazil

Vitor Hugo de Oliveira
Embrapa Agroindústria Tropical, CP 3761, CEP 60511-110, Fortaleza, CE, Brasil, vitor@cnpat.embrapa.br

The international marketing scenario shows that for the production of any commodity emphasis must be taken on production quality and environmentally friendly technologies. The main Brazilian fruit importer countries as well as the type of fruits exported from Brazil have shown high marketing perspectives regarding the adoption of clean production methods and the changing habits of consumers by preferring safe products meant by: (i) most consumers, mainly European ones are moving by searching for products like fruits and vegetables free from pesticide residues which are harmless to health; (ii) the enforcement of European food market chains represented by EUREGAP which have pressured the exporter countries to follow rules of production standards meant by reduction of pesticide residues, environmental safety production procedures and working conditions of labors in field and post harvest caries. In Brazil, Integrated Fruit Production (IFP) system aim the production high quality food by using clean technologies taking into consideration environmentally friendly practices in order to fulfill requirements of a sustainable agricultural development. The IFP is regulated by specific technical guidelines which enforce accomplishment of production and processing standards regarding soil, water, plant and post harvesting treatments. The IFP guidelines are classified in four categories: mandatory, recommended, forbidden and allowed with restrictions. All these requirements are strictly followed and supervised aiming a high quality and a certified product. At moment there are fifteen species of fruit crops under IFP system. In the near future other commodities like grains, flowers and vegetables will be under theses regulations.

C10

Postharvest handling of horticultural crops produced under integrated producing systems

Reginaldo Báez Sañudo
Centro de Investigación en Alimentación y Desarrollo, A.C.
Carr. a La Victoria Km. 0.6, Hermosillo, Sonora. México. e-mail: rebasa@hmo.megared.net.mx; rbaez@cascabel.ciad.mx

Different countries are developing the basis of integrated production for different economical important crops and establishing production norms or rules in order to get quality certification. This procedure is the guarantee for product traceability for better exportation with consumer acceptance. Those countries had established standards procedures for specific fruit and vegetables production, but these standards do not refer the post harvest handling procedures, necessary to reach the markets with high quality fruits and vegetables. The recognizing by a third party of the application of GAP's and GMP's some based in recognized HACCP had been required by the customers from the main importers countries. There are some commercial trade marks that are certifying these applications and are using logos like eurepgap, SQF, QC, AB, but the need of experts to develop and implement the systems into the growers is required. The systems must be consist of the field and water used recognized, personnel training, safe and quality system implementation with the specific procedures documented (SSOP's), audits realization and procedures in order to assure the customers requirements. By the other hand, markets are requiring fruits and vegetables with high quality referring the intrinsic characteristic such are depending of the postharvest handling and must be handling into the quality system implemented.

C11

Production of sapindaceae fruits in China

Xuming Huang
Physiology Laboratory for South China Fruits, College of Horticulture, South China Agricultural University, Guangzhou 510642, China, huangxm@scau.edu.cn

Sapindacae fruits commercially cultivated in China include litchi (*Litchi chinensis* Sonn), longan (*Democarpus long*) and rambutan (*Nephelium lappaceum* L). Litchi and longan originated and have been cultivated for thousands of years in south China. Cultivation of rambutan started in late 1960s, while introduction the fruit from Malaysia and Thailand dates back to the early 1900s. Commercial activity of litchi and longan is concentrated in Guangdong, Guangxi, Fujian, Taiwan and Hainan provinces, with a minor industry in Sichuan, Yunnan and Guizhou, while rambutan production is confined in southern Hainan. The areas under litchi, longan and rambutan are 584,000, 444,000 and 2000 ha producing about 1000, 600 and 5 thousand tons respectively. Over 60% of the orchards have been developed in the last decade. Most of the fruits are marketed domestically with less than 2% of production exported. The large production of litchi and longan in relatively short season plus the short shelf-life of the fruits has highlighted the urgent need to increase the capacity of postharvest handling and marketing in China. Besides postharvest problems, the industry is also constrained by problems such as irregular bearing, unfavorable weather, pest and diseases and the poorly organized production by individual growers. Current R & D activities are targeted to these major constraints.

C12

Pineapple crop management in response to brazilian market demands

Domingo Haroldo Reinhardt
Embrapa Mandioca e Fruticultura, CP 7, CEP 44.380-000, Cruz das Almas-BA, Brazil, dharoldo@cnpmf.embrapa.br

Brazil has been one of the three largest pineapple producers in the world over the past ten years, reaching a volume of 1.4 billion fruits or about 1.9 million metric tons, in 2002, from 61,000 hectares harvested, according to the IBGE (Brazilian Institute of Geography and Statistics). 99 % of this production is consumed inland, mostly on fresh fruit markets located at long distances from the main production areas. Consumer preferences may be influenced by regional habits, but usually the demand is for large (>1.5 kg), sweet and juicy fruits, with a good external appearance, including a partly yellow rind. Lower volume of fruits offered from February to April has determined higher prices on farmer and consumer levels. Those demands and market characteristics have influenced pineapple crop management in Brazil, resulting in adjustments of traditional cultural practices and the introduction of new ones, which will be addressed in this work. Emphasis will be given to aspects of planting systems and their interaction with fruit sizes, strategies to reduce natural flowering and get off-season fruit harvest and to the selection of genotypes and cultural practices related to fruit quality.

C13

Glyphosate: secondary effects on plants and physiological implications

Paulo Roberto de Camargo e Castro[1], *Tsuioshi Yamada*[2]
[1]USP/ESALQ – Dep. Ciências Biológicas, CP 9, CEP 13418-900, Piracicaba-SP, Brazil, e-mail: prcastro@esalq.usp.br
[2]Diretor POTAFOS

Direct sowing or no tillage system is used today in 25 millions of hectares or in 50% of the area covered with annual crops in Brazil. The adaptation of this practice by the farmers was just possible by the development of herbicides, among them glyphosate, the most important and applied. The no tillage system brings very important benefits to the agriculture and to the environment, but the herbicides may also promote some undesirable side effects. The objective of this purview was to analyze the glyphosate action mechanisms, the possible side effects and the way of use with the best efficiency as possible for the sustainable agriculture system, with the maximum economical harvest. Through the photosynthesis the plants produce organic compounds considered primary and secondary metabolites. Glyphosate is the most important herbicide that affects the synthesis of secondary metabolites (shikimic acid, acetate and aliphatic amino acids) because it can inhibit the path of shikimic acid with several physiological and ecological implications. Glyphosate blocks indolyl acetic acid (IAA), phytoalexins, lignin and protein synthesis, photosynthesis, respiration, transpiration, membrane permeability and others. It's necessary the herbicide attain to the target plants (weeds) without interference or translocation to the crop plant.

C14

Strategies for the use and enhancement of biological control of postharvest fruit decays

Wojciech J. Janisiewicz
Appalachian Fruit Research Station, United States Department of Agriculture, ARS, Kearneysville 25430, West Virginia, USA. wjanisie@afrs.ars.usda.gov

Biological control of postharvest decays (BCPD) has been used commercially on pome and citrus fruits since 1996 in the United States, and its use were later expanded to include cherries and seed potatoes. The spectrum of activity of these biocontrol products differs with respect to fruit type and maturity, stage of pathogen infection, and specific pathogen causing decay, and is not as broad as fungicides. Thus, commercial use of BCPD has been targeted for certain commodities and may even be limited to certain postharvest applications within a commodity. Unlike fungicides, currently registered biocontrol products are exempt from residue tolerance by the U.S. Environmental Protection Agency and can be used well into storage even to the point of packing fruit for shipment. Recent research has focused on improving biocontrol itself and/or combining BCPD with other alternative methods to synthetic fungicides. The efficacy of BCPD has been improved by developing antagonist mixtures, and manipulation of growth and formulations of antagonists. Manipulation of biocontrol mechanisms have not yet resulted in improved biocontrol. The potential of foreign antimicrobial genes introduced into antagonists is also being explored. Greater efficacy and broader spectrum of postharvest decay control on fruit was achieved by combining BCPD with heat treatment, GRAS substances, lytic enzymes, or the induction of resistance in fruit by physical or chemical means.

C15

Integrated management of tropical fruit diseases

Laércio Zambolim
Professor of Integrated Disease Management, Plant Pathology Department, Federal University of Viçosa, Viçosa-Minas Gerais, Brazil, zambolim@ufv.br

The term Management implies "utilization of all the available techniques within a unified program, in such a manner to maintain the population of harmful organisms below the Threshold of Economical Damage, without harm to the agro-ecosystem. The model based on large scale continued application of agrochemicals for tropical fruit disease (TFD) control resulted in environmental imbalance, high residues in fruits, contamination of operators, and increased production cost. The TFD varies from region to region, field to field, and according to the season, microclimate, altitude at which the crop is grown, soil type, and within a farm it can vary from site to site. The establishment of the management strategies for TFD should know the pattern and the spatial-temporal disease distribution; sampling techniques, evaluation frequency, disease quantification scales, the economical yield loss potential the disease represents, and finally the decision making for the control. All the diseases that develop on tropical fruit plants occur because one or more predisposing factor is in disequilibria. The tactics most commonly used in the control of TFD involve a combination of genetic resistance, plant nutrition, cultural practices, appropriate fungicides, anti-resistance strategy and healthy seedlings. However, there are numerous other measures such as careful selecting planting site, the crop conduction tactics, irrigation method, rouging of diseased exotic plants, use of organic composts, programmed pruning, elimination of diseased crop residues.

C16

Apple integrated pest management in Santa Catarina State: ue of *Neoseiulus californicus* (Acari: Phytoseiidae) for control of *Panonychus ulmi* (Acari: Tetranychidae)

Lino Bittencourt Monteiro
Professor of Acarology and Integrated Pest Management, Federal University of Paraná, Paraná, Brazil, lbmonteiro@terra.com.br

Apple producers in the region of Fraiburgo, State of Santa Catarina, have been using biological control of European red mites (*Panonychus ulmi* Koch) since 1995. In 10 years the continuous use of biological control strategies indicates a great evolution in ecological conception of these apple producers. Control strategy was proposed based on phytoseids (*Neoseiulus californicus* McGregor) raised in a greenhouse followed by successive inoculative releases in the orchard. Phytoseid produced in the greenhouse and naturally grown in pruned branches were used to release in apples areas with high population rates of European red mites. The insecticides effects on phytoseids were used to choose the pesticides to control the other pests. Weed management on tetranychid mites (*P. ulmi* and *Tetranychus urticae*) and phytoseids movement was evaluated. The highest population of *N. californicus* was observed where weed development in the orchard was not controlled by herbicide. In the years following its introduction, *N. californicus* resurged on the apple trees, migrating from weed to apple trees on December of each year. The reduction of European red mite populations was significant, and the use of acaricides was not necessary. In Fraiburgo region biological control have been applied to more than 7.000 ha (17,297 acres), and other projects of arthropods biological control have been tested.

C17

Fruit softening during ripening - causes and regulation

Robert E. Paull, Nancy Jung Chen
Tropical Plant and Soil Sciences, University of Hawaii at Manoa, Honolulu, Hawaii 96822. U.S.A

Fleshy fruits have evolved repeatedly in several plant clades, including five times in Rosaceae. Different tissues have become the fleshy edible portion including the mesocarp, accessory tissues, aril, and flower tissue. Hence, ripening physiology may differ significantly between different species. Temporal and spatial differences exist between species in ethylene production and respiration rates and softening related changes. Papaya ripening illustrates some of the differences that can occur between species. Papaya's unique ripening variants in which skin and flesh color development are separated from respiratory rise and ethylene production, and softening. One variant softens to the edible stage in six days versus 11 days for the commercial varieties and another that does not begin to soften until 14 days from mature green stage and reaches the edible soft stage at 21 days. These papaya variants contrast sharply with the profound disruption shown by the tomato single gene ripening mutants. We have also purified a fruit ripening associated endoxylanase that is 32.5 kDa and coded for as a 64.96-kDa protein. The protein contains a secretory sequence, carbohydrate binding domain and the endoxylanase catalytic domain. Endoxylanase expression data from the ripening variants supports the possibility that it has a role in papaya mesocarp softening during ripening. The results suggest that different fruit may use different combinations of cell wall hydrolases to cause ripening related fruit softening. Tomato can be a model in that it can provide research direction. In a different fruit the results from tomato need to be confirmed at gene expression, physiology and functional level.

C18

Effect of volatiles to maintain postharvest quality of tropical and subtropical Fruits

Gustavo A. González-Aguilar
Centro de Investigación en Alimentación y Desarrollo, A.C. (CIAD, AC). Carretera a la Victoria Km 0.6, La Victoria. Hermosillo, Sonora (83000) Mexico, gustavo@cascabel.ciad.mx, www.ciad.mx

The objective of this seminar is to present the effects of different volatiles used to reduce physiological disorders of mango, papaya, guava and tomato. Some of the volatiles studied include methyl jasmonate, ethanol, 1-MCP and hexanal. Methyl jasmonate treatment reduced significantly chilling injury (CI) and deterioration of papaya, mango and guava fruit stored at 10, 7 and 5°C, respectively. The effectiveness of MJ was related to the induction of some enzymes like phenylalanine ammonia-lyase (PAL), lipoxygenase (LOX), and metabolites such as polyamines, abscisic acid, some phenols, flavonoids and new proteins (JIP's). 1-MCP treatment had no effect on quality of mango fruit, stored at 5, 10 and 20°C. The use of MJ in conjunction with 1-MCP did not prevent ethylene synthesis in mango and papaya fruit and no beneficial effects on quality of mango fruit were observed. Ethanol was effective to reduce deterioration of papaya and tomato but did no prevent CI and suppressed ethylene synthesis, compared with controls. The possible mode of action of these volatiles to preserve postharvest quality will be discussed.

C19

Alleviation of low temperature injury in tropical and subtropical fruits

Chien Yi Wang
Produce Quality and Safety Laboratory, U. S. Department of Agriculture, ARS, Beltsville, MD 20705-2350, USA, wangc@ba.ars.usda.gov

Methods that have been shown to alleviate chilling injury of tropical and subtropical fruits include temperature preconditioning, heat treatment, intermittent warming, controlled atmosphere storage, treatments with calcium or other chemicals, waxing, film packaging, genetic modification, and applications with ethylene, abscisic acid, methyl jasmonate, polyamines, or other natural compounds. Low temperature conditioning and intermittent warming maintain high levels of phospholipids, increase the degree of unsaturation of fatty acids, increase spermidine and spermine levels, and stimulate free radical scavenging enzymes. Heat treatment induces heat shock proteins, suppresses oxidative activity, and maintains membrane stability. Methyl jasmonate can increase pathogenesis-related protein and alternative oxidase gene expression. Polyamines may act as free radical scavengers and membrane stabilizers. Genetic modification aims at transfer of chilling-resistant genes into sensitive species. All of these treatments can enhance chilling tolerance of tissues and reduce low temperature injury of chilling-sensitive tropical and subtropical fruits.

C20

Safety related issues for the production, packing, and distribution of fresh fruits in the USA

Juan L. Silva, Taejo Kim
Department of Food Science, Nutrition, and Health Promotion, Mississippi State University, Box 9805, Mississippi State, MS 39762, USA, jls@ra.msstate.edu

Increased demand for fresh fruits and vegetables coupled with increased surveillance, have led to an increase number of produce related food-borne outbreaks. Studies have shown that the incidence of pathogens in domestic and imported products is about 2-4%, however some products specific to regions have been banned from importation. Reports show that the implementation of safety practices on the farm and at the packinghouse is sometimes not adequate to insure a safe product. Lack of infrastructure, hygiene, and inadequate or poor water handling are some of the major causes of produce contamination. We will review some produce outbreaks, the causes, the fresh produce safety system, and recommendations. The major causes of produce-related outbreaks in the USA are microbiological (~85%), but chemical hazards are still significant in some countries. Moreover, the great majority of food-borne outbreaks occur in the foodservice arena (~75%), but farm and packing operations have also been implicated. The cost of implementing a food safety system in a produce operation is estimated at 20% of the cost of production, with little return. However, not implementing these systems will lead to loss of market, potential civil and criminal liability, and loss of jobs. We will review some important outbreaks in raspberries and strawberries, tomatoes, apple juice, and melons, reported surveillance data, and other sources. Recommendations which programs and how to implement them will be discussed, with validation as a required tool.

C21

Traceability for fruits in natura and industrialized

José Carlos Fachinello
Federal University of Pelotas, CP 354, CEP 96010-900, Pelotas-RS, Brazil, jfachi@ufpel.tche.br

Besides the quality it expresses of the fruits, the market started to demand control and registration on the whole production system, including analysis of residues of pesticides in the fruits, evaluation about environmental impact and the health, or be, it is necessary that traceability of the whole productive chain is had, assuring to the consumer transparency of the system and production process. The consumer's alimentary safety became one of the most critical and priority subjects for the chain of nutritious supplies. The traceability is an administration option for analysis of risks and it carries out an important function in the inspection systems and certification of victuals during the import and export process. The increase of the Brazilian participation in the international market, mainly in Europe, forced the assistance of this demand, because, according to the Law of the European Union nº 178/2002, in Article 18 – "the traceability will be assured in all of the phases of the production, transformation and distribution of the nutritious goods, of the victuals for animals, of the animals producing of nutritious goods...". The traceability for the productive chain of fruits presents a standardized solution for the production phases, guaranteeing integral control of the whole productive process, is at the orchard, classifying, industrialization and distribution, rebuilding the technician-commercial history.

C22

Brazil at the Center of the worldwide fruit market

Moacyr Saraiva Fernandes
IBRAF - Instituto Brasileiro de Frutas, Av. Ipiranga 952, 12º andar, 1040-960 São Paulo-SP, Brazil, ibraf@uol.com.br

Brazil, the third largest producer of fruit in the world (38 million tons) behind China (133 million tons) and India (58 million tons), wants to increase its participation in the International Market. This is one of the main goals of the Horizontal Project for Promoting Brazilian Fruit Exports, coordinated by IBRAF – the Brazilian Fruit Institute – in partnership with APEX BRASIL – the Brazilian Exports Promotion Agency. Over two years approximately R$8.5 million will be invested in the Horizontal Project, with R$4 million being financed by APEX-BRASIL and R$4.5 million coming from private sources. IBRAF's expectation is that it will attract 500 new companies – growers and/or exporters. Currently the Brazilian fruit-growing sector employs 5.6 million people, which corresponds to 27% of the total labor force employed in agriculture. Fruit growing is one of the segments with the greatest potential for growth in the Brazilian export market. "This program is a great opportunity to consolidate the Brazilian fruit-growing industry in a competitive way and conquer the world market". Overt the last four years (1998/2002), the volume of fruit exports has grown by approximately 127.04%, leaping from 294,614 tons to 668,906 tons and generating revenues of US$ 241.04 million – 102.4% greater than in 1998 (US$ 119.09 million). The objective of the Brazilian Fruit program is to organize and build up the capabilities of the sector and creates a model of competitiveness that is strong enough to establish the Brazilian fruit "brand" in external markets.

C24

A brand, a quality, a market

João Miguel Sobral Costa Mota Mendes
BARGOSA PORTUGAL, Unipessoal Lda., MARL – Pav. A11, 2670-838 S. Julião do Tojal, Loures, Portugal

When marketing fresh produce several strategic questions must be answered in order to prepare a business plan that will cover the whole spectrum of commercialization, enabling success to be obtained. It all begins in production. What to grow and with what objectives? How to produce/grow? Where and in what conditions? Once this is covered and we have a product, then we must market it and more questions arise. How to pack the product? What presentation? What volumes? To which destinations? What quality and for which type of client? The logistics needed? Promotions, press releases or other marketing tools? What cost to reach x profitability in y time? Using Papayas and Mangoes as an Exotic fruits example, I will create a case covering these key issues. Using Melon and Limes as subtropical fruits the same will be done.

WORKSHOPS

W01

Antioxidants in fruits and their possible apticancer property

Shiow Ying Wang
Agricultural Research Service, USDA, Beltsville, MD., 20705, USA, wangs@ba.ars.usda.gov

Fruits have been shown to contain high levels of antioxidant compounds such as carotenoids, vitamins, phenols, flavonoids, dietary glutathionine, and endogenous metabolites. These antioxidants are capable of performing a number of functions including acting as free radical scavengers, peroxide decomposers, singlet and triplet oxygen quenchers, enzyme inhibitors, and synergists. Active oxygen species are generated as by-products of normal metabolism. Increased levels of these active oxygen species or free radicals create oxidative stress, which leads to a variety of biochemical and physiological injuries often resulting in impairment of metabolism, and eventually cell death. There is little doubt that successful prevention will be the key to controlling morbidity and mortality from chronic diseases affecting humankind. The different antioxidant components found in fruits provide protection against harmful free radicals and have been associated with lower incidence and mortality rates of cancer and heart disease, in addition to a number of other health benefits. This talk summarizes the antioxidant capacities of various fruits, and the factors which affect their antioxidant activities such as crop genotype variation and maturity, pre-harvest conditions, post-harvest handling and processing. Many attractive opportunities exist for enhancing the quantity and quality of essential nutrients present in fruits. Discussion will be made on some strategies for establishing a new research and production paradigm such as improving selection criteria among different horticultural cultivars, and improving pre-harvest conditions and post-harvest handling to enhance nutrient quality. Evidence will also be presented on the prevention and inhibition of tumor growth by fruit extracts and bioactive compounds isolated from fruits.

W02

Prevention of lipophilic compounds oxidation

Jorge Mancini Filho
Departamento de Alimentos e Nutrição Experimental, Faculdade de Ciências Farmacêuticas, Universidade de São Paulo-SP, Brazil, j.mancini@usp.com

The oxidative deterioration of fats and oils in foods is responsible for rancid and flavour, with a consequence of nutrition quality loss and the aldehydes and ketones compounds formation with toxic potential. The unsaturated fatty acids with more than one double bond are more susceptible to oxidation than other fatty acids. The loss of hydrogen of the carbons atoms between the double bonds results in one free radical that can react with oxygen to produce hydroperoxide compounds. These structures are very unstable and responsible by the formation of secondary compounds. The presence of antioxidants is necessary to prevent oxidative rancidity. Normally synthetic antioxidants as butylated hidroxyanisol (BHA), butylated hydroxytoluene (BHT) and tert-butyl hydroquinone (TBHQ) are added to the food. Sources of natural antioxidants compounds as vitamins C and E, carotenoids and phenolic compounds are present in fruits and vegetable. These compounds are thoroughly distributed in the nature and can prevent the food oxidation by different mechanism as hydrogen donator, metal chelators, scavenging radicals and decomposing peroxides. Often, more than one mechanism is involved, therefore causing homo or hetero synergism. The antioxidant activity can be measured by the protective action toward lipid oxidation, by linoleic acid and β carotene model system, or using vegetable oils or fish oils as substrate to oxidation. All those antioxidants synthetic and these from natural sources are substances that can prevent the lipophilic compounds oxidation.

W03

Tropical and subtropical fruits: phytonutrients and anticipated health benefits

Beverly A. Clevidence
Diet and Human Performance Laboratory, Beltsville Human Nutrition Research Center, Agricultural Research Service, USDA, Beltsville, MD, 20705, USA, ClevideB@ba.ars.usda.gov

Tropical fruits are rich sources of phytochemicals, and these compounds hold promise for preventing disease and extending productive, active lifespans. Phytochemicals can be classified as isoprenoids (e.g., carotenoids, limonoids), flavonoids (e.g., anthocyanins, flavanones) and other phenolic compounds, and amino acid-based (e.g., capsaicinoids) compounds. Although phytochemicals are best known as antioxidants, protection may also be provided by phytochemical-induced upregulation of detoxification enzymes, communication among adjacent cells, apoptosis, and control of angiogenesis. Phytochemical content of fruits can vary widely within and among varieties, and storage and processing of fruits can affect stability and bioavailability of these compounds. The body of knowledge linking individual phytochemicals to human health is intriguing, but efficacy is uncertain and dietary recommendations for individual phytochemicals are premature. There is, however, a strong scientific-base of evidence for recommending increased consumption of phytonutrient-rich whole foods for health promotion and disease prevention.

W04

Antioxidant activity of Northeastern Brazilian fruits

Selene Maia de Morais, Juliana Gaspar Alan e Silva, Caroline Sampaio, Jason Stone Martins Neto, João Jaime Giffoni Leite
CCT/UECE, Departamento de Física e Química, Fortaleza-CE, Brazil, CEP 60740000, e-mail: selene@uece.br

Antioxidants are compounds that protect cells against the damaging effects of reactive oxygen species (ROS). An imbalance between antioxidants and ROS results in oxidative stress, leading to cellular damage. Oxidative stress has been linked to cancer, aging, arteriosclerosis, ischemic injury, inflammation and neurodegenerative diseases. The recognized dietary antioxidants are vitamin C, vitamin E, selenium, and carotenoids. Recent studies have demonstrated that flavonoids found in fruits and vegetables may also act as antioxidants. In this work several Northeastern Brazilian fruits were tested for their free radical scavenging activity, using DPPH (Diphenyl picryl hidrazyl). Vitamin C content was also determined by iodometric method. The fruits were: guava, starfruit., cantalupe, mango, passion fruit, tamarind, hog plum, tangerine, orange, lemon and West Indian cherry (acerola). Acerola is known for its high yield of vitamin C and was used to compare its antioxidant activity and vitamin C content. In general the fruits presented high antiradical activity. Acerola was one of more active antiradical fruits in the test, being similar to hog plum, starfruit, guava and mango. Only cantalupe and sapodilla demonstrated low antiradical activities. The vitamin C content in all fruits was at least ten times less than in acerola. The antioxidant activity in some fruits like hog plum, starfruit, mango and tamarind was not directly related to vitamin C content. These fruits present high levels of flavonoids and tannins that could be responsible for their high antiradical activity.

W05

Particle film technology: a new tool for agriculture

Michael Glenn, G.J. Puterka
USDA, ARS, Appalachian Fruit Research Station, Kearneysville, WV 25430, USA, mglenn@afrs.ars.usda.gov

Scientific evidence that chemically active pesticides are residually present on food, in water supplies, in the soil, and that these chemicals may interfere with animal growth and development has resulted in a mandate to develop reduced risk alternatives to chemical pesticides. New paradigms were needed to control plant pests in an economically sustainable and environmentally safe manner. Particle film technology is a combined synthesis of knowledge on mineral technology, insect behavior, and light physics as they apply to pest control and plant physiology. Current particle film technology is based on kaolin, an aluminosilicate mineral that easily disperses in water and is chemically inert over a wide pH range. Technical advances in kaolin processing have made it possible to produce kaolin particles with specific sizes, shapes, and light reflective properties. An effective particle film on plant tissues has certain characteristics: (1) chemically inert mineral particle, (2) particle diameter < 2 µm, (3) formulated to spread and create a uniform film, (4) porous film that does not interfere with gas exchange from the leaf, (5) transmits photosynthetically active radiation (PAR) but excludes ultraviolet and infrared radiation to some degree, (6) alters insect/pathogen behavior on the plant, and (7) can be removed from harvested commodities. Many of these characteristics are similar to natural plant defenses consisting of increasing cuticle thickness and pubescence to reduce water and heat stress and to interfere with disease and insect damage. The purpose of this presentation is to describe the use of particle films in agriculture.

W06

The use of kaolin for the control of the red spider mite and broad mite on papaya in Brazil

Richard Ian Samuels, Déborah Coracini
Department of Plant Protection, UENF-CCTA, Av. Alberto Lamego 2000, Campos dos Goytacazes-RJ, CEP 28013-600, Brazil, richard@uenf.br

The red spider mite (*Tetranychus urticae*) and the broad mite (*Polyphagotarsonemus latus*) are serious pests of many plants. In Brazil, these mites are key pests of papaya and are currently only controlled by application of pesticides. We are currently investigating alternatives to chemical control, which include the use of entomopathogenic fungi and particle film applications. In the first experiment mites were placed on leaf discs that had been dipped in kaolin suspensions. Half of the disc had a film of kaolin (10 %) whilst the other half remained untreated. The distribution and behavior of the mites was observed for 4 days. During the first 3 days the distribution of *P. latus* was uneven, with approx. 50 % more mites remaining on the untreated half of the leaf disc than on the kaolin part of the discs. The behavior of *T. urticae* differed to that of *P. latus*, in that the two spotted spider mites were observed to be evenly distributed from day 1. *P. latus* was only seen to lay eggs on the non-kaolin treated half of the discs. In another experiment, mite mortality on leaf discs treated with 10 % and 20 % kaolin suspensions, was evaluated. Twenty percent kaolin caused ~50 % mortality of *P. latus* and 17 % mortality of *T. urticae* over a 10-day period. Mite mortality was probably due to the physical distruption of locomotion and feeding, especially in *P. latus*. The application of the entomopathogenic fungi, *Metarhizium anisopliae* and *Beauveria bassiana* formulated in kaolin, did not have a synergistic effect on mite mortality under laboratory conditions.

W07

Effects of processed-kaolin particle film on papaya leaves: a study related to gas exchange, leaf temperature and light distribution /reflection in canopy

Eliemar Campostrini, O.K Yamanishi*; F.Oliveira Reis; M.A de Souza; G.Ferreguetti, E.Santana,*
UENF/CCTA/LMGV, Plant Physiology, CEP 28013-600, Campos dos Goytacazes-RJ, Brazil, campost@uenf.br
Financial support: FINEP, Caliman Agricola SA, FAPERJ, Engelhard Corporation (NJ,USA)

Environmental factors such as light, temperature, water and mineral nutrients can affect physiological processes in papaya plants. A deeper understanding about the effects of such environmental factors over the physiological processes is of extreme importance, since it will allow us to trace strategies for managing them, and will optimize the effects of these factors in relation to the growth and development of *Carica papaya* L. Processed-kaolin particle films are used in horticultural crops to repel insects, suppress disease incidence and reduce heat stress and solar injury. Effects of foliar sprays of a processed-kaolin particle film(Surround WP) on gas exchange, leaf temperature of sun-exposed leaves and light distribution/reflection in canopy on field-grown papaya plants (*Carica papaya* L.) were studied September 25 and 26, 2003 in Linhares/ES/Brazil. Papaya plants were sprayed with two applications, using ≅13L (10 % processed-kaolin). The 10 % foliar processed-kaolin particle film application did not affect net CO_2 assimilation rates, stomatal conductance and transpiration in papaya leaves; although the light reflection was higher and the temperature on the leaves was lower during the period from 12 pm and 2 pm in the plants that received the particles on the leaves. Studies with elite genotypes are being conducted in the Sector of Plant Physiology with the objective to understand the photosynthetic capacity and the effects of the processed kaolin on fruit production, disease incidence and xylem sapflow.

W08

Breeding papaya (*Carica papaya)* in South Africa

Aart J. Louw
Agricultural Research Council, Institute for Tropical and Subtropical Crops, Private bag X11208, Nelspruit, 1200, Republic of South Africa, aart@itsg2.agric.za

The papaya breeding programme in South Africa was initiated by J.D.J. Hofmeyer in 1935 but was sadly interrupted in 1943 to be continued by the author in 1993. The environmental conditions for the growing of papayas in the subtropics are less than ideal. The relative low winter temperatures (<15°C) and very high temperatures during summer have a number of adverse effects on the papaya. The characteristic most severely affected is the sex differentiation of the flowers in hermaphroditic papaya genotypes. The breeding programme utilized cultivars and selections from around the world. At first the aim was to create maximum variability for selecting of outstanding, heterozygous, individuals to be propagated by vegetative means. This would have been done by tissue culture or grafting. Numerous problems in this regard forced the breeding programme to develop pure lines. Severe inbreeding suppression, in contrast to the available literature, has been encountered. Strategies in addition to synthetic F1-Hybrids are discussed. An overview regarding the genetic limitations of genetic transformation is given.

W09

The eksotika papaya: Malaysia's flagship variety for export

Ying Kwok Chan
Horticulture Research Centre, Malaysian Agricultural Research and Development Institute (MARDI), GPO Box 12301, 50774 Kuala Lumpur, Malaysia, ykchan@mardi.my

The breeding program for Eksotika papaya was initiated in 1972 involving hybridization of a local cultivar Subang 6 with the Sunrise Solo. Repeated backcrosses to Sunrise Solo with selection for local adaptation and fruit size resulted in development of L20 which was later released as Eksotika in 1987. This cultivar has the excellent eating qualities of Sunrise Solo but with improved fruit size, yield and adaptability. In 1991, an improved F_1 hybrid called Eksotika II was developed by sib-crossing L20 with L19. The hybrid showed heterosis in yield, larger fruits, reduced fruit freckle and had longer storage life. The Eksotika and Eksotika II are now the flagship varieties for export to Singapore, Hong Kong and China and grossed USD 25 million in export revenue in 2002. Eksotika has propelled Malaysia to be the second largest exporter of papaya in the world. The success of Eksotika depended to a large extent on the systems approach in its research and development. The research component includes breeding and variety improvement and development of supporting technologies like agronomic requirements, R & D management and post harvest handling to give a complete technology package for Eksotika. The development component covers packaging the technology, technology transfer, publicity and promotion, supply of quality seed and maintenance of fruit quality for export. Some aspects of current research to further improve Eksotika are also highlighted.

W10

Combining ability studies in papaya diallel crosses

Sérgio Lucio David Marin[1], *Messias Gonzaga Pereira*[2], *Osvaldo Kiyoshi Yamanishi*[3], *José Antônio Gomes*[4], *Luiz Aurélio Peres Martelleto*[5], *Carlos David Ide*[5]
[1]Hera Sementes, Linhares-ES, serdavid_papaya@yahoo.com.br
[2]UENF, Campos-RJ
[3]UnB
[4]Incaper, Vitória-ES
[5]Pesagro-Rio, Macaé-RJ

Genetic inferences were made for the development of papaya cultivars using Partial Diallel with the objective of improve papaya breeding process. Sixteen progenitors were chosen based on divergent traits, combined in two groups of eight, respectively, the cultivars of the 'Solo' and 'Formosa' groups. Pollen was transferred from hermaphrodite or male plants from the 'Formosa' group to stigmas of the female group 'Solo'. All the combinations p (p + 1)/2 were obtained and the reciprocals were discarded. Eighty treatments (64 hybrids and 16 self fertilized genitors) and four replications were studied under Griffing's procedure for partial diallel analysis. The superiority of the genetic additive effects in combination to the results of genotypic variability ($\hat{\Phi}_g$) of the genotypic determination coefficient (H^2) and of the variation index (I_v) demonstrated a very favorable situation for breeding for height of insertion of the first fruit (HIFF), number of fruits per plant (NFpl2), fruit weight (PMF) and flavor savoring (DgSAB), indicating the intra population method as the best breeding strategy for obtaining genetic gains. Best hybrid combinations were: 'Sunrise Solo 783' x 'Cariflora', 'Sunrise Solo 72/12' x 'JS 12', 'Santa Bárbara' x 'Tailândia', 'São Mateus' x 'JS 12', 'Sunrise Solo TJ' x 'Cariflora' and 'Sunrise Solo 783' x 'JS 12'.

W11

Research on genetic breeding of mango *(Mangifera indica* L.) in Brazil

Alberto Carlos de Queiroz Pinto, M. C. R Cordeiro, F.G Faleiro, S. R. M Andrade
Embrapa Cerrados, CP 08223, BR 020 Km 18, CEP 73301-970 Planaltina-DF, Brazil, alcapi@cpac.embrapa.br

The cultivated area of mango in Brazil was around 70 thousand hectares with a production higher than 600 thousand tones in 2002. About 133 thousand tones were exported with a value of US$ 73.4 millions in 2003. However, the Brazilian production is highly concentrated (79%) on an only cultivar – Tommy Atkins. Although this cultivar has some important characteristics such as high yield, attractive skin and long shef-life, its susceptibility to malformation, high incidence of pulp breakdown and only a fair taste are unacceptable characteristics that must be improved. Some Institutions, such as Embrapa, University of São Paulo State – Unesp, in Jaboticabal and Agronomic Institute of Campinas - IAC, São Paulo, have been involved on mango breeding program to develop and release new mango cultivars with better characteristics than 'Tommy Atkins'. Embrapa Cerrado started a breeding program through intervarietal hybridization in 1980 with the objective to evolve superior cultivars for fresh consumption and agroindustry aiming the internal and external markets. Besides the improvement of conventional breeding techniques using open and control crosses, evaluation of cultivars and species of the National Germplasm Bank, study on pathogeny of malformation disease, the use of biotechnology (DNA markers) to characterize the germplasm, to analyze genetic diversity and to identify parentals, and to reduce the time for mango release have been the strategies of the new National Mango Breeding Project. This paper has the objective to present and discuss the main results of mango breeding in Brazil.

W12

Genetic control of black sigatoka in Brazil

Sebastião Pedro da Silva Neto
Campo Biotecnologia Vegetal Ltda.
Rua Lindolfo Garcia, 1000, Paracatu - MG, Brazil sebastiao@campo.com.br

Bananas (*Musa* spp.) have a great social and economic importance in Brazil, especially in the northern region where the consumption is over 57 kg/person/year. Notification of disease Black Sigatoka (*Mycosphaerella figiensis*) in the Amazon area in 1998 represented an enormous concern. As a consequence the Brazilian Ministry of Agriculture established an emergency program to avoid the spread of the disease to the rest of the county. The strategy of the program was to plant a significant amount of resistant varieties. A public-private-partnership (PPP) was established between Embrapa and Campo (a Brazilian micropropagation private company). Embrapa program for the genetic improvement of bananas was the source of resistant materials and Campo performed the mass propagation. Banana genotypes Caipira, Thap Maeo, FHIA-18, Prata Zulu and Pacovan Ken were choose among the Embrapa germoplasm bank according consumers preference. In less that three years an amount of 4 million plants resistant to Black Sigatoka were provided to the small growers of Amazon, Acre, Pará and Roraima States. As an effect, more than 4000 ha of bananas resistant to Black Sigatoka were planted. Nowadays, it is projected that more that 50% of the banana production supplied to the Amazonic market are coming from that resistant varieties. Black Sigatoka was kept inside the borders of northern region until May of 2004, when it was notified affecting banana plantations of Sao Paulo State.

W13

Regulation of phytosanitary treatment of fruits based on ionizing radiation, in Brazil

Tarcisio da Silva Siqueira
Departamento de Defesa e Inspeção Vegetal, MAPA, Brasília, DF, Brazil, tarcisio@agricultura.gov.br

The regulation of the use of ionizing radiation in phytosanitary treatment of fruits in Brazil is now in the final phase of public consultancy. The treatment aims at the control of several fruit fly species and shall contribute to the increase of Brazilian exportation of fruits. Doubtless, the major restrictions to the fruit exportation are related to the presence of flies from the genus *Anastrepha* and *Ceratitis* in the main fruit production regions in the country, especially Northeast. Proposed by the Department of Plant Protection and Inspection - DDIV, the regulation will discipline the habilitation and credential of establishments to realize quarantine phytosanitary treatments, as a single treatment or in combination with other treatments in packing operations and bulk or packed products. The objective will be preventing the introduction or dissemination of pests, through the various mechanisms. Largely diffused and accepted in several countries, the use of ionizing radiation for phytosanitary purposes, showed extremely efficient in control of pests associated to fruits. This fact will largely amplify transit of Brazilian fruits in the international market. The final version of the text is on the way to the public consultancy to prepare the Instructions for training of Federal Enforcement Personnel responsible for the Fruit Phytosanitary Certification to fruit export and also import to and from Brazil.

W14

Improving fruit quality through irradiation

Julio Marcos Melges Walder
Universidade de São Paulo - Centro de Energia Nuclear na Agricultura, C. Postal 96, 13400-970- Piracicaba-SP, Brazil. jmwalder@cena.usp.br

Food irradiation is not a new technology. The use of ionising radiation to preserve food was the subject of patent applications over 90 years ago and since then it has become one of the most extensively studied and controversial methods of food processing. The safety and efficacy of the technology has been repeatedly considered and assured. Irradiation of fruits, carried out under conditions of good production and post-harvest handling practice, is commended as a safe and effective quarantine processing method. The process brings potentially huge benefits for Brazil where fruit flies are endemic. Irradiation also offers new opportunities for producers to extend the shelf live of some fruits, not only to export but also for Brazilian market. As challenges, many research on Brazilian fruits needs to be performed to determine the optimum doses for specific local varieties and for the local growing conditions, and to determine the best time to irradiate and the best method of pot-harvest handling. Fruit producers, distributors, retailers and specially consumers, must be educate by presenting them with unbiased, unemotional evidence of the pros and cons of the food irradiation so that they are able to make their own decision.

W15

Irradiation of minimally processed fruits

Mariza Landgraf
Departamento de Alimentos e Nutrição Experimental, Faculdade de Ciências Farmacêuticas, Universidade de São Paulo, São Paulo, SP, Brazil, landgraf@usp.br

Consumer attitudes towards foods have changed in the last two decades increasing requirements for fresh products. Consequently, less extreme treatments or additives are being required. Minimally processed foods have fresh characteristics and satisfy this new consumer demand. Besides freshness, the minimal processing also provides convenience required by the market. This market was responsible for the movement of US$ 30 millions in Brazil and US$ 10 billions in the United States, in 2000. However, foodborne disease outbreaks due to the consumption of this type of food have been reported showing that the minimal processing does not ensure the safety of the food. Irradiation, a preservation technology that has been thoroughly studied, has already proven to be useful in improving the microbiological safety of food as well as its shelf life. Several studies are being carried out around the world using irradiation to improve the hygienic quality of fresh, pre-cut fruits. Fruits such as mango, grapefruit, jackfruit and fruit salad are among them. So far, the results have shown that, depending on the dose, irradiation can be used to reduce the population of pathogenic and spoilage microorganisms without impairing the sensory attributes as well as extending their shelf life.

W16

Food irradiation

Dirceu M. Vizeu
Rua Agostinho Togneri 399, CEP 04690-090, São Paulo – SP, Brazil, dmvizeu@embrarad.com.br

Food irradiation is a technology used to improve quality reducing microbial contamination and also to preserve and extend shelf life. To irradiate food means to expose it to an adequate quantity of radiation (dose) emitted by a radioisotope mainly Cobalto-60. The radiation will interact with the electrons of the atoms destroying microorganisms by breaking their DNA bonds. This technic does not leave any sort of residues, toxic or radioactive. The "Codex Alimentarius" in 1980 declared that irradiated food does not need to submit to toxicological analysis. The interaction is just with electrons there is no way to make food radioactive because radioactivity is a nuclear property. Using this technology one can: Inhibit sprouting in onion and potatoes etc; Desinfestation in tropical fruits, mangoes, papaya etc; Eliminate pathologic microorganisms such as Salmonella in Chicken, E-Coli O.157 in hamburger, Trichinella in pork meat etc; Reducing microbial load - spices, sea food, meat, dry food etc; Extending Shelf life; Sterilization diet for patients needing implants diet for astronauts. Finally this is a technology approved by several international institution as World Health Organization, Food ad Agricultural Organization, and International Atomic Energy Agency, Food and Drug Administration (FDA), Codex Alimentarius. In Brazil Food irradiation was approved by the "Agência Nacional de Vigilância Sanitária" according to RDC n° 21, dated January 26th, 2001.

W17

Genetic resources of bael (*Aegle marmelos* Correa): a potential underutilized fruit

Sisir K. Mitra, C. S. Maity, D. Mani, B. Ghosh
Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741252, Nadia, West Bengal, India, sisirm@vsnl.net

In India large section of population spends their life below poverty lines. They are suffering from malnutrition due to economic weakness, which limits their purchasing ability and they can not consume traditionally available high ranked fruits like apple, grape, citrus etc. from the markets. The farmers will be benefited both ways if they take initiative to grow the underutilized fruits like bael, which grows around the villages, and are rich in several minerals and vitamins. Selection of superior clones to use as fresh fruit and the processing industry, as well as for high yield, better quality and tolerance to abiotic and biotic stress, would be of great value for commercialization of this underutilized nutritive fruit. The collection and evaluation of over 1200 bael trees in West Bengal was initiated in 1994. Six types have been identified as superior clones and are being conserved at the Faculty of Horticulture Research Station. Wide variability in yield (20 – 437 fruits/tree), fruit weight (130-1825 g), fruit shape, rind thickness, pulp colour, number of seeds, total soluble solids (23-42 ^{o}Brix), fruit acidity (0.23-0.44 %) and ascorbic acid (22-30 mg/100g) content were observed among the genotypes. The clones T_1, T_5, T_8, T_{10}, T_{15}, and T_{16} were selected for cultivation.

W18

Alternative tropical fruits in order to increment the offer to European market

Enrique Sauri Duch, A.R. Centurión Yah
Instituto Tecnológico de Mérida. Centro de Graduados e Investigación. Departamento de Ingeniería Química y Bioquímica, Km. 5, Carr. Mérida-Progreso, Mérida, Yucatán, C.P. 97118, México, esauri@ labna.itmerida.mx

In the American tropical and in the peninsula of Yucatan, a great diversity of fruits is produced, thoroughly consumed in the regions of production, and a lot of them they possess very good characteristic of quality. Great part of them is not very well-known in the markets of the developed countries. During last years, in developed countries the interest to consume new and different fruits has been incremented. The objective of the work was to introduce some tropical fruits produced in the peninsula of Yucatan, Mexico, not very well-known in international markets in these days, and expound the possibility of their introduction and successful commercialization in the markets of the European countries. The principal characteristics of 5 fruits are described: mamey (*Calocarpum mammosum*), zapote (*Achra sapota*), saramuyo (*Annona squamosa*), pitahaya (*Hylocereus undatus*), caimito (*Chrysophyllum cainito*) their principals uses and some important characteristic to keep in mind in the commercialization are exposed. Some of them are known for the European peoples that travel to the tropical countries. Some of them are produced in winter and another in sprig and summer time. In function of their characteristics of quality and good acceptance, it is considered that these fruits could be exported to these markets and have good acceptance.

W19

Economic potential of Brazilian fruits and present research

Luiz Carlos Donadio
Estação Experimental de Citricultura de Bebedouro, Caixa Postal 74, 14700-970, Bebedouro-SP, Brazil, lcd@asbyte.com.br

Due to the high diversity of Brazilian native fruit species and the large variation of climate and soils occurring at the different biomes, several Brazilian native species are marketed in the world as important fruits or by products, such as guava, pineapple, cashew, cacao, passion fruit, Pará (Brazilian) nut and feijoa. Many others are important fruits at local market, for instance pitanga (*Eugenia pitanga*), cupuaçu (*Teobroma grandiflorum*), açai (*Euterpe oleracea*), guaraná (*Paulinia cupana*), umbu (*Spondia tuberosa*), jabuticaba (*Myrciaria cauliflora*) and bacuri (*Platonia insignis*). At least ten other fruits would be of commercial interest, if better studied in some main aspects, such as propagation, selection of productive cultivars and economic use as fresh or processed fruits. All these aspects will be commented for the cited species and also mangaba (*Hancornia speciosa*), araçá (*Psidium araca*), uvaia (*Eugenia uvalha*), butiá (*Butia eriospatha*), marolo (*Annona crassiflora*), araçá-boi (*Eugenia stipitata*), abiu (*Lucuma caimito*), biribá (*Rollinia mucosa*), baru (*Dipteryx alata*) and camu-camu (*Myrciaria dubia*).

ORAL PRESENTATION

O01

Citrus varieties for fresh fruit market on Brazilian northeast

Orlando Sampaio Passos, *Marcelo Amaral Santana*
Embrapa Mandioca e Fruticultura, C.P. 007, CEP 44380-000, Cruz das Almas-BA, Brazil, orlando@cnpmf.embrapa.br

The citrus industry in the Brazilian Northeast is analyzed with emphasis on the identification of potential areas for citrus production to the fresh fruit market. A correlation between the population growth rate and fruit production is made in order to predict the perspectives of the citrus industry, especially to supply the domestic market. It was preliminarily selected some of high altitude areas such as Chapada Diamantina in the State of Bahia, Chapada de Ubajara in the State of Ceará, Brejo Paraibano in the State of Paraíba and Garanhuns in Pernambuco State. In addition, observations are made on the behaviour and habitat of the Melrosa, Russas and Flor sweet orange varieties originated and very well accepted in the Northeast region.

O02

New durian hybrids: 4 decades of breeding

Siti Zainab Ramawas[1], *J. Siti Hawa*[2]
[1]Mardi Bukit Tangga, 06050 Bukit Kayu Hitam, Kedah, Malaysia
[2]Horticulture Research Center. MARDI, P.O. 12301, General Post Office, 50774 Kuala Lumpur, Malaysia, sizra@mardi.my

Malaysia is considered a center of diversity for the genus *Durio* to which durian belongs. We have tremendous natural genetic variation for the cultivated durian and through systematic clonal selection; more than 100 varieties have been selected and registered. Some of these clones, because of their yield and fruit quality performance, have become recommended. In the late 1960's there was concern that progress in durian clonal selection was showing signs of slowing down, perhaps due to dwindling crop natural variability. New improved clones were harder and take longer time to be identified. There was a need for alternative breeding methods to complement straight-forward clonal selections. Hybridization was considered most promising to generate new variability for selection. Out of this initial hybridization program, the first three commercial durian hybrid clones were released namely MDUR 78, MDUR 79 and MDUR 88 in 1991/1992. These were the world's first F1 hybrid durian clones developed through systematic breeding. The hybrid clones became instantly popular with growers in Malaysia. Following this success a new set of F1 hybrid durian progenies were raised in late 1980's. *Interse* crosses were conducted, in a staggered manner, between 1987 - 1989 using ten selected clones as parents consisting of 6 local clones and 4 Thai clones. Promising durian hybrids have yet to be identified.

O03

Developing transgenic papaya to improve broad disease resistance against fungal pathogens

Y.Judy Zhu[1], Ricelle Agabayani[1], C.S. Tang[2] and Paul H. Moore[3]
[1]Hawaii Agriculture Research Center, Aiea, USA.
[2]University of Hawaii, Honolulu, USA.
[3]U.S. Department of Agriculture, Agriculture Research Service, Aiea, USA.

Papaya (*Carica papaya* L.), one of the more important fruit crops of the tropics, has limited resistance to a range of fungal pathogens that may kill the plants or, at a minimum, reduce productivity and quality of the fruit. Phytoalexins have been shown to be important natural components in the defense of plants against pathogen infection. Several fruit crops, including grapevine and peanut synthesize the stilbene-type phytoalexin, Resveratrol, (trans-3, 4', 5-trihydroxy-stilbene) when attacked by fungal pathogens such as, *Botrytis cinerea* or *Plasmopara viticola* (Blaich, 1980). The level of resistance to *P. viticola* was positively correlated with the capacity of *Vitis* spp. to synthesize stilbene (Dercks, 1989). We conducted in-vitro pathogen inhibition assays to show that Resveratrol inhibited fungal pathogens of tropical plant, papaya (*Carica papaya* L.). Resveratrol at 1.0 mM in V8 agar culture medium inhibited mycelia growth of *Phytophthora palmivora* up to 50% of control. The compound was active against *P. palmivora* as low as 100 • M. Resveratrol was not as effective against the anthracnose pathogen, *Colletotrichum gloeosporiodes*. Further, we transformed papaya embryogenic cultures with the stilbene synthase gene cloned from grapevine and driven by its own inducible promoter along with the hygromycin resistance or kanamycin resistance gene under the control of a CaMV35S promoter. The presence of transgenes was confirmed by PCR and Southern blot analysis. Transgenic papaya plants were challenged with *P. palmivora* in greenhouse condition. Data from greenhouse studies showed that disease level in transgenic plant was reduced to 35% of the disease level in non-transformed control plants. This result indicated that metabolic engineering *Carica papaya* with heterologous phytoalexins either under its own inducible promoter or a constitutive promoter can improve plant defenses against fungal pathogens.

O04

Identification and evaluation of *Ziziphus g*ermplasm from the south of Iran

Aziz Torahi
Breeding Department, Date Palm & Tropical Fruits Research Institute, P.O. Box 61355-16, Ahwaz, Iran, aziztorahi@yahoo.com

Ber (*Ziziphus* spp.) is the hardiest cultivated fruit tree grown in most of hot drier regions of many countries for its fresh fruits. Its deep taproot system enables it to survive for long periods without water, even when the soil surface completely dries out. Ber trees can grow under conditions of extreme stress from drought, salt and waterlogging and can therefore be grown on degraded or marginal lands. It produces a nutritious fruit, which is rich in the B group of vitamins (thiamin, riboflavin and niacin), vitamin C and β-carotene. Ber can provide sustained production irrespective of occurrence of drought. A number of products are produced for industry from the ber tree. There are different wild *Ziziphus* species and types distribute all over the southern parts of Iran and they show a great adaptability to the dry climate conditions of the arid and semi-arid regions. The identification and evaluation of over 2500 ber trees in Khouzestan province was initiated in 2000. Twenty-nine trees have been identified as superior types. Wide variability in tree performance, yield, fruit fresh weight (2.4-19g), fruit dry weight (0.85-4.7g), fruit shape, fruit length (10-48 mm), fruit diameter(12-27.5 mm), fruit volume(2.2-20.2cc), peel colour, presence or absence of seed and seed weight (0-1.3g) were observed among the genotypes. The growth and maturity (early February-April) of fruits also showed variations among the genotypes.

O05

Recovery of seven wild fruits species in Ceará State Coast, Brazil

Reginaldo Brito Bastos Crisóstomo[1], *Maria Pinheiro Fernandes Corrêa*[1], *José Magno Queiroz Luz*[2], *Maria Socorro Moura Rufino*[1], *Ricardo Elesbão Alves*[1]

[1]Embrapa Agroindústria Tropical, CP 3761, 60511-110, Fortaleza, CE, Brazil, elesbao@cnpat.embrapa.br

[2]Universidade Federal de Uberlândia, Instituto de Ciências Agrárias, Caixa Postal, 593 CEP: 38400-902, Uberlândia-MG, Brazil, jmagno@umuarama.ufu.br

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The Ceará State coast ecosystem presents a wide diversity of vegetal species, many of which feed the local communities. The losses of genetic variability caused by human action are significant and mainly due to the destruction of the natural habitats of the plant populations. It is of utmost importance for biodiversity maintenance to make feasible research and other procedures directed towards the preservation of these materials. This work intended to rescue information about native fruit trees from the Ceará Coast region *in situ.* The study was carried out in three steps: bibliographic information research, consultation to the Federal University of Ceará herbarium and data gathering in the fields of Cascavel, Guanacés and Pacajus, by using specific questionnaires, by observing and registering the species *in situ*. Among the species found in the sites, some are remarked: *Araticum* (*Annona coriacea*); *Batiputá* (*Ouratea fieldingiana*); *Chichá* (*Sterculia striata*); *Mangaba* (*Hancornia speciosa*); *Murici* (*Byrsonima crassifolia*); *Murta* (*Eugenia insipida*) and *Puçá*/*Manipuçá* (*Mouriria pusa*). The conclusion is that the native fruit trees of this ecosystem are going through a deep genetic erosion process, with the treat of extinction. Preservation *in situ* and conservation *ex situ* should be priorities to evaluate, multiply and value these resources, making them available to society.

O06

Results of nematological analysis recovered through information system regarding fruit plant germoplasm imported by Brazil (1981 – 2003)

V.R.V. Rissoli[1], *Renata C.V. Tenente*[2], *J.E Cares*[3], *H.I. Nascimento, M. Prates*[2]

[1]Universidade Católica de Brasília, QS 07-Lote 01 CEP 70.022-900, Taguatinga, DF, Brasil. vandor@ucb.br

[2]Embrapa Recursos Genéticos e Biotecnologia, C.P. 02372, Brasília- DF, Brazil, CEP 70.770-900, renata@cenargen.embrapa.br

[3]UNB, C.P. 4457, Brasília- DF, Brasil, CEP 70.910-900.
Conj. B, Brasília-DF, Brazil

The Computing System was developed based on a database of nematological analysis in imported germplasm, from 1981 to 2003. This database includes the descriptions of: product, origin, destination, analysed and infected accession numbers and detected nematodes. Through this database, it was verified that from 520 introductions, 108 were infected by nematodes; originated from 31 countries. Among the introductions, banana accessions were infected with *Aphelenchoides* sp., *Ditylenchus* sp., *D. equalis*, *Helicotylenchus* sp., *Radopholus similis*, *Rotylenchulus reniformes* and *Xiphinema* sp.; *Citrus* and *Vitis* accessions were infected by *Aphelenchoides* sp.; guava and papaya accessions had *Aphelenchus* sp. Passion fruit has not shown nematode infection. These donor countries should take preventive measures, trying to eliminate parasites from these important genetic materials, using the thermal treatments. The nematological analysis database is located at Embrapa Genetic Resources and Biotechnology, Brazil. This survey data showed that in 23 years of germplasm exchange, it was crucial to intercept pests in the analysed material and to diminish new pest's risk of introduction and the cost benefit is demonstrated and revealed a great contribution to the Brazilian agriculture.

O07

Applications of biotechnology to tropical fruit crops in Queensland

Rod A. Drew[1], *M.K. Smith*[2]
[1]School of Biomolecular and Biomedical Science, Griffith University, Nathan Q4111, Australia, r.drew@griffith.edu.au
[2]Department of Primary Industries and Fisheries, Maroochy Research Station, Nambour, Q4560, Australia

Tropical fruits play an important role in the economy of Queensland, with the major crops being banana, mango, pineapple and papaya. Biotechnology has been applied to tropical fruit species in Queensland for the past 20 years. Micropropagation systems were developed for banana, pineapple, papaya, ginger, passion fruit and coffee; and, good embryogenic protocols have been employed in banana, mango and papaya. A program of interspecific hybridization between papaya and related *Vasconcellea* species has continued since 1991 and has been facilitated by embryo rescue, plantlet production and micropropagation in vitro. Cryopreservation protocols are being developed for tropical fruit species. Transformation systems have been used to produce disease resistant cultivars of banana and papaya; and, to prevent blackheart, to control flowering and delay ripening of pineapple. Molecular marker technology has been applied to these fruit species. Markers have been used for genotype identification and to confirm intergeneric hybrids between papaya and related *Vasconcellea* species; and, molecular maps have been developed for two *Vasconcellea* species. Markers have been used to confirm cultivar identity of ginger rhizomes prior to factory processing to maintain quality standards in the production of confectionery ginger. Genetic diversity within mangosteen populations and between related wild species has been evaluated with RAF markers. Specific DAF markers have been identified for sex determination in papaya, and SCAR markers have been developed to identify dwarfism in bananas and the PRSV-P resistant gene in *Vasconcellea cundinamarcensis.*

O08

Pineapple (*Ananas comosus*) fruit cDNA sequencing project

Richard Moyle, Jonni Ripi, David Fairbairn, Jimmy R. Botella
Plant Genetic Engineering Laboratory, Department of Botany, University of Queensland, Brisbane 4072, Australia, j.botella@botany.uq.edu.au

Pineapple is a tropical fruit crop of significant commercial value, yet surprisingly little molecular information exists. A nucleotide database search of Genbank yields only 54 sequence entries for *Ananas comosus* (as of February 2004). As a first step toward understanding the molecular basis of pineapple fruit development we have initiated a sequencing project to survey a range of expressed sequences from green unripe and yellow ripened fruit tissue. A highly abundant metallothionein transcript estimated to account for over 50% of all transcribed cDNA was identified during library construction. Library clones subtracted of metallothionein were sequenced and 408 unripe green and 1140 ripened yellow edited EST clone sequences retrieved at an average read length of 785 bp. Clone redundancy was high, as the combined 1548 clone sequences clustered into just 634 contigs comprising of 191 consensus sequences and 443 singletons. Sequence analysis and functional classification reveal major differences between the types of genes expressed in the unripe green and ripened yellow fruit tissues. The analysis of the sequencing project has revealed very interesting facts about pineapple fruit ripening. We will present the results of the sequence analysis, including contig assemblies, clustering and the identification of abundantly transcribed genes.

O09

Control of ripening in papaya (C*arica papaya*) by genetic engineering

Jimmy R Botella[1], *Peter Leeton*[1], *Helen Sargent*[1], *Mae Mendoza*[2], *Tony Laurena*[2], *Pablito Magdalita*[2]
[1]Plant Genetic Engineering Laboratory, Department of Botany, University of Queensland, Brisbane 4072, Australia, j.botella@botany.uq.edu.au
[2]Institute of Plant Breeding, University of the Philippines, Los Banos, Laguna 4031, Philippines.
Financial support: Australian Center for International Agricultural Research (ACIAR)

A large percentage of fruits and vegetables crops are lost due to spoilage after harvesting, and the problem is especially acute in sub tropical and tropical countries. Classic technologies such as atmosphere control (CO_2 and humidity) and refrigeration have proven useful in controlling some post-harvest losses, but their implementation requires the development of costly infrastructure in rural areas. Development of new technologies is fundamental in minimizing post-harvest losses. Ethylene gas is one of the major factors contributing to the spoilage of fruits and vegetables after harvest; therefore considerable effort has been directed to control the rate of ethylene production. We have cloned and characterized ethylene biosynthetic genes involved in the ripening of papaya fruits. Two different ACC synthase and two different ACC oxidase genes show varying patterns of expression during fruit ripening. We have produced over 100 independent transgenic lines containing different constructs in sense and antisense orientation for each of the two ACC synthase genes. We have also produced genetic constructs containing RNA interference cassettes with perfect inverted repeats separated by intron sequences. Regulatory approval has been obtained to perform field trials and transgenic trees are now growing in the field. We will present the results of the field trials and evaluation of transgenic fruits.

O10

Gene expressions involved in flavonoid biosynthesis pathway are associated with tannin accumulation in japanese persimmon (*Diospyros kaki* Thunb.) fruit

Keizo Yonemori[1], *Ayako Ikegami*[1], *Akira Kitajima*[2]

[1]Laboratory of Pomology, Graduate School of Agriculture, Kyoto University, Sakyo-ku, Kyoto 606-8502, Japan, keizo@kais.kyoto-u.ac.jp
[2]Experimental Farm, Kyoto University, Takatsuki, Osaka 569-0096, Japan

Japanese persimmons (*Diospyros kaki* Thunb.) are classified into the following four types depending on the effect of pollination on flesh color and whether the fruit lose astringency on the tree: 1) pollination-constant non-astringent (PCNA), 2) pollination-variant non-astringent (PVNA), 3) pollination-variant astringent (PVA), and 4) pollination-constant astringent (PCA). Among these four types, PCNA-type is the most desirable persimmon for fresh consumption, since the fruit can be eaten always while firm without any postharvest treatments. The PCNA-type appeared uniquely in Japan probably due to loss of the ability of tannin accumulation. PCNA-type fruit stops accumulating tannins at the early stage of fruit development. However, the molecular mechanism controlling tannin accumulation in persimmon is not so clear. Persimmon tannins are categorized into condensed tannins consisted of polymeric proanthocyanidins which are synthesized via flavonoid biosynthesis pathway. So, we investigated varietals and seasonal changes in expressions of nine genes involved in flavonoid biosynthesis (PAL, C4H, 4CL, CHS, CHI, F3H, F3'H, F3'5'H, and DFR). The expressions of these genes were high until late stages of fruit growth in astringent-type, whereas those disappeared at the early stage of fruit growth in PCNA-type fruit. As for PVNA-type fruit, the expressions of these genes also disappeared coincident with the loss of astringency in the middle stage of fruit development. The relationship between transcripts of these genes and tannin accumulation in the fruit will be discussed in this study.

O11

Development of microsatellite markers for fingerprinting and breeding subtropical fruit tree species

M.A. Viruel, M.P. Escribano, J. Iñaki Hormaza
Departamento de Fruticultura Subtropical y Fitopatología, Estación Experimental de la Mayora-CSIC, Algarrobo-Costa, Spain, ihormaza@eelm.csic.es

Microsatellites or SSRs are considered as the marker of choice for fingerprinting and breeding in both plant and animal species. However, in most subtropical fruit tree species no SSR sequences are currently available. In this work, we describe the development of SSR sequences in three subtropical fruit tree species: cherimoya (*Annona cherimola* Mill.), lychee (*Litchi chinensis* Sonn.) and mango (*Mangifera indica* L.). In order to develop the SSRs a genomic library enriched in GA/CT repetitive sequences was performed for each species from DNA of standard cultivars: "Fino de Jete" for cherimoya, "Mauritius" for lychee and "Tommy Atkins" for mango. Microsatellite polymorphism was evaluated in germplasm collections of the three species. For cherimoya, 15 polymorphic SSRs were studied in 40 accessions; for lychee, 12 polymorphic SSRs in 21 accessions and for mango 15 polymorphic SSRs in 30 accessions. For all the three species studied, the microsatellite enrichment procedure was highly successful since over 70% of the clones studied contained the repetitive sequence in cherimoya and mango and over 50% in lychee. The results are discussed in terms of their implications for fingerprinting, germplasm resources management and breeding of subtropical fruit tree species.

O12

Identification of *Durio* species, cultivars and F_1 hybrids by DNA amplification fingerprinting

Songpol Somsri[1], *Suchirat Sakuanrungsirikul*[2], *Wanida Ngam-Ngern*[2]
[1]Horticulture Research Institute, Department of Agriculture, Chatuchak, Bangkok 10900, Thailand, songpol@doa.go.th, songpolsom@yahoo.com
[2]Chanthaburi Horticultural Research Center, Plew, Lam sing, Chanthaburi 22190, Thailand

The polymerase chain reaction (PCR)-based DNA amplification fingerprinting (DAF) approach was used to investigate genetic relationships among 7 species of genus *Durio*, 18 cultivars of common durian (*D. zibethinus* Murr.) and F_1 hybrids. Pairwise similarity matrix were developed using band-sharing data generated by the selected 10-12 primers out of 180 primers such as Operon A-04, A-06, A-09, A-19, A-20, B-01, B-03, B-16, C-06, G-20, S-01 and S-02. In the experiment there are 193 polymorphic loci from 226 loci or 85.4% for species and cultivars identification and 163 polymorphic loci from 282 loci or 57.8% for promising F_1 hyprids identification. Dendrogram were constructed using the unweighted pair group method with arithmetic averages (UPGMA), could separate the genotypes of species and cultivars into 4 groups and the genotypes of promising F_1 hybrids and their parents into 3 groups.

O13

Systems for early diagnosis of papaya sticky disease

M. T. Souza Júnior, V. A. Marinho, E. T.Tavares, M. M. M. de Araújo
Embrapa Recursos Genéticos e Biotecnologia, Parque Estação Biológica, Final Av. W5 Norte, CP 02372, Brasília, DF, CEP 70.770-900, Brazil, msouza@cenargen.embrapa.br

Papaya sticky disease, also know as "Meleira", was first reported in the late 1980's. Today this disease is present in most of the main papaya growing regions in Brazil. For some of these regions, it has become already the most limiting biotic stress for this fruit crop. A virus named temporarily as *Papaya meleira virus* (PMeV) is the causal agent of this disease. PMeV has a rod shaped particle, about 40-50 nm in diameter, and a dsRNA genomic molecule of about 12 kb long. Very few are known about this virus epidemiology, host and vector range, as a consequence of the lack of reliable and highly sensitive diagnosis tools. The diagnosis is currently done mainly via the appearance of symptoms on the fruit surface, which shows an excessive exudation of watery latex that soon darkens as it oxidizes. Sometimes, mostly at moderate temperatures, infected plants show a burn on the borders of the younger leaves. Our lab has engaged in the development of sensitive, large-scale diagnosis tools for this disease for the last three years. So far two protocols for fast dsRNA purification and visualization were developed and validated, and a RT-PCR system using only one oligonucleotide as primer, as well as an antibody are in final phase of validation period.

O14

Identification of candidate genes involved in abiotic and biotic tolerance in cDNA library from *Musa Acuminata* ssp. *Burmannicoides*, var. Calcutta 4 (AA) leaves

Manoel T. Souza Júnior, C. M. R .Santos, N. F. Martins., H. M. Hörberg, E. R. P. de Almeida, M. C. F. Coelho, F. R. da Silva, A. R. Caetano
Embrapa Recursos Genéticos e Biotecnologia, Parque Estação Biológica, Final Av. W5 Norte, CP 02372, Brasília, DF, CEP 70.770-900, Brazil, msouza@cenargen.embrapa.br

In order to discover genes expressed in leaves of *Musa acuminata* ssp. *burmannicoides* var. Calcutta 4 (AA) plants, we produced and characterized two full-length enriched cDNAs libraries. Total RNAs from plants submitted to temperatures ranging from 5°C to 25°C and from 25°C to 45°C were used to produce a COLD and a HOT cDNA library, respectively. We sequenced a total of 2.880 clones, 1.440 of each library. After cleaning, the remaining 2.286 sequences from both libraries were assembled into 1.019 putative transcripts, 217 clusters and 802 of which are formed by one single read. These putative transcripts were denominated *Musa acuminata* Assembled ESTs Sequence (MaAES), and 22.87% of them present no match with existing sequences in public databases. Annotation of the MaAES data set categorized then in 22 functional classes. Out of the 2,286 high quality sequences, 715 (31.28%) came from full-length cDNA clones, and produced a set of 149 unique genes. MaAES with high sequence similarity to genes described as involved in abiotic and biotic stress, such as drought and salt tolerance, and fungi resistance, were identified. These MaAES are important tools for gene discovery in the long-term process of development of banana plants more tolerant to abiotic and biotic stresses.

O15

Effects of the different dates of female flower bloom on fruit growth and size in litchi (*Chinensis sonn*)

Li Jianguo, Huang Xuming, Huang Huibai
China Litchi Research Center, South China Agricultural University, Guangzhou 510640, PR China, jianli@scau.edu.cn

Fruit growth and fruit size were comparatively studied between fruit from early and late blooms on the same panicle in litchi cv. 'Feizixiao' (mid-season cultivar), and between fruit from the female flower blossomed on different date in 'Nuomici' (late cultivar) on different trees in the same orchard. The results showed that litchi fruit growth could be divided into two stages (Stage I and Stage II). No differences in the growth patterns of whole fruit and fruit parts (single S pattern) were revealed between fruit from female bloom at different dates. However, fruit from earlier bloom showed longer stage I and longer fruit development period. The lengths of stage I and stage II of fruit from early bloom were respectively 44 and 31 d in 'Feizixiao', and 65 d and 24 d in 'Nuomici', while those from late bloom were 34 d and 35d in 'Feizixiao', and 45 d and 31 d in 'Nuomici'. Fruit from early bloom were significantly larger than those from late bloom, with larger pericarp and aril. Fruit weights from early and late bloom of 'Feizixiao' were respectively 32.41g and 20.79g, and those of 'Nomici' were 26.17g and 22.98g. By comparison of fruits from panicles bloomed at the date between the two cultivars differing in maturation season, it was found that the duration from pollination to full maturity mainly depends on the length of stage I.

O16

Effects of hydrogen cyanamide on bud break of grapevine cv. Italia in the São Francisco River Valley

Patrícia Coelho de Souza Leão, Emanuel Élder G. da Silva
Embrapa Semi-Árido, CP 23, CEP 56300-970, Petrolina-PE, Brazil, patricia@cpatsa.embrapa.br, davi@cpatsa.embrapa.br
Financial Support: CNPq, Banco do Nordeste, Improcrop

In conditions of tropical climate as the São Francisco valley, northeast of Brazil, grapevine presents dormancy of buds and high apical dominance. This work aimed to evaluate the effects of hydrogen cyanamide, spreader-sticker and torsion of the canes after the pruning on grapevine bud break cv. Italia. The trial was carried out in petrolina, pe, during two growing seasons (2001-2002). The treatments were as follows: 1) control; 2) h_2cn_2 2.45%; 3)H_2CN_2 2.94%; 4)h_2cn_2 3.43%; 5)h_2cn_2 2.94% + break- thru® 0.03% and 6) h_2cn_2 2.45% + torsion of the canes, in a randomized blocks design with four replications. The results shows that the hydrogen cyanamide, independent of the doses increased the bud burst and bud fruitfulness, with increments of 68% and 84% in the yield per plant, respectively in the 1st and 2nd growing seasons. There were no effects on the berry size, sugars and acidity content of the fruits, as well as, harvest anticipation. There was no response to the spreader-sticker. On the other hand, the practice of torsion of the canes presented a tendency to increase the effects of the hydrogen cyanamide.

O17

Effects of gibberelic acid, crop-set and girdling on the quality of bunches of table grape cv. 'Catalunha' in São Francisco river valley

Patrícia Coelho de Souza Leão, *Davi José Silva, Emanuel Élder G. da Silva*
Embrapa Semi-Árido, C.P 23, CEP 56300-970, Petrolina, PE, Brazil, patricia@cpatsa.embrapa.br, davi@cpatsa.embrapa.br
Financial support: CNPq, Banco do Nordeste, Improcrop

The present research was aimed to evaluate the effects of the gibberellic acid, bio-stimulant Crop-Set and girdling applied during bloom and post-bloom stage to improve yield and quality of the marketable bunches of the seedless grape cv. Catalunha in the São Francisco River Valley, Northeast of Brazil. The trial was carried out throughout two growing seasons (2001-2002) in the Bebedouro Experimental Station, Embrapa Semi-Árido, Petrolina, PE. The trial was laid out in a randomized complete block design with three replicates, each replicate consisting of a four-tree plot. The treatments were: gibberellic acid in unique dosage with five time applications (10 + 15 + 15 + 50 + 50 mg/L), Crop-Set in two doses 0.1 and 0.2% and trunk girdling, isolated or combined to each other. In 2001, the maximum values for berry weight, length and diameter were observed with girdling + gibberellic acid and girdling + gibberellic acid + Crop-Set 0.1% treatments. The treatments girdling and Crop-Set when applied isolated and/or combined to each other was not efficient to increase the berry size. In 2002, the treatments girdling + gibberellic acid and girdling + gibberellic acid + Crop-Set 0.2% promoted larger berries, increasing 32% in the berry length.

O18

Effect of fruit thinning on strawberry guava (*Psidium cattleianum*) fruit quality and alternate bearing

Thierry Michels, *Frédéric Normand*
CIRAD-FLHOR, BP 180, 97455 Saint Pierre cedex, Réunion Island, France, thierry.michels@cirad.fr

Strawberry guava naturally bears heavy crop at the end of the hot and rainy season, with a poor fruit quality as a consequence. Nitrogen triggers a floriferous flush in that species, leading to an interesting off-season production. For phenological constraints, nitrogen is usually applied just after the heavy natural crop and the triggered flush is weak and not very floriferous. As carbohydrate availability seems involved in the characteristics of the triggered flush, fruit thinning on the natural production appeared as a means to overcome the low response to nitrogen. Two treatments were compared, thinned and unthinned trees, for their effect on the fruit quality of the natural production, and on the characteristics of the subsequent triggered flush. Fruit thinning had a positive effect on the fruit quality of the natural cycle: the means fruit weight was improved (7.1g for thinned trees versus 5.4 g for unthinned trees), but total soluble solids were not affected. Fruit thinning had also a positive effect on the intensity and the floriferous quality of the flush triggered after the natural production, leading to a heavier off-season crop. The overall annual production was not affected by the treatments and was more evenly distributed between the natural and the triggered production cycles on thinned trees, whereas alternate bearing occurred on unthinned trees. The positive effect of thinning on yield steadiness continued during five consecutive production cycles.

O19

Leaf water potential and carbon dioxide assimilation influence flowering and yield of litchi (*Litchi chinensis* Sonn.)

S. Debnath, S. K. DuttaRay, S. K. Mitra
Department of Fruits and Orchard Management, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur 741252, Nadia, West Bengal, India, sisirm@vsnl.net

Low yield of litchi is a major problem worldwide. It is thought to be related to poor flowering intensity. A dry period before flower differentiation is considered beneficial to litchi flowering. To obtain a better understanding of the effects of soil water deficits on flowering and yield of litchi, we studied the effects of water deficits on water relation, carbon dioxide assimilation, growth and yield of field-grown 22 years litchi cv. Bombai. We suggested that tree water status should not fall below a leaf water potential in the morning of -1.3 Mpa. This will be equivalent to watering every 10 to 12 days in sandy loam soil. The period of anthesis and early fruit development (fruit fresh weight < 1.0 g) appears sensitive to drought. Water deficit decreased fresh weight of flesh (20% lower in total fresh weight per fruit) than fruit from irrigated trees.

O20

Progress and problems in rooting *Carica papaya* cuttings

Peter Allan, Colleen Carlson
Horticultural Science, School of Agricultural Sciences & Agri-business, University of KwaZulu-Natal, Private Bag X 01, Scottsville 3209, Pietermaritzburg, South Africa. allan@nu.ac.za

Carica papaya is one of the few fruit crops that is still propagated commercially by seed. In the cool subtropical Pietermaritzburg area, a female clone 'Honey Gold' has been propagated successfully by rooting leafy cuttings for over 40 years. Vigorous stock plants, strict sanitation, adequate bottom heat, and even distribution and good control of intermittent mist to ensure leaf retention, are crucial for success. Rooting medium has a marked effect on rooting. While peat moss and perlite were used initially, the unavailability or high cost led to pine bark being used. Variable results have been obtained depending on bark age and composting technique. Tannins adversely affect rooting. Bacterial rots have occurred randomly. Application of bacillus and Tricoderma cultures or addition of coir peat to coarse bark medium had no benefit. Whereas 80-90% rooting has been achieved in 6-8 weeks in the past, in recent years only around 20% rooting has been achieved after 4 months in certain pine bark media. Methods to ensure good rooting at a reasonable cost are being investigated. Well-rooted cuttings have given excellent production with premium prices being paid for uniform quality fruit in South Africa, where distortion ringspot virus is not a problem.

O21

Papaya (*Carica papaya* L.) crown substitution of tainung 01 female plants for hermaphrodite ones through lateral grafting

Lucimar A. Lima[1], *Rodrigo M. Melo*[1] *and Osvaldo K. Yamanishi*[2]
[1] FAV/UnB, Brasília-DF, Brazil, PIBIC/CNPq Scholarship.
[2] FAV/UnB, Associate Professor, CNPq Researcher, kiyoshi@unb.br
Financial support: Fazenda Agronol. & Fazenda Grande Oeste

In Brazil, Tainung 01 is propagated through seeds imported from Taiwan (US$ 2,300.00/kg). Besides, 50% of the plants originated are female ones, with no commercial value. Cloning plants entitle to 100% of hermaphrodite plants and grafting allows scion/rootstock choice. A commercial planting of Tainung 01 at Bahia, was used to evaluate the performance of female plants grafted just after the flower sex definition. Scion pieces with different sizes and number of leaves were obtained from bearing hermaphrodite plants. Lateral grafting with six types of scion pieces: with no leaf, with one and two expanded leaves and different diameters (9-13mm; 13-15mm; 15-17mm) collected from lateral sprouting shoots of papaya trees was used. Effectiveness index 30 days after grafting was 93%. Best and significant results were accomplished by treatments that used small scion pieces and no humid chamber. No differences were found 120 days after grafting, for leaf area and number of fruits among grafted and control plants. Lateral grafting can be an excellent alternative for substitution of female plants, opening way to the planting of rootstock varieties (dwarf and/or tolerant to soil born diseases) to be grafted later on with a scion giving 100 % hermaphrodite plants of Tainung 01 or any other cultivar.

O22

Ultraestructural studies on the modes of action of a yeast antagonist (*Criptococcus magnus*) able to control anthracnose (*Colletotrichum gloesporioides*) of papaya

Guy de Capdeville[1], *Simone P. Miranda*[1], *Jansen R. P. Santos*[1]
[1]Embrapa Recursos Genéticos e Biotecnologia, Brasília-DF 70770-900

Papaya fruit (*Carica papaya* L.) are subjected to a number of postharvest diseases, which reduce fruit quality and market value. Among those diseases is Anthracnose caused by *Colletotrichum gloesporioides* (Penz.) Sacc. Infection by this fungus is, generally, initiated before harvest, but symptoms of the disease appear mainly after harvest as the fruit ripens. The main goal of this work was to study what possible modes of action may be involved in the ability of *Criptococcus magnus* (isolate CEN 63) to control *Colletotrichum gloesporioides* (Penz.) Sacc. the causal agent of anthracnose of papaya. Scanning Electron Microscopy analysis of the interaction between *Colletotrichum gloesporioides* (Penz.) Sacc., the yeast antagonist and fruit tissue was analyzed in freshly made wounds treated with the antagonist (10^8 cells/ml) and inoculated with the fungus at different times after the application of the antagonist (0, 24, 48 and 72 h). The population of the antagonist increased over time in the wounds as number of cells seemed to increase when time of application of the yeast in the wound increased. A flocculent material was found covering the wounds mostly in the treatments where the yeast was applied at times of 24 h or greater before incoculation with the pathogen. Evidences were found suggesting that mycoparasitism is one of the modes of action of the antagonist since hypha of the fungus were frequently seen covered by yeasts cells. Additional studies are underway to determine other possible modes of action including the ability of the yeasts to produce chitinases and glucanases with effect on the pathogen, and ability to induce resistance in the fruit tissues.

O23

Liming to an adult guava tree orchard

Márcio Cleber de Medeiros Corrêa[1], *William Natale*[2], *Renato de Mello Prado*[2], *David Ariovaldo Banzatto*[2]

[1]Embrapa Agroindústria Tropical, CP 3761, CEP 60511-110, Fortaleza-CE, Brazil, mcmcor@ibest.com.br

[2]FCAV/Unesp, CEP 14884-900, Jaboticabal-SP, Brazil

Financial support: FAPESP

A field experiment was conducted with the objective to study the effect of doses of common (PRNT = 80 %) and calcinated (PRNT = 131 %) lime applied without incorporation on chemical properties of the soil (Yellow Red Podzolic - Ultisol), on leaf and fruit composition, and on adult guava (*Psidium guajava* L., cv. Paluma) tree orchard productivity. It was installed in Taquaritinga (21º24' S and 48º29' W; 521 m), São Paulo state, Brazil. The doses for the 0-20 cm layer were calculated as follows: 0; ½; 1; 1½ and 2 time the dose needed to increase V = 70 %, which corresponded to 0; 1.2; 2.4; 3.6 and 4.8 t ha^{-1} of common lime and 0; 0.75; 1.5; 2.25 and 3.0 t ha^{-1} of calcinated lime. A 2 x 5 factorial arrangement in three randomized blocks was used. Chemical evaluations of the soil were performed 6, 12 and 24 months after liming, and chemical evaluations of the leaves and fruits were performed annually at the time of full flowering and at the peak of harvesting, respectively, and annual production was assessed. The results obtained in the field trial showed that liming with common lime significantly increased the pH, the exchangeable Ca and Mg concentrations, the sum of bases and the base saturation, and reduced the potential acidity of the soil at a depth of 0-10 cm in the three samplings performed. These changes were also observed in the 10-20 cm layer 12 months after liming with calcinated lime and 24 months after liming with common.

O24

Efficiency of nitrogen fertilization on citrus orchard

Fabiano Zancaner Ueta[1], *Antonio Enedi Boaretto*[1], *Paulo Cesar O. Trivelin*[1], *Takashi Muraoka*[1], *Dirceu Mattos Jr.*[2]

[1]Centro de Energia Nuclear na Agricultura - USP, Av. Centenário 303, CEP 13400-00 Piracicaba-SP, Brazil, aeboaret@cena.usp.br

[2]Centro APTA Citros Sylvio Moreira, Rod. Anhanguera Km 158 s/n, CEP 13490-970 Cordeirópolis-SP, Brazil.

Nitrogen fertilization has increased the fruit production in Brazilian citrus plantation. ^{15}N enriched nitrogen fertilizers have been used for better understanding the absorption and distribution in different plant organs. Studies on the fate of N and of the validation of the N dose recommendation are scarce in Brazilian and international literature. In the present work the dynamics of the ^{15}N (ammonium sulfate), applied to soil, in the citrus orchard and the response of citrus tress to N fertilization rates were studied. Three year old 'Pera-Rio' orange trees grafted on lemon 'Cravo' were fertilized with 300g per tree of ^{15}N at fruiting stage to study the fate of N in the soil-orange tree system. Additionally, 0, 150, 300, 450 and 600g of N per each tree, split in three parts, were supplied from the beginning of spring to summer seasons. After harvesting the fruits, the trees that received the ^{15}N was cut and split in trunk, old twig, new twigs, leaves and fruits. The roots and the soil samples were also collected. Plant and soil samples were analyzed for isotope ratio of $^{14}N/^{15}N$ and total N. The response of N fertilization was measured by fruit yield. The data permitted to calculate the ^{15}N absorbed from fertilizer and the localization of it within the organs of the trees and the ^{15}N remained in the soil. The data of fruit yield did not show response to rate of N applied.

O25

Ethylene depending and non-depending metabolisms during postharvest ripening of banana

F. Mencarelli, G. DeMartino, A. Bellincontro, M. Mincini, R. Botondi
DISTA-LAPO, University of Viterbo, Via DeLellis, 01100 Viterbo, Italy, mencarel@unitus.it

Banana as soon as arrived at the port were treated with 1-MCP before and after ethylene treatment (200 ppm for 24 h). Banana treated before the ethylene treatment did not ripe even though at the end of storage period the firmness decreased dramatically. Bananas treated with 1-MCP after ethylene treatment changed color more slowly than the control but lost greatly the firmness. Sugars increased lower than control. After this test we decided to study the different metabolism involved as dependent and non dependent from ethylene focusing attention on chlorophillase activity and carotenoids, sucrose synthase gene expression and glucose, fructose, sucrose content, and finally to pectolitic enzymes involved in the firmness loss.

O26

Precooling parameters of the fig (*Ficus carica* L.) 'Roxo de Valinhos' packed in wooden box

Saul Dussan Sarria[1], *Sylvio Luis Honório*[2]
[1]Embrapa Agroindústria Tropical, CP 3761, CEP 60511-110, Fortaleza-CE, Brasil, sauldussan@yahoo.com.br
[2]Feagri/Unicamp, CP 6011, CEP 13083-875, Campinas-SP, Brazil, honorio@agr.unicamp.br
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The fig of the variety 'Roxo de Valinhos' are currently cooled in a cold room at a temperature between 1 to 3°C, and it is unknown how long it takes to cool the fruits to that temperature. This work was based on the need to determine the parameters of forced air precooling of the fig packed in wooden box used in the commercialization in the CEASA/Campinas-SP. The fruits were harvested at the harvest rami (3/4 of maturity) and size type 8 corresponding to 8 fruits per box, making up a total of 24 fruits per package. The wooden box refers to a box without cover with external dimensions: length 39 cm, width 29 cm and height 10 cm and opening area of 36 cm^2. Were utilised 48 packings, 24 in each side to form the californian tunnel. The air flow were 2.8 L/s per kilogram of product, with average velocity of the air of 1.5 m/s. The initial temperature of the fruits was of 19°C and the final temperature of 1°C, suitable temperature for the cooled storage. In the accompaniment of the internal temperature of the fruits was used thermocouples type T (AWG #24) and the evolution of the temperature was registered through the system of acquisition of data (AQDADOS) of the Linx. Based in the experimental data, the cooling curve was made and the exponential analytical model to predict the cooling time. The cooling time was 100 minutes, the cooling coefficient of 0.0289 min^{-1}, the Biot number of 1.0 and convective heat transference coefficient of 18.8 W/m^2°C.

O27

Effect of ethylene on chilling injury of 'Valência' oranges

Ricardo Alfredo Kluge[1], Maria Carolina Dario Vitti[1], Silvio Tavares[1], Maria das Graças Ongarelli[1], Angelo Pedro Jacomino[2], Giuseppina Pace Pereira Lima[3]

[1]USP/ESALQ–Dep. Ciências Biológicas, CP 09, CEP 13418-900, Piracicaba- SP, Brazil, rakluge@esalq.usp.br

[2]USP/ESALQ – Dep. Produção Vegetal

[3]UNESP/IB –Dep. Química e Bioquímica, CP 545, CEP 18618-000, Botucatu- SP, Brazil

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Fruit of many citrus cultivars become injured when exposed to low, non-freezing temperature. The objective of this study was to verify the change in ethylene production and its relation to the development of chilling injury on 'Valência' oranges during cold storage. The treatments applied were: temperature conditioning, intermittent warming (IW), 2-chloroethylfosfonic acid (ethephon), 1-methylcyclopropene (1-MCP) and aminoethoxyvinilglicine (AVG). Fruits were stored at 1°C and 90-95% RH during 90 days being evaluated each 15 days. Fruits without treatment (control) and ethephon-treated fruits showed greater chilling injuries, presenting 40-50% of fruit affected after 45 days of storage and nearly 100%, after 75 days. IW has significantly reduced chilling injury during cold storage, while 1-MCP and AVG showed lower effect when compared to IW. Ethylene was detected after 15 days in ethephon-treated fruits (4μL Kg^{-1} h^{-1}), while in the other treatments ethylene were detected only after 75 days (range of 0.5 to 2.0 μL Kg^{-1} h^{-1}). Little alterations on physical-chemical characteristics of fruits were observed in relation to applied treatments. Yet, there is not consistent evidence if ethylene is correlated with development of damage of chilling injury or with the resistance of fruit to chilling temperature.

O28

Identification of volatile compounds in mangaba (H*ancornia speciosa*) fruit at different stages of maturity

Narendra Narain[1], Daniel S. Ferreira[2], Daniela M.A.F. Navarro[3]

[1]Universidade Federal de Sergipe, CEP 49100-000, São Cristóvão, SE, Brasil, narendra@ufs.br

[2]Embrapa Algodão, Rua Osvaldo Cruz, 1143, Centenário, Caixa Postal 174, CEP 58107-720, Campina Grande, PB, Brasil, daniel@cnpa.embrapa.br

[3]Universidade Federal de Pernambuco, CEP. 50670-901, Recife, PE, Brasil, dmafn@ufpe.br

Financial support: CNPq

Mangaba (*Hancornia* speciosa) fruit of *Rio Tinto* type were harvested at different stages of maturity (85, 100 and 112 days after budding). Volatile compounds from the fruit pulp were extracted by using Likens and Nickerson's apparatus. Several extraction parameters such as weight of the pulp, dilution with water, solvent volume and extraction period were standardized to obtain highly characteristic fruit aroma extracts. The extracts were concentrated and analyzed for the identification of volatile compounds using a system of high resolution gas chromatograph coupled with mass spectrometer. Better separation was achieved in a polar capillary column (HP-INNOWax 30 m x 0.25 mm x 0.25 μm). Compounds were positively identified when the mass spectrum and retention index data of the identified compound matched with that of the authentic standard run under identical analytical conditions. A total of 106 volatile compounds were separated out of which 57 compounds were positively identified. The class of compounds which decreased in their contents from the fruit harvested at 85 days to that of the fruit harvested at 112 days were alcohols (3.2%), esters (3.6%) and terpenes. The principal volatile compounds present in the mangaba pulp were 3-hexanol (10.7%), 3-pentanol (3.8%), benzene (3.8%), 3-methyl 3-buten-1-ol (2.5%) and furfural (1.5%).

O29

Improving shelf life of fresh-cut mangoes (*Mangifera indica* cv 'Tommy Atkins') using UV-C irradiation and modified atmosphere packaging

Beatriz Murguía-Gutiérrez, J. Fernando Ayala-Zavala, Saúl Ruiz-Cruz, Gustavo A. González-Aguilar
CIAD, AC, DTAOV, Carretera a la Victoria Km 0.6, La Victoria. Hermosillo, Sonora (83000) México, gustavo@cascabel.ciad.mx

The effect of different exposure time to UV-C irradiation (0, 1, 3, 5, and 10 min) and modified atmosphere packaging (MAP) prior storage during 14 days at 5°C on shelf life of fresh-cut mangoes (rectangles) was investigated. At different intervals of storage, in-package atmosphere (O_2 and CO_2), percentage of leaked juice, firmness, color (L*, a* and b*), browning and decay index, total phenolic compounds, polyphenol oxidase (PPO), and phenyl-alanine ammonia lyase (PAL) activity, were evaluated. In-packaged atmosphere was significantly affected by storage time but not by UV-C treatment. Control fresh-cut-mangoes showed the highest leaked juice (%) followed by those treated with UV-C during 10 min. Firmness decreased in different extent in UV-C treated fresh-cut mangos during the storage time, being more noticeable in non-treated fruits. Fresh-cut mangoes treated with UV-C for 1 and 3 min, prevented significantly firmness loss and color change, compared with other treatments. However, UV-C exposure for 5 and 10 min enhanced these losses, which correlated positively with the higher phenolic compounds and PPO activity, similar to that observed in controls. UV-C treatment for 1 and 3 min, increased for 6 days shelf life of fresh-cut mangos without affecting visual appearance and sensorial attributes. We concluded that UV-C treatment could be considered as a new alternative to maintain quality of fresh-cut mangos during cold storage.

O30

Effects of postharvest treatments and film packaging on quality of 'Haden' mangoes (*Mangifera indica* L.)

Josalba Vidigal de Castro[1], *Roberta Normanha Bardauil Conte*[1], *Cássia Regina Limonta Carvalho*[1], *Carlos Jorge Rossetto*[2]
[1]Instituto Agronômico, IAC/APTA, CP 28, CEP 13001-970, Campinas, SP, Brazil, josalba@iac.sp.gov.br
[2]Apta Noroeste Paulista, CEP 15500-000, Votuporanga-SP, Brazil
Financial support: Pibic/CNPq

Brazil is one of the ten mango world producers and the second exporter country of this tropical fruit. Mango fresh fruits are perishable and the main problems are fruit overripening and disease development. Chitosan, derived from chitin, is biodegradable and ecofriendly besides exhibits antimicrobial properties. Essential oil of *Eucalyptus citriodora* also shows antimicrobial activity. It is useful as an alternative to replace chemical control in postharvest. In the present research the effects of postharvest treatments (hot water, chitosan coating and oil emulsion) and modified atmosphere on quality of 'Haden' mango fruits were studied. Mangoes in LDPE bags with and without potassium permanganate absorber were stored at 12°C and 90% RH. Quality parameters (TSS, pH, acidity, firmness, pulp and skin color) and losses (weight and rots) were evaluated. Control fruits (with no plastic film) were not influenced by postharvest treatments. Weight loss was reduced nine times in packed mangoes compared to control mangoes. The absorber did not improve mango quality. However, decay incidence was completely controlled for up to 28 days of refrigerated storage and the fruits remained firm for mangoes with combined treatment (hot water followed by chitosan) in polyethylene. Chemical variables for treatments and packing using Principal Components analysis showed 3 groups of ripening evolution: slower, similar and faster than the control.

O31

Postharvest factors affecting carotenoids in mango fruit - an overview

Zora Singh, K.T.H. Dang, S. Nair, H.D.J. Lalel, A.U. Malik
Muresk Institute, Division of Resources and Environment, Curtin University of Technology, GPO Box U1987, Perth, Western Australia 6845, Australia, zora@muresk.curtin.edu.au

Ripe mango fruit is a rich source of carotenoids (0.9–11 mg/100 g pulp) and β-carotene is the predominant carotenoid comprising 48-84% of the total carotenoids in mango (Pott et al, 2003). Present review will focus on the effects of various postharvest factors which regulate carotenoid production in mango fruit with a major focus on postharvest application of polyamines, edible coatings, controlled atmosphere storage (CA), low temperature storage, and chilling injury (CI) as well as fruit ripening temperature. Postharvest dip application of polyamines reduced total carotenoids (21%) as compared to control mango fruit. We found that mango fruit storage for 35 days under CA storage (9% CO_2 and 2% O_2) resulted in 2.5 times higher • carotene than control fruit. ß-carotene content of ripe fruit was significantly lower in the fruit, which were stored at 0 or 5ºC as compared to the fruit stored at 10, 15 and 20ºC. Our results suggested that the ß carotene biosynthesis during ripening was reduced due to CI induced by storing fruit at lower temperatures. Total carotenoids in the pulp of ripe fruit increased as the ripening temperature increased during the ripening period. Fruit ripened at the higher temperatures (30^{o}C or 35^{o}C) resulted in significantly ($P \leq 0.05$) higher total carotenoids content (77.93 and 79.11 mg kg^{-1} respectively) compared to the fruit ripened at 15^{o}C, 20^{o}C or 25^{o}C. In conclusion various postharvest factors including exogenous application of polyamines, edible coatings, CA storage, chilling injury and ripening temperature influence the production of carotenoids in ripe mango fruit.

O32

Quality of c*antaloupe* 'Torreon' melons after postharvest treatment with 1-MCP, chitosan and freshseal™

Carlos Farley Herbster Moura, Adriano da Silva Almeida, Wlairton Tome Moura, Ebenézer de Oliveira Silv, Ricardo Elesbão Alves, José Luiz Mosca, Maria Raquel Alcântara de Miranda
Embrapa Agroindústria Tropical, CP 3761, CEP 60.511-110, Fortaleza, CE, Brazil, elesbao@cnpat.embrapa.br, raquel@cnpat.embrapa.br

'Torreon' melons were submitted to postharvest treatments with 1-MCP (1-methylciclopropene) and with waxes chitosan and freshseal™ to enhance its quality. Experiments used fruits harvested on December of 2003 at a commercial farm in Mossoró in northeastern Brazil and were then transported to Embrapa Agroindustria Tropical located at Fortaleza, three hours distant. Upon arrival at Embrapa, fruits were sorted and treated with 1-MCP 600 ppb, chitosan 1% and freshseal™ 8%. Treatments were applied isolated from one another or in combination as examples some fruits were treated only with 1-MCP while others were treated with 1-MCP and then freshseal™. Fruits were then cold stored (5ºC and 90% R.H.) for 18 days when they were removed and kept under ambient conditions (25ºC and 90% R.H.) for more 9 days. Fruits were analyzed immediately after removal from cold storage and at each third day at ambient condition for internal and external appearance, firmness, skin color and weight loss. Only those fruits apt for consumption were analyzed. Torreon melons had a postharvest life of 22 days for all treatments. Firmness of fruits treated with 1-MCP followed by freshseal™ and chitosan followed by 1-MCP was greater for a longer period. Melons treated with both 1-MCP and freshseal™, either way, and 1-MCP followed by chitosan lost the least weight.

O33

Development of internal quality measurements for mangoes in Japan using near infrared technology

T. Akinaga[1], T. Tanabe[2], R. Hasbullah[3]
[1]University of the Ryukyu, Nishihara, Okinawa 903-0213, Japan, akinaga@agr.u-ryukyu.ac.jp
[2]FANTEC Research Institute Inc., Kosai, Shizuoka 431-0401, Japan
[3]FATETA, Bogor Agricultural University, Bogor 16002, Indonesia

Irwin is a major commercial cultivar in Japan. The fruits are manually sorted based on the inspector's experience and its quality is quite variable. To distribute high quality fruits, it is necessary to guarantee a high internal quality. We have carried out feasibility studies on the prediction of the internal quality of the mango fruits using an NIR analyzer since 1992. Some results were reported at ICTF 1996. The first mango sorting machine was installed in Okinawa by using a reflection type NIR analyzer in 1998. However, the mango sorting machine has been not become popular in Japan due to its cost and performance. In 2003, a new compact portable NIR analyzer was developed and began to gather multipurpose data for prediction of the internal quality and amount of fertilizer use in the orchard. A new mango sorting machine with an installed NIR analyzer for predicting the internal quality will be commercialized in the near future in Japan.

O34

Physical and chemical characterization of papaya fruit under mechanical injury

L.Vitorazi, Eder D. Resende, M.L.L. Martins, L.K.A Pinto, C.A.M Cordeiro
LTA/CCTA/UENF, Av. Alberto Lamego 2000, Parque Califórnia, Campos dos Goytacazes-RJ, Brazil, CEP 28013-600, eresende@uenf.br
Financial Support: CAPES, FAPERJ, FINEP

In this work it is investigate the influence of abrasion/puncture injury on the chemical and physical characteristics of papaya fruit related to mesocarp depth and sun face exposition. Papaya fruits cv 'Golden' were sorted in the packaging line of Caliman Agrícola S.A (Linhares-ES), in November 2003, having chemical and heat treatments and presenting 10% to 15% fruit skin yellowing. After mechanical injury treatments (T1• 15 e T2• 30 rolling times), they were wrapped in PEBD plastic film and stored in BOD for 22 days at 16^{o}C (85-95% RH). At time intervals, six fruits were evaluated into four parts: the upper and lower mesocarp halves and sunny/non-sunny fruit face. Results showed that bruising increased the mass loss after four days of storage. The Hunter parameters L and b was lower in treated fruits, being lower at sunny fruit face during the maturation. Fruit firmness was higher at the sunny fruit face of the outer mesocarp halves only for green fruits, decreasing after four days of storage, but the control presented higher firmness during the ripening. Fruits treated with T1 presented difference in firmness in four days of storage for both faces, but fruits treated with T2 had lost the firmness at this time. In all treatments, the PEBD film bags impaired the expected TSS accumulation, but bruising occurred after four days of storage. In treated fruits it was noted a slight accumulation of organic acids in the outer mesocarp halves at twelfth day of storage, also being higher in the sunny fruit face.

O35

Small-scale cultivation of two *Passiflora* spp. in the yungas of the department La Paz, Bolivia

Marleen Delanoy, Patrick Van Damme[2]
University of Gent, Dept. Plant Production, Lab. Tropical and Subtropical Agronomy and Ethnobotany, C.Links 653, 9000 Gent,
Belgium,marleen.delanoy@UGent.be, patrick.vandamme@UGent.be

In Nor and Sur Yungas, the cultivation system of *Passiflora edulis flav.* Deg. and *P. ligularis* Juss., locally known as "maracuyá" and "granadilla", respectively, was investigated. During 3 months of fieldwork, 307 individual, semi-structured interviews were carried out with villagers who where selected ad random. Detailed information about knowledge on and uses of both *Passiflora* species was collected. People growing *P. edulis flav.* or *P. ligularis* were asked about the cultivation system and they use the reason(s) why they cultivate that specific *Passiflora* species, preference in taste and size of the fruit and cultivation problems encountered. If the fruit was commercialised by the respondent, questions were asked about the commercialization and related possible problems. The two investigated species are commonly known and knowledge about them is influenced by the informant's age and altitude at which the informant lives. 42.8% of informants own at least one *Passiflora* plant. All growers use a low-input cultivation system and the production is destined for self-consumption. 61.5% of informants selling *P. edulis flav.* fruits have no problems with their commercialisation, while this is even 75% for *P. ligularis*. Cultivation of *P. edulis flav.* or *P. ligularis* appears to be profitable.

O36

The main tropical and subtropical fruits production in Mainland China

Jianguo Li, Houbin Chen
Tropical and Subtropical Fruits Research Lab., South China Agricultural University, Guangzhou, 510640, PR, China, jianli@scau.edu.cn

Lychee, longan, banana, mango and pineapple are the top five tropical and subtropical fruits in Mainland China. Geological and ecological distribution, production (planted area, harvested area, production and value in the major production provinces of China during 1998-2002), major varieties, marketing and main constraints for these fruits were included in this paper. These five crops are concentrated in the southern five provinces (Guangdong, Guangxi, Hannan, Fujian and Yunnan) where more than 90 percent are grown. The total planted area of the whole country in 2002 for lychee, longan, banana, mango and pineapple were approximately 570,835.70 hectares, 449,950.54 hectares, 259,657.87 hectares, 294.000 hectares, 56,866.84 hectares with the total production of about 1523300 metric tons, 950600 metric tons, 5,565.900 metric tons, 3,343.000 metric tons, 827.100 metric tons respectively. Most of these fresh fruits are locally consumed, only very small scale is exported to South-East Asia. In general, the local market price of litchi is the highest among these five crops, but it fluctuated largely year to year due to production fluctuation. Poor quality and no good brand are the common constraints for these crops. Moreover, irregular bearing and short storage period are another two constraints for litchi and longan, and frost, typhoon and *Fusarium* wilt are the main constraints for banana.

O37

Indonesia tropical fruit industry – challenges and opportunities

Roedhy Poerwanto
Directorate of Fruit Crops, Directorate General of Horticulture Production, Ministry of Agriculture, Jakarta, Indonesia roedhy@indo.net.id

Lying astride the equator in South East Asia region, Indonesia is one of the tropical countries with wide biological diversity. Numerous edible fruit species are found over the archipelago, offering wide variation of nutritional quality, taste, flavor, and seasonal availability. Some of the fruit species have become commercial, but have not been explored optimally. Recently, market potential of tropical fruits, both for foreign as well as domestic market, increased significantly due to population growth, better living condition, and promotion of international tourism. The total production of fruits in 2002 is 11.663.517 tons, which is dominated by banana, mango, citrus, salak, papaya, and pineapple in successively. Almost all fruit are produced in compound garden as secondary crops by small farmer or in house yard. The commercial orchards of fruit trees are existing on limited are of banana (Cavendish for export), pineapple (for canned fruits), mango, and citrus. Mangosteen, pineapple, banana, and mango are the major fruit exported by Indonesia. The role of Indonesia in international fruit market is small due to high national demand and the quality has not met international standard. However, in the future Indonesia will play significant role in international fruit market, especially for pineapple, mango, banana, and mangosteen.

O38

Wax apples industry in Taiwan

Zen-hong Shü[1], Rong-mao Lai[2], Ji-jwo Huang[3], Ming-chuan Lee[2], Der-nan Wang[3]
[1]Department of Plant Industry, National Pingtung University of Science and Technology, NeiPu, Pingtung 912, Taiwan, P. R. China, zhshu@mail.npust.edu.tw
[2]Kaohsiung District Agricultural Improvement Station, COA, Pingtung 900, Taiwan, P.R. China
[3]Fengshan Tropical Horticultural Experiment Station, TARI, COA, Fengshan, Kaohsiung 830, Taiwan, P.R. China

The Wax apple is native to Malaya to the Andaman and the Nicobar islands. It is very common in Southeast Asia, Taiwan, India and also grows well in central and South America. This tropical tree can grow to a height of 5-15 m depending on environmental conditions. Fruits of wax apples are bell-shaped and prefer warm temperatures for normal development. Flowers appear in March in south Taiwan and fruits ripen in May under natural condition. However, thanks to the off-season production technique, fruits can be harvest year-round in Taiwan now. Trunk girdling, shading on tree canopy, root pruning or flooding create favorable conditions for flower forcing. The 'Pink' cultivar represents 95 % of the planted area in Taiwan. Despite its name, this cultivar produces fruits varying from pink to deep red, depending on environmental and cultural conditions. Best prices are obtained with big, crispy, thick-fleshed, juicy, sweet and deep red fruits. Fruit quality is influenced by many factors, such as light, temperature, position on the tree, growing stage, leaf:fruit ratio, supplemental calcium and manganese applications.

POSTERS

P001

Overview of value addition in tropical fruits in India

Sisir K.Mitra[1], *Ivi Chakraborty*[2]
[1]Department of Fruits and Orchard Management, Faculty of Horticulture, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur 741252, West Bengal, India, sisirm@vsnl.net
[2]Department of Postharvest Technology of Horticultural Crops, Faculty of Horticulture, West Bengal, India, sisirm@vsnl.net

Endowed with diverse climatic conditions and blessed with fertile land, India is at the enviable position in the world in terms of production of primary agricultural products. Despite being the world's leading producer of several commodities such as fruits, vegetables, rice, wheat, tea, sugar, milk and fishery and aquaculture products, its position in the international trade in agriculture is not very significant. Across the world, food industry plays a vital in development the economy. In India, however, this does not appear to be the case, where the value addition is less than 2% of total horticultural produce compared with 70% of the total produced in Brazil and 78% in Philippines. The 70 billion-dollar Indian Food Processing Industry is characterized by the predominance of small and tiny units all over the country. The domestic food industry is also undergoing a sea change of food consumption pattern of Indian consumers. Increase in income, increase in number of working female population and effect of internationalization are cited as major reasons in change of food consumption pattern. Value addition can be accomplished through modern practices and processes. Changes in consumers' desires today for foods that are more convenient to store and prepare for consumption, are higher in quality and freshness, more natural, nutritionally healthier and medicinally sound. Strategies to meet these demands include modifications to existing foods and the adoption of innovative and more sophisticated processing technologies.

P002

Present status and future potential of subtropical fruits in the Outer Himalayan region of Himachal Pradesh

Shashi K Sharma, Sd Badiyala
University of Horticulture and Forestry, Regional Horticultural and Forestry Research Station, Bhota, Hamirpur, Himachal Pradesh – 176 041, India, shashi_uhf@rediffmail.com

Subtropical fruits have attained significant growth in acreage in the outer Himalayan region of Himachal Pradesh, during the recent past. This region is stretched between 30°22’ to 33°12’ N latitude and 75°47’ to 79°41’E longitude with altitudinal variation between 350 to 1000m a.s.l. Present paper discusses in detail the strength and weaknesses of subtropical fruit growing in the region. Late maturity of the fruits, bring better market remuneration to the farmers, and suboptimal growing conditions are reported to be strongest strength and weakness respectively, of the region. Prioritization of subtropical fruit species for different agro-ecological situations of the region have been described through micro level priority setting procedures.

P003

Buying and consumption preferences of banana (*Musa* spp.) in Boa Vista, Brazil

Cássia C. Caliari[1], Moisés Mourão Jr.[1], Rosianne N. T. Barbosa[1], Lionésia S. Esbell[1], Paulo R V. S. Pereira[1], Admar B. Alves[1], André D. Cerri[2], Ailton R. Santana[3], Karina P. Brito[3]

[1]Embrapa Roraima, CP 133, CEP 69301-970, Boa Vista, RR, Brasil, cassia@cpafrr.embrapa.br

[2]Secretaria Estadual de Desenvolvimento, Boa Vista, RR, Brasil

[3]Secretaria Estadual de Agricultura e Abastecimento, Boa Vista, RR, Brasil

Many factors can influence consumer's buying behavior, such as cultural, social, personal and psychological factors. According to the principle of marketing administration, there are five philosophies, based upon determined concepts, which guide the activities of a company. (i) production; (ii) product; (iii) sale; (iv) marketing; and (v) social marketing. So, the knowledge of the preferences and habits of consumers became fundamental to understand the market behavior and consequently offer appropriate products, in order to keep and conquer customers. The objective of the present research was to identify buying and consumption preferences of banana consumers in Boa Vista, Roraima, Brazil. The research method used was a survey and by means of a questionnaire a sample of 383 consumers were interviewed in nine different stores. The most remarkable results were the preference of consumers by the varieties "maçã" and "prata"and by mature and midle sized fruits. The habit buying is in clusters, weekly. The prefered ways of consumption are *in natura* and as a lactic beverage.

P004

Research and fruit production potential of changunga [*Byrsonima crassifolia (*L.) Kunth] in Michoacan, Mexico

Jeannette Sofía Bayuelo Jiménez[1], Julio César Lozano Rico[2]

[1]Univ. Michoacana de San Nicolás de Hidalgo, Km. 9.5 Carr. Morelia-Zinapécuaro, C.P. 58880, Michoacán, México, jsbayuelo@hotmail.com

[2]Univ. Michoacana de San Nicolás de Hidalgo, Paseo Gral. Lázaro Cárdenas y Berlín s/n, C.P. 60190, Uruapan, Michoacán, México, jucelo11@yahoo.com

It is expected to show the possibility of making a mass utilization of a polyvalent species of the deciduous tropical forest in the State of Michoacan, Mexico. The 'Changunga' [*Byrsonima crassifolia* (L.) Kunth] specie is studied, because it has high perspectives to be used in reforestation programs and fruit production in tropical areas having no raining pattern. The objective of this research was to evaluate promising wild Changunga accessions for fruit production of the Southern-Eastern Michoacan considering aspects of geographical, ecophysiological, morphological, agronomic and marketing parameters. The first stage of this study presents the evaluation of qualitative and quantitative characteristics of 65 fruit tree accessions of Changunga. Clusters analysis of data indicated three distinct groups with 33, 12, and 20 trees, respectively. Canonic discriminating analysis detected the variables more affecting group differentiation. Those were fruit acidity, Brix degree, pH, proteins, fruit and endocarp length, fruit diameter, fruit weight; tree high, fructification and distribution. The origin of these materials is related to the classifications obtained on field studies. These observations provide the first reported in-depth insights into the genetic diversity of Changunga for fruit production in Michoacan. Most of these accessions are not yet commercially exploited but nevertheless represent a fruit production potential for regional markets. They might be employed for fresh consumption, or for industrial processing.

P005

Trend of prices for mangoes produced and commercialized in the sub-middle São Francisco region, Brazil

José Lincoln Pinheiro Araújo[1]*; Rebert Coelho Correia*[1]*, Edílson Pinheiro Araujo*[2]
[1]Embrapa Semi-Arido, C.P. 23, CEP 56300-970, Petrolina-PE, Brazil, lincoln@cpatsa.embrapa.br
[2]FACAPE, Brazil

The study had the purpose of showing the seasonal mango price variation produced and commercialized from 1995 to 2003 in the Sub-middle São Francisco region. The analyses used the monthly price average, adjusted with the Getúlio Vargas foundation index. The data were monthly collected at the Juazeiro Producer Trade center that is a reference in horticultural commercialization in Northeast of Brazil. The studies showed that the January index was equal to the annual average and that from February to May the index was higher than the annual average. In the rest of months of the year, the index was lower than the annual average. The seasonal highest index occurred in May, 53% over the average one. The lowest one occurred in November with 52.71% below the annual average. In relation to big variations, the analyses showed that it occurred only in the months of February and March. The χ^2 of the statistical test indicated that the index of prices for mangoes in the Sub-middle São Francisco region during the analyzed period were very unstable.

P006

Analysis of production costs and profit of melons produced in the sub-middle São Francisco river valley, Brazil

José Lincoln Pinheiro Araújo[1]*; Edílson Pinheiro Araujo*[2]
[1]Embrapa Semi-Árido, C.P. 23, CEP 56300-970, Petrolina-PE, Brazil, lincoln@cpatsa.embrapa.br
[2]FACAPE, Brazil

In this study, the production costs and profit of melon exploitation in the Sub-middle São Francisco River Valley were analyzed. This region is the third melon grower in Brazil. However, having this crop a high production cost, it is necessary for the producers to know the real situation of the costs and the profitability of the agribusiness. The data were obtained from typical melon growers of the region and were composed by fixed and variable costs. In order to obtain the economical viability of this activity, the partial budget method, from the Agricultural Economy Institute, was utilized. The results indicated that the inputs fertilizers, seeds and pesticides were the items which most contributed to the costs of melon cultivation, being responsible for 73.40 % of the total costs, with the seeds, the more expressive, making up 29.23 % of the total costs. The analysis of economical viability showed that melon exploitation in the Sub middle São Francisco River Valley presents economically satisfactory results within several economical efficiency indices. The cost-benefit analysis was 0.42 %, the break even corresponded to the yield of 14,084 kg/ha, and the safety line registered a value of –0.29.

P007

Identification of differentially expressed genes in banana ripening using differential display-PCR

A.Godoy, F.M. Lajolo, J.R.O. Nascimento
Depart. de Alimentos e Nutrição Experimental – FCF/USP, Av. Prof. Lineu Prestes 580, Butantã-SP, Brazil CEP 05508-000, adrgodoy@usp.br
Financial spport: CAPES and FAPESP

Fruit ripening is a developmental process that involves biochemical changes dependent on gene expression. The study of gene expression can allow the identification of regulatory genes. In this work, the differential display technique (DD-PCR) is used to identify genes that change in expression during banana (*Musa acuminata*) ripening. Total RNA was isolated from unripe and ripe bananas and the first-strand cDNA was synthesized using oligo (dT_{12-18}) as primer. The cDNA was amplified by PCR with several pairs of primers in the presence of [α^{32}P]-dCTP. The amplified cDNAs were separated by polyacrylamide electrophoresis and the profiles of cDNA bands from unripe and ripe fruits were compared. The differentially expressed bands were cut out of the gel, eluted and reamplified with the same primes. About 250 bands were selected and analyzed by Reverse Northern-blot. The sequenced bands were compared with the available data from Genbank and some of them presented a high identity level. Others sequences showed low identity, probably because they contained most of the 3' untranslated region RNA.

P008

Genetic variability of cajá umbú (*Spondias* spp.) accessions in the tropical rainforest zone of Pernambuco State, Brazil

José Severino de Lira Júnior[1], Ildo Eliezer Lederman[2], Rosimar dos Santos Musser[1],Luiza Suely Semen Martins[1]
[1]Universidade Federal Rural de Pernambuco, CEP 52171-030, Recife-PE, Brazil, lira.jr@bol.com.br
[2]Empresa Pernambucana de Pesquisa Agropecuária, CEP 50761-000, Recife-PE, Brazil

Analysis of isozymes has many applications in plants breeding, mainly, in the study of genetic variability, as they are direct product of genes expression. The objective of this study was to estimate genetic similarity among thirty-three accessions of caja-umbu Germplasm Bank grown under climatic conditions of the tropical rainforest zone of Pernambuco state – Brazil. The analysis were conducted on a 300mg sample taken from young leaves and macerated with sucrose, polivinilpirrolidon and lithium borate and Tris-citrate buffers, submitted to electrophoretic run in polyacrilamide gel. The gels were coloured for the following isoenzymatic sistems: Peroxidase (POX), Esterase (EST), Acid Phosphatase (ACP) and Glutamate-Oxaloacetate Transaminase (GOT). By genetic similarity analysis, samples were grouped in main sub-groups, showing relations between agronomic and isoenzymatic characteristics among the accessions examined.

P009

Cytogenetic analysis of jenipapo (*Genipa americana* L.)

Rita C.V. Santos[1], *M.R. Bertão*[2]
[1]Departamento de Ciências Biológicas, Universidade Estadual de Santa Cruz, Ilhéus, BA, Brazil, ritabiologa@hotmail.com
[2]Departamento de Ciências Biológicas, Universidade Estadual de São Paulo, Assis-SP, Brazil
Financial support: UESC, FINEP, FAPESB

The 'jenipapo' (*Genipa americana L.*, Rubiaceae) is largely distributed over the tropical American continent. In this work, we aimed at the karyotypic characterization of *G. americana* through morphometric parameters, as well as by evaluations of active nucleolus organizing regions (NOR). Seeds from trees at UESC's campus (Ilhéus-BA) were germinated, the root tips collected and subjected to a pre-treatment with 0.03% of 8-hydroxyquinoline for 2,5 hours, to obtain cytological preparations at mitotic metaphases. The roots were fixed in Carnoy (3:1) and transferred to 70% ethanol, where they were subjected to staining assays by the methods of Feulgen and NOR banding. Cytological preps were obtained through the technique of smashing roots in 2% acetic orcein (Feulgen) and Carnoy fixer (NOR banding). The cytological analysis evidenced a diploid number of 22 chromosomes for *G. americana*, confirming previous data by Guerra (1988). The morphometric analysis of the chromosomes allowed the production of a standard karyotype constituted by metacentric and submetacentric chromosome pairs, whereas the NOR banding technique indicated the presence of interphase nuclei bearing 1 to 2 nucleolus organizing regions, corresponding to rDNA active sites. The information here obtained is important for the development of strategies dealing with conservation and sustainable exploration of this species, as well as for applications in 'jenipapo' breeding programs.

P010

Isolation and culture of longan (*Dimocarpus longan* Lour) protoplasts

Kazumitsu Matsumoto[1], *Simon Raharjo*[2], *Pamela A. Moon*[2], *Richard E. Litz*[2]
[1]Embrapa Genetic Resources and Biotechnology, PqEB Final, Av. W3 Norte, CEP 70770-900 Brasilia-DF, Brazil
[2]Tropical Research and Education Center, University of Florida, Homestead-FL, USA, kazumoto@cenargen.embrapa.br

Somaclonal mutant selection on protoplasts and somatic hybridization by protoplast fusion could be useful methods for fruit tree breeding. Aiming to make them practicable, a method of isolation and culture of longan (*Dimocarpus longan* Lour.) protoplasts was developed. Approximately two millions of protoplasts were obtained from a 100-mg-callus after the treatment with 0.375% Cellulase onozuka RS and 0.05% Pectolyase Y23 for 15 hours. They were inoculated with a density of 10^6 protoplasts·ml^{-1} or higher into a modified liquid MS medium supplemented with 0.55M D-mannitol as an osmotic regulator, and cultured on a gyratory shaker with slow shaking in dark. After 2 weeks, D-mannitol of the medium was reduced to 0.22M. Cultivating further 3 weeks, the cultures were transferred to a modified solid MS medium without the osmotic regulator. Microcalli were regenerated from the protoplasts after 3 months of culture.

P011

Fingerprinting analysis of mango (*Mangifera indica* L.) cultivars produced in Brazil using RAPD markers

Fábio G. Faleiro, Maria C.R. Cordeiro, Alberto C.Q. Pinto, Carlos J. Rosseto, Solange R.M. Andrade, Lilia M.S. Braga, Thiago L.P.O. Souza
Embrapa Cerrados, CP 08223, CEP 73301-970, Planaltina-DF, Brazil, ffaleiro@cpac.embrapa.br

The Brazilian mango commercial production is highly concentrated on cultivar Tommy Atkins, which has low quality fruit. Brazilian cultivars, such as IAC 110 and 'Roxa' have been evaluated to substitute 'Tommy Atkins' although 'Keitt', 'Palmer', 'Joa', 'Bourbon' and other cultivars are also being evaluated. Some of the cultivars have been cultivated in different regions with some phenotypic variations. The objective of this work was to evaluate the genetic similarities of 12 mango cultivars cultivated in different Brazil regions using RAPD markers. The genomic DNA of each cultivar was extracted and amplified using 18 decamer primers to obtain RAPD markers. These markers were transformed into a binary matrix data to estimate genetic similarities among varieties and to perform cluster analysis. It was obtainded 186 molecular markers, from which 29.0% were monomorphic. The genetic similarities among the 12 cultivars ranged from 0.728 and 0.985. There are not genetic variation between 'Tommy Atkins' cultivated in São Paulo and Savanna region. The same result was verified to Keitt and Palmer cultivars. The 'Bourbon' cultivated in São Paulo was genetically different of 'Bourbon' cultivated in Savanna region. 'Joa' was not genetically related to any other cultivar analysed. Brazilian cultivar IAC 110 and Roxa showed the shortest genetic distances to 'Tommy Atkins'.

P012

Genetic variability of mango (*Mangifer indica* L.) varieties used in Embrapa Cerrados breeding program using RAPD markers

Fábio G. Faleiro, Alberto C.Q. Pinto, Maria C.R. Cordeiro, Victor H.V. Ramos, Graciele Bellon, Solange R.M. Andrade, Jefferson F.N. Pinto
Embrapa Cerrados, CP 08223, CEP 73301-970, Planaltina-DF, Brazil, ffaleiro@cpac.embrapa.br

Embrapa Cerrados has been working on mango breeding program through intervarietal hybridization using varieties from India, Africa, Mexico, USA and Brazil since 1980. The objective of this work was to evaluate the genetic variability of 28 mango varieties of the group parental used in the Embrapa Cerrados breeding program. The genomic DNA of each variety was extracted and amplified using 21 decamer primers to obtain RAPD molecular markers. These markers were transformed into a binary matrix data to estimate genetic distances among varieties and to perform cluster analysis. It was obtained 350 molecular markers, from which 16.3% were monomorphic. The genetic distances among the 28 varieties ranged from 0.098 and 0.331. The lower genetic distances were detected between the varieties Edward and Glenn (0.098), Tommy Atkins and Keitt (0.101), and Apple and Malindi (0.112). There are high genetic variability among mango varieties from different countries, including the Brazilian ones. There was a grouping tendency of the important varieties from USA. These results emphasize the importance of the varieties used in the Embrapa Cerrados breeding program and provide useful information for future mango breeding activities.

P013

Parental identification of mango hybrids obtained by open crosses using RAPD markers

Maria Cristina R. Cordeiro, Alberto C. Q. Pinto; Fábio G. Faleiro, Lilia M.S. Fraga, José Neto Dias, George K.B. Lopes
Embrapa Cerrados, Rod. BR 020 km 18, CP 08223, CEP 73301-970, Planaltina, DF-Brazil, cristina@cpac.embrapa.br

Nowadays, mango represents one of the largest Brazilian commodities, which production increased significantly with great benefits for the country's economy. Embrapa Cerrados started a Mango Breeding Program during the eighties to solve some cultivar problems, such as pathogen susceptibility, physiological disorders and low fruit quality. This program has already released four new cultivars: Alfa, Beta, Lita and Roxa. The main methodological steps to obtain improved cultivars have been the controlled cross followed by agronomical and physical-chemical evaluations. The controlled cross methodology is efficient, however, it is difficult and time consuming, which also does not permit to obtain large families for genetic studies. In order to bypass these problems, a study was developed with open crosses of five important cultivars established in the field in a Latin square design with the aim of controlling the new harvested hybrid fruits. This work represents the first effort to establish an identification methodology of the male parent of hybrids produced in the Latin square area using RAPD molecular markers. It was proposed two main strategies: a) similarity analysis between parentals and hybrids and; b) presence of amplified fragments in hybrid and its most probable male parent. We think that at this stage, in which the experimental mango trees are still at young development, the factor plant proximity had less influence on fruit set of hybrid fruits than the wind and flowering period factors.

P014

Physical mapping of 5S and 45S rDNAs by fluorescent *in situ* hybridization in mango (*Mangifera indica* L.)

Keizo Yonemori, Kiyomi Nishiyama, Young-A Choi
Laboratory of Pomology, Graduate School of Agriculture, Kyoto-University, Sakyo-ku, Kyoto 606-8502, Japan, keizo@kais.kyoto-u.ac.jp

Mango (*Mangifera indica* L.) is thought to be diploid despite quite many numbers of chromosomes ($2n=2x=40$). Although the allopolyploid nature of *M. indica* is reported by Mukherjee (1950), no chromosome studies are available to elucidate genome composition of mango until now. We have applied fluorescent *in situ* hybridization (FISH) technique using 5S and 45S ribosomal DNAs (rDNAs) as probes on the somatic metaphase chromosome of mango for the first step to elucidate genome composition of mango. The digoxigenin (DIG)-labeled 5S or 45S probe was hybridized onto the chromosomes separately, and both of them were visualized by incubation with anti-DIG-fluorescein isothiocyanete (FITC). Strong signals of 5S rDNA were observed on two chromosomes and these two seemed to be homologous chromosomes due to their size and identical chromosomal location of 5S rDNA loci. On the other hand, six chromosomes were demonstrated to carry 45S rDNA loci. Among these six chromosomes, two chromosomes seemed to be homologous from their size and the location of rDNA loci in addition to signal intensity. But, other four chromosomes could not be identified whether or not these four form two pairs of chromosomes, since no clear images of these chromosomes were observed. In addition, multicolor FISH using 5S and 45S rDNA probes differently labeled with DIG and biotin, revealed separate localization of the two rDNA genes on different chromosomes of mango. We could distinguish eight chromosomes among forty chromosomes of mango in this study, but no evidence was obtained for a possibility of polyploidy nature in mango.

P015

Use of SSR molecular markers to determine pollen parent contribution to seed production in clementine (C*itrus reticulata*) orange

Stephen M. Southwick, Riaz Ahmad
Pomology Department, One Sheilds Avenue, University of California, Davis, CA, USA 95616l, smsouthwick@ucdavis.edu

Seeds in Clementine Mandarin (*Citrus reticulata*) oranges are not desirable when sold in the fresh market. Even though the Clementine oranges may be produced largely in solid blocks, seeds may be found where any self-pollination leads to seedless fruit. Seeds are believed to arise from undesirable cross pollination. Although it is believed that cross pollination is the cause of the seed, it is not clear which pollen parents are responsible and over what distance the pollen may travel. We collected seeds from fruit of selected Clementine and W. Murcott cultivars presumed to be seedless in order to investigate which pollen parents contribute to seed production. To determine the pollen parent source, we collected leaf samples from all potential pollen parents in the surrounding area near the source of fruiting Clementine. DNA was extracted from the seed (female) and from the leaves (male, potential pollen parent) and the DNA analyzed with 15 SSR markers previously developed from an enriched library of citrus cultivar 'Washington Navel' orange. We found that the SSR markers were able to determine the source of pollen for outcrossing in 95% of cases. Cultivars used for fruit and leaf samples and additional results will be presented.

P016

Cloning and sequencing of a putative myrosinase from papaya fruit (*Carica papaya* L.)

Maria Rosecler Miranda Rossetto, João Roberto Oliveira do Nascimento, Franco Maria Lajolo, Beatriz Rosana Cordenunsi
Departamento de Alimentos e Nutrição Experimental - FCF/USP, Avenida Lineu Prestes 580, CEP**:** 05508-000, São Paulo-SP, Brazil, rosecler@usp.br
Finacial support: FAPESP

The glucosinolate-myrosinase system is part of the defense response in plants. When tissue is damaged, the glucosinolates are degraded by myrosinases and toxic compounds are released. In papaya (*Carica papaya*) fruit the major compounds released are the benzylisothiocyanates, which seems to act against fruit flies and other microorganisms. This work describes the isolation and cloning of cDNA sequences that seems to encode for papaya myrosinase. The primers were based on the consensus sequence through conserved regions of the myrosinase from other plants and used to PCR amplify the cDNA, which were synthesized from seed RNA. Three PCR products were purified and cloned in the pCR® 4-TOPO vector and the sequencing of these clones indicated that they are all derived from the same sequence. The longest clone (975 bp) would encode for 325 aa (± 36kDa) of the myrosinase. This partial sequence is highly similar to the myrosinase from *Sinapis alba* (62%), *Brassica napus* (47%), *Raphanus sativus* (47%) and *Arabdopsis thaliana* (67%), which are species with high levels of the glucosinolates. This partial clone will be useful to prepare probes for the northern-blots, which could reveal the changes in myrosinase transcript level during papaya development and ripening.

P017

Isolation of papaya fruit genes affected by ethylene treatment

João Paulo Fabi, Beatriz Rosana Cordenunsi, Franco Maria Lajolo, João Roberto Oliveira do Nascimento
Departamento de Alimentos e Nutrição Experimental-FCF/USP, Av. Lineu Prestes 580 Bloco 14, CEP 05508-900, São Paulo SP Brazil, jpfabi@usp.br
Financial support: FAPESP

Papaya fruits (*Carica papaya*) are strongly affected by ethylene. In order to isolate some genes affected by ethylene treatment, the technique of "Differential Display-PCR" was employed to analyze cDNAs from treated and non-treated fruits. The cDNAs were submitted to PCR amplification with a combination of three random sense primers and nine antisense primers. The PCR reactions were separated in a denaturing PAGE and after the comparison of profiles; at least 50 bands corresponding to differentially expressed genes were removed from the gel and re-amplified. The difference in gene expression was confirmed by "Reverse Northern Blot" and the fragments were cloned, sequenced and compared to the Genbank® using the BLAST tool. Some of the sequences were predicted to encode enzymes from cell wall degradation and auxin-induced genes, while others were not clearly identified. These results are in accord to the expected changes in pulp firmness and hormone-response genes affected by ethylene treatment. The technique of "Differential Display-PCR" seems to be a powerful tool to investigate changes in gene expression during fruit ripening.

P018

Control of flowering in pineapple using genetic engineering

Yuri Trusov[1], Ebe Firoozabady[2], Neal Gutterson[2], Jimmy R. Botella[1]
[1]Plant Genetic Engineering Laboratory, Department of Botany, University of Queensland, Brisbane 4072, Australia, j.botella@botany.uq.edu.au
[2]DNA Plant Technology, 6701 San Pablo Ave. Oakland, CA 94608 USA

Smooth Cayenne accounts for approximately 70% of the world production of pineapple. Because Smooth Cayenne is highly heterozygous and exhibits considerable transgressive recombination, conventional breeding is unsuitable for developing new processing types if the outcomes are to be achieved in a reasonable time frame. Genetic engineering is ideally suited to improve Smooth Cayenne as it allows specific changes to be made to target genes without rearranging the entire genome. Natural flower induction is a major industry problem, usually occurring when shortening days and low temperatures give raise to increased ethylene production in the leaf tissue and plant stem apex which in turn stimulates flowering. Natural flowering fruit matures 4 to 6 weeks ahead of the normal summer harvest resulting in the need for extra harvest passes. Ethylene is produced through the sequential action of ACC synthase and ACC oxidase. Our team has cloned an ACC synthase gene from pineapple, expressed in meristems and activated under the environmental conditions that induce flowering in nature (ACACS1). Genetic constructs have been produced containing ACACS1 in sense orientation to induce silencing of the gene in the plant by co-suppression mechanisms. Transgenic plants have been produced and field trials conducted in Queensland for four years in order to study the characteristics of the transgenic lines. Promoter constructs driving the expression of the GUS gene have also been tested in the field trial. We have identified a number of transgenic lines with promising behavior that seem to have natural flowering inhibited.

P019

Toward improved fungal resistance in taro through genetic transformation

X. He[1], S. C. Miyasaka[1], M. Fitch[2], Y. Judy Zhu[3], P. H. Moore[2]
[1]University of Hawaii, Department of Tropical Plant and Soil Sciences, Hawaii, U.S.A
[2]USDA, PBARC, U.S.A
[3]Hawaii Agriculture Research Center, Hawaii, U.S.A, Jzhu@harc-hspa.com

Taro [*Colocasia esculenta* (L.) Schott] is one of the most important food crops in many Pacific Islands in the tropical region, and it has grown widely throughout Africa, Asia, the West Indies and South America. Phytophthora leaf blight, caused by *Phytophthora colocasiae* is the major fungal disease causing production losses of taro. To improve the taro disease resistance, a genetic transformation and regeneration system for taro has been developed. In this report, we will present our research on improving fungal resistance in taro through genetic engineering approach. A rice chitinase gene (CHI11) in a plasmid vector (pBI121) was introduced into taro calli using biolistic particle bombardment. Highly regenerative taro calli of cv. Bun Long were used as targets of bombardment. Bombarded calli were selected on Murashige and Skoog (MS) medium containing 2 mg L^{-1} BA, 1 mg L^{-1} NAA and 50 mg L^{-1} geneticin (G418). The candidate transgenic calli were screened by polymerase chain reaction (PCR) amplification using a primer set for the CHI11 gene. Shoots were regenerated from PCR positive calli and screened by PCR amplification again. The presence of CHI11 transgene was further confirmed by Southern blot analysis. The transgenic plant lines were propagated for fungal disease resistance assays. Preliminary result of fungal resistance bioassay will be reported.

P020

Analysis of genetic relationships in wax apple cultivars using RAPD markers

Chia-chien Chi[1], Zen-hong Shü[2]
[1]Institute of Tropical Agriculture and International Cooperation, P.R. China
[2]Department of Plant Industry, National Pingtung University of Science and Technology, NeiPu, Pingtung, Taiwan, P.R China, zhshu@mail.npust.edu.tw

Genetic markers are not only to be useful for cultivar identification but also for the purpose of mango breeding. The discovery of polymerase chain reaction (PCR) has led to development of another genetic marker system for detecting DNA polymorphisms. Random amplified polymorphic DNA (RAPD) involves PCR amplification of total genomic DNA using a single random primer of about ten bases and separating amplified products by agarose gel electrophoresis. About 95% of the wax apples in the current market are the 'Pink'. In recent years, however, many bigger types of wax apples have appeared in different areas, and these areas are expanding. Nevertheless, these big-fruited lines have neither been systematically classified nor had their characteristics investigated. The aim of the research was to find out the difference between the 'Pink' and these big-fruited lines and to compare the horticultural characteristics among these big-fruited lines. Thirteen wax apple cultivars were screened for RAPD markers. The selected markers were tested for the identification of these cultivars. Eight 10-mer primers were selected form 100 primers. Cultivar identification using RAPD analysis was performed with the 8 arbitrary primers. A total 84 RAPD markers were amplified among these cultivars. The genetic similarity between cultivars was assessed on the basis of Jaccard's similarity coefficient and cluster analysis was complemented with unweighted pair-group method analysis (UPGMA). The 13 wax apple cultivars can be categorized into 6 groups.

P021

Developing subtropical stone fruits in Taiwan

Ien-chie Wen
National Plant Genetic Resource Center, Taiwan Agricultural Research Institute, 189 Chungcheng Rd., Wufeng 413, Taichung Taiwan R.O.C., icwen@wufeng.tari.gov.tw

Taiwan, situated on the western edge of the Pacific Ocean, is transversed by the Tropic of Cancer and has a summer rainy season in a subtropical climate with a warm winter - the limiting factor for producing traditional temperate zone deciduous fruits. Local stone fruits (peach, plum and mume) varieties in Taiwan originated from genotypes brought by immigrants from southeast China about 1600 to 1700 AD. These stone fruits may not have the fruit quality (size, skin color, aroma and TSS, etc.) to compete in the modern fruit market, but these germoplasm have good adaptation, 50-100 chill units (cu), to Taiwan winters and tolerance to the hot and humid summer climate and can be grown with mango, papaya and banana in the subtropical lowlands. For developing low-chill, high quality stone fruits, more than 350 peach and plum cultivars were introduced from Brazil, Japan, South Africa, and the United States (Florida) in the last 20 years and crossed with Taiwan local varieties. The characteristics of new selections will be discussed in this paper.

P022

Toward fruit exploitation based on rainfed conditions or with a low water supply in the Brazilian Semi-arid region

Carlos Antonio Fernandes Santos, Francisco Pinheiro de Araujo, Nilton de Brito Cavalcanti, José Moacir Pinheiro Lima Filho, Viseldo Ribeiro de Oliveira, Clovis Eduardo de Souza Nascimento, Natoniel Franklin Melo
Embrapa Semi-Árido, C.P. 23, Petrolina-PE, Brasil, CEP 56300-970, casantos@cpatsa.embrapa.br

The Brazilian semi-arid region (BSA) comprises an area of around 900,000 km^2. The fruit exploitation has been done in irrigated fields, in an estimated area of 600,000 ha. It has been estimated that the potential irrigated area in the BSA is around 2.0 million ha, due to competition to generate electricity and to supply cities with water. On the other hand, it has been identified around 300 species endemic or sub-endemic to the BSA environment, some of them are native fruits species with specific or unique xerophytic mechanisms, which enable a long-term fruit production in the cyclical year water stress or deficit. Indeed, some species have the ability to flower before the first rainfall, showing a complete adaptation to the BSA environment. Some approaches have been pursued by the Embrapa Semi-Arid researchers, at Petrolina, state of Pernambuco: 1) expedition and collection of germplasm, pre-breeding and crop management of native fruits in order to establish managed fields of a specific species; 2) exploitation of a native species as rootstock of another species of the same genus in order to diversify and to increase the option of cultivation of non-water tolerant species; 3) eco-physiological studies to improve crop management and to help future genomic dissection of some xerophytic mechanisms. The overall expected results should be a 2 to 3-fold increase in the potential irrigated area, improving livelihoods through a sustainable fruit production in the poorest region of the country.

P023

Asian pear breeding for subtropical areas of Brazil

Wilson Barbosa[1], Celso V. Pommer[2], Antonio Fernando C. Tombolato[1], Laura M. Molina Meletti[1], Renato F. A. Veiga[1]
[1]Instituto Agronômico (IAC), Campinas-SP, Brazil, wbarbosa@iac.sp.gov.br
[2]Universidade de Brasília, Brasilia, DF, Brazil, pommer@unb.br

Crosses among Asian (*P. pyrifolia* (Burm.f.) Nakai) and European (*P. communis* L.) pear cultivars were made from 1992 to 1998 aiming to find new pear types for subtropical areas of Brazil. The first interspecific hybrids of IAC pear breeding were planted in various regions of São Paulo State, at latitudes from 21º11'S to 24º11'S and 11 to 200 chilling units (CU). The hybrids and its parents were genetically characterized through RAPD markers. In the progeny of 'Okusankichi' x 'D'água', the mean ages for the first bearing and fruit development period (FDP) were 3.8 years and 137 days, respectively. The fruit characters: early-ripening, round shape, russet-brown skin, crisp flesh were predominant in all crosses of Asian x Asian and Asian x European pears. Twenty six hybrids were selected, from which 12 of them are still under test in subtropical-tropical climate (0-80CU): IAC193-18, IAC193-122, IAC194-5, IAC194-32, IAC194-135, IAC293-5, IAC294-3, IAC294-117, IAC394-11, IAC394-14, IAC394-115 and IAC494-2. Its main characteristics are: fruit - round, oblate, oblong or pyriform shape, russet-brown or green skin, crisp or soft flesh; plant - medium-high vigor, upright-spreading form and FDP from 110 to 160 days. Through RAPD analysis, it was verified a clear separation among Asian and European types, which confirms the effectiveness of this technique for hybrid identification from different botanical groups.

P024

Growth and development of banana genotypes in Roraima, Brazil

Ana V.C Silva, E.N. Muniz, M. Mourão Júnior, O.R. Duarte, C.E.V. Lopes, G.C. Nogueira Filho
Embrapa Roraima, Br 174 Km 8, Distrito Industrial, CEP 69301-370 Boa Vista-RR, Brazil, anaveruska@hotmail.com

Despite the great number of varieties of banana in Brazil, when aspects such as preference of the consumer, productivity, tolerance to diseases and resistance to drought are considered, few of them present possibilities to be used commercially. Thus, the objective of the present work was to evaluate the growth and development of 12 genotypes of banana in Roraima, Brazil. The evaluated genotypes were: Pacovan, ST 1231, Bucanner, FHIA 2, Grane Naine, Nanicão, Ambrosia, Prata Anã, PV 4214, PV4285, 4268 PV and Calipso. It was utilized a randomized block design, with 12 treatments and 3 repetitions. The parameters evaluated were: height of the plant (m); the perimeter of stem (cm); nº of children emitted until the budding; nº of alive leaves in the budding; date of emission of 1º cluster; date of emission of 2º cluster and date of the harvest. "Nanicão" (2.12-2.64 m) and "Prata Anã" (2.39-2.65 m) presented the lesser size. The number of emitted children varied from 2.28 (hibrido ST 1231) to 3.61 (Nanicão and Ambrosia). The leaf number in the bloom presented two groupings, where "Fhia 2" presented the lesser leaf number (14.06) and "Bucanner" the greater, with 23.82 leaves. All the indicators of duration of the production cycle had presented influence of the genotypes and the average duration of the cycle of the banana for the first harvest varied from 278 to 292 days. The emission of the first cluster was precocious in the Prata Anã (103-130 days).

P025

Postharvest evaluation of banana genotypes cultivated in Roraima, Brazil

Ana V.C Silva, E.N. Muniz; M. Mourão Júnior, O.R. Duarte, C.E.V. Lopes, G.C. Nogueira Filho
Embrapa Roraima, Br 174 Km 8, Distrito Industrial, CEP 69301-370 Boa Vista-RR, Brazil, anaveruska@hotmail.com
Financial support: DCR/CNPq

The knowledge of the characteristics of varieties and hydrids after harvesting is important to breeders, farmers and consumers in order to use these information when making decisions. The objective of this work was to evaluate the fruits of twelve genotypes of banana (Pacovan, ST 1231, Bucanner, FHIA 2, Grane Naine, Nanicão, Ambrosia, Prata anã, PV 4214, PV4285, PV 4268 and Calipso). The characteristics evaluated were: weight of the cluster (kg); weight of rachis (kg); number of bunchs per cluster; number of fruits per cluster; weight of stems (kg); fresh mass, length (cm) and diameter (cm) of fruits; and thickness of peel (cm). The biggest fresh weight of clusters was observed in "Grane Naine" (17,98 kg). The productivity values varied from 10.01 t/ha in "Prata anã" to 26.28 t/ha in "Grane Naine". Between the most productive genoptypes, "Calipso" was the one that presented the higher proportion of high quality fruits and "Grane Naine" presented the higher number of high quality bunchs per cluster. There was a significant effect between number of fruits and genotypes, with "Fhia 2" achieving the best results (89.9). The genotype "Pacovan" presented the lesser number of fruits per cluster (48.6), followed by "PV 42142" (57.3), despite of have presented the higher percentage of good quality fruits per cluster.

P026

Improvement of musa cv. Raja (Aab): exploiting natural diversity

Siti Hawa Jamaluddin and M. Mooruthy
Horticulture Research Centre, Malaysian Agricultural Research and Development Institute (MARDI), GPO Box 12301, 50774 Kuala Lumpur, Malaysia, sitihawa@mardi.my

An approach has been attempted for the improvement of the dessert varieties in Malaysia with encouraging results for Pisang Mas, Pisang Berangan and Pisang Rastali. Pisang Raja is a dual-purpose variety – either as a sweet or as cooking variety. However, while fruit quality is superior, the yield is low compared to other cooking varieties. Time (months) to flowering is also longer (9-10) when compared to the dessert bananas as Pisang Mas (6), Pisang Berangan (7) and Cavendish (6-7). Tall plants is another negative feature of Pisang Raja as well as susceptibility to *Fusarium* wilt. About 1-3 clumps were collected per village or district with 1-4 suckers per clump. The average yield for Pisang Raja is about 14-16 kg, time to shooting at 250-300 days and plant height is 250-300 cm. Several accessions have been identified to be an improvement over the general average. One accession, '51-B', sourced from Raub, Pahang gave a bunch weight of 16.0 kg at first harvest, progressively increasing to 17.0 kg and 23.4 kg in the second and third harvest respectively, and is still free of *Fusarium* wilt disease after 3 fruiting cycles. Plant height however increased from 280 cm to 399 cm by the third harvest, while time to first flowering was recorded at 232 days. Other potential accessions include Pisang Raja Sanggang, Pisang Raja Ulu Dong with bunch weights of 18.0 kg and 16.8 kg recorded respectively at first harvest. These Pisang Raja accessions were multiplied through in-vitro and continuous selections made on the somaclonal population to further improve yield, earliness to fruiting and *Fusarium* wilt tolerance.

P027

Physical-chemical characteristics of caja-umbu fruits grown under the tropical rainforest of Pernambuco State, Brazil

José Severino de Lira Júnior[1], *Ildo Eliezer Lederman*[2], *Rosimar dos Santos Musser*[1], *Enayde de Almeida Melo*[1]

[1]Universidade Federal Rural de Pernambuco, CEP 52171-030, Recife-PE, Brazil, lira.jr@bol.com.br

[2]Empresa Pernambucana de Pesquisa Agropecuária, CEP 50761-000, Recife-PE, Brazil

Twenty five accessions of the Germplasm Bank of caja-umbu trees are being characterized at the Itambé Experimental Station belonging to Pernambuco State Agriculture Research Organization – IPA. The physical-chemical analyses were conducted at the Food Physical-chemical and Sensorial Laboratory of the Domestic Sciences Department/UFRPE. A sample composed of 40 ripe fruits was used for physical and chemical analysis namely fresh weight, longitudinal and transversal diameters, total soluble solids (TSS), acidity (TTA), pH and SST/TTA ratio. Among the accessions fruit weight ranged from 12,19 to 35,56 g; TTS ranged from a minimum of 9,10°Brix and a maximum of 11,45 °Brix whereas acidity ranged from 1,45% to 1,90% and juice pH ranged from 1,92 to 2,35.

P028

Evaluation of *cajuí* (*Anacardium spp.*) germplasm from Mid-North Brazilian Region by multivariate analysis

Maria do Socorro Moura Rufino[1], *Maria Pinheiro Fernandes Corrêa*[1], *Edson Basílio Soares*[2], *Lúcio Flavo Lopes Vasconcelos*[3] *Ricardo Elesbão Alves*[1], *Fernando Antonio Souza de Aragão*[4]

[1]Embrapa Agroindústria Tropical, CP 3761, CEP 60511-110, Fortaleza-CE, Brazil, elesbao@cnpat.embrapa.br

[2]Universidade Federal do Piauí, Campus Agrícola do Socopo, S/N, CEP 64049-550, Teresina-PI, Brazil, ebs@ruralnet.com.br

[3]Embrapa Meio-Norte, Caixa Postal 01, CEP 64000-970, Teresina-PI, Brazil, lucio@cpamn.embrapa.br

[4]Embrapa Hortaliças, CP 218, CEP 70359-970, Brasília, DF, Brazil, aragao@cnpat.embrapa.br

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In a local collect (in natives areas) of data, physic-chemical, morphological and yield production parameters were quantified in thirty accessions of cajuí, in Mid-North Brazilian region. Observations were made for following characteristics: total and nut weight; apple weight, length and diameter; total soluble solids (TSS); pH; total titratable acidity (TTA) and TSS/TTA. The present work was designed to estimate the dissimilarity of accession of *cajuí*, principal characteristics involved in this differentiation and superior genotypes. By variance analyze and Scott-Knott test, all characteristics evaluated presents difference among accessions. The coefficient variation was low for all characteristics, except for TSS/TTA. Canonical variable analyses, Tocher cluster and Single Linkage method (both based on Mahalanobis distance) formed seven groups of genotypes, of which five contained only one access each. Total soluble solids, pH, apple weight and basal diameter were the characteristics with highest importance in the discrimination of genotypes performance. In addition, the index selection showed the genotypes codified '1', '3', '8', '9' (from Monsenhor Gil, PI State), '19' (from Teresina, PI State) and '29' (from Passagem Franca, Piauí State) with superior behavior in this experiment, which maybe used as progenitors in breeding program.

P029

Leaf characteristics of custard apple tree progenies

Paulo Sérgio Lima e Silva[1], *Decio Barbin*[2], *Ranoel José de Sousa Gonçalves*[1], *João Domingos da Cruz Firmino*[1], *Idaiane Costa Fonseca*[1]

[1]Escola Superior de Agricultura de Mossoró, ESAM, CP 137, CEP 59625-900, Mossoró-RN, Brazil, paulosergio@esam.br

[2]Escola Superior de Agricultura "Luiz de Queiroz"-ESALQ, CP 9, CEP 13418-900, Piracicaba-SP, Brazil, debarbin@esalq.usp.br

Leaf area measurements are required in several agronomical studies. Usually, there is an interest for measurement methods that are simple, quick and that will not destroy the leaf. The objectives of this work were to evaluate leaf area (*y*), length (*c*) and width (*l*) of 20 half-sibling progenies of custard apple tree (*Annona squamosa* L.), and to fit regression equations of the type y = a + bx, where x = *c.l*, that will allow *y* to be estimated based on *c* and *l*. The experiment was conducted as random blocks with five replicates and four plants per plot. Five mature leaves were randomly collected from each plant. Area was measured with an automatic measuring device and leaf dimensions were determined with a ruler. All values of *b* were significantly different from zero. Differences occurred only in 11% of the 190 possible comparison pairs between progenies, with regard to the estimates of *b*. The coefficient of determination value ranged from 0.80 to 0.97. No differences were observed between progenies with respect to leaf length, width and area. In view of this fact, the equation y = 0.72 x (R^2 = 0.77) was fitted for all progenies.

P030

Assessment of mangaba (*Hancornia speciosa*) genotypes to determine the best characteristics and putative progenitors

Florisvaldo Gama de Souza[1], *Raimundo Wilane de Figueiredo*[2], *Ricardo Elesbão Alves*[1], *Maria do Socorro Moura Rufino*[1], *Ivaldo Antonio de Araújo*[3], *Fernando Antonio Souza de Aragão*[4]

[1]Embrapa Agroindústria Tropical, CP 3761, 60511-110, Fortaleza-CE, Brazil, elesbao@cnpat.embrapa.br

[2]Universidade Federal do Ceará, Av. Mister Hull s/n Pici, 60455-760, Fortaleza-CE, Brazil, figueira@ufc.br

[3]EMEPA, C.P. 275, 58013-290, João Pessoa-PB, Brazil, ivaldo.a.a@bol.com.br

[4]Embrapa Hortaliças, CP 218, 70359-970, Brasília-DF, Brazil, aragao@cnpat.embrapa.br

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Physical and chemical characteristics were evaluated in ten accessions of mangaba (EXT1, IPJ3, IPJ4, IPJ5, NF1, NF6, NF8, PAR11, RIT7, and TOU48) in clonal orchard from Germplasm Bank of the EMEPA, João Pessoa, Paraiba State, Brazil. It was evaluated eighteen characteristics: weight, length, diameter, firmness, number of seed, percentage of (pulp + skin), percentage of seeds, soluble solids (SS), pH, titratable acidity (TA), SS/TA, vitamin C, chlorophyll, soluble sugars, reducing sugars and phenolics. This assay aimed to determinate best characteristics for differentiation among accessions and putative progenitors for breeding program. No differences among accessions were observed for two characteristics: length and chlorophyll. All multivariate analysis, canonical variable analyses, Tocher cluster and Single Linkage method (both based on Mahalanobis distance), formed four groups of genotypes: (1) EXT1, IPJ3, IPJ5, NF6, NF8, RIT7 and PAR11; (2) IPJ4; (3) TOU48 and (4) NF1. This multi-trait analysis also indicated firmness, number of seeds, pH and polymeric phenolics as being the characteristics with highest relevance to discriminate accession behavior. Additionally, the index selection indicated the genotypes EXT1, IPJ3 and RIT7, with superior performance in this assay, which may be used as progenitors in breeding program in order to improve firmness, SS, soluble sugars and reducing sugars.

P031

Selection of mango germplasm for cross breeding program based on multivariate analysis in the Brazilian Semi-arid

João Gomes da Costa, Carlos Antônio Fernandes Santos, Joston Simão de Assis
Embrapa Semi-Árido, C.P.23, CEP 56302-970, Petrolina-PE, Brazil, jgomes@cpatsa.embrapa.br

In order to identify mango accessions for a cross breeding program, multivariate analysis was applied in a germplasm collection to estimate the genetic divergence among them. 48 accessions of the Embrapa Semi-Arid Mangoes Germplasm Bank, located at Juazeiro, BA, Brazil were evaluated for seven fruit quantitative traits. The multivariate technique was Tocher cluster, based on the averaged Euclidian distance of the standardized original data. It was observed a huge genetic divergence among accessions, suggesting a large genetic variability among them for many agronomic traits. The largest and the shortest genetic divergence were observed between the cultivar Parwin and Favo de Mel, and Bonita and Dama de Ouro, respectively. Taking in account the genetic distance and the agronomic performance, the crosses between Parwin x Espada Ouro, Parwin x Eldon, Parwin x Maia, Parwin x GI Proc. 006, Parwin x Favo de Mel, Palmer x Maçã, Palmer x Espada, Palmer x GI Proc 006, Palmer x Espada Ouro, Palmer x Pêssego, Manzanillo x Carabao, Smith x Foice and Momi-K x Kensington should result in a good genetic combinations, and therefore they are recommended for mango breeding program in the Brazilian Semi-Arid Region.

P032

Breeding for superior mangoes in Malaysia-Interim findings

Johari Sarip
Horticulture Research Centre, Malaysian Agricultural Research and Development Institute (MARDI), Serdang, 43400 Selangor, Malaysia, joharis@mardi.my

A breeding plot containing 200 indigenous and non-indigenous mango varieties was established in 1990. Five thousand open-pollinated seeds were collected from the six most popular indigenous and six non-indigenous varieties which have attractive skin color and resistance to anthracnose. Three thousand of the F_1 populations from open-pollinated progenies were planted at 3m by 3m at MARDI Research Station, Bukit Tangga, Kedah, in 1997. Forty percent of the population produced fruits at the age of 5 years. Significant variations for the desirable traits were observed among the F_1 progenies such as fruit weight, total soluble solids content, flesh texture, juiciness, percentage of flesh recovery, flesh and skin colour, resistance to anthracnose and fruiting habits.

P033

Influence of mono and polyembrionic rootstocks on growth, yield and quality of mango fruits at the Cerrado region of Brasilia, Brazil

Vitor H. Vargas Ramos, A.C.Q Pinto, N.T.V Junqueira, A.C. Gomes, M.C.R. Cordeiro, S.M.R. Andrade
Embrapa Cerrados, BR 020 Km 18, C.P 08223, CEP 73301-970 Planaltina-DF, Brazil, vhugo@cpac.embrapa.br

Selection of rootstocks for dwarfness has been an important aspect of the breeding program of mango at Central Region of Brazil, since both Tommy Atkins and Haden are vigorous scion cultivars, which make difficult cultural practices and harvest. This study was carried out with a split plot design in which eight rootstocks were used as whole plots and four scions as sub-plots. 'Mallika', 'Amrapali', 'Santa Alexandrina', 'Extrema', 'Imperial', 'Maçã', 'Comum' and 'Rosinha' were used as rootstocks while 'Tommy Atkins', 'Haden', 'Winter' and 'Van Dyke' as scion cultivars. The monoembryonic rootstock 'Amrapali' reduced tree height regardless the scion cultivar used while 'Tommy Atkins' cultivar presented a higher yield when 'Rosinha' was used as rootstock. 'Winter' and 'Van Dyke' showed the best fruit quality regardless the rootstock used. Therefore, the main objective of this study is to present and discuss the influence of rootstocks on growth, yield and fruit quality of mango cultivars at Cerrado conditions.

P034

Genetic relationships between *Carica papaya* and *C. monoica* by meiotic analysis

Margarete Magalhães Souza[1], Telma Nair Santana Pereira[2], Fabiane Rabelo Costa[2], Pedro Corrêa Damasceno Júnior[2], Lídia Márcia Silva Santos[2], Alexandre Pio Viana[2], Messias Gonzaga Pereira[2]
[1]UESC, DCB, Rodovia Ilhéus-Itabuna Km 16, CEP 45650-000, Ilhéus, BA, Brazil, souzamag@ig.com.br
[2]UENF, CCTA, LMGV, CEP 28013-600, Campos dos Goytacazes, RJ, Brazil, telmasp@uenf.br
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Carica papaya L. (2*n* = 18) is an important crop in many subtropical and tropical countries, and diseases are the major limiting factor in papaya production worldwide. Brazil is currently the largest producer of papaya, producing fruits for both the domestic market and export. For evaluating the genetic relationships among the cultivated species *C. papaya* and a wild species *C. monoica* (2n = 18), flower buds were fixed in Carnoy for 24 hr. Slides were prepared by the squashing technique and cells were stained with acetic carmine. It was observed in both species, *C. papaya* and *C. monoica*, respectively: a) normally, nine bivalents; b) variation among chiasmata number (12.2 and 12.4 by cell) and position, and recombination index (20.8 and 21.2 means) not significant; c) the meiotic index means greater than 92% (92.8 and 95.7%); d) some incidence of abnormalities (%): chromosome irregular dispersion (8.0 and 8.25 on MI, 15.4 and 9.7 on AI, 3.3 and 4.4 on TI, 2.6 and 11.3 on MII, 2.4 and 3.7 on AII, 0.0 and 1.2 on TII); irregular spindles at meiosis II (28.3 and 7.0 on MII, 24.4 and 19.8 on AII, 22.9 and 33.3 on TII); asynchrony during meiosis II (7.0 and 12.7 on MII, 9.7 and 9.4 on AII). Pollen sterility ranged from 2.8 to 6.9% in the cultivated and wild species. The present results indicated that both species present certain homology and can be used to hybridization breeding programs.

P035

Irradiation-induced mutation breeding of papaya

Ying K. Chan
Horticulture Research Centre, Malaysian Agricultural Research and Development Institute (MARDI), GPO Box 12301, 50774 Kuala Lumpur, Malaysia, ykchan@mardi.my

Irradiation-induced mutation breeding of papaya was started at MARDI in August, 2000 as a contract research project with the IAEA. Tests on sensitivity to gamma-irradiation showed that 525 Gy and 42.5 Gy were the most suitable dosages for mass irradiation of dry and pre-soaked papaya seeds respectively. In the M1 population (Eksotika variety), many physiological defects were observed including stem splitting, leaf variegation, crinkled dwarfs and leaf puckering. In the M2 population, wide variability was recorded for many traits. At seedling stage, low irradiation of 42.5 Gy on pre-soaked seeds produced high number of M2 progenies that were shorter and more vigorous in leaf development than those irradiated at 525 Gy and control seedlings. The distribution patterns of M2 progenies for nine quantitative characters showed great variation with ranges often exceeding the limits of the control population. There appears to be good prospects in improving Eksotika papaya especially in development of more dwarf trees with lower fruit bearing stature, higher total soluble solids in fruits and larger fruit size. Several M2 mutants also showed very good resistance to malformed top disease. However, no resistance to papaya ringspot virus disease was found in 1760 M2 seedlings that were inoculated.

P036

Performance of papaya (*Carica papaya* L.) genotypes in the severity of root rot

Antonio Alberto Rocha Oliveira[1], *Lucas de Carvalho Leal*[2], *Jorge Luiz Loyola Dantas*[1]
[1]Embrapa Mandioca e Fruticultura, CP 007, CEP 44380-000, Cruz das Almas, BA, Brazil, alberto@cnpmf.embrapa.br
[2] Escola de Agronomia da Universidade Federal da Bahia-AGRUFBA, Cruz das Almas-BA, Brazil

Papaya root and fruit rot, caused by *Phytophthora palmivora*, is one the most important fungal diseases that limits the papaya (*Carica papaya* L.) production. Control measures comprise the expensive fungicide application, which can be potentially harmful to the environment. These aspects emphasize the necessity of alternative control measures based on environmentally sound practices, such as the search for new sources of disease resistance. The aim of this work was to assess the reaction of ten papaya (*Carica papaya* L.) genotypes, five from the 'Formosa' group (Tainung 01, CMF 05, CMF 36, CMF 68 and CMF 74), and five from the 'Solo' group (Sunrise Solo, CMF 31, CMF 40, CMF 56 and CMF 113), to inoculation of *Phytophthora palmivora*. Plant height was measured at weekly intervals. Root rot severity ratings, according to a scale varying from 1 (no root rot) to 5 (complete root rot resulting in the death of the plant), and dry weight of roots and shoots were assessed as plants died or on surviving plants 10 weeks after transplanting. Plant height, root and shoot dry weights were reduced with *P. palmivora* inoculation. Root and stem lesions were observed in all plants inoculated with *P. palmivora*, but disease severity was least in the genotype CMF 74.

P037

Advances in peach breeding for subtropical-tropical areas of São Paulo State: evaluation of IAC selections

Wilson Barbosa, Celso Valdevino Pommer, Antonio Fernando Caetano Tombolato, Laura Maria Molina Meletti, Renato Ferraz de Arruda Veiga
Instituto Agronômico-IAC, CP 28, 13001-970 Campinas-SP, Brazil, wbarbosa@iac.sp.gov.br

The first Brazilian peach breeding program started at the IAC by the end of 1940s aiming full adaptation of selections to subtropical-tropical climate of São Paulo State. During five decades and after five generations, 58 low chilling cultivars were released for cultivation on areas with 0 to 200 hours below 7.2^{o}C. The main fruit traits of IAC peach are: green epidermis (Talismã), yellow (Canário), rose (Jóia-1), red (Centenário, Centenária); yellow flesh (Dourado-1), white (Delicioso Precoce); texture firm non-melting (Aurora-1), soft (Tutu); cling stone (Brasão), free (Jóia-5); sweet flavor (Supermel), sweet-acid (Arlequim); canning (Régis, Biuti); early maturation (Tropical, Tropical-2), medium (Aurora-2), late (Bolão); extra-large size (Douradão), and others as shape global, oblong, round, with tip or without; high, medium, low pubescence, double finality (fresh-canning). About 46% of 58 cultivars have yellow flesh, 54% white flesh, 47% rose and red skin, 53% green and yellow skin, 65% freestone and 35% clingstone, being 10% for canning purpose. The IAC peach harvest occurs between August and February, about 70-210 days after full bloom, respectively. Their vegetative and reproductive developments were evaluated in subtropical-tropical regions, under meadow orchard system. The results obtained during eight years indicate that the Tropical, Aurora-1, Aurora-2, Régis and Centenária cultivars are the most adequate to warm climate.

P038

Morphology and quality of hot peppers (*Capsicum chinense* Jarq.)

Sérgio Dias Lannes, Jordânia Valentim, Isabela Navarro Barbosa, Mirela Della-Lucia, Fernando Luiz Finger
Universidade Federal de Viçosa, Departamento de Fitotecnia, Av. P. H. Rolfs s/n, CEP 36571-000, Viçosa-MG-Brazil, ffinger@ufv.br

Hot peppers *C. chinense* are grown in several regions of Brazil, however their potential for paprika production is still undetermined by the food industry. A high content of dry weight, total soluble solids and extractable color are important characteristics for the yield in dry processed products. The goal of this work was to identify accesses of *C. chinense*, from the Federal University of Viçosa Vegetable Germplasm Bank (BGH), which have the potential for paprika production. Vine ripe fruits were harvested and analyzed for dry weight content, total soluble solids, thickness of pericarp and extractable color. There were significant differences among the accesses for the above characteristics analyzed by Scott Knott test at 5 % probability. The percentage of fruit dry weight ranged from 8.5 to 19.2 % and total soluble solids from 4.9 to 10.2 %. The thickness of the pericarp varied from 1.57 to 2.79 mm and color intensity from 94.3 to 546.5 ASTA units.

P039

Productive behavior of *Ananas comosus* var. 'Pérola' and var. 'Smooth Cayenne' in Campos dos Goytacazes-RJ

Wallace Rudeck Sthel Cock, Leandro Marelli de Souza, Flávio Dessaune Tardin, Karla Silva Ferreira, Nilton Rocha Leal

Universidade Estadual do Norte Fluminense, Av. Alberto Lamêgo 2000, Parque Califórnia, CEP 28013-000, Campos dos Goytacazes- RJ, Brazil, karlasf@uenf.br, souzamar@uenf.br

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'Pérola' and 'Smooth Cayenne' pineapple varieties, planted in February of 2002, were induced to bloom with ethefon at eight, nine, ten, eleven and twelve months after the plantation using slips weighing approximately 250g. It was analyzed the weight of the fruit without its crown, the firmness of the pulp, the relation ºBrix/acidity, pH and vitamin C content. A randomized blocks design with 4 factorial repetitions was arranged at 2 x 5 (genotypes x environments) and was applied the F test as well as Turkey at 5%. It was not identified significant interactions for pulp firmness, ºBrix/acidity relation and pH. The ºBrix/acidity relation presented a difference between the induction months, which was in average 19.23 ± 3.42 at eight and nine months and 13.42 ± 1.61 at ten, eleven and twelve. Regarding the 'Smooth Cayenne', the average weight of the fruit was 1230.74 ± 211.13 g. Concerning the 'Pérola', the weights were 844.55 g(c), 1019 g(bc), 1153.01 g(ab), 1330.87 g(a) and 1240.37 g(a) at eight, nine, ten, eleven and twelve months, respectively. The vitamin C contents (mg/100 g), at 'Pérola' presented a difference among other months of floral induction, going from 21.08 at month eight to 49.26 at month twelve. At the 'Smooth Cayenne' the vitamin C contents were 11.87(a), 11.60(a), 11.09(ab), 9.99(ab) and 9.44(b) at ten, twelve, eleven, eight and nine months, respectively. The pH, with average of 3.13 ± 0.11, did not vary between genotypes and floral induction time.

P040

Evaluation of promising sapotaceae species for fruit production in Michoacan, Mexico

Jeannette Sofía Bayuelo Jiménez[1], Norma Rivera Alcántara[2]

[1]Instituto de Investigaciones Agropecuarias y Forestales, Universidad Michoacana de San Nicolás de Hidalgo, Carr. Morelia-Zinapécuaro Km 9.5, Tarímbaro, Michoacán C.P. 58880. México, jsbayuelo@hotmail.com

[2]Facultad de Biología, Universidad Michoacana de San Nicolás de Hidalgo, Edificio R Ciudad Universitária, Av. Fco. J. Mújica s/n, Morelia, Michoacán C.P. 58030, México, rian__1207@yahoo.com

Fruticulture in Michoacan is typified by the export-orientated planting avocado, mango, guava and lemon. However, there is a great diversity of plant families and species, which can be cultivated as tropical and subtropical fruits. Specifically there is a high potential for different Sapotaceae family species with edible fruits. The objective of this research was to evaluate promising sapotaceae species for fruit production of the Central-Western Michoacan considering aspects of geographical, ecophysiological, morphological, agronomic and marketing parameters. The first stage of this study presents the evaluation of qualitative and quantitative characteristics of 45 accessions of mamey sapote, *Pouteria sapota* [(Jacquin) H.E. Moore & Stearn]. Clusters analysis of data indicated three distinct groups with 11, 21, and 13 trees, respectively. Canonic discriminating analysis detected the variables more affecting group differentiation. Those were fruit acidity, Brix degree, pH, total solid content, nitrogen, proteins, fruit and seed length, fruit diameter, fruit weight, leaf length and width, tree high, branch architecture, fructification and distribution. The origin of these materials is related to the classifications obtained on field studies and farm analysis. These observations provide the first reported in-depth insights into the genetic diversity of mamey sapote for fruit production in Michoacan. They furnish the necessary informational framework for future studies in that region.

P041

Preventive measures against microbial contamination and rescue of contaminated explants during micropropagation

Kazumitsu Matsumoto[1], Cristina Salgado Junqueira[2], Luis Pedro Barrueto Cid[1] and João Batista Teixeira[1]

[1]Embrapa Genetic Resources and Biotechnology, PqEB Final, Av. W3 Norte, CEP 70770-900, Brasilia-DF, Brazil

[2]Brazilian Consortium of Research and Development of Coffee, Embrapa, Brasilia-DF, Brazil, kazumoto@cenargen.embrapa.br

Plant Preservative Mixture (PPM), miconazol and ticarcillin in culture media, was studied aiming to prevent microbial contamination without phytotoxic effects on *in-vitro* explants of longan, coffee and banana. The rescue of highly bacterium-contaminated banana explants was carried out by the effect of cefotaxime and sodium hypochloride. Miconazol was efficient to prevent microbial contamination but was highly phytotoxic in the concentration used. The two antibiotics, which were ticarcillin and cefotaxime, had low phytotoxicity and prevented bacterial but not fungal contamination. The PPM (1 $ml \cdot L^{-1}$) prevented well the microbial contamination without phytotoxicity. To rescue the bacterium-contaminated banana explants, the contaminated browned parts of the tissue were removed in the 0.5% sodium hypochloride solution, and without rinsing in sterile water, the explants were transferred to a fresh culture medium. Approximately 50% of the explants turned free from the bacteria. The bacterium-free explants were also obtained after 5 weekly-subcultures on the medium supplemented with 200 $mg \cdot L^{-1}$ cefotaxime.

P042

Somatic embryogenesis from rhizome explants of banana cv. Grand Naine

E.W. Sandoval-Yugar, Elaine C. Stolf, D.A. Steinmacher, M.P. Guerra

Plant Developmental Physiology and Genetic Laboratory, Department of Plant Science, Federal University of Santa Catarina, CEP 88010-970, Florianópolis-SC, Brazil, edgaryugar@yahoo.com, ecstolf@yahoo.com.br

The present work aimed to develop *in vitro* somatic embryogenesis regenerative protocol from *in vitro* cultured rhizome tissues of banana cv Grand Naine. These explants were inoculated in MS culture medium, supplemented with picloram (100 μM), 2-iP (300 μM), activated charcoal (1.5 $g.L^{-1}$) and glutamine (0.0 to 200 mM). Direct somatic embryogenesis was observed after 60 days. The highest rate (13.4% and 3.1 somatic embryos/explant) of embryogenic induction was observed in culture medium containing 10mM of glutamine. Histochemical analysis with periodic acid showed positive reaction to Schiff reaction revealing starch grain location. Several experiments were conducted attempting to convert somatic embryos. Culture medium containing BAP (22.2 μM) resulted in the conversion to plantlets showing 8% rate. Plantlets recovered were transferred to a MS culture medium free of plant growth regulators and supplemented with activated charcoal (1.5 $g.L^{-1}$) until they reach up to 3 cm high, being after this successfully acclimatized.

P043

Somatic embryogenesis from roots explants of banana cv. Grand Naine

E.W. Sandoval-Yugar, D.A. Steinmacher, Elaine C. Stolf, M.P. Guerra
Plant Developmental Physiology and Genetic Laboratory, Department of Plant Science, Federal University of Santa Catarina, CEP 88010-970, Florianópolis-SC, Brazil. edgaryugar@yahoo.com, ecstolf@yahoo.com.br

The present work aimed at to study the *in vitro* embryogenic competence of root explants of banana cv. Grand Naine. Root segments 7 cm long were inoculated in MS culture medium supplemented with picloram (50-200 μM), 2-iP (0 or 300 μM) and activated charcoal (1.5 $g.L^{-1}$). The direct induction of somatic embryos resulted from the culture medium with Picloram (200 μM) and 2-iP (300μ). The number of somatic embryos was affected by the distance from root apex, being the rate of somatic embryo induction positively correlated with the proximal region of the explant. The somatic embryo number also increased in time yielding 116 somatic embryos/explant after 90 days in culture. All stages of somatic embryos development could be observed and histological studies were performed. Somatic embryos arose from periclinal divisions of pericycle cells. Several experiments were established in order to convert somatic embryos in plantlets however this was not achieved probably due to the residual effect of high levels of PGR used.

P044

Potential of Somatic Embryo Genesis in Banana (*Musa Abb* Cv. Dwarf Cavendish)

Mohammad E. Amiri
Department of Horticulture, University of Zanjan, Zanjan, Iran, mohammad_amiri@yahoo.com

Potential of regeneration in banana is very high. Pith and callus tissue was tested for many porpoises. Meristematic cells excised from proliferating meristem cultures of banana. Initially produced callus when cultured on de Fassard basal medium (MMZM) supplemented with 2,4-D (0.25 mg/l). On prolonged incubation, the callus developed numerous globular white proembryogenic masses all over the surface. Upon transferring to de Fassard basal medium devoid of 2, 4-D and supplemented with other cytokinins, the proembryoids turned whiteness and produced shoots. Although the apparent shoot apical region showed definite greening no further leaf development was noticed. On the other hand, proembryoids, obtained from de Fassard liquid medium containing 2, 4-5- T (1.25 mg/l) regenerated bipolar embryoids when transferred to fresh medium with NAA (0.02 mg/l) and BA (0.25 to 2.5 mg/l). The somatic embryos when compared histological showed some resemblance with their zygotic counterparts. In both cases distinct bipolarity has been noticed where the shoot and the root primordial form a hook-like embryonal axis which is a characteristic feature of the members of musacease.

P045

Dormency break treatments effect on seed germination of carnauba (*Corpenicia prunifera* Moore)

Valdomiro Aurélio Barbosa de Souza[1], *Lúcio Flavo Lopes Vasconcelos*[1], *Jaíra Maria Alcobaça Gomes*[2], *Eline Chaves de Abreu Almendra*[3], *Waldima Alves da Rocha*[3]

[1]Embrapa Meio-Norte, CP 1, CEP 64.006-220, Teresina-Piaui, Brazil, valdo@cpamn.embrapa.br

[2]Dept. Economia, Universidade Federal do Piaui, Campus do Ininga, CEP 64049-550, Teresina-PI, Brazil

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The objective of this work was to study the effect of dormancy breaking treatments on the carnauba seed germination. The experiment was carried out at Embrapa Meio-Norte experimental area, in Teresina, PI, Brazil, in a nursery with 50% shading, from January to April of 2004. The dormancy breaking treatments were: T1 (control treatment) - intact seeds; T2 - seeds without endocarps; T3 – seeds without endocarps immerged in water for 24 hours; T4 - intact seeds immerged in water for 24 hours; T5 - seeds without endocarps immerged in water for 48 hours; and T6 - intact seeds immerged in water for 48 hours. A completely randomized experiment design with six replications of 15 seeds each was used. The characteristics evaluated were: percent of seed germination, measured at 38, 45, 52, 59, 65 and 77 days from the planting date; germination speed index (GSI); germination average time (GAT); germination average speed (GAS); root emission rate (RER) and root length (RL), measured at 25 days after planting. All studied characteristics, except GAS, were affected by the treatments. The T2 treatment had the highest rates of seed germination in all the evaluation dates, reaching 90% at 52 days from planting. However, after 65 days from planting there was no more difference among treatments. T2 (0.340), T5 (337) and T3 (323) showed the highest values of GSI, indicating that endocarp removal accelerated the germination process. T1 (0.235) and T6 (237) presented the lowest IVE values.

P046

Germination of citrus seeds in vitro

O. Leontiev-Orlov, A. Mossi, R. Cansian, V. Marca, Marcelo Malysz

Universidade Regional Integrada do Alto Uruguai e das Missões, Erechim-RS, Brazil, sidmalysz@yahoo.com.br

Citrus are an important fruits in Brazil. *Trifoliata* orange (*Poncirus trifoliata* L. Raf) and Limão cravo (*Citrus limonia* L. Osbeck) are most important rootstocks for citrus. Breeding program and rapid multiplication of new hybrids need studies on germination of seeds in vitro. Fruits were kept under refrigeration for a month. Seeds were extracted from fruits and were washed with alcohol (96%) during 1-2 min were sterilized by diacid (0.1%) during 5-20 min, hypochlorite Na during 5-20 min or $KMoO_4$ (0.1%) during 1-10 min and were placed on mediums WPM, B-5, RS-1, MS (25%, 50%, 75%, 100 %, 125% of macroelements) with GA_3 0,1-10 mg/l or BAP 1-5 mg/l. The tubes with seeds were kept in a growth room at temperatures of 19-34 ^oC and 16 h of light per day, for 1 month. With alcohol and $KMoO_4$ occurred 100% of sterilization. Higher temperatures were more effective for the first 2 weeks, but at the end of the month more seeds germinated at 31 ^oC. Low concentration of GA_3 stimulated germination at first 3 weeks, higher levels of GA_3 (10m g/l) stimulated germination more frequently and was more effective. BAP on concentration 1 mg/l stimulated 100% germination of seeds on mediums WPM and MS (75%, 100% of macroelements).

P047

Rooting of trifoliata orange (*Poncirus trifoliata*) in vitro: effect of naphthalene acetic acid and macroions

O. Leontiev-Orlov, A. Mossi, R. Cansian, V. Marca, Marcelo Malysz
Universidade Regional Integrada do Alto Uruguai e das Missões, Erechim-RS, Brazil. sidmalysz@yahoo.com.br

In Citrus species, one of the most relevant rootstocks is *trifoliata* orange. Rapid propagation and effective cost of in vitro methods of production make them available of commercial and researching purposes. The improvement of the protocol of rooting is one of the main limiting factors of this propagation. Levels of auxin and ions in the medium have influence on metabolic activity and rizogenesis of explants. Microshoots multiplied in vitro were placed on Murashige-Skoog medium with NAA; 0.1-5 mg/l and different concentrations of macroions: NO_3-, SO_4^{-2}, PO_4^{-3}, K^+, Ca^{+2}, NH_4. The highest rates of rooting occurred in the medium with high level of ion K^+ and concentration of NAA - 0,5-1 mg/l, but this ion was important in all concentrations of NAA. This was the best level of NAA-3 mg/l to increase the number of roots on shoot. Is this concentration of auxin, ion $K^=$ was the most important. The biggest root elongation was obtained on low concentrations of auxin. For root elongation the most important ion were $K^=$, NH^{4+}, NO^{3-}. These results gave possibility to compose new mediums with new compositions of macroions. On medium RZ-7 all index of rooting of explants were higher (905 of rooting, 8,8 roots/explant, lengths of roots-18,7 cm).

P048

Study of morphogenesis of *Poncirus trifoliata* leaves

Oleg Leontiev-Orlov, A. Mossi, R. Cansian, V. Marca, M. Malysz
Universidade Regional Integrada do Alto Uruguai e das Missões, Erechim-RS, Brazil, oleg@uri.com.br

The citrus culture can be considered as one of the most important and competitive agro industrial activities in Brazil. To increase the quality of the rootstocks is necessary to develop efficient protocols of culture regeneration in vitro. Explants used were foliate pricked rootstocks *Poncirus trifoliata* inoculated in Petry dishes with medium MS with the combinations of the concentrations 1.0; 3.0; 5.0; 7.0 mg.L of BAP and 0; 1.0; 3.0; 5.0; 7.0 of NAA. The experiment stayed in growth camera with a photoperiod of 16 hours, brightness 25 $\mu mol.m^{-2}.s^-$ and temperatures 24-26ºC. For the calligenesis process, the presence of the auxine was fundamental, being the best concentration of BAP 1.0 mg.L with 5.0 mg.L of NAA, where 100% of the explants formed calluses. For morphogenesis of leaves the best result was 30% with the concentrations of 3.0 mg.L of BAP and 1.0 mg.L of NAA. This variant presented the largest number of shoots, average of 2.8 per explants. The diameter of the calli was 3.5 mm with the use of 1.0 mg.L of BAP and 5.0 mg.L of NAA, the other concentrations presented decrease in the size.

P049

Study of new medium influences on morfogenisis of *Poncirus trifoliata* callus

Oleg Leontiev-Orlov, A. Mossi, R. Cansian, V. Marca, M. Malysz
Universidade Regional Integrada do Alto Uruguai e das Missões, Erechim-RS, Brazil, oleg@uri.com.br

Brazil is one of the largest world producers of citrus, it is very important to continue researches in this area to improve productivity and quality of fruits. This research aims to study the influence of different mediums and doses of BAP in morphogenesis of primary *Poncirus trifoliata* calluses. Six culture mediums were tested with a specific concentration of salts per each one, plus the mediums MS and N1. The experiment was developed in growth camera with photoperiod of 16 hrs, brightness 25 $\mu mol.m^{-2}.s^{-}$ and temperatures 24-26ºC. For each one of these was evaluated the action of 1.0, 2.0 and 3.0 mg.L of BAP. Results showed that MS and N1 mediums were inferior to the other concentrations of BAP. The medium of culture MG-5 in concentration 1.0 mg.L of BAP presented superior results, with a larger morphogenesis percentage (94%), plus amount and length of shoots per callus (12,9 and 68,5 mm). Also great amount of buds, with average of 56.7 buds per callus. The best results of the MS were with 1,0 mg.L of BAP where were obtained 87.5% of morphogenesis, 3,3 shoots per callus, medium length of the shoots per callus 11.3 mm and 10.2 buds per explants.

P050

Effect of different substrates on seedlings production of custard apple (*Annona squamosa* L.) in polystyrene foam trays

Eudes de Almeida Cardoso, Liane de Souza Menezes,Jean de Oliveira Souza, Damiana Cleuma de Medeiros, Gilberto de Sousa Pires
ESAM, CP 137, CEP 59600-900, Mossoró-RN, Brazil, eudes@esam.br

The production of seedlings uses several technological aspects that should consider the perfect formation of root system and easiness in transplant. There is not enough information on substrates that propitiates the seedling's best formation and initial development. The objective of this work was to evaluate the effect of different substrates on the seedlings production of custard apple (A*nnona squamosa* L.) in polystyrene foam trays. The experiment was carried out in seedling nursery of the Escola Superior de Agricultura de Mossoró-ESAM. A completely randomized blocks design was used with four treatments and four replications. The treatments consisted of the following substrates: 10% of sand (S) + 30% of chicken manure (CM) + 60% of vermiculite (V), 15% of S + 35% of CM + 50% of V, 20% of S + 40% of CM + 40% of V and 25% of S + 45% of CM + 30% of V. Evaluations for plant height, lap diameter and plant height/lap diameter ratio, shoot and root dry mass were made. The substrate composed of 20% of S + 40% of CM + 40% of V was the best for shoot dry mass when compared to others. For the others assessed characteristics there was no significant difference among the substrates.

P051

Use of sulfuric acid on dormancy breaking and viability of hog-plum seeds (*Spondias lutea* L.)

Eudes de Almeida Cardoso, Alexandre Cavalcante Teixeira de Carvalho, Jean de Oliveira Souza, Damiana Cleuma de Medeiros
ESAM, CP 137, CEP 59600-900, Mossoró-RN, Brazil, eudes@esam.br

The hog-plum seed takes a considerable time to germinate, indicating some type of dormancy. With the objective of testing the efficiency of chemical scarification on dormancy breaking in hog-plum seeds and observing the seed viability, an experiment was carried out in the nursery of the Escola Superior de Agricultura de Mossoró-ESAM. An entirely randomized experimental design in 2 x 3 factorial scheme was with four replications. The treatments consisted of two methods for breaking dormancy: control (immersion in water for one hour) and immersion of the seeds to the sulfuric acid in the times of (60, 120 and 180 minutes). Testing seed viability, non-probabilistic samples were selected at random, where it was computed the arithmetic averages, being used four replications of 100 pits. The increase exhibition period of hog-plum seeds to the sulfuric acid did not increase nor reduce the percentage of germination of the seeds. It was observed that endocarp had 78.75% of formed seeds and 21.25% of non-formed seeds.

P052

Evaluation of different times in the accomplishment of intercrafting in custard apple

Eudes de Almeida Cardoso, Adalberto Rocha Girão, Jean de Oliveira Souza, Damiana Cleuma de Medeiros
Núcleo de Pós-Graduação, ESAM, CP 137, CEP 59600-900, Mossoró-RN, Brazil, eudes@esam.br

The technique of intercrafting, using a plant of low load, could to result possibly in custard apple of reduced load, what will facilitate cultural practices. The experiment was carried out in seedlings production nursery of the Escola Superior de Agricultura de Mossoró-ESAM, with the objective of evaluating different times in the accomplishment of the intercrafting in custard apple. A completely randomized design was used with three treatments and six replications. The treatments consisted of the interval of days between the first and the second grafting (0, 30 and 60 days). Evaluations for success rate and survival index were made. It was not observed a response function for rate of success under different times in the accomplishment of the intercrafting in custard apple. For index of survival, it was registered a linear fitting in function of the interval of days between the first and the second grafting.

P053

Germination of kiwano seeds stored in different periods

Isabele Sarzi; Erval Rafael Damatto Junior; Rodrigo de Menezes Trigueiro; Sarita Leonel
Universidade Estadual Paulista, Faculdade de Ciências Agronômicas, Departamento Produção Vegetal/Horticultura, Faz. Exp. Lageado s/n, CP 237, CEP 18603-970, Botucatu-SP, Brazil, isasarzi@fca.unesp.br

The kiwano (*Cucumis metuliferus*) is a member of the Cucurbitaceae family and it is also known by the names "Horned Melon", "Jelly Melon", "Melano", and "African Horned Cucumber". Inside kiwano closely resembles a pomegranate, in that it is full of seeds, each surrounded by a bit of juicy flesh. Kiwano grows best when the weather is very warm. It should ripen in about 100 days. When it is ripe, the skin should be a vivid orange. It usually only reaches a length of 12 to 14 centimeters. Seeding optimum germination temperatures are between 20°C and 35°C. Germination is delayed at 12°C, and inhibited at temperatures lower than 12°C or above 35°C. Thus it is recommended to sow in trays and transplant into the field at the two true leaf stages. The best time for transplanting into an open field is in the spring when soil and air temperatures rise to around 15°C. This work had the objective to study the germination of kiwano's seeds stored in different periods in ambient temperature. Seeds were stored for 0, 7, 14 and 21 days. The seeds had been placed to germinate between paper, in a germination chamber with photoperiod of 12 hours, and alternating temperature of 20°C and 30ºC. The experiment was arranged in a completely randomized design. Vigor of seeds, germination percentage and germination velocity index were evaluated. Vigor of seeds and germination velocity index were not influenced by the period of storage. The germination percentage showed that kiwano's seeds can be stored for up to 14 days (57.5%).

P054

A protocol for surface decontamination of mango (*Mangifera indica* L.) explant

Solange Rocha Monteiro de Andrade[1], João Batista Teixeira[2], Alberto Carlos de Queiroz Pinto[1], Fábio Gelape Faleiro[1], Victor Hugo Vargas Ramos[1], Maria Cristina Rocha Cordeiro[1]
[1]Embrapa Cerrados, CP 08223, CEP 73301-970, Planaltina-DF, Brasil, solange@cpac.embrapa.br
[2]Embrapa Recursos Genéticos e Biotecnologia, PqEB S/N, Brasília-DF, CEP 70770-900, Brazil

The decontamination of explants is a basic stage for plant tissue culture. The microorganisms, if they are not eliminated, the competition for nutrients of the culture medium might modify the normal development of the explant. The decontamination consists of eliminating the microorganisms, however preserving plant explant to be regenerated. The objective of this work was to develop a decontamination protocol of internodal segments to be introduced into plant tissue culture medium, in order to establish methods for micropropagation of lateral buds. The explants had been submitted to treatments with ethanol, sodium hypochlorite and benomyl, for development a surface decontamination protocol. High sodium hypochlorite concentration, or time of exposure, did not decrease fungus contamination. Treatments with benomyl without a previous treatment with sodium hypochlorite did not increase the decontamination rate. For explants collect from experimental fields, it is necessary to wash first for 30 minutes in tap water with neutral detergent before treat them with sodium hypochlorite and benomyl. The degree of contamination of the explants source had high effect on the explants decontamination rate. Results showed that explants should be treated with sodium hypochlorite 1% plus Tween, then 15 seconds sonication in benomyl (500 mg/L) followed by 30 minutes of incubation into the solution. In general, the treatment has been efficient for decontamination of fungus, however, it does not eliminate contamination for endogenous bacterium.

P055

Preliminary assay to control an endogenous bacterium in mango (*Mangifera indica* l.) shoots

Solange Rocha Monteiro de Andrade[1], *Alberto Carlos de Queiroz Pinto*[1], *João Batista Teixeira*[2], *Fábio Gelape Faleiro*[1], *Victor Hugo Vargas Ramos*[1]

[1]Embrapa Cerrados, CP 08223, CEP 73301-970, Planaltina-DF, Brazil, solange@cpac.embrapa.br

[2]Embrapa Recursos Genéticos e Biotecnologia, PqEB S/N, Brasília-DF, CEP 70770-900, Brazil

Bacteria, if not eliminated from the explant, compete for nutrients from the culture medium and also eliminate toxins in the medium modifying the normal development of the explant. The decontamination consists of microorganism elimination, however preserving plant explant to be regenerated. The objective of this work was to develop a protocol to control an endogenous bacterium of mango internodal segments for the introduction in plant tissue culture medium. The explants had been submitted to treatments with ethanol, sodium hypoclorite and benomyl, for surface decontamination. In general, the treatments had been efficient for fungous decontamination; however, do not eliminate the endogenous bacterium contamination. Inclusion of copper sulphate (25 and 50 mg.L-1) into the nutritive medium controlled the endogenous fungi, however did not control of the bacterium growth. The preliminary evaluation demonstrated that the bacterium is gram positive and resistant to the antibiotics rifampycin (300 mg.L-1), kanamycin (150 mg.L-1), ampicylin (150 mg.L-1), tetracyclin (150 mg.L-1), chloramphenicol (150 mg.L-1), carbenicyllin (150 mg.L-1) and streptomycin (300 mg.L-1). Studies are being carried out with sulfamethoxazole + trimethoprim. The first results demonstrated that the combination of both antibiotics and sulfamethoxazole alone showed satisfactory result on the control of this endogenous bacterium, however trimethoprim did not work alone. New studies are being made to determine the best antibiotic combination.

P056

The production of the mangaba seedlings (*Hancornia speciosa* Gomes) using sterile or non sterile soil under different fertilizations

Juvenal Goubert Lessa Oliveira, *Eurico Eduardo Pinto de Lemos*, *Ricardo Manoel dos Santos Silva*

UFAL-CECA, BR 104 Km 14, CEP 57100-000, Rio Largo-AL, Brazil, juvenallessa@ig.com.br

Mangaba tree (*Hancornia speciosa* Gomes) is natural of Brazil and produces a fruit that has a great economic potential. It is usually propagated by seeds. This work evaluated the seedlings production on non sterile and sterile soil with two kinds of fertilization. Seeds of Mangaba were germinated in 30 cm high plastic tubes, in a greenhouse with a microirrigation system. It was used sterile and not sterile sandy substrate for Mangaba tree areas associated or not with organic fertilization. The treatments were a randomized blocks design using a factorial 2 x 2, with eight replicates. The seedlings were evaluated monthly for four months, analyzing the variables: leaves number, seedlings height, root length and shoot dry matter weight. The results showed a positive answer of soil sterilization for the studied variables. The non sterile soil, with organic fertilization, had negative answer in the leaves number and root length variables, showing that addition of organic fertilization associated with microorganisms of soil become in a negative answer for Mangaba tree.

P057

Seed germination of false mangosteen (*Garcinia cochinchinensis* Choisy) influenced by fruit maturation and temperature

Rodrigo Sobreira Alexandre[1], *José Carlos Lopes*[2], *Maristela Dias*[2], *Victor Martins Maia*[1], *Claudio Horst Bruckner*[1], *João Paulo Bestete de Oliveira*[2]

[1]Departamento de Fitotecnia, Universidade Federal de Viçosa, Av. P.H. Rolfs s/n, CEP 36570-000, Viçosa-MG, Brazil, rsalexandre@click21.com.br, vmaia@alunos.ufv.br, bruckner@ufv.br

[2]Centro de Ciências Agrárias, Universidade Federal do Espírito Santo, Alto Universitário s/n, CEP 29200-000, Alegre-ES, Brazil, sementes@npd.ufes.br

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The germination of false mangosteen seeds (*Garcinia cochinchinensis* Choisy) was studied. The seed were collected from fruits at three maturation stages: 1. fruits strongly adhered to the peduncle; 2. fruits weakly adhered to the peduncle; 3. fruits picked off the ground and submitted to three temperatures during germination: 1. constant 30ºC; 2. constant 20ºC and 3. alternated 20/30ºC. The experiment was set up on an entirely randomized design following a factorial arrangement of 3 x 3, with four replications of 50 seeds. Evaluation were performed for the germination (%), index of emergency speed, hard seeds (%), dry mass (mg) and length (mm) of seedlings aerial part. The temperature of 30ºC favored the germination (%) and index of emergency speed and reduced hard seeds (%) of seeds collected in all stages of fruit maturation. The highest germination (%) of seeds submitted to 30ºC was observed when the seeds were collected at stage of fruit maturation 2, and it reached 100%. The alternate temperatures of 20°C-30ºC disabled the germination of the seeds. Some seeds showed to be poliembrionic. The seedlings emerged of seeds collected at stage of fruits maturation 1 and submitted to 20°C or 30ºC had the highest aerial part (141,7 and 104,1 mm, respectively) and the highest dry matter mass of the aerial part (365,3 and 369,0 mg, respectively).

P058

Seed germination and emergency of two *Myrciaria* species on three substrata

Rodrigo Sobreira Alexandre[1], *Américo Wagner Junior*[1], *Jacson Rondinelli da Silva Negreiros*[1], *José Carlos Lopes*[2], *Maristela Dias*[3], *Claudio Horst Bruckner*[1]

[1]Departamento de Fitotecnia, Universidade Federal de Viçosa, Av. P.H. Rolfs s/n, CEP 36570-000, Viçosa-MG, Brazil, rsalexandre@click21.com.br

[2]Departamento de Genética e Melhoramento, Universidade Federal de Viçosa, Av. P.H. Rolfs s/n, CEP 36570-000, Viçosa-MG, Brazil, jacson@vicosa.ufv.br

[3]Centro de Ciências Agrárias, Universidade Federal do Espírito Santo. Alto Universitário s/n, CEP 29200-000, Alegre-ES, Brazil, sementes@npd.ufes.br

The jaboticabas are native and very popular fruit trees in Brazil. They belong to the genus *Myrciaria* (Mirtaceae), which includes *Myrciaria jaboticaba* Berg, named as Sabará, and *Myrciaria peruviana* Poir var *truncifolia* Mattos, named Cabinho. The effect of three substrata: sand, vermiculite and Bioplant® on the germination of the jaboticabas Sabará and Cabinho was studied. An entirely randomized experimental design with four replications of 50 seeds, in a factorial outline 2 x 3 (two species and three substrata) was utilized. The appraised characteristics were: germination (%); index of emergency speed; length of aerial part, radicule total (cm). The germination Cabinho was not significantly affected by the substrata, while vermiculite promoted better germination (77.0%) and better index of emergency speed (1.5213) of Sabará, which germination was higher than the one of Cabinho (38.0% and 0.6923, respectively). Initial seedlings grow of the two species was better on vermiculite. Sabará appear to have higher poliembriony degree than Cabinho.

P059

Influence of the scion wood storage period in the papaya (C*arica papaya* L.) grafting

Andrey Gyorgy Filgueira de Araújo[1], *Lucimar A. Lima*[2], *Rodrigo Marques de Mello*[2], *Marcio de Carvalho Pires*[3], *Osvaldo Kiyoshi Yamanishi*[4]

[1] Faculdade de Agronomia e Medicina Veterinária, Universidade de Brasília, 70910-970 Brasília-DF, Brazil, CNPq Scholarship, [2]FAV/UnB, PIBIC/CNPq Scholarship

[3]IB/UnB, CNPq Scholarship

[4]FAV/UnB, Associate Professor, CNPq Researcher, kiyoshi@unb.br

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The influence of scion wood storage on success rate of grafted nursery papaya trees was evaluated at University of Brasília, from November to December 2003, under net-house condition. It was used a randomized block design with six treatments, four replications and five plants per treatment. Treatments consisted of one rootstock (Golden), one scion wood cultivar (Tainung 01) and six periods of scion storage (0, 2, 4, 6, 8, and 10 days after collected). Scion wood was collected from lateral shoots of hermaphrodite bearing trees of Tainung 01 hybrid at Fazenda Grande Oeste, São Desidério city, Bahia state. Afterward, collected material was held in a moist paper, put in plastic bags and left in the BOD (10ºC) and grafted on the rootstocks with 120 days after sowing. The scion wood of 0, 2, 4 and 10 days of storage result in 100% of success rate. Therefore, lateral grafting showed to be an excellent option for grafting papaya.

P060

Evaluation of five passion fruit (*Passiflora* spp.) species propagated by cutting

Givanildo Roncatto[1], *Geraldo Costa Nogueira Filho*[2], *Carlos Ruggiero*[3], *João Carlos de Oliveira*[3], *Antônio Baldo Geraldo Martins*[3]

[1]Engº Agrônomo, Dr. em Agronomia – Produção Vegetal.

[2]Embrapa Roraima, geraldo@cpafrr.embrapa.br

[3]FCAV/UNESP

The objective was to establish a cutting propagation protocol for different passion fruit (*Passiflora* spp.) species, commercials and rootstock ones. In the first phase, the experiment was conducted in an intermitent mist on a shadow house (50%) using cuttings of the middle part of vegetative branches with 15cm length, three nodes and two half leaves collected from adult plants on *Passifloraceae* Active Germoplasm Bank (BAG) of the Plant Production Department of FCAV/UNESP and commercial orchards, in four seasons. The species were divided in two groups, the commercial ones like *P. edulis* f. *flavicarpa*, *P. alata*, and the rootstock ones like *P. giberti*, *P. nitida* and *P. setacea*. The cuttings were treated with indolbutiryc acid (IBA) at 0, 500, 1000 and 2000mg.L^{-1} concentrations and conditioned i in plastic trays (40x30x10cm) with vermiculite during 60 days. In the second phase, cuttings were transplanted to plastic bags with substrate (soil, sand and fertilizer, 3:1:1) in shadow house (50%) and with daily irrigation. After 60 days, they were planted on field. The commercial species rooting percentage was higher for *P. edulis* f. *flavicarpa* on spring (76.7%) and for *P. alata* on summer (58%), on winter (56.7%), on spring (53.3%) and on fall (45%). On rootstocks species, *P. giberti* rooted on summer (73.3%), on spring (66,7%) and on fall (55%). *P. nitida* rooted on spring (36.7%) and on winter (40%). *P. setacea* cuttings didn't show rooting. Plant survival, root number and length were higher on spring.On field, the stem diameter, plant height and number of leaves were better for cuttings than for seedlings at Jaboticabal, SP. At Araguari, MG, stem diameter was larger in the seedlings, while plant heigths and number of leaves were larger on cuttings.

P061

Relationship of seed vigor with lipid peroxidation during the storage of papaya seed

Edna Maria Mendes Aroucha[1], Roberto Ferreira da Silva[2], Jan Schripsema[2], Maria Célia Mendes Aroucha[2]

[1]Escola Superior of Agricultura de Mossoró, CP 137, CEP 59625-900, Mossoró, RN, Brazil, aroucha@esam.br

[2]Universidade Estadual do Norte Fluminense, UENF, CEP 28013-602, Campos, RJ, Brazil

The relationship between the decline of seed polyunsaturated fatty acids and its vigor had been investigated in naturally ageing seed. This work aimed at to quantify the percentage of lipid and determine the profile of fatty acids and hydroperoxide level and the probably relationship of hydroperoxide level with the decline of vigor in papaya seed. The seeds were extracted of papaya fruits cv. 'Golden' and hybrid 'Tainung 01', in the stages 1, 2, 3, 4 and 5 of maturation. Afterwards, the seeds were extracted and dried without sarcotesta until they reach the moisture content varying of 8 to 10 %. Half of the seeds were analyzed immediately and the other half were stored in impermeable packing and conserved for 15ºC during 8 and 16 months. Part of the seeds of cv 'Golden' was also stored at 23ºC, by same periods. The averages of lipid and papaya seed fatty acids profile of Tainung 01 and Golden fruits had similar values and also the values were similar among the maturation stages. Higher percentage of lipid was approximately of 18 to 23 %. This lipid had the same fatty acids profile of oleic acid (69.5%), palmitic acid (25.0%), linoleic acids (1.1 %) and estearic acid (5.0%). The seeds of cv Golden lost its viability after the storage period at 23ºC for 16 months. The hidroperoxide levels in the seeds, along the storage, were less in the seeds stored at 23ºC in relation to 15ºC, indicating to be an unstable compost during the process peroxidative.

P062

Production of yellow passion fruit nursery trees through hypocotiledonar grafting with seven rootstocks

Geraldo C. Nogueira Filho[1], G. Roncatto[2], C. Ruggiero[2], J.C. Oliveira[2], E.B. Malheiros[2]

[1]Embrapa Roraima, CP 133, CEP 69301-970, Boa Vista-RR, Brazil, geraldo@cpafrr.embrapa.br

[2]Faculdade de Ciências Agrárias e Veterinárias, Universidade Estadual Paulista, CEP 14870-000, Jaboticabal-SP, Brazil

Yellow passion fruit (*Passiflora edulis* Sims. F. *flavicarpa* Deg.) is the main species of Passifloraceae cultivated in Brazil, and its crop presents some obstacles, mainly concerning to orchard longevity, which is decreased due to incidence of diseases and nematodes that attack the root system. The object of this work was to indicate technologies for production of yellow passion fruit nursery trees, through hypocotiledonar grafting with seven rootstocks. The species yellow passion fruit was utilized as scion variety grafted on rootstock of *P. edulis* F. *flavicarpa; P. caerulea; P. alata; P. giberti; P. coccinea; P. cincinnata*, e *P. setacea*. A completely randomized design was utilized, with 36 replicates for each rootstock. The parameters assessed were: graft survival percentage, plant height, number of leaves and rootstock diameter. The hipocotiledonar grafting methodology adopted was successful for most species utilized. The rootstocks *P. caerulea; P. giberti; P. cincinnata*, and *P. flavicarpa* showed better performance both considering rate of "takes" and precocity in obtaining the nursery tree.

P063

Yellow passion fruit hypocotyledonar grafting union histological aspects

Geraldo C. Nogueira Filho[1], *G. Roncatto*[2], *C. Ruggiero*[2], *J.C. Oliveira*[2], *C.F. Damião Filho*[2]
[1]Embrapa Roraima, CP 133, CEP 69301-970, Boa Vista, RR, Brasil, geraldo@cpafrr.embrapa.br
[2]Faculdade de Ciências Agrárias e Veterinárias, Universidade Estadual Paulista, CEP 14884-900, Jaboticabal, SP, Brasil

The object of this work was to verify, one month after the hypocotyledonar grafting procedure, the connection between scion and rootstock vascular tissues and anatomic differences among seven rootstocks as considering grafting union formation. The grafting region was collected from two nursery trees for each scion-rootstock combination. The samples were prepared through fixation, alcoholic dehydration, paraffin immersion, block processing, and microtome sectioning. The obtained sections were placed on glass blades, deparaffinated, colored with safranine and dehydrated once again, with attainment of permanent histological blades. Around 800 sections were observed and analyzed through optic microscope and photomicrographed. Anatomic similarity was verified in grafting union formation considering all seven rootstocks. The vascular tissue connection between scion and rootstocks was observed one month after grafting.

P064

Somatic embryogenesis and plant regeneration of peach-palm

Douglas A. Steinmacher, *M.P. Guerra*
Plant Developmental Physiology and Genetic Laboratory, Department of Plant Science, Federal University of Santa Catarina, CEP 88010-970, Florianópolis-SC, Brazil, golden_fass@hotmail.com, mpguerra@cca.ufsc.br
Acknowledgments: INPA – Amazônia National Research Institute

Plants of peach-palm (*Bactris gasipaes* H.B.K.) were regenerated through somatic embryogenesis. Mature zygotic embryos were cultured in Murashige and Skoog's (MS) medium containing picloram (10-40 μM) and 2-iP (0 or 5 μM). After 20–24 weeks, embryogenic calli were induced. Picloram (10μM) was effective in inducing embryogenic calli in 10.9±2.7 % (SE) of the primary calluses which were compact, yellow with non-organized growth. Embryogenic calluses had organized structure, granular aspect and appear mostly in sectors of primary culture that was in contact with the medium. Embryogenic calluses were maintained in a medium containing 2.4-D (40 μM), 2-iP (10 μM) plus glutamine (1g.L^{-1}), hydrolysated casein (0.5 g.L^{-1}) and activated charcoal (1.5g.L^{-1}). Several responses were achieved in this medium, as root induction, loss of embryogenic capacity, and embryo conversion. Somatic embryos were converted to plantlets on a MS medium plus 2-iP (24.6 μM) and NAA (0.44 μM). Plantlets were maintained in MS medium plus activated charcoal (1.5 g.L^{-1}) until they reach up to 6 cm height and then acclimatized. After 18 weeks 84.2±6.4 % survival rate was observed.

P065

Somatic embryogenesis in pineapple guava (*Feijoa sellowiana* Berg): induction, conversion and artificial seeds

G.C. Cangahuala-Inocente, L.L Dal Vesco, Douglas A. Steinmacher, M.P. Guerra
Plant Developmental Physiology and Genetic Laboratory, Department of Plant Science, Federal University of Santa Catarina, CEP 88010-970, Florianópolis-SC, Brazil, mpguerra@cca.ufsc.br, golden_fass@hotmail.com

Pineapple guava (*Feijoa sellowiana* Berg. sin. *Acca sellowiana*), a Myrtacea indigenous to southern Brazil is under domestication. Previous works showed this species is responsive to somatic embryogenesis and recalcitrant to conventional vegetative methods of clonal propagation. In the present work it was evaluated the role of components of culture medium in the induction and development of somatic embryos. The technology of synthetic seeds was also evaluated in this species. Zygotic embryos were inoculated in LPm medium supplemented with 8 mM glutamic acid (Glu) and 8 mM L-glutamine (Gln), 2,4-Dichlophenoxiacetic acid (2,4-D, 20 μM) and myo-inositol. For conversion of somatic embryos and synthetic seeds it was tested the effect of 6-benzylaminopurine (BA) and gibberellic acid (GA_3) combined or not with activated charcoal. The highest values for embryogenic induction (100%) and number of somatic embryos/explant (113) were observed in the LPm medium supplemented with Glu (8 mM), and 2,4-D. The culture medium supplemented with BA (0.5 μM) and GA_3 (1 μM) and activated charcoal (1.5 $g.L^{-1}$) enhanced the conversion of somatic embryos to plantlets. Pre-germinated somatic embryos encapsulated in sodium alginate with those growth regulators showed well developed radicles. The use of synthetic seeds was a requisite for the survival of plantlets.

P066

Rooting of soursop (*Annona muricata* L.) cuttings

Eurico Eduardo Pinto de Lemos[1], Gustavo de Albuquerque Marinho[2], Antônio Dias Santiago[2], Juvenal Goubert Lessa Oliveira[1], Gilson Moura Filho[1]
[1]Universidade Federal de Alagoas, CECA, Maceió-AL, Brazil, CEP 57072-970, eepl@ceca.ufal.br, gmf@fapeal.br
[2]CPATC/EMBRAPA, CP 2013, Rio Largo-AL, Brazil, CEP 57061-960, santiago@cnptc.embrapa.br

The vegetative propagation by cuttings has not shown satisfactory results four soursop crop. This work objective's was to evaluate the interaction among the indol-butiric acid, leaf area and injuries to rooting induction in mature soursop cuttings to produce superior clonal seedlings. The experiment was carried out in a commercial nursery in Maceió, Brazil. The facilities included 80% shaded green-house with a fog system. The cuttings were collected from 9 year-old soursop trees of the local variety "Crioula". The cuttings collected from young vigorous branches were pruned to 25 cm long and treated with Indol-butiric acid – IBA (0 mg L^{-1}, 2000 mg L^{-1} and 4000 mg L^{-1}); removed all leaves, left with two pairs of entire leaves, left with two halved pairs of leaves; injured or not injured at the base. After the treatment of the cuttings bases with IBA for 5 minutes they were planted in 200 cm^3 plastic tubes filled with fine clean sand. Results showed the total number of rooting cuttings increased 2.5 fold compared to those without IBA. The combination of injury and 2000 mg L^{-1} of IBA improved 7 fold the number of rooted cuttings.

P067

Water stress in osmoconditioning of tamarind seeds

Ana Veruska Cruz da Silva[1], *Terezinha de Jesus Deléo Rodrigues*[2], *Moisés Mourão Júnior*[3], *Evandro Neves Muniz*[3]

[1]Universidade Federal de Sergipe, São Cristóvão-SE, Brazil, anaveruska@ufs.br

[2]Universidade Estadual Paulista, Deptº de Biologia Aplicada. Jaboticabal-SP, Brazil

[3]Embrapa Roraima. Boa Vista-RR, Brazil

The objective of this work was to evaluate the behavior of tamarind seeds (*Tamarindus indica* L.) from three crop seasons, under water stress conditions, osmoconditioned and non osmoconditioned. Tamarind seeds of 1998, 2000 and 2001 crop seasons, kept refrigerated, were used. Half of the seeds were submerged in a PEG (polyethylene glycol) solution with –1,0 Mpa potential, placed in germination chambers, in the presence of light and at 20 ^{o}C during four days. The PEG potentials tested were 0.0; -0.3; -0.6 e –1.2. Germination rate, emergence velocity index and the time to occur 50 % of germination (T50) were evaluated. The Excel software was used to manage and structure the raw data and the statistical analysis were done using SAS System and STATISTICA 5.5 packages. The presence of the PEG as well as the time of storage did not show any influence, both in germination rate and in the velocity of emergence. However, the osmotic potential presence significant influence ($p<0.01$) for germination rate and for velocity of emergence.

P068

Cloning and expression analysis of • -amylase during banana ripening

Adair Vieira Júnior, João Roberto Oliveira do Nascimento, Franco Maria Lajolo

Faculdade de Ciências Farmacêuticas, Universidade de São Paulo, CEP 05508-000, São Paulo, SP, Brazil, adairjr@usp.br

The starch-to-sugar conversion in plant is accomplished by several enzymes, and it is the main feature of the ripening in climacteric fruits, such as banana. The role played by β-amylase (α-1,4-D-glucan maltohydrolase, EC 3.2.1.2) in starch-to-sucrose metabolism during banana ripening seems to be very important, in spite of some previous report suggest that it does not act in starch degradation process, being considered as a vegetative storage protein. A full-length β-amylase cDNA encoding for a putative protein of 484 amino acids, with high similarity to other plant β-amylases, was obtained by screening of a banana pulp cDNA library. This cDNA clone was used for further expression of a recombinant β-amylase protein in an *E.coli* system, which was injected subcutaneously into rabbits. The polyclonal antisera was used in immunoblotting assay against the extract of banana pulps, treated or not with ethylene, to evaluate the level of translation of the β-amylase gene along different stages of ripening. Although the final concentration of starch and sucrose was similar in treated and control fruits, the rates of starch hydrolysis and sucrose accumulation were different. In the treated fruits, the β-amylase activity and expression was anticipated and it was concomitant to starch degradation. On the other hand, changes in enzyme activity and expression in control fruits had appeared only after fourteen days. These results suggest that, in bananas, β-amylase activity and expression patterns seem to be directly related to starch degradation.

P069

Use of magnetic resonance imaging technique in the analysis of development and morphology of inner cashew nut

Clovis I. Biscegli[1], *João R. Paiva*[2], *Antônio C. Lima*[2], *Wilson T. L. Silva*[1], *Marcelo L. Simões*[1]
[1]Embrapa Instrumentação Agropecuária, C.P. 741, CEP 13560-970 São Carlos- SP, Brazil, clovis@cnpdia.embrapa.br
[2]Embrapa Agroindústria Tropical, C.P. 3761, CEP 60511-110 Fortaleza-CE, Brazil

The objective of this study was to demonstrate that magnetic resonance imaging can be used as an alternative and non-destructive method to visualize the development and morphology of inner of the cashew nut of common cashew-tree clones, since the method currently used do not allow the access to the inner of the cashew nut without destroy them, besides the problems involved to open a fresh cashew nut. Samples of cashew nut of 40 clones harvested in 2002, were imaged using the Varian Inova 2T Magnetic Resonance Imaging System at National Agricultural Instrumentation Research Center in São Carlos, São Paulo State. Sagital and transversal tomography images performed in the individual samples showed that most clones produced cashew nut with small blank space among cotyledon and between nut and the endocarp. The results achieved by tomography, also showed that some clones presents nuts with severe deformations and different sizes. This is a strong indication that tomography is a promising option in the quality evaluation of cashew nut, it can also give support to others research areas related to the cashew nut study.

P070

Date palm (*Phoenix dactylifera* L.) fruit growth pattern study

Aziz Torahi[1], *Kazem Arzani*[2]
[1]Breeding Department, Date palm & Tropical fruits Research Institute, P.O. Box 61355-16, Ahwaz, Iran, aziztorahi@yahoo.com
[2]Horticultural Department, College of Agriculture, Tarbiat Modarres University, Tehran, Iran

Pollinated and unpollinated inflorescences of date palm cvs. Sayer and Barhee have been studied. The pollinated flowers produced normal seed-bearing fruits, but unpollinated flowers produced two kind of seedless fruits: i) parthenocarpic single and ii) parthenocarpic triplets. In both cultivars the seed-bearing fruits growth curve was single sigmoid and till common harvesting time they passed all the date fruit growth stages (hababouk, kimri, khalal, rutab and tamar stages) and reached whole of their size. But seedless fruits continued to grow till harvesting time and they showed the same growth pattern but at a different rate. The seedless fruits never reached the rutab and tamar stages and stayed smaller than seed-bearing fruits. Data of studying the stained seed-bearing fruits by ink showed that the fruit growth regions are close to the fruit calyx.

P071

Influence of ph and temperature on polyphenoloxidase activity of litchi (L*itchi chinensis* Sonn.) pericarp

Gisele Polete Mizobutsi[1], Fernando Luiz Finger[2], Rosilene Antonio Ribeiro[2], Rolf Puschmann[3], Gerival Vieira[2], Ludmila Lafetá de Melo Neves[2]
[1]UNIMONTES, Centro de Ciências Agrárias, CEP 39440-000, Janaúba, MG, Brazil
[2]UFV, CEP 36571-000, Viçosa, MG, Brazil, flfinger@yahoo.com

Once harvested, the red color of litchi fruit pericarp is lost rapidly, which results in discoloration and browning throughout storage and commercialization. The lost of the red color is due to degradation of anthocyanins or lost of their stability. The polyphenoloxidase action is usually related to browning and discoloration of several fruits. This work had the goal to evaluate the influence of pH and temperature on polyphenoloxidase activity in a partial purified preparation of pericarp from litchi cv. Brewster fruits harvested at full red-mature stage. Polyphenoloxidase was partially purified by sequential saturation up to 80% ammonium sulfate. At concentration of 40-50% ammonium sulfate, the activity of polyphenoloxidase was 124 times higher to that found in the crude extract. The enzyme showed optimum activity between the pH 6.5 and 7.0 and no activity was detected at pH 2.5 and 9.5. Pre-incubation of the enzyme extract up to 35 minutes, at pH 2.5 or 9.5, completely inactivate the enzyme, being the acid pH more effective in reducing the action. The activity of polyphenoloxidase increased from 10 to 20^{o}C, followed by continuous decrease at higher temperatures. The enzyme was inactivated completely when heated for 10 minutes at 60^{o}C. The data suggest that polyphenoloxidase can be more easily inactivated by heat or acid treatment.

P072

Influence of pH and temperature on peroxidase activity of litchi (*Litchi chinensis Sonn*.) pericarp

Rosilene Antonio Ribeiro[1], Gisele Polete Mizobutsi[2], Fernando Luiz Finger[1], Rolf Puschmann[1], Gerival Vieira[1], Márcia Lima Moura[1]
[1]UFV, CEP 36571-000, Viçosa-MG, Brazil, flfinger@yahoo.com, rosi_ribeiro@hotmail.com
[2]UNIMONTES, Centro de Ciências Agrárias, CEP 39440-000, Janaúba-MG, Brazil

The red color of the pericarp of litchi fruits is lost rapidly once harvested which results in dark fruits usually rejected by the consumers. The lost of color is due to degradation of anthocyanins, which is related to increase on peroxidase activity. Reducing the peroxidase action may result in the maintenance of the red color, improving the fruit shelf life. This work had the goal to evaluate the influence of pH and temperature on peroxidase activity in a partial purified preparation of pericarp, from litchi cv. Brewster fruits harvested at full red-mature stage. Peroxidase was partially purified by sequential saturation with ammonium sulfate. At 60-70% ammonium sulfate saturation, the activity of peroxidase was near 158 times higher compared to the crude extract. The enzyme showed optimum activity at pH 6.5 and no activity was detected at pH 2.5 and 9.5. Pre-incubation of the enzyme extract up to 45 minutes at pH 2.5 or 9.5 caused continuous reduction on peroxidase activity, with higher degree of efficiency at pH 2.5. The maximum activity of peroxidase was at 70^{o}C, remaining active for a period of 120 minutes at 70 and 80^{o}C. The enzyme was inactivated completely when heated for ten minutes at 90^{o}C or for one minute at 100^{o}C. The data suggest that, due to high temperature for the inactivation of peroxidase, activity maybe reduced by treating the fruits with acid or alkaline solutions.

P073

Peroxidase and polyphenol oxidase ativities in mango (*Mangifera indica* L.) cv. Tommy Atkins during ripening

Andréia Cristiane Souza Azevedo, *Gláucia Maria Pastore*
UNICAMP, Rua Monteiro Lobato 70, CEP 13081-970, Campinas, SP, Brazil, aazevedo@fea.unicamp.br, glaupast@fea.unicamp.br
Financial support: CNPq, Recope/FINEP

The mango (*Mangifera indica* L.) which belongs to the family Anacardiaceae, is widely found in many tropical and sub-tropical regions, and is one of the most popular edible fruits in the world. This work was conducted with the objective of evaluating changes in peroxidase (POD) and polyphenol oxidase (PPO) activities and phenols content in the pulp of mango cv. Tommy Atkins, during ripening. The variables evaluated were: total soluble solids (TSS), total titrable acidity (TTA), pH, total phenols, polyphenol oxidase and peroxidase activities. The enzyme activity was determined by spectrophotometry. 1U was defined as the enzyme quantity that produces an increase of absorbance of 0.001 UABS/min. The results demonstrate an enzyme activity loss during the maturation process. The polyphenol oxidase activity in unripe fruits was higher (313 U/mL/min) than in ripe fruits (135 U/mL/min). The peroxidase activity was higher in ripe fruits (4150 U/mL/min) than in unripe fruits (2264 U/mL/min). Concluding the maturation caused peroxidase enzyme activity to increase and polyphenol oxidase enzyme activity to decrease. Regarding the analysis of the total phenols content among the method developed by Folin-Ciocalteau, no correlation between the maturation and the total phenol content was observed in the studied lots.

P074

Physical changes of mango fruit 'Tommy Atkins' during development and maturation

Maria Auxiliadora Coêlho de Lima[1], *Ivanildo Martins Formiga Júnior*[2], *Klígio Nunes Solon*[2], *Suellen Soraia Nunes Azevedo*[3], *Dourival Almeida Carvalho*[4]
[1]Embrapa Semi-Árido, C.P. 23, CEP 56.302-970, Petrolina, Pernambuco, Brazil, maclima@cpatsa.embrapa.br
[2]Escola Superior de Agricultura de Mossoró, C.P. 137, CEP 59.625-900, Mossoró-Rio Grande do Norte, Brazil
[3]Universidade de Pernambuco, BR 203 Km 02, CEP 56.300-000, Petrolina, Pernambuco, Brazil
[4]Universidade do Estado da Bahia, C.P. 171, CEP 48.905-680, Juazeiro-Bahia, Brazil
Financial support: PIBIC-FACEPE/CNPq

Physical attributes of mango fruit 'Tommy Atkins' cultivated in São Francisco River Valley (Brazil) were measured with the objective of characterizing them during development and maturation. Fruits of 40 mm diameter (at 52 daf - days after fruit set) were selected and periodically evaluated until became ripe on tree. Six hundred fruits from forty eight plants distributed in four selected rows on the orchard were used. The treatments corresponded to the age of the fruits. The experimental design was completely randomized with four replications constituted of ten fruits. Fruit fresh mass increased until 120 daf. After that, the differences could be attributed to sampling. Fruit length and diameter stabilized from 106 daf when the pulp became orange. Pulp color changes were important indexes to monitor fruit maturation, being characterized by decreases on luminosity and ºHue and increase on croma values. Red pigments on skin began to be exhibited at 99 daf. Values of ºHue were lower than 18 from 106 to 125 daf, indicating a purpled-red color. Pulp firmness decreased from 113 to 54 N, during the period from 113 to 139 daf. Then, it is recommended an accompaniment of pulp color and firmness from 106 daf to decide the harvest time.

P075

Quality of yellow and charantais melons affected by the fruit size

Francisco Hevilásio F. Pereira, Mário Puiatti, Fernando Luiz Finger, Leonardo A. de Aquino
Departamento de Fitotecnia-UFV, CEP 36571-000, Viçosa-MG, Brazil, flfinger@yahoo.com

In this study the objective was to evaluate the quality of Yellow hybrid Gold Mine (Group Inodorus) and Charentais hybrid Fleuron (Group Cantaloupensis) influenced by the fruit size. The experiment was conduced between 11/24/2003 03/11/2004 at the garden field of the Federal University of Viçosa. The fruits were harvested 42 days after anthesis at commercial stage and graded as type 6 (1.63 kg), 9 (1.05 kg) and 12 (0.74 kg) fruits/box with capacity of 10 kg of Gold Mine and type 4 (1.37 kg), 6 (0.90 kg) and 8 (0.64 kg) fruits/box with capacity of 5 kg of Fleuron fruits. For the hybrid Gold Mine the pulp firmness, pericarp thickness and respiration were higher in the fruits type 6. However, the total soluble solids were reduced and the ethylene production increased in smaller fruits. In the hybrid Fleuron, the pulp pH, firmness, titratable acidity, total soluble solids and ethylene production were higher in fruits graded as type 4, but the pericarp thickness diminished with the reduction of the fruit size. The results of this experiment suggest that the fruits with smaller fresh weight are qualitatively inferior regardless the hybrid utilized.

P076

Changes in cell wall composition during development of persimmon fruit

Luis C.O. Lima, M.R.Ville
Food Science Department, UFLA, Lavras-MG, Brazil, lcolima@ufla.br
Financial support: CNPq

Cell walls were isolated from persimmon (*Diospyros kaki* L.) fruit pericarp at four developmental stages. Isolated walls were analyzed for changes in the composition and solubility of constituent polysaccharides during development. Pectic polysaccharides decreased from approximately 20% of total wall polysaccharides during development. Decreases in uronic acid, arabinose and galactose were accompanied during development. The loss of pectins was also accompanied by a depolymerisation of the polysaccharides extracted with 0,05M Trans- 1,2 diaminocyclohexane – N,N,N',N' – tetraacetic acid (CDTA), and water. Overall, the results indicate that major changes in cell wall polysaccharide composition occurred during softening of ripening.

P077

Polyphenol oxidase and peroxidase in *Hylocereus undatus* (Haworth) Britton & Rose

Andréia Cristiane Souza Azevedo, Gláucia Maria Pastore
UNICAMP, Rua Monteiro Lobato, 70 CEP 13081-970, Campinas, SP, Brasil, aazevedo@fea.unicamp.br, glaupast@fea.unicamp.br
Financial support: CNPq

Several species of climbing cacti of the genus *Hylocereus* have recently been developed as fruit crops. The fruit of these species, known as pitaya, pitahaya or dragon fruit in Latin America is a medium-large berry bearing large green or red scales. Compared to the more common cactus pear (*Opuntia* sp.) the usually red peel from *Hylocereus* possesses large scales instead of spines and its pulp is fine and juicy and contains numerous small digestible seeds. Pulp color in *Hylocereus* fruit varies from white to red and purple. The main objective was to study the enzyme activities of polyphenol oxidase and peroxidase in pitaya fruit pulp and to verify the regarding enzyme activities in half ripe and completely ripe fruits. The enzyme activity was determined by spectrophotometry. 1U was defined as the enzyme quantity that produces an increase of absorbance of 0.001 UABS/min. The results show that ripe pitaya fruit has higher mean enzyme activities for polyphenol oxidase (325 U/mL/min.) and peroxidase (89 U/mL/min.) than the half ripe pitaya fruit: polyphenol oxidase (232 U/mL/min.) and peroxidase (29 U/mL/min.). The obtained data allows the conclusion that the polyphenol oxidase and peroxidase enzyme activities increase during the maturation process of the pitaya fruit.

P078

Relationship between AOX activity and the presence of a multigene family during the ripening of soursop fruit

Isabella Montenegro Brasil[1], Jose Helio Costa[2], Dirce Fernandes de Melo[2], Maria da Guia Silva Lima[2], Geraldo Arraes Maia[1], Raimundo Wilane de Figueiredo[1], Elena Graciela Orelano[3]
[1]CCA/UFC, CP 12168, CEP 60356-000, Fortaleza-CE, Brazil, Isabella@ufc.br
[2]CC/UFC, CEP 60541-970, Fortaleza, CE, Brazil
[3]Universidad Nacional del Rosario, Argentina

Climacteric fruit are defined by a respiratory burst a CN-resistant respiration, mediated by alternative oxidase (AOX). In some plants, the AOX is encoded by a multigene family and its expression is induced by several stresses. The purpose of this work was to investigate the relationship between the CN-resistant respiration and the presence of AOX multigenic family during ripening of soursop fruit (*Annona muricata* L.). To study the activity of alternative respiration, mitochondria from pulp was extracted during ripening to study AOX genes. Genomic DNA was obtained from leaves through nucleus isolation. Specific primers to detect Aox of type 1 and 2 from dicot plants were utilized for amplify DNA fragments by PCR. The highest percentage of KCN-resistant respiration was found in mitochondria from ripe fruit and was at least twice as high as that found for unripe fruit. Three fragments were obtained for Aox type 1, two (700bp) and the third of 900bp, for Aox type 2 there were two fragments of 1000bp.The results suggested that the rise of alternative pathway at the climacteric is due to the presence of a multigene AOX family.

P079

Physical characteristics of sugar apple (*Annona squamosa* L.) fruits at different stages of growth

Marlon Cristian Toledo Pereira, Lílian Caren Bráz, Silvia Nietsche, Lize Moraes Vieira Cunha, Fernando Almeida Santos, Cynthia Lima, Wagner Ferreira Mota
Departamento de Ciências Agrárias, Universidade Estadual de Montes Claros, UNIMONTES, CP 91, CEP 39440-000, Janaúba-MG, Brazil, marlon.pereira@unimontes.br

This study aimed to evaluate harvest time effect in sugar apple fruits in vegetative growth. The experiment was carried out in a commercial orchard, under irrigation system condition, in Nova Porteirinha District, MG, Brazil. A randomized block design was used with four replications, sixteen harvest times and five fruit per plot. The first harvest was realized at fifteen days after the artificial pollination (DAP) and after that, every seven days. The characteristics evaluated were diameter, length, volume, fruit mass and percentage of dry matter. All the evaluated features were submitted to sigmoid growth pattern, being adjusted the logistical model. It was observed that at 40 and 50 days after artificial pollination, the fruits showed the greatest growth rates. The largest accumulation of dry matter was verified exactly at fifty days after artificial pollination. Concerned to increment curve of fruit weight, increases were observed up to 78th DAP, getting establishment from that date, being the fruits gathered in an average of 108 DAP. Such results indicate that management practices, like fertilization and irrigation, must be prioritized in the period between 40 and 80 days after pollination, in the north of Minas Gerais conditions.

P080

Physical and chemical characteristics of umbra plum tree (*Spondias* spp) from agricultural poles of Low-Jaguaribe, CE and Assu-Mossoró, RN

Eudes de Almeida Cardoso, Milene Arcângela Souza de Noronha, Jean de Oliveira Souza, Damiana Cleuma de Medeiros
ESAM, CP 137, CEP 59600-900, Mossoró, RN, Brazil, eudes@esam.br

Umbra plum tree fruits were harvested from nine trees, being six locate in the Low-Jaguaribe pole and the other three located in Assu-Mossoró pole, with the objective of studying the physical and chemical fruits characteristics. Of each plant, 20 ripe fruits were harvested randomly with good external quality traits. In the physical aspect, the mean length varied between 28.88 and 29.60, the width varied 29.11 to 29.57 mm, thickness of the pulp varied from 13.999 to 14.57 mm and average weight oscillated between 12.60 to 13.24 g. The pulp yield was of approximately 72 % of fruit weight, having no significant effect in both maturation stages. The values obtained at the two maturation stages for total soluble solids (TSS) varied between 11.04 and 12.88 %, for the titratable total acidity (TTA) varied between 18.04 and 16.83 mmol (H+)/100g. For pH, it was verified values between 3.15 and 3.27 and for reducer sugars and humidity content, it was observed values between 6.77 and 7.70 % and 86.02 and 86.62 %, respectively.

P081

Some properties of peroxidase extracted from pulp of star fruit (*Averrhoa carambola*)

C. Laurenti, Edmar Clemente
Laboratório de Bioquímica de Alimentos, DQI/UEM, Av. Colombo 5790, CEP 87020-900, Maringá – PR, Brazil, eclemente@uem.br

After harvest the fruits and vegetables are subjects to quantitative and qualitative losses of the product. Many of those losses can be attributed the enzymatic activity, such as modifications in the color, texture and alterations in the nutritional value. The present work carried out studies on soluble and ionically bound peroxidase (EC. 1.11.17) extracted from pulp of green star fruit, 1/3 ripened and ripened. The enzymatic activity of those extracts was determined by spectrophotometry. For the study of the thermal stability of the peroxidase, the crude extracts were submitted to temperatures of 60°C, 65°C, 70°C, 75°C, 80°C and 85°C and the enzymatic activity was carried out in periods of 0, 2, 4, 6, 8 and 10 minutes. After electrophoreses, it was possible to observe the presence of isoenzymes anionic and cationic. An isoenzyme was isolated; molecular weight was 64 kDa and pI 5.70. The degree of maturation of the fruit did not give influence in the activity of the soluble peroxidase. In the evaluation of the activity of the peroxidase front to the thermal treatment was observed that the enzyme lost it activity with the increase of the time and temperature.

P082

Total leaf area estimation of green dwarf coconut palm (*Cocos nucifera* L.)

Elias Fernandes de Sousa, Marilaine Campanati Araújo, Robson Prucoli Posse, Edenio Detmann, Salassier Bernardo, Pedro Amorim Berbert, Paulo dos Santos Albernaz
UENF/CCTA/LEAG, Av. Alberto Lamego 2000, Campos dos Goytacazes-RJ, Brazil, CEP 28013-602, efs@uenf.br

It is a well known fact that the leaf area has a significant effect on tree transpiration, and its measurement is of importance in many fields of sciences. This work aimed at developing a non-destructive, practical, and empirical method to estimate the total leaf area of green dwarf coconut palms (*Cocos nucifera* L.) in plantations located at the northern region of Rio de Janeiro state, Brazil. To this end, a mathematical model was developed to estimate the total leaf area of the green dwarf coconut palm. The model was capable of estimating total leaf area values (AFT) as a function of the average lengths of the last three leaf rachis (CR3), and of the number of leaves in the canopy (NF). Results showed that model has a satisfactory degree of accuracy, for agricultural engineering purposes, to estimate the AFT of green dwarf coconut trees for the conditions studied.

P083

Uneven fruit ripening-hybrids responses to environmental stress in durian

Siti Zainab Ramawas[1], *J. Siti Hawa*[2]
[1]MARDI, Bukit Tangga, 06050 Bukit Kayu Hitam, Kedah, Malaysia
[2]Horticulture Research Center. MARDI, P.O. 12301, General Post Office, 50774 Kuala Lumpur, Malaysia, sizra@mardi.my

Durian (*Durio zibethinus)* has been the most important tropical fruit type grown in Malaysia. It is currently one of the most important exported fruit types next to watermelon and papaya Durians are mainly exported with minimum processing to the neighboring countries. Uneven fruit ripening, characterized by the formation of hardened leathery aril at ripening, causes a decline in aril sweetness and fruit quality especially for minimum processed product. This disorder is not a single factor problem. It may be affected by a combination of factors such as nutrition level, water availability and environmental conditions. Intense crosses were conducted in 1987 till 1989 using ten selected clones as parents consisting of 6 local clones and 4 Thai clones. The hybrids were assessed for the disorder. Observations made since 1995 had shown no incidence of uneven fruit ripening (UFR) among the progenies. Unlike the previous years, in the 2001/2002 fruit season, UFR was incidentally high among the hybrid progenies, the highest, 100 %, in hybrid 1199-1.

P084

Adaptability and stability of galia melon hybrids in the Rio Grande do Norte State, Brazil

Glauber Henrique de Sousa Nunes, Elaíne Welk Lopes Pereira, Edna Maria Mendes Aroucha, Anne Katherine A. Barros, Lonjoré Leocádio de Lima, Paulo Sérgio Lima e Silva, Francisco Bezerra Neto
Escola Superior de Agricultura de Mossoró – ESAM, Núcleo de Pós-Graduação, C.P. 137, CEP 59625-900, Mossoró-RN, Brazil, aroucha@esam.br

The interaction genotype x environment is present in the results of routine multi-environment cultivar trials. Breeders and growers are interested in identifying cultivars with desirable performance at set environments. The objectives of this work were to check the importance of hybrids x environments interaction and to identify among the available hybrids those which are most adapted and stable. The study was realized using the data previously obtained of twelve yield trials carried out from 2000 to 2001 in the Rio Grande do Norte State, Brazil. The experimental design was randomized blocks with four replications. The plot was two rows with 20 plants. The method utilized to measure the amount of components of interaction was proposed by Cruz and Castoldi (1991). The methodology utilized to study of stability was proposed by Toler (1990). It was verified that the magnitude of simple interaction was more predominant than complex interaction, indicating the general adaptation of hybrids and facilities to selection or recommendation. The hybrids differed on adaptability and stability of yield. The hybrids DRG 1537 e DRG 1531 were classified in the group A, because they showed double favorable response. These genotypes showed the most desirable performance in the different environments.

P085

The effects of endogenous hormone levels on alternate-bearing in olive

Salih Ulger, Ibrahim Baktir, Lami Kaynak
Department of Horticulture, Faculty of Agriculture, Akdeniz University, 07058, Antalya, Turkey, ulger@akdeniz.edu.tr

Olive (*Olea europaea* L.) is native to the Mediterranean basin where about 97% of the world's olive production is produced. Although olive trees are well adapted to the region, they have certain drawbacks such as alternate bearing. Mature 30-year-old 'Tavsan Yuregi' olive tree growing at the Murat Pasha Foundation Orchard in Antalya, Turkey was used in this experiment. Hormonal analysis was conducted on the current season growth at nodes, shoot tips and leaves along with fruit samples at monthly intervals over two successive years. Abscisic acid (ABA), gibberellic acid (GA_3), indole acetic acid (IAA) and cytokinin-like concentrations were determined and their relationship to flower bud formation were examined during on and off years. The obtained results indicated that high levels of phytohormones, especially GA_3, in the initiation period promoted vegetative bud formation while lower concentrations favored flower bud formation. Lower levels of GA_3 and slightly higher levels of ABA in particular favored flower bud formation during the fall initiation period. GA_3 and IAA levels were found to be higher in the off-year while kinetin-like cytokin levels were found to be essentially the same in both on and off-years during bloom (May). The results of this study showed a general interrelationship between plant hormone levels and alternate bearing in fruiting and vegetative development responses in olives.

P086

Redistribution of nitrogen in the young orange trees

Tatiele Anete Bergamo Fenilli, Antonio Enedi Boaretto, Takashi Muraoka
Centro de Energia Nuclear na Agricultura - USP, Av. Centenário 303, CEP 13400-00, Piracicaba-SP, Brazil, aeboaret@cena.usp.br

The objective of this work was to study the absorption of ^{15}N from nutrient solution by young orange trees ('Pera' on 'Cravo' lemon rootstock) and the redistribution of N within the organs of the tree. The treatments were constituted by four periods of ^{15}N labeling (spring, summer, autumn and winter). In the first treatment, five young orange trees were grown in pots with ^{15}N nutrient solution during the spring and were collected at the end of the period. The new part, which was developed during the ^{15}N labeling period, was separated in twigs and leaves, and also in flowers and fruits wherever presents. The old part was separated in leaves, twigs, stem and roots. The same procedure was followed in the other treatments. The total N and ^{15}N were analyzed by mass spectrometry. In the spring and summer around 80% of N present in the new plant parts was derived from the nutrient solution and the remaining (20%) from the other parts of the plant, redistributed mainly from old leaves. In the autumn and winter the major portion of absorbed ^{15}N was accumulated in old part of tree (root, stem, twig and leaves). At the end of the winter, new organs received around 40% of N from the nutrient solution and 50-60% of N within these organs from the old parts of tree.

P087

Leaf-age related differences in chlorophyll fluorescence and spad reading of five papaya (*Carica papaya* L.) genotypes

E. Campostrini, M. Araújo-Souza, L. Costa-Azevedo, A. Torres-Netto, T. Barroso-Chiquieri, F. Oliveira-Reis
Plant Physiology Sector – LMGV/CCTA/UENF, Campos dos Goytacazes-RJ, CEP 28013-600, Brazil, campost@uenf.br
Financial Support: FINEP/Caliman Agricola SA/FAPERJ

The relationships between chlorophyll fluorescence of leaves and SPAD readings (chlorophyll index) were used to characterize the decline in activity of photosynthetic performance during the development of intact leaves of 3 month old plants of five papaya genotypes. The genotypes (Golden, Solo 7212, JS12, Tainung and UENF/Caliman 01 [Hybrid JS12 x Solo 7212], cultivated in greenhouse conditions. The measurements [F_m, F_0, F_v/F_m, F_v/F_0, area above fluorescence curve (Area), length of the leaf central vein (LLCV) and SPAD readings] were carried out 2 weeks after leaf initiation (WALI) and the measurements was made each week, during 9 WALI. For all genotypes, the highest SPAD readings (50), and LLCV (200mm) were 3-4 WALI. However, after 2 WALI, Golden genotype showed reduced SPAD values (max. 30). After 3-4 WALI, LLCV maintained stable values of approx. 200mm, but SPAD readings fell to zero at 9 WALI, for all genotypes, showing complete senescence. At 8 WALI, JS12 and Tainung showed the highest SPAD values, F_v/F_m, F_o (20-25; 0.60-0.10; 800-1200; respectively). For all genotypes, except Tainung, the F_v/F_m values were constant at 7 WALI and reduced after this time. Tainung genotype only showed this characteristic after 8 WALI. The F_v/F_0 values were stable until 5 WALI and, in this period, Hybrid and Tainung had higher values (22-17, respectively). Area and F_v/F_0 did not show a relationship with leaf longevity. The results showed that JS12 had higher leaf longevity and, possibly, in papaya plants the chlorophyll concentration could be an important factor for determination of leaf longevity.

P088

Mechanical conditioning for control of growth in papaya (*Carica Papaya* L.) seedlings

S.C. Prucoli-Posse[2], E. Campostrini[1], R. Ferreira-Silva[2], A. Torres-Netto[1]
[1]LMGV/CCTA/UENF, Campos dos Goytacazes-RJ, Brazil, CEP 28013-600, campost@uenf.br
[2]LFIT/CCTA/UENF, Campos dos Goytacazes-RJ, Brazil, CEP 28013-600
Financial Support: FINEP/Caliman Agrícola SA/FAPERJ

Stretching is the excessive elongation of stems during the production of high-density transplants. One technique that can prevent excessive elongation is mechanical stimulation by brushing. The combined effects of the number of brush strokes per day and frequency of brush strokes have been studied for a number of agricultural crops but studies on papaya seedlings have been scarce. Tainung seedlings were grown in 96- flat pots with 440 plants m^{-2} under greenhouse conditions. Daily doses from 0 [Control(C)] to 40 brush strokes per day (8:00-9:00AM) were applied until the non-treated plants reached a canopy height of 180mm. In addition, a treatment using 96- flat pots at 220 plants m^{-2} to optimize light distribution were used (OL). The final height and leaf area of plants of 1 month old was reduced by ≅ 50% for 20, 30, 40 brush strokes and OL, had a significant effects at 10 strokes per day (30%), compared to the controls. The reduction in stem diameter was ≅10% with 20, 30, 40 brush strokes and OL and the final shoot and root dry matter showed significant reduction with 20, 30 and 40 stroke with 50 and 40%, respectively. The treatment OL had elevated root dry matter. Furthermore, leaf number was unaffected by treatments. The mechanical stimulation (MS) did not affect the final gas exchange and chlorophyll fluorescence measurements. In summary, mechanical stimulation significantly reduced the growth of papaya seedlings, but the physiological characteristics (gas exchange and F_v/F_m) measured in the final experiment were unaffected by MS.

P089

Photosynthetic potential and dark respiration of four papaya (C*arica papaya* L.) genotypes

A. Torres-Netto[1], M.A. Araújo-Souza [1], L.C. Costa-Azevedo[1], M.M. A. Gomes[1], F.A. Castro [1], M.M. Chaves [2], E. Campostrini[1]

[1]LMGV/CCTA/UENF, Av. Alberto Lamego 2000, CEP 28013-600 Campos dos Goytacazes-RJ, Brazil, alena@itqb.unl.pt

[2]Instituto de Tecnologia Química e Biológica - ITQB/LEM. Av. da República Apartado 127, Oeiras, Portugal, CEP 2780

Financial support: FINEP/Caliman Agrícola SA/FAPERJ

The photosynthetic characterization in papaya genotypes is very important for the future breeding programs. Data regarding photosynthetic potential in papaya plant are scarce. The objective of this study was to determine whether there are genotypic differences in photosynthetic potential between papaya genotypes and, if so, whether these differences are related with structural or biochemical traits. Thus, four papaya genotypes (3 months old): Golden, Solo 7212, JS12 and UENF/Caliman 01 (hybrid (JS12 x Solo 7212)) were studied under greenhouse conditions [photosynthetic active radiation (PAR) ranging from 400µmol m^{-2} s^{-1} (max.) to 20µmol m^{-2} s^{-1} (min.) during the day]. Photosynthetic potential rate (A_{pot}, at saturating light (2300µmol m^{-2} s^{-1}), CO_2 and 35ºC), light response curves (A_{pot} *versus* PAR) and dark respiration, quantum yield and SPAD reading (chlorophyll index) were determined at the 4th and 5th leaves from the apex. Golden genotype showed a reduced SPAD reading (32) as compared with the other genotypes, which showed SPAD readings about 53. The quantum yield (0.0197 – 0.0201 µmol O_2 µmol photon^{-1}) and dark respiration (1,2-1,4µmol m^{-2} s^{-1}) did not differ between genotypes. However, Golden genotype presented the highest A_{pot} values (around 11 µmol $m^{-2}.s^{-1}$). The reduced chlorophyll concentration on the leaf did not affect A_{pot} and quantum yield in the Golden genotype.

P090

Influence of brassinosteroids on proline and abscisic acid contents in passion fruit plants submitted to water stress

M.M.A Gomes[1], T.M. Ferraz[1], L.N. Siqueira[1], R.C.C. Rosa[1], E. Campostrini[1], A. Torres-Netto[1], N.R. Leal[1], M.G. Pereira[1], M.A.T Zullo[2], M. Núñez-Vázquez[3]

[1]LMGV/CCTA/UENF, Campos dos Goytacazes-RJ, Brazil, CEP 28013-600, maramag@uenf.br, campost@uenf.br

[2]Seção de Fitoquímica - IAC, Campinas-SP, Brazil

[3]Instituto Nacional de Ciencias Agrícolas, La Habana, Cuba

Financial support: FAPERJ

The efficiency of brassinosteroids (BR) in passionfruit plants (six months old) submitted to drought stress was conducted to study the effect of this hormone on plant metabolism. Passionfruit plants were grown in pots under greenhouse conditions and submitted to the following treatments: control (irrigated plants, I), irrigated plants with BR (less and more concentrated doses, I- and I+); water deficiency (WD); water deficiency with BR (less and more concentrated doses, WD- and WD+). Stomatal conductance (g_s) was measured daily and leaves for proline and abscisic acid (ABA) quantification were collected every other day. It was verified that stressed plants, under more severe stress (5th day), presented highest proline and ABA contents than irrigated ones. WD- showed highest proline and ABA content and WD+ showed a reduced proline concentration but the ABA content was similar to WD. On the 5th day, WD+ showed greater g_s than the other stressed treatments. BR application improved the behavior of irrigated plants as it simulated a stress condition, reducing g_s, although ABA and proline dit not vary among them. In water stressed plants, WD+ on the 5th day did not feel the same effects of stress as g_s was slightly greater and proline content was much lower when compared to WD and WD- treatments. These beneficial effects of BR application resulted in preparing the plant before a stress really happens or diminish its effects.

P091

Na^+ and Cl^- uptake and distribution by passion fruit plants grown under salinity conditions

Jailson Lopes Cruz[1], Manoel Teixeira de Castro Neto[1], Eugênio Ferreira Coelho[1], Adriana Queiroz de Almeida[2], Jurema Rosa de Queiroz[2], Antonivalda Tosta Dias[2]

[1]Embrapa Mandioca e Fruticultura, CP 007, CEP 44 380-000, Cruz das Almas-BA, Brazil, jailson@cnpmf.embrapa.br

[2]Universidade Federal da Bahia-UFBA, BA, Brazil

Financial support: FAPESB, CNPq

The present study aimed at evaluating the influence of soil salinity on absorption and distribution of Na^+ and Cl^- in yellow passion fruit (*Passiflora edulis f. flavicarpa*) plants grown under three concentrations of NaCl (0, 50 and 100 mol.m^{-3}). Sixty days after starting of treatments the experiment were ended and the plants harvested and divided into roots, stems, newly formed leaves and old leaves. Plants grown without NaCl showed total dry matter of 2.82g, while plants grown under 50 and 100 mol.m^{-3} of NaCl presented 2.15g and 2.18g, respectively. Under salinity conditions plants extracted and translocated to the shoot larger amounts of Cl^- than Na^+. The cumulative Na^+ content was larger in leaves than in stems or roots, as well as in old leaves than in young ones. The results also showed that under salt stress roots cumulated more Cl^- than Na^+ in their tissues. The larger accumulation of Na^+ in older leaves and of Cl^- in both older leaves and roots under salt stress may be a strategy used by passion fruit plants to reduce the movement of these ions to the younger leaves, that are physiologically more active, and to the leaf apex, in order to protect some of its meristematic regions.

P092

The use of the 13-carbon in the partitioning of photosynthate in vegetative and reproductive twigs of sweet passion fruit (P*assiflora alata* Dryander)

Marco Antonio da Silva Vasconcellos[1], Carlos Ducatti[2], Almy Junior Cordeiro de Carvalho[3], Geisa Ribeiro Leitão[1]

[1]UFRRJ/IA/Departamento de Fitotecnia, CEP 23851-970, Seropédica-RJ, Brazil, masv@ufrrj.br

[2]UNESP/IB/Departamento de Botânica, Botucatu-SP, Brazil

[3]UENF/CCTA, Campos dos Goytacazes-RJ, Brazil

This study objective the evaluation of photosynthates partitioning and source-sink relationships, in vegetative and reproductive twigs of sweet passion fruit, using carbon-13 as tracer. The leaves of vegetative and reproductive twigs were placed in a sealed chamber and $^{13}CO_2$ were injected for 30 minutes. After six hours, the different organs of the twig were collected and immersed in liquid nitrogen (-196ºC). All samples were oven-dried, powdered in cryogenic mill, combusted in an elemental analyzer and determined the value of relative enrichment ration $^{13}C/\ ^{12}C$ (• ‰) in isotopic ratio mass spectrometer. The value of relative natural enrichment of leaves, buds flowers and fruits was $^{13}_{C,\ PDB}$ • = -27.22‰ ± 0.2‰. The results showed that the methodology was efficient to evaluate the partitioning of photosynthates. In the vegetative twigs, the new open leaves, the closed leaves and growth meristem were the principal sink for the source leaves enriched with $^{13}CO_2$. In the reproductive twigs with only flowers buds, the source-sink relationship was changed and the flowers buds turn to be the principal sink and the growing leaves were secondary sinks. The presence of young fruits changed again the source-sink relationship of the twig, and they were the principal sinks. The apical leaves, with 60% of final leaf area were also a sink for photosynthates.

P093

Gas exchanges in peach palm as a function of irradiance and temperature

Maria Luiza Sant'Anna Tucci[1], *Marilene Leão Alves Bovi*[2]; *Eduardo Caruso Machado*[2]
[1]Centro de Horticultura, Instituto Agronômico de Campinas (IAC), Av. Barão de Itapura, 1481, CEP 13001-970, Campinas-SP, Brazil, tucci@iac.sp.gov.br; mlabovi@iac.sp.gov.br
[2]Centro de Ecofisiologia e Biofísica, IAC, Campinas-SP, Brazil, tucci@iac.sp.gov.br; mlabovi@iac.sp.gov.br
Financial support: FAPESP (00/02782-6)

Peach palm (*Bactris gasipaes* Kunth) is an Amazonian palm cultivated nowadays for heart-of-palm production. Differences in climatic conditions as irradiance and air temperature affect gas exchange rates and consequently plant growth and yield. Gas exchange responses to irradiance and temperature variation were studied under controlled conditions, utilizing peach palm plants, from spineless landrace, grown in 3 L containers in nursery. Measurements were taken in the youngest fully expanded leaf, with three replications, using a portable LCA-4 IRGA, connected to a leaf microclimate control system (ADC BioScientific Ltd., England). Temperatures range varied from 18°C to 39°C, while photosynthetic photon flux density (PPFD) ranged from 1,800 to 0 µmol $m^{-2}.s^{-1}$. Data were analyzed by regression and curving fitting, using polynomial equations adjusted to the measured variables. Maximum responses in CO_2 net assimilation rate and stomatal conductance occurred in temperatures between 22°C and 28°C and PPFD ranging from 1,200 to 1,800 µmol $m^{-2}.s^{-1}$. Maximum values in transpiration rate were detected in temperatures varying from 28 to 32, and PPFD ranging from 1,700 to 1,800 µmol $m^{-2}.s^{-1}$. The results suggested that peach palm is acclimated to high irradiance levels. Nonetheless, temperatures higher than 28°C decrease the CO_2 net assimilation rate, probably due to a negative effect over the mesophyll carboxilation capacity.

P094

Soil water deficit effects on chlorophyll *a* fluorescence in peach palm

Maria Luiza Sant'Anna Tucci[1], *Eduardo Caruso Machado*[2]; *Marilene Leão Alves Bovi*[2]
[1]Centro de Horticultura, Instituto Agronômico (IAC), Av. Barão de Itapura, 1481, 13001-970, Campinas-SP, Brazil, tucci@iac.sp.gov.br; mlabovi@iac.sp.gov.br
[2]Centro de Ecofisiologia e Biofísica, IAC, Campinas-SP, Brazil, tucci@iac.sp.gov.br; mlabovi@iac.sp.gov.br
Financial support: FAPESP

The effects of the soil water deficit over the chlorophyll *a* fluorescence were studied in nine-month old spineless peach palm plants, grown in 80 L containers in glasshouse. Two soil water regimes were imposed during 21 days, with five replications. In the control the soil was maintained at field capacity, while the water deficit was imposed by water withdraw until 12th day, followed by rewatering at the level of the control plants. Leaf water potential was evaluated using a chamber pressure twice a day, at 5:30 AM and 1:00 PM. Leaf chlorophyll fluorescence measurements were taken by a modulated fluorimeter (PAM-200, Walz, Germany), three times a day, at 6:00 AM, 1:00 PM and 4:00 PM. Maximum (F_v/F_m) and effective (• $F/F_{m'}$) quantum yield were determined. The control plants showed a midday depression in (F_v/F_m), reflecting photosynthetic regulatory responses to excess absorbed light energy. Plants submitted to water deficit, showed a decline in F_v/F_m from the 5th day on, without recuperation, indicating an irreversible photoinhibition, repaired only several days after rewatering. Water deficiency causes a decline in • $F/F_{m'}$. Although a stomatal effect of water deficit on the CO_2 net assimilation rate of peach palm was already known, this paper showed that the water deficiency could cause also a non-stomatal effect, by damage in the photosynthetic apparatus itself.

P095

Correlation between seasonal variations and carbohydrate metabolism in a São Francisco river valley vineyard

Bárbara França Dantas, Luciana de Sá Ribeiro, Alexandro Pereira da Silva, Sara Raquel de Sousa Luz
Embrapa Semi-Árido, BR 428 km 152, Zona Rural, CP 23, CEP 56300-970, Petrolina-PE, Brazil, barbara@cpatsa.embrapa.br
Financial support: Banco do Nordeste do Brasil

The irrigated agriculture at the São Francisco River Valley, Northeast Brazil, shows an increasing production of grapes for winery. Among the wines produced the one obtained from *Vitis vinifera* L., cultivar Petite Syrah, stands out due to its adaptation to the climatic conditions of the region. Little is known, however, about carbohydrates metabolism of vines cultivated in this region. The objective of this work was to evaluate the correlation between weather conditions and sugar metabolism during two consecutive growing seasons. The experiment was carried out at Embrapa Semi-Árido and at Vitivinícola Santa Maria, respectively located at Petrolina and Lagoa Grande, Pernambuco State- Brazil. Weekly, from January to December of 2003, leaves were collected and assessed for reducing sugars (RS), total soluble sugars (TSS) and starch contents, as well as for acid (AI) and neutral invertases (NI). The results indicate that only RS content and both AI and NI activities in Petite Syrah vine leaves were positively correlated to maximum and mean temperatures and radiation, and only NI was correlated to insolation. Invertases activities are highly correlated to number of days after pruning (DAP), indicating correlation to phenological phases. On the other hand, TSS content was negatively correlated to minimum temperature and number of DAP and starch did not correlate with any of the weather nor phenological parameters.

P096

Production of banana 'Prata-Anã' with organic fertilization

Erval Rafael Damatto Junior, Roberto Lyra Villas Boas, Sarita Leonel
Faculdade de Ciências Agronômicas-UNESP, Fazenda Experimental Lageado s/n, CP 237, CEP 18603-970, Botucatu-SP, Brazil, ervaljr@fca.unesp.br
Financial support: FAPESP

Banana is one of the fruits more consumed in the world and Brazil is a big producer, but its participation in the international market is insignificant. Wherever, in the last years the exports of organic banana for the European Community grew about 65%, arriving to 38 thousand tons. Also the importations had grown for Japan and United States, and for this last one the imports arrived at 19 thousand tons in the year of 2000. The exports of organic banana represent now just 0.55% of the world exports of the fruit, but the perspectives is to increase this market, becoming a great opportunity for the Brazilian producer. This work proposed to evaluate the effects of different doses of organic fertilizer in the production of the banana (*Musa sp*. cv Prata). The experiment was conduced in Botucatu/SP, in a Nitossolo Vermelho and the treatments were doses of organic fertilizer (organic compost): T1 = 0g of K_2O/plant; T2 = 98.5g of K_2O/plant; T3 = 197g of K_2O/plant; T4 = 290.5g of K_2O/plant; T5 = 394g of K_2O/plant. The experiment was arranged in randomized blocks design The parameters evaluated were bunch weight, number of fruits for bunch, number of hands, number of fruits in the 2nd hand and days to produce. The results of the first year of banana production did not present significant difference between the treatments, but we found that is possible to produce fruits in quantity with a good quality. The medium production was 23.8 ton/ha, with 1600 plants by hectare.

P097

Evaluation of fungi incidence on dwarf green coconut produced in Rio do Fogo-RN

Miécio de Lima Almeida, Josivan Barbosa Menezes, Klígio Nunes Solon, Anne Katherine de Araújo Barros, Mayara Kelly Martins de Medeiros, Aurélio Paes Barros Júnior, Lindomar Maria da Silveira, Marta de Oliveira Mendes, Maria José Tôrres Câmara

Escola Superior de Agricultura de Mossoró, CP 137, CEP 59625-900, Mossoró-RN, Brazil, annekbarros@uol.com.br

This work was carried out in Rio do Fogo-RN with objective to evaluate the fungi incidence in dwarf green coconut fruits. The experiment was installed at Escola Superior de Agricultura de Mossoró. The fruits were deriving from commercial orchard of Rio do Fogo-RN. A postharvest treatment with Sportak fungicide was effectuated, where the fruits were immersed and after involved in a PVC film (10µm). The experimental design was randomized complete block, factorial arrangement 3 x 2 x 3 with two replications. The treatment factors were three orchard ages (3, 5 and 7 years), two harvest period (6 and 7 months) and three storage periods (31, 34 and 37 days). The fruits passed 28 days stored at 12 ± 1°C and 90 ± 5% RH and then for 3, 6 and 9 days at 20 ± 1°C and 60 ± 5% RH. There was significant interaction among storage and harvest period. The greater storage period the greater was fungi incidence, however in 6 months the fungi incidence was bigger in storage time. The older the orchard the higher was fungi incidence.

P098

Floristic composition and growth of weeds under custard apple tree progenies

Paulo S.L. Silva[1], Zenaide Barbosa[2], Odaci F. Oliveira[1], Paulo I.B. Silva[1]

[1]Escola Superior de Agricultura de Mossoró-ESAM, CP 137, CEP 59625-900, Mossoró-RN, Brazil, paulosergio@esam.br

[2]Faculdade Vale do Jaguaribe, Rua Cel. Alexandrino 563, CEP 62800-000, Aracati-CE, Brazil, fvj@secrel.com.br

Weeds negatively influence several fruit tree characteristics, including yield, and can make management practices difficult to conduct in orchards. The objective of this work was to evaluate the floristic composition and growth of weeds under the canopies of irrigated custard apple tree progenies. Twenty half-sibling progenies around three years of age were evaluated in a random block design with five replicates and four plants per plot. A circle with a 0.5 m^2 area was established around the trunk of each plant. The composition, fresh matter, and dry matter mass of the above-ground part of weeds were evaluated in this area. The major five families with the most number of species were Leguminosae, Convolvulaceae, Euphorbiaceae, Malvaceae and Sterculiaceae, in decreasing order. The number of weed species/plot ranged from 6 to 18, but there was no difference between the mean percentages of different weeds under the canopies of the progenies. The smallest weed fresh matter and dry matter masses occurred in progenies JG1 and SM8, respectively. There were no differences between progenies with regard to root collar diameter and leaf area; however, one of the smallest weed dry matter yields was observed under the canopy of progeny FE4, which showed the largest canopy diameter.

P099

The effects of organic fertilization on growth and production of fig trees

Sarita Leonel
Departamento de Produção Vegetal, Universidade Estadual Paulista, Fazenda Experimental Lageado s/n, CP 237, CEP 18603-970, Botucatu-SP, Brazil, sarinel@fca.unesp.br
Financial support: FAPESP

Fig trees are currently cultivated in Brazil. This culture in São Paulo state is concentrated in the Campinas region, although many farmers in other regions of the state have shown interest in growing figs. Botucatu-SP is a city situated at 22º 52' 47" S, 48º 25' 12' W and 810 meters has favorable conditions to fig production and farmers interesting to grow this plant. Other point is that information on the organic fertilization is scanty in this culture. The research had the purpose to evaluate the effects of organic fertilization on growing and production of fig trees with 1-2 year old. The fig cultivar was 'Roxo of Valinhos'. The fig cuttings were planted in the experimental orchard in July/2001. When the trees had one year old (july/2002) received the treatments with manure at the following levels: 0; 0,8; 1,6; 2,4; 3,2; 4,0; and 4,8 Kg of manure per plant that was the same as 0; 10; 20; 30; 40; 50 and 60 g of nitrogen levels per plant. The fertilization was completed with 60 g of P_2O_5 per plant. The experiment was entirely randomized with 7 treatments, 4 replications and 10 plants by experimental parcel. The parameters evaluated were the higher, branches diameter, number, weight and medium diameter of fruits after 6 months of nitrogen levels application with the fruits harvest. The manure application enhanced the fruits production. The maximum production was obtained with 2,4 Kg (40 g of N per plant) of manure per plant, with 1660 plants by hectare.

P100

Nitrogen fertilization on seedless grapes at the São Francisco river valley on 2001 harvest seasons

Davi José Silva, Patrícia Coelho de Souza Leão, Emanuel Elder Gomes da Silva
Embrapa Semi-Árido, CP 23, CEP 56302-970, Petrolina-PE, Brazil, davi@cpatsa.embrapa.br

Aiming to determine the appropriate level of nitrogen, applied through fertirrigation, that provides a satisfactory plant development, better quality of the fruit and higher yields, an experiment was carried out in Petrolina-PE, in the semi-arid of Brazilian Northeast. The main treatments consisted of five seedless table grape varieties (Perlette, Thompson Seedless, Marroo Seedless, Catalunha and Superior Seedless), and the secondary treatments were four nitrogen levels (0, 75, 150 and 300 kg ha^{-1} N). The experiment was disposed in a split plot design in random blocks. Nitrogen was applied through microsprinkler. Two harvest seasons in 2001 were evaluated (first and second semester). The variety 'Marroo Seedless' presented the highest yield in both yield cycles. 'Perlette' and 'Superior Seedless' also had good production. The N level 75 kg ha^{-1} promoted the highest yields for Marroo Seedless, Perlette and Superior Seedless varieties being respectively 26.4, 12.5 and 10.6 t ha^{-1}. The number of bunches per plant shows a direct relation for applied N levels and the yield. There was not significant effect of N levels on the other bunches characteristics evaluated.

P101

Effects of gibberelic acid, crop-set and girdling on the quality of bunches of table grape cv. 'Marroo Seedless' in the São Francisco river valley

Patrícia Coelho de Souza Leão, Davi José Silva, Emanuel Élder G. da Silva
Embrapa Semi-Árido, C.P 23, CEP 56300-970, Petrolina-PE, Brazil, patricia@cpatsa.embrapa.br, davi@cpatsa.embrapa.br
Financial support: CNPq, Banco do Nordeste, Improcrop

The purpose of this research was to evaluate the effects of the use of gibberellic acid, Crop-Set bio-stimulant and girdling to improve yield and quality of the marketable bunches of the seedless grape cv. Marroo Seedless in the São Francisco River Valley, Northeast of Brazil. The trial was carried out throughout two cycles (2002-2003) in the Bebedouro Experimental Station, Embrapa Semi-Árido, Petrolina, PE. The trial was laid out in a randomized complete block design with three replicates, each replicate consisting of a four-tree plot. The treatments were: gibberellic acid in one dosage with two time applications (5 + 40 mg/L), Crop-Set in two doses 0.1 and 0.2 % and trunk girdling, isolated or combined to each other. The cv. Marroo Seedless didn't show any response to the treatments with gibberellic acid, Crop-Set and girdling for none of the variables evaluated in 2002, except for total titratable acidity. In 2003, the berry weight and length were bigger in the treatments where gibberellic acid was present. The berry weight in the gibberellic acid and girdling + gibberellic acid + Crop-Set 0.2 % treatments differed significantly of the untreated control. The best result for berry length (23.09 mm) was showed in the girdling + gibberellic acid + Crop-Set 0.2 % treatment. Total titratable acidity and total soluble solids/ total soluble solids ratio presented significant differences among the treatments.

P102

Effects of gibberellic acid, crop-set and girdling on the quality of bunches of table grape cv. 'Perlette' in the São Francisco river valley

Patrícia Coelho de Souza Leão, Davi José Silva, Emanuel Élder G. da Silva
Embrapa Semi-Árido, C.P 23, CEP 56300-970, Petrolina-PE, Brazil, patricia@cpatsa.embrapa.br, davi@cpatsa.embrapa.br
Financial support: CNPq, Banco do Nordeste, Improcrop

The aim of this study was to evaluate the effects of the gibberellic acid, bio-stimulant Crop-Set and girdling applied during bloom and post-bloom stage to improve yield and quality of the marketable bunches of the seedless grape cv. Perlette in the São Francisco River Valley, Northeast of Brazil. The trial was carried out during two growing seasons (2001-2002) in the Bebedouro Experimental Station, Embrapa Semi-Árido, Petrolina, PE. The trial was laid out in a randomized complete block design with three replicates, each replicate consisting of a four-tree plot. The treatments were: gibberellic acid in one dosis with three time applications (5 + 20 + 40 mg/L), Crop-Set in two dosis 0.1 and 0.2% and trunk girdling, isolated or combined to each other. It were evaluated the bunch and berry weight, berry length and diameter, rachis and pedicels weight, yield per plant, number of bunches per plant and chemical composition of the fruits. In the cycle of 2001, the largest berry weight and length were obtained in the treatment gibberellic acid + Crop Set 0.2%. In 2002, just the berry length and diameter answered to the application of the treatments, and the best results were showed with girdling + gibberellic acid. The rachis and pedicels of bunches treated with gibberellic acid became stronger, resulting in the largest rachis weight. There were no effects on other variables.

P103

Liming and fixation of fruits in guava tree

William Natale[1], *Márcio Cleber de Medeiros Corrêa*[2], *Renato de Mello Prado*[1]
[1]Departamento de Solos e Adubos, FCAV/Unesp, CEP 14884-900, Jaboticabal-SP, Brazil
[2]Embrapa Agroindústria Tropical, CP 3761, CEP 60511-110, Fortaleza-CE, Brazil, mcmcor@ibest.com.br
Financial support: FAPESP

It was studied to evaluate the effect of liming in the index of fixation of fruits in guava tree (*Psidium guajava* L., cv. Paluma). A field experiment was conducted in the Experimental Citros Culture Station of Bebedouro (20º53'16"S and 48º28'11"W; 601 m), São Paulo state, Brazil, in a Red Latosol (Typic Haplustox: pH $CaCl_2$ = 4.7, Ca = 9 and Mg = 4 $mmol_c$ dm^{-3}, V = 26%, in 0-20 cm layer). The guava irrigated orchard was installed in December/1999 and the treatments consisted of the absence and presence of liming (zero and 1.5 time the dose needed to increase V = 70 %, for base saturation method). The experimental design used was randomized blocks with 4 replications. Lime was incorporated into the soil (0-30 cm layer) four months before the guava cuttings planting on field. In the peak of flowering to second harvest (October, 2002) branches were marked around the plants, in the medium third of the canopy, and the number of present buttons, flowers and little fruits was counted. The operation was repeated about 30 days later. The final counting of fruits was made one week before the harvest. The index of fixation of fruits was calculated with the total number of emitted floral buttons (NB) and fixed fruits (NF), [IP = (NF/NB).100]. Parcels that received calcareous presented IP (39.9%) significantly superior to those that didn't receive (IP = 29.8%), showing the effect of the liming.

P104

Amino acid sprays on mango (*Mangifera indica* L.) yield and quality

Maria Aparecida do Carmo Mouco[1], *Maria Auxiliadora Coelho Lima*[1], *Sandra Cristina Alves dos Santos*[1], *Fabrício Marques Rodrigues*[2], *Adriane Luciana da Silva*[1], *Suellen Soraia Nunes Azevedo*[1]
[1]Embrapa Semi-Árido, CP 23, CEP 56300-970, Petrolina-PE, Brazil, maria@cpatsa.embrapa.br
[2]Technes Agrícola, Petrolina-PE, Brazil
Financial support: FACEPE, Pibic/ CNPq

Farmers of the São Francisco River Valley (Brazil) have been spraying amino acids on mangoes with the objective to increase panicle length and improve fruit retention and quality. This study tested the effect of spraying amino acids at concentrations of 0.0%; 0.02 %; 0.04% and 0.06 %, on mango plants, cv Tommy Atkins, at budding phase (panicles with 5 cm), at fruit set and during fruit growth (5 cm diameter). It was carried out from June to October, period of natural harvest in the region. Appropriate management of nutrition, water and growth regulators, besides climatic conditions, mainly temperature and solar radiation, could explain no statistical differences among treatments regarding panicle length and fruit production. Characteristics of fruit quality during storage (23.8 $\pm$ 2.8 °C and 45 $\pm$ 8% RH), as weight loss, total soluble solids, total titratable acidity and pulp firmness were not significantly affected by amino acid spraying. Changes on those variables were registered as a consequence of fruit ripening. Amino acids sprays lightly delayed the evolution of skin luminosity and °Hue of pulp, but the differences could not be visually identified. The doses of amino acids were not efficient for improving the natural concentrations of these substances in the leaves; which could explain the non significant effects on the variables analyzed.

P105

Bioassay for paclobutrazol detection in soil

José Moacir Pinheiro Lima Filho, Maria Aparecida do Carmo Mouco, Sandra Cristina Alves dos Santos
Embrapa Semi-Árido, CP 23, CEP 56302-970, Petrolina-PE, Brazil, moacir@cpatsa.embrapa.br

Paclobutrazol (PBZ), a growth regulator that inhibits gibberellin synthesis, has been applied in the management of mango (*Mangifera indica* L.) floral induction at the São Francisco River Valley (Northeast Brazil). Soil applied PBZ can result on long lasting residual accumulation that may hamper plant development and fruit production. Aiming at establishing a simple and fast approach for PBZ detection, sorghum seeds (*Sorghum bicolor* L.) were planted under greenhouse conditions in pots containing 3 kg of a sandy soil. The chemical was applied six months before sowing at concentrations of 0.0; 0.25; 0.50 and 1.0 g. a.i. in a completely randomized experimental design with five replicates. Twenty days after germination the seedlings were sampled for the bioassay evaluation based on germination, length and dry weight of tops and roots. The results showed that PBZ did not play a significant role on seed germination, root growth and dry weight. Nevertheless, it was observed a significant decrease on growth and dry weight of the tops for all the concentrations, suggesting that this approach may be easily used, taking into account the growth of sorghum seedlings tops for the qualitative PBZ residue detection on mango orchards helping farmers to decide whether or not to apply PBZ.

P106

Effects of flower density on tree efficiency, fruit weight and alternate cropping of mango cv. Lippens

E. Guirado[1], J.M. Farré[1], José M. Hermoso[2]
[1]C.I.F.A. de Málaga, 29140 Churriana, Málaga, Spain, eguirado@eelm.csic.es
[2]Estación Experimental "La Mayora" CSIC, 29750 Algarrobo-Costa, Málaga, Spain, jmhermoso@eelm.csic.es

The experiment was carried on for two years on 5-6 years old trees, with local poliembrionic seedling rootstocks, and a canopy area of 0.8-2 m^2 measured. They were growing on permeable, non calcareous shale soil; drip irrigated 3 times per week in summer, with tow 4 $l.h^{-1}$ drippers, when Etp was 6-8 $mm.day^{-1}$. The design was on randomized blocks with 1 $tree.treatment^{-1}.block^{-1}$ and 21 replicates. Trees with a heavy bloom were chosen at fruit set and their flowers panicles thinned to 5 or 10 per tree (light and heavy thinning). Control trees were not thinned. None of the trees were thinned in the second year of the experiment. Alternate cropping was eliminated by light thinning and reversed with heavy thinning. The effects were more marked in small trees. The combined yields of the two years were higher on thinned trees, independently of tree size. Mean fruit weight was a function of flower density, the number of fruits and the size of the tree. Heavily thinned trees produced medium size fruits in both years while control trees had widely different fruit sizes. A high flower density appears to decrease mean fruit weight independently of the final yield. A high yield in year 1 markedly decreased the percentage of flower buds and yield in year 2. The number of picked fruits per panicle was higher on heavily thinned trees, partly compensating their negative effects on final yield.

P107

Induction of Flowering and Fruiting in Unproductive 'Chuasa' Mango Orchards

Shashi K Sharma, Sd Badiyala
University of Horticulture and Forestry, Regional Horticultural and Forestry Research Station, Bhota, Hamirpur, Himachal Pradesh –176 041, India, shashi_uhf@rediffmail.com

Mango orchards of cultivar 'Chausa' have reported to go unproductive after few years of bearing commercial crop under low hill and valley areas of Himachal Pradesh (Anon. 2000). The studies were conducted, at progeny cum demonstration orchards of Department of Horticulture Himachal Pradesh, on induction of flowering and fruiting in 22 year old orchard which was reported to be unproductive for last six years. The cause of unproductiveness of the orchard was identified as excessive vegetative growth of the orchard which out scored the reproductive growth. A number of treatments were designed to trigger reproductive growth in the unproductive trees. Foliar application of ethaphone @ 200 ppm (4 sprays) applied at monthly interval starting from October onwards enhanced flowering significantly but could not influence fruiting significantly during the year 2003. Further studies on fruiting of the orchards are under progress and results will be available by end of July, 2004.

P108

Biological answer of the culture of the melon plant to the application of fertilizantes fosfatados of low solubility in argisolo intensely cultivated in the area of Mossoró, RN

Paloma Magui D. B. de Araújo[1], *Letúzia Maria de Oliveira*[1], *Maurício de Oliveira*[2]
[1]UFV, CEP 36571-000, Viçosa-MG, Brazil, palomadamasceno@hotmail.com
[2]ESAM, CP 137, CEP 59625-900, Mossoró-RN, Brazil

In the State of Rio Grande do Norte, soils where melon is cultivated are submitted to handling of heavy manure, seeking to adapt them to the needs of the culture. The objective of the present work was testing different sources of phosphorus and evaluating the productivity of melon plants in an Argissolo Vermelho-Amarelo (Alfisol) cultivated in the Mossoró city region, in Rio Grande do Norte State, Brazil. Sources of P of low solubility were tested (natural phosphate Gafsa and Fosbahia) and commercial fertilizers (simplesuperphosphate and triple superphosphate). Better response of the culture of the melon plant were verified when it was applied P sources with smaller solubility and with smaller concentration of P2O5 (Gafsa and simple superphosphate, respectively).

P109

Production and quality of fruits of melon ´Piel del Sapo´ in two plant densities

Elaíne Welk Lopes Pereira[1], Edna Maria Mendes Aroucha[2], Glauber Henrique de Sousa Nunes[1], Lonjoré Leocádio de Lima[3], Caroline da Costa Melo[3], Francisco Bezerra Neto[1], Rui Sales Júnior[1], Aurélio Paes Barros Júnior[1], Anne Katherine de Araújo Barros[1]

[1]Núcleo de Pós-Graduação, ESAM, CP 137, CEP 59600-900, Mossoró, RN, Brasil

[2]Núcleo de Pós-Graduação, ESAM, CP 137, CEP 59600-900, Mossoró, RN, Brasil. aroucha@esam.br

[3]Escola Superior of Agricultura de Mossoró, CP 137, CEP 59625-900, Mossoró, RN, Brasil

An experiment was carried out the objective to study the effect of two planting densities on yield and fruit quality of three melon hybrids Piel del Sapo. The experimental design used was of randomized complete blocks in 3 x 2 factorial scheme with six replications. Each plot was composed of three lines of 10m length. The treatments consisted of the combination of three melon hybrids (Sancho, Tendecy e PS 07) with two planting densities (10.000 and 20.000 plants/ha). Evaluations for fruit yield and average weight, internal cavity, pulp thickness, total solube solids and total fruits number. Higher yield and total fruits number. Higher yield and total fruits number were obtained with planting density increasing. Independently of planting density, the melon hybrid "Tendency" had the best yield performance.

P110

The use of biofertilizer and goat manure in melon culture in the São Francisco River valley: I - effects on the soil

Reginaldo de Menezes Leite, Tâmara Cláudia de Araújo Gomes, Núbia Cristina Santos de Carvalho, Maria Sonia Lopes da Silva, Deusalete de Sousa Freitas, Scheila Antunes Amorim, Marcus Vinícius Malheiros da Silva

Embrapa Semi-Árido, P.O. Box 23, 56302-970, Petrolina-PE, Brazil; tamara@cpatsa.embrapa.br

Financial Support: Embrapa and World Bank (Prodetab)

It was evaluated the influence of a liquid biofertilizer, which was elaborated by organic fruit farmers of the São Francisco River valley (goat manure, cameroon grass, cow blood, ashes, EM4, sugarcane syrup and water), in presence or absence of goat manure, on the characteristics of two soil types cultivated with melon: Vertissolo and Argissolo Acinzentado. An experiment was realized for each soil, using pots of 3.5 dm^3, in protected nurseries, with two plants per pot. The experimental design was a complete random blocks in factorial arrangement 3 x 2, with four repetitions. The treatments were by biofertilizer or conventional fertilization (urea, triple super phosphate and potassium chloride) and or absence of fertilizer, combined with the presence or absence of manure. The quantity of biofertilizer was calculated considering the absorption of N for the melon culture during the first 35 days of the cycle. The treatments influenced the studied soils in varying manners. In Argissolo the biofertilizer, with or without manure, increased CE, total bases, and values of K and Na, whereas conventional fertilization increased the P values. A significant interaction among the analyzed factors on pH, CTC and Ca values were observed in Argissolo. In Vertissolo no significant interaction was observed. The biofertilizer increased the P values in a similar fashion as the conventional fertilization and it also increased CE and the values of K and Na, while the Ca and pH showed to be significantly smaller. Significant decreases were observed for P and Mg values when manure was applied.

P111

The use of biofertilizer and goat manure in melon culture in the São Francisco River valley: II - nutrients of phytomass and vegetative performance

Núbia Cristina Santos de Carvalho, Tâmara Cláudia de Araújo Gomes, Reginaldo de Menezes, Maria Sonia Lopes da Silva, Deusalete de Sousa Freitas, Scheila Antunes Amorim, Marcus Vinícius Malheiros da Silva

Embrapa Semi-Árido, P.O. Box 23, 56302-970, Petrolina-PE, Brazil; tamara@cpatsa.embrapa.br

Financial Support: Embrapa and World Bank (Prodetab)

It was evaluated the influence of a liquid biofertilizer elaborated by organic fruit farmers of the São Francisco River valley (goat manure, cameroon grass, cow blood, ashes, EM4, sugarcane syrup, and water), associated or not with to goat manure on the nutrient values of the aerial phytomass and on initial development of melon. Two experiments were conducted, using pots of 3.5 dm^3, in protected nurseries (on Vertissolo and Argissolo Acinzentado) with experimental design of blocks with a factorial arrangement 3 x 2, with four repetitions. The treatments were combined biofertilizer or conventional fertilization or absence of fertilizer, with the presence or absence of goat manure. The quantity of biofertilizer was calculated considering the N absorption for the melon culture during the first 35 days of the cycle. Independently of goat manure effect, the melon phytomass on Argissolo presented higher values for K, Mg and Na with the biofertilizer, and higher values of P with conventional fertilization. The highest values of B and Cu and the lowest of N occurred with the presence of goat manure. On Vertissolo higher values of Ca and Mn occurred in presence of biofertilizer and lower values of N occurred in the presence of goat manure. A significant interaction occurred only for Mg. The dry weight of the aerial part and roots of the melon culture, as well as the volume of the roots, showed to be higher due to the biofertilizer, whereas on Argissolo conventional fertilization presented a greater effect.

P112

Transplant production and stand establishment of melon under tropical conditions

Warley Marcos Nascimento[1], Rosane Sousa Pereira[1], Richard A. Muller[2], Fernando Antonio Souza Aragão[1]

[1]Embrapa Vegetables, CP 218, Brasília-DF, 70359-970, Brazil [2]TopPlant Mudas, Sítio Gravier, Icapuí-CE, 62841-000, Brazil aragao@cnpat.embrapa.br

The production of melon in Brazil in 2002 reached 283,300 ton from 14,100 ha. Approximately 81% of melon production area is located in Northwestern Brazil, in the Rio Grande do Norte and Ceará states. In recent years, some important changes in melon production have been observed, including the utilization of imported hybrids. Traditionally melons have been direct seeded because of ease and inexpensive seed, mainly of the open-polinization cultivars. However, high cost of hybrid seeds is changing the way of stand establishment for this crop. Nowadays, the growing of transplants in plug trays has been used for some growers in some regions in Brazil. The use of transplants should be increased and certainly will be a important stage in the melon production, similarly that is occurring in other vegetable crops. The major advantages of using transplants in melon are: reduced seed use, especially with expensive hybrids; increased early yields; precise and uniform stand establishment; possibility of growing under adverse conditions; reduced use of chemical products and better control of weeds, pests and diseases. In addition, low seed quality and inadequate conditions for seed germination and emergence can be problems during transplant production. Preliminary results of research regarding to seed germination, stand establishment and production of melon under tropical conditions indicated that areas established with transplants had a better stand, higher uniformity of plants and fruits, and higher proportion of fruits per plants compared to direct seeding.

P113

Yield and classification of yellow melon 'Goldex' grown in different soil coverages and amount of water in rainy period

Maria José Tôrres Câmata, Maria Zuleide de Negreiros, José Francismar de Medeiros, Francisco Bezerra Neto, Anne Katherine de Araújo Barros, Aurélio Paes Barros Júnior, Lindomar Maria da Silveira, Mayara Kelly Martins de Medeiros, Nézia Maria Sarmento Barros
ESAM, CP 137, CEP 59600-900, Mossoró-RN, Brazil, annekbarros@uol.com.br

The experiment was carried out from April to July of 2003, in Santa Júlia farm (Mossoró-RN) to evaluate the yield and classification of yellow melon 'Goldex', grown in different soil coverages and water amount. The experimental design was of randomized complete blocks, factorial arrangement 5 x 3 with four replications. The treatments of the factorial consisted of the combination of five soil coverages (naked soil, films black, gray, yellow and brown polyethylene) and three amounts of water (100 %, 86 % and 72 % standard water amount). There was a higher number of commercial fruits in gray and brown films. The higher number of total fruits was observed in all treatments with film and the higher yield of commercial fruits was observed in the black, gray and brown films. The yield and commercial and refused average fruit weight were influenced by amount of water. It was observed higher percentage of fruits type 8 for external market in black, yellow and brown films with amount of water 86 % and type 7 in naked soil with amount of water 72 %. In the internal market, the higher percentage of fruits type 8 and 9 was observed in black, gray and brown films in the naked soil without depend on amount of water.

P114

Yield of melon plants cultivated in Cambissolo Háplico at the Semi-Arid Rio Grande do Norte State in Brazil using organic agriculture

Letúzia M. Oliveira[1], Paloma M.D.B. Araújo[1], Marcos R. Barbosa[2], Maurício Oliveira[2], Roberto B. Moura[3]
[1]UFV, CEP 36571-000, Viçosa-MG, Brazil, letuzia@hotmail.com
[2]ESAM, CP 137, CEP 59625-900, Mossoró-RN, Brazil
[3]Mil Folhas, CEP 59625-900, Mossoró-RN, Brazil

Today, melons productions in all developed countries are limited by commercial barriers due problems in large use of high pollution products in agricultural systems. This present paper is results of a gold mine yellow melon (*Cucumis melo* L.) conducted using organic agriculture principles cultivation in a Cambissolo Háplico (Inceptisols) in Agrarian Project of Rancho Pereiro in municipal district of Baraúna, RN – Brazil. Experimental area was cultivated with located irrigation. Experiment was conducted in blocks design, with 4 replications, following an experiment arrangement in strips (split block). The experimental design consist in different populations of plants, and a incorporated or no incorporated of a cocktail of plants in soil, cultivated before cultivation of melons culture without use of pesticides and/or manure and high soluble fertilizers. Experimental results showed that no incorporate cocktail is an advantage to production of melons in Cambissolo studied. In this situation, a larger production of melons is obtained, and high amount of macro and micronutrients is observed in plant tissues of cultivated melon. The best population plants are when the spacing of 0.60 m among plants are used. In this situation, more proportions of micronutrients are absorbing by plants, and if plants cocktail are incorporated, these results are indifferent of plants populations. Absorption of calcium, magnesium and sodium was large than P and K when cocktail are incorporated in soil.

P115

Physiological and biochemical indices in washington navel orange trees influenced by iron foliar application

Samy M. El-Shazly
Pomology Dept., Faculty of Agriculture, Alexandria University, El-Shatby-21545, Alexandria, Egypt, samyshazly55eg@yahoo.com

Washington navel orange trees were sprayed with Fe-EDDHA for 0.00, 1.25, 2.50, 5.00 and 7.50 g/tree through two or four equal doses. Generally, increasing both Fe-EDDHA concentration and spraying number markedly increased vegetative growth and yield and improved fruit quality characteristics. Leaf carbohydrate fractions, ferrodoxin and total chlorophyll contents responded positively to Fe-EDDHA foliar sprays, especially at the high Fe concentration sprayed four times. Leaf nitrate reductase, peroxidase and catalase activities markedly increased with increasing Fe concentration and spraying number. Regarding leaf N fractions, increasing Fe concentration significantly decreased soluble N and increased assimilated N, meanwhile, spraying number had no effect. Both leaf soluble and assimilated significantly increased with increasing Fe concentration and spraying number, furthermore, the increments in assimilated Fe fraction were more pronounced as compared with soluble Fe. Generally, Fe foliar sprays markedly increased leaf K, Ca and Fe contents but decreased leaf N, P, Mg, Mn, Zn and Cu contents. Number of Fe sprays did not affect leaf elemental composition except Fe leaf content, which increased.

P116

Growth and quality of four *Ananas comosus* cultivars under different periods of floral induction in Campos dos Goytacazes, RJ

Wallace R.S. Cock, Nilton R. Leal, Flávio D. Tardin, Janine C. Avelar, Leandro M. Souza, Karla S. Ferreira, Silvério P. Freitas Jr
Universidade Estadual do Norte Fluminense, Av. Alberto Lamego 2000, CEP 28013-602, Campos dos Goytacazes-RJ, Brazil, rudeck@uenf.br

Pineapple cultivars, ‘Smooth cayenne’, ‘Pérola’, ‘Jupi’ and ‘Favo de mel’, planted in May, 2001 were induced to bloom with ethefon at eight, nine and ten months after the planting date using slips weighting approximately 200 g. The analyzed characteristics were evaluated in relation to weight of the fruit without crown (FWC), relation °brix/acidity (RBA) and vitamin C content (VC), in a RCBD with 4 replications factorially arranged at 4 x 3 (genotypes x environments). It was applied the F test and Tukey at 5%. In FWC it was not identified significant interactions between genotypes and induction treatments, showing values of 1055,23 g(a), 949,20 g(a), 937,87 g(a) and 638,07 g(b), respectively, for ‘Smooth cayenne’, ‘Jupi’, ‘Pérola’ and ‘Favo de mel’. The highest average occurred in the inductions on the nine and ten months. RBA and VC presented significant genotypes x environments interactions. In ‘Smooth cayenne’, VC was not affected by the induction treatment, showing average of 12,68 mg/100 g. In RBA were verified the averages: 15,10(a), 11,51(b), 6,72(c), respectively, at inductions of nine, ten and eight months. For the ‘Pérola’, VC averages were: 38,08 mg/100 g(a), 28,03 mg/100 g(b) and 27,63 mg/100 g(b), at induction of nine, eight and ten months, and RBA, the observed averages were: 18,22(a), 15,50(b), 14,10(b), respectively. The induction treatment not affect the RBA for cvs. ‘Jupi’ and ‘Favo de mel’, with respective averages, 13,84 and 14,12. It was verified in ‘Jupi’ the highest VC (40,00 mg/100 g) in fruits of induced plants at ten months, while ‘Favo de mel’ presented its highest content (24,99 mg/100 g) at eight months.

P117

Nitrogen triggers floriferous flush in strawberry guava (*Psidium cattleianum*)

Frédéric Normand, Thierry Michels
CIRAD-FLHOR, BP 180, 97455 Saint Pierre cedex, Réunion Island, France, thierry.michels@cirad.fr

Empirical observation seemed to indicate that NPK fertilisation induced a rapid floriferous flush in strawberry guava (*Psidium cattleianum*), modifying thus its natural phenological cycle. Factors affecting the plant response to fertilisation have been investigated: identification of the nutrient(s) responsible for the flush; effect of the amount of fertiliser and of the plant phenological stage. A complete NPK fertilisation is followed after 30 to 50 days by the emergence of a floriferous flush. Nitrogen was the trigger of this flush, enhancing the rate of flushing branches. The amount of fertiliser or the leaf nitrogen content had no effect on the flush characteristics. The phenological stage had a strong influence on the plant response, with a more intense and less variable flush when fertilisation was applied after a 3 months resting period than just after a harvest. This suggested that the carbohydrate availability was involved in the plant response, in particular its floriferous status. The possibility of triggering production cycles by nitrogen has interesting agronomic consequences, such as off-season production.

P118

Vienna 8: The mediterranean fruit fly strain that will be used in the biofábrica Moscamed Brasil, in Juazeiro-BA

Beatriz Aguiar Jordão Paranhos
Embrapa Semi-Árido/Brasil, BR428, km 152, C.P 23, CEP 56.302-970, Petrolina-PE, Brazil, bjordao@cpatsa.embrapa.br

The first time, the American Entomologist, E.F. Knipling thought about sterile insect technique (SIT), in the 40's decade, both male and females were reared in the Mediterranean fruit fly Factories (*Ceratitis capitata*, Diptera: Tephritidae). In spite of the females released were sterile, they continued laying eggs in the host fruits, which could cause damage in the peel. Some years later, the experts developed a strain in which females had white pupae and males brown pupae (wild color). It was a great advance in fruit flies business because it was possible to separate females from males before adult's emergence and release only sterile males in the field. But, the goal was to find a way to separate males and females in the earlier phases than pupae, to decrease the production cost in the Mediterranean fruit fly Factories. After many sophisticated studies, they developed strains which female eggs had lethal sensibility to temperature higher than 34ºC, named of tsl strains. Until now, they have developed 4 tsl strains, each time more productive and genetically stable. The objective of this work is to describe the steps to rear Vienna 8, the most recent and productive strain, which will be released in the irrigated fruit crop of semi-arid, to suppress *C. capitata* population.

P119

Effect of different organic manures in banana clones for control of *Meloidogyne incognita* under greenhouse condition

L.C.V. Boas[1], J.E Cares[1], Renata C.V Tenente[2]
[1]Universidade de Brasília, CP 4457, Brasília-DF, Brasil, CEP 70.910-900, lenisavb@uol.com.br
[2]Embrapa Recursos Genéticos e Biotecnologia, CP 02372, Brasília-DF, Brasil, CEP 70.770-900, renata@cenargen.embrapa.br

The present work had the objective to evaluate the effect of organic manures with two varieties of banana plants, Grande Naine and Prata Anã, looking for the control of *Meloidogyne incognita*, under greenhouse conditions. The assay was carried out at the University of Brasilia Experimental Station. In the assay was used organic fertiliser, for varieties, the chicken and cattle manure, Bokashi-MOA and organic compound-MOA. The evaluated parameters were the height and weight of the aerial parts, weight of roots, eggs/juveniles nematode number recovered from soil and roots, and nematode reproduction rate. Among the treatments, the organic compound-MOA and cattle manure were the best, related to the weight and height of the aerial parts. The plants that received the Bokashi had the highest root weight, but statistically it was not showed significant difference among treatments and controls. Regarding to the nematode number and the reproduction rate, the treatment with chicken manure had the highest number and the biggest reproduction rate, showing significant difference among treatments, including the controls. The results showed the importance of using organic fertilisers for the development of banana plants. The low nematode reproduction rate obtained in this assays, suggested that the nematode population was not pathogenic, since that a low nematode multiplication indicates non-pathogenicity.

P120

Efficiency of terbufos and carbofuran on the control of banana weevil borer *Cosmopolites sordidus*

Flávia Rabelo Barbosa, Eduardo Alves de Souza, Wellington Antonio Moreira, José Adalberto de Alencar, Francisca Nemaura P. Haji, Cherre Sade B. da Silva
Embrapa Semi-Árido, CP 23, CEP 56302-970, Petrolina-PE, Brazil, flavia@cpatsa.embrapa.br

Effectiveness of two granulated insecticides terbufos 150 G and 50 G, at different dosages, and carbofuran 50 G, were tested in order to control banana weevil borer *Cosmopolites sordidus* (Coleoptera: Curculionidae). The trial was conducted under field conditions, in an irrigated area of Petrolina municipality, Pernambuco State, Brazil, in a randomized complete block design with five treatments and five replicates. The treatments (g c.p./planting hole) were: 1. terbufós 150 G (13); 2. terbufós 150 (20); 3. terbufós 50 G (60); 4. carbofuran 50 G (80) and 5. untreated check. There were 25 plants per treatment, cv. Pacovan, being evaluated number of insects before application (6.09 insects per bait). The effect of the treatments on the pest was measured by Mesquita (1985) method at 90 and 120 days after application, which consisted of transversal cut of the rhizome, on its maximum perimeter, to observe the occurrence of galleries, resulting from borer infestation. The data were statistically analyzed and the means were compared by the Tukey test at 5% level. Data of the coefficient of infestation of the rhizomes were transformed in $\sqrt{x+0,5}$. The mean efficiency was calculated using the Abbott formula. Results showed that terbufos and carbofuran, in the dosages tested, were effective to control banana borer. However, there was no difference among treatments. The percentages of efficiency ranged from 96.7% to 100%.

P121

Development of a model defining relationship between field weather variables and incidence of grape downy mildew in Semi-arid conditions on São Francisco valley

Carlos A. T. Gava, Selma C. C. de H. Tavares, Antonio H. de C. Teixeira
Embrapa Semi-Árido, CEP 56302-970, Petrolina-PE, Brazil, gava@cpatsa.embrapa.br

A set of weather variables obtained in grape yards in the São Francisco valley were evaluated to define the correlation to Downy Mildew (*Plasmopara viticola*) incidence. Using the time series studies procedures Spectral analysis and Lag Cross Correlation was defined a delay of 6 days from environmental events and field detection of symptoms. The variables continuous hours of RH greater than 80%, hours of continuous temperature from 20°C to 25°C, and rainfall showed greatest R^2 in Step Wise Multivariate Regression. Using these variables a forecast model was developed to predict infection periods of *P. viticola* to the semi-arid conditions characteristic to the São Francisco valley. According to data, maximal infection should appear between 12 and 20 continuous hours showing RH greater than 80% and temperature varying from 20°C to 25°C. Rainfall greater than 5 mm was associated with high disease incidence, which should be magnified if followed by warmer temperature. Based on these variables a polynomial model was obtained and a matrix for combination of accumulated times of RH superior to 80% and accumulated medium temperature determining the environmental favorability index. At this moment Embrapa Semi-Árido and grape producers evaluate the model to schedule fungicide spray.

P122

Detection survey for grapevine rust at the irrigated areas of the São Francisco valley, Brazil

Daniela B. Lopes, C.P. Cabral
Embrapa Semi-Árido, C.P. 23, 56300-970, Petrolina-PE, Brasil, daniela@cpatsa.embrapa.br

Grape rust, caused by *Phakopsora euvitis* Ono, was introduced in Paraná, south of Brazil, in 2001. It is considered a quarantine pest, being under official regulation. Grape rust can cause early defoliation in susceptible varieties, compromising yield and reducing the vigor of the plant for the following seasons. The irrigated viticulture of the São Francisco Valley produces high quality table grapes and is responsible for 95% of the whole amount of grape exported by Brazil. Therefore, the risks of introduction and establishment of the disease in the region must be minimized. Information on the disease and the risks of its introduction is being disseminated during regional meetings with technicians and growers and in the local media. A detection survey was conducted in the rural area of Petrolina-PE, Juazeiro-BA, according to FAO recommendations (ISPM 6, FAO, 1997). The survey occurred in September and October 2003, and March 2004. In the first period, 34 commercial orchards scattered throughout the main producing areas were visited, representing 2700 ha planted with grapes. In each orchard, a folder with basic information on the disease was handed and 1 ha of an area in production (50 to 120 days after pruning) was sampled in 21 of the 34 orchards. Fifteen plants were selected at random and the underside of mature leaves, three branches per plant, was observed. In March 2004, 20 orchards were visited, following the same procedure. In both periods of survey, grape rust was not observed in the visited areas.

P123

Efficiency of natural insecticides and thiamethoxam on the control of thrips in grapes and selectivity to natural enemies

Luiz Ronaldo Nali[1], Flávia Rabelo Barbosa[2], Carlos Alfredo L. de Carvalho[1], Jackson Bonfim C. dos Santos[3]

[1]UFBA, CEP 44380-000, Cruz das Almas-BA, Brazil, mudas1@uol.com.br, calfredo@ufba.br

[2]Embrapa Semi-Árido, CP 23, CEP 56302-970, Petrolina-PE, Brazil, flavia@cpatsa.embrapa.br

[3]Universidade do Estado da Bahia-UNEB, EP 48900-000, Juazeiro-BA, Brazil

The viticulture is an important economical activity in the irrigated agriculture of the São Francisco river Valley. The rapid expansion of this fruit crop has been altering the agroecosystem and favoring the emergence of pests. The objective of this work was to verify the efficiency of natural insecticides and thiamethoxan on the control of *Selenothrips rubrocinctus* and *Frankliniella* sp. and their selectivity to natural enemies. The trial was conducted under field conditions, in an irrigated area of Juazeiro municipality, Bahia State, Brazil, in a five-year old vineyard, cv. Benitaka, in a randomized complete block design with five treatments and four replicates. The treatments were: (1) Neem-I-Go 0.5%; (2) Rotenat 0.5%; (3) Bio Alho 0.3%; (4) thiamethoxam 250 WG (20g c.p./100 L of water) and (5) untreated check. There were twelve plants per treatment, being evaluated number of thrips and natural enemies, in inflorescences before application and 2, 4 e 6 days after application. Rotenat and Nim-I-Go were the most effective, respectively, 52.04% and 48.37% of control efficiency, followed by thiamethoxam (46.00%) and Bio alho (23.07%). Two days after application the efficiency of thiamethoxam was 76.79%. However its average efficiency was low. The grades in the selectivity to natural enemies scale to Bio alho, Nim-I-Go, Rotenat and thiamethoxam were, respectively, 2 (slightly harmful), 3 (moderately harmful), 3 and 4 (harmful).

P124

Strategies for monitoring and action level of T*riozoida* sp. in guava plants in irrigated areas of the São Francisco river valley, Brazil

Flávia Rabelo Barbosa, Wellington Antonio Moreira, Francisca Nemaura P. Haji, José Adalberto de Alencar

Embrapa Semi-Árido. CP 23, CEP 56302-970, Petrolina-PE, Brazil, flavia@cpatsa.embrapa.br

The São Francisco River Valley, Northeast Brazil, is an important producing area of guava (*Psidium guajava* L.). The rapid expansion of this fruit crop has been altering the agroecosystem and favoring the emergence of new pests. *Triozoida* sp. (Hemiptera, Psyllidae) is the main guava pest in the region, causing yield lost. Aiming to implement an integrated pest management program, studies involving sampling strategies for monitoring and action level of psyllida were conducted. Monitoring should be done weekly in 20 trees, in areas up to 5 ha. The plants should be sampled randomly, following a zigzag pattern. Each plant must be subdivided in quadrants, observing the presence of infested shoots and/or young leaves at eight branches (two in each quadrant). Insect control should start when 30% of infested shoots and/or young leaves are observed.

P125

Chemical control of stem-end rot on mango fruits in the San Francisco river valley

Wellington A. Moreira[1], Edineide E. Magalhães[1], Daniela B. Lopes[1], Flávia R. Barbosa[1], Alba V. S. Pereira[1], Adriana Andrade Azevedo[2]

[1]Embrapa Semi-Árido C.P. 23, CEP 56300-970 Petrolina-PE, Brasil; wmoreira@cpatsa.embrapa.br

[2]ESAM, Mossoró-RN, Brazil

Lasiodiplodia theobromae is specifically important for mango (*Mangifera indica*) grown in semi-arid regions of Brazil, attacking branches and panicles and also causing major problems after harvesting as a stem-end rot pathogen. The objective of this study was to assess the efficacy of some fungicides in reducing the incidence of stem-end rot when applied after flowering onset. The following products and its respective dosages per hectare were tested: difenoconazole (7.5 g, 10 g, 12.5 g), azoxystrobin (8.0 g + nonil phenol ethoxilate, 0.05%), chlorothalonil (123 g) and propiconazole (100 g). The experiment was conducted in an eight-year-old commercial orchard, cv. Tommy Atkins, in Petrolina-PE. The chemical treatments and an untreated control were randomly assigned to a complete block design, with four replicates. The experimental unit was comprised of three plants. The treatments were sprayed six times, beginning at the onset of flowering, at 15-days intervals. At harvest, 96 fruits per treatment were brought to the laboratory and stored at room temperature for 15 days. The fruits were then visually assessed for symptoms of stem-end rot, and the presence of *L. theobromae* was confirmed through isolation in PDA. All chemical treatments significantly reduced the incidence of stem-end rot (Tukey, $P< 0.05$), when compared to the control. The incidence reduction varied from 56.7% (chlorothalonil) to 67.57% (propiconazole). There was no statistical difference among the chemical treatments.

P126

How to cope with the disadvantages of using green ants, *Oecophylla smaragdina* (Hymenoptera: Formicidae), to manage mango insect pests in Australia

Rengkang Peng, K. Christian

School of Science, Charles Darwin University, Darwin NT 0909, Australia, renkang.peng@cdu.edu.au

To reduce mango growers' dependency on toxic insecticides and to explore the possibility of 'organic' production, we have been conducting research on integrated pest management using green ants as a key element since May 2001 at six study sites in Darwin area, Northern Territory, Australia. The results demonstrated that green ants are efficient repellents and predators in controlling the eight most important species of insect pests in mango orchards. However, they protect scales and mealy bugs, damage fruits by their formic acid and disturb people picking fruits. To solve these three disadvantages, field and laboratory experiments were conducted in 2001 and 2002. The results showed that several soft chemicals can reduce mealy bug and scale numbers up to 90% without devastating green ants, ant colony isolation reduces fruit damage by formic acid from 5.4% to 2.5% and pure water spray reduces the ant activity more than 70% prior to picking fruit. An IPM model using green ants as a major component is discussed with respect to the production of 'organic' or 'insecticide-free' fruits.

P127

Utilization of weaver ants, *Oecophylla smaragdina*, (Hymenoptera: Formicidae) as a major component to manage insect pests in mango orchards in Northern Australia

Rengkang Peng, K. Christian
School of Science, Charles Darwin University, Darwin NT 0909, Australia, renkang.peng@cdu.edu.au

Mangoes are an important smallholder and commercial crop in Southeast Asia and northern Australia. To achieve high yield and quality, growers rely on regular use of insecticides to control the major insect pests, resulting in economical, environmental and social problems. Therefore, a better control program is needed. Weaver ants are known to control over 40 species of insect pests on many tropical tree crops, but they are not being used to combat mango insect pests, although they naturally occur abundantly in mango orchards. To determine whether these ants can be used as a major component of an IPM program in mango orchards, we have studied them in Australia, Vietnam and Thailand. Based on the results from field and laboratory experiments and long-term monitoring from 2001 to 2003 at six study sites in the Northern Territory, an IPM program of using weaver ants together with the use of soft chemicals and farming strategies has been established. This poster, together with a video display, will demonstrate which mango insect pest can or cannot be controlled by weaver ants, how to use the IPM program with the potential of producing 'organic' product, and how to stabilize weaver ant populations in mango orchards.

P128

Carbon fixation, yield and total soluble solids of melon fruits from plants infected with *melon yellowing-associated virus* and whitefly

Marlos Alves Bezerra, Antonio Apoliano dos Santos, José Emilson Cardoso
Embrapa Agroindústria Tropical, CP 3761, CEP 60511-110, Fortaleza-CE, Brazil, marlos@cnpat.embrapa.br

The aim of this work was to study the influence of *Melon yellowing-associated virus* and whitefly on the carbon fixation and yield of melon plants as well as on the total solid soluble (ºBrix) of fruits. Experiments were carried out in greenhouse, of Embrapa Agroindústria Tropical, in Fortaleza city (Ceará state, Brazil), and in a commercial field of Agrosagno farm, in Russas counties (Ceará State, Brazil). In Fortaleza, the experimental design used was a completely randomized with 4 treatments (T1 = Plants virus and whitefly free; T2 = Plants virus infected and without whitefly; T3 = Plants virus infected and with whitefly; T4 = Plants virus free and with whitefly) and 5 replications. In Russas, only two treatments were used (T1 = Plants virus free; T2 = Plants virus infected) and 15 replications. Under greenhouse conditions virus symptoms appeared 20 days later but photosynthesis rate was influenced only after 45 days without affecting neither the yield (fruit weight) nor the fruits quality (total solid soluble). These variables were affected by the presence of whitefly, in the forms of eggs, nymphs and adults**.** Although photosynthesis rate had negatively been affected in field conditions in the later plant stages neither the yield nor the fruit ºBrix exhibited reduction.

P129

Influence of the dosage of aqueous extracts from fresh and dry nim seeds on melon white fly nymphs

Ana Luiza Xavier Carlos
Escola Superior de Agricultura de Mossoró – ESAM, Núcleo de Pós-Graduação, C.P. 137, CEP 59625-900, Mossoró-RN, Brasil, analuizaesam@hotmail.com

The objective of this work was to evaluate different concentrations of aqueous extract of fresh and dry seeds of Nim (*Azadiracta indicates* A. Juss.) on nymphs of white-fly on melon plant, under conditions of vegetation house. The experimental design used was six blocks with factorial outline 5×2, where the first factor refers the concentrations of the extracts (0.0; 2.5; 5.0; 7.5 and 10.0%) and the second factor refers the fresh and dry seeds of nim. The extracts were applied on the Orange flesh melon plant. 50 adults were placed on each plant, in each cage (block) during 24:00. The count of nymphs was made in disks of 2.3 cm by leaf of each plant (treatment), when the nymphs reached the final phase of development (characterized by your size). The aqueous extract of fresh seeds of Nim influenced the number of nymphs of white fly from 7.5% of concentration, being more efficient in 10.0% concentration. When evaluated the concentrations of the extract of dry seeds of Nim, the efficiency was observed from 5.0% concentration, where the number of nymphs decreased with the increase of the doses. The reduced number of nymphs observed in treatments with Nim extracts is due the action of the azadiractina, that has repellent and toxicant effect.

P130

Seed-borne nematodes in imported melon and watermelon seeds, detected by nematological analysis and recovered by germoplasm information system search

Renata C.V. Tenente[1], *V.R.V. Rissoli*[2], *J. E. Cares*[3], *H.I. Nascimento*[5], *M. Prates*
[1]Embrapa Recursos Genéticos e Biotecnologia, C.P 02372, Brasília, DF, Brazil, CEP 70.770-900. renata@cenargen.embrapa.br
[2]Universidade Católica de Brasília, QS 07-Lote 01, CEP 70.022-900, Taguatinga-DF, Brazil. vandor@ucb.br
[3]Universidade de Brasília, DF, C.P. 4457, Brasília-DF, Brazil, CEP 70.910-900.
[4]UPIS, Brasília, SGAS Quadra 913 s/n Conj. B, Brasília-DF, Brazil

The Nematological Laboratory of Embrapa Genetic Resources and Biotechnology has analysed imported plant material with the purpose to detect plant-parasitic nematodes from different countries. For the analysis, nematodes were extracted by tray technique, Baermann funnel and germination paper. Nineteen melon accessions were found infected in a total of 434 and one watermelon accession infected in a total of 56. The melon seeds were infected by *Aphelenchoides* sp. and *Ditylenchus* sp. (Sweden); *Ditylenchus* sp. (from France, Holland and Spain); *Aphelenchus* sp. (Spain); *Coslenchus* sp. (from USA); *Ditylenchus emus* and *Seinura* sp. (France). Watermelon seeds were infected by *Aphelenchoides* sp. The database of nematological analysis is located at Embrapa Genetic Resources and Biotechnology, Brazil. The pest interception is very important to diminish the risk of entrance of new nematode species. The cost benefit analysis demonstrated by the database revealed a great contribution to the Brazilian Agriculture, decreasing the pest risks by the efficiency of the system in recovering data.

P131

Reaction of papaya (*Carica papaya*) genotypes to foot rot caused by *Phytophthora palmivora*

A. *C. Dianese, L. E. B. Blum, J. B. Dutra, L. F. Freitas, L. F. Lopes, M. C. Sena, L. A. Lima, O. K. Yamanishi, D. M. S. Martins*
Universidade de Brasília, Dept. Fitopatologia, Brasília-DF, CEP 70910-900, Brazil, adianese@unb.br, kiyoshi@unb.br
Financial Support: CAPES, CNPq

Papaya foot and root rot caused by *Phytophthora palmivora*, is a serious problem in 'Bahia' and 'Espírito Santo', the main Brazilian states where this crop is planted. Ten genotypes ("NT Red", "Golden", "Baixinho de Santa Amália" and "Sunrise Solo", from the "Solo" group, and "Cross Paris", "Tailândia Verde", "Tailândia Roxo", "Tainung-1", "Tailândia Roxão" and "Sekati" from the "Formosa" group) were evaluated for resistance to *P. palmivora* on field and on two pot trials using naturally infested soil (Experimental Station of the University of Brasília, Brasília, DF, Brazil). A scale that varied from 1 (0 to 5% wilting) to 9 (90 to 100% wilting) was used on the field evaluations. Another scale varying from 0 (0% wilting) to 3 (seedling death) was used to evaluate the pot tests. "Tailândia Roxão" and "Cross Paris" were the least susceptible genotypes on both field and pot trials. 'Baixinho de Santa Amália', 'Tailândia Verde' and 'Tailândia Roxo' reacted differently under field (moderate resistance) and pot (susceptibility) conditions. All other genotypes were considered susceptible in both tests. It seems that resistance is more frequent among the cultivars in the Formosa group.

P132

Pre and postharvest data collecting system using the compact NIR analyzer

H. Aoki[1], *T. Tanabe*[1], *T. Akinaga*[2]
[1]FANTEC Research Institute Inc. Kosai, Shizuoka 431-0401, Japan, mail@nir-fantec.co.jp
[2]University of the Ryukyus, Nishihara, Okinawa 903-0213, Japan, akinaga@agr.u-ryukyu.ac.jp

The development of portable near infrared spectroscopic analyzer for outdoor use was started in 1996. Fruit-tester-20 (FT20) was developed in 1998. This device has fulfilled the needs for outdoor use such as small size, lightweight, one-body, rechargeable battery, weather resist and easy data handling. The FT-20 composed of a spectroscope, CPU board, indicator, memory card, lighting device, optical fiber, battery and charger in one box weighed about 4kg. A new model has been developed in 2003. This NIR spectroscopic analyzer called the NIR-GUN is the most compact NIR analyzer on the world market. The weight of the NIR-GUN is only 0.75kg, which allows it to be handled on the tree in a orchard. The NIR data can be transferred to a personal computer using an RS232C interface. Several research institutions and fruit industries have introduced the NIR-GUN to collect physiological data or quality control data on site.

P133

The ethylene absorption analysis in the modified atmosphere composition of the "hass" avocado during its conservation under different temperatures

Paulo César Corrêa, Osvaldo Resende, Deise Menezes Ribeiro
UFV- Departamento de Engenharia de Alimentos (DEA), Viçosa-MG Brazil, copace@ufv.br, oresende@vicosa.ufv.br, deise@vicosa.ufv.br

The objective of this work is to verify the ethylene absorbing effect on the conservation of the avocado fruits stored under modified atmosphere and different temperatures. 10 fruits were packed in the plastic boxes, wrapped up with low density polyethylene bags. 2 sets of procedures were done: one without ethylene absorber and another with (Green Keeper®) absorber, under temperature of 3.6ºC and 20ºC. The air samples from the inside of the plastic bags were taken with a syringe, the amount of CO_2 and C_2H_4 were determined by gas chromatography apparatus. The physical quality index studied was the loss of the fruit peel resistance evaluated through maximum rupture force, determined by puncture test on the equatorial zone of the fruit in three equidistance points in 5 fruits taken randomly from the plastic bags. The data were taken on 0, 5th, 7th, 9th and 11th days for temperature of 20°C and on 0, 11th, 18th, 25th, 32nd, 39th, 46th, 53rd e 60th days for temperatures of 3°C and 6°C. The results obtained from de data analysis it may be concluded that at the temperature of 20°C the use of the ethylene absorber will retard the fruit ripening indicated by the higher peel resistance evaluated through the maximum puncture force. For the temperature of 6°C the ethylene absorber effect on ripening started from the 39th day. Although for the temperature of 3°C due to the metabolic activity blockage of the avocado fruits no ethylene absorption action was observed.

P134

Effect of 1-methylcyclpropene (1-MCP) on gene expression during banana (*Musa acuminata* cv Nanicão) ripening

Eduardo Purgatto, Walter Arato Bastos, Janaína Aparecida Mainardi, Beatriz Rosana Cordenunsi, Franco Maria Lajolo
Depto de Alimentos e Nutrição Experimental, FCF-USP, CEP 05508-900, São Paulo, SP, Brasil, epurgatt@usp.br
Financial support: FAPESP, CNPq, CAPES

The 1-methylcyclopropene has recently been added to the list of substances for extending the shelf-life of fruits We used banana fruit as a model in panels of differential gene expression to assess the effects of the 1-MCP on the ripening and to identify genes whose transcription vary in response of the 1-MCP treatment.. Green pre-climacteric bananas were fumigated with the 100 ppb 1-MCP and, their cDNA panels were compared to those of control samples either treated or non-treated with ethylene. The cDNA panels were obtained using the cDNA-AFLP technique. The selected fragments were sequenced and their differential transcription was confirmed by reverse Northern. Forty selected fragments revealed significant identity with genes linked to starch, polyamines and flavonoids metabolism, transcription factors, homeostasis of metals among others. Considering the importance for fruit quality, we can point out the maintenance of the gene expression of the starch-synthase, branching enzyme and starch phosphorilase on samples treated with 1-MCP, suggesting that the compound can provoke a displacement of the starch metabolism in the synthesis direction, leading to a decrease on sugars levels during fruit ripening. These and other analyses will allow assessing in depth the viability of the 1-MCP as controller of fruit ripening.

P135

Maturation physiology under modified atmosphere of 'Prata' banana treated postharvest with 1-Methylcyclopropene

Otávio do Carmo de Oliveira Neto[1], *Silvanda de Melo Silva*[2], *Ebenézer de Oliveira Silva*[3]
[1]CFT/UFPB, CEP 58.220-000, Bananeiras-PB, Brazil
[2]CCA/UFPB, CEP 58.397-000 Areia-PB,Brazil, silvasil@cca.ufpb.br
[3]Embrapa Agroindústria Tropical, CP 3711, CEP 60511-110, Fortaleza–CE, Brazil

The aim of this research was to evaluate the influence of 1- methylcyclopropene (1-MCP) and modified atmosphere packaging on the maturation of banana cultivar 'Prata' harvested in the maturation stage 1. Banana hands were treated at room temperature with 0 and 60 ppb 1-MCP in sealed plastic chambers of 0.19 m^3, during 24 hours. Following the exposition to 1-MCP, a set of three fruits were packed in polystyrene trays and packed using Xtend™ film (Stepac, L. A., Israel) for modified atmosphere generation, and kept under ambient (AA) and modified atmospheres (MA) at 15 °C and 90 ± 2 % of Relative Humidity and room temperature (23 ± 2 °C and 85 ± 2 % RH). At each evaluation period, three replications (three fruits /rep) from each treatment were used. 1-MCP application delayed the onset of respiratory peak, reduced the rate of chlorophyll degradation and delayed the onset of carotenoids. It also maintained fruit gloss and retarded the increase in the *a** and *b** values, which is a result of the also delayed transition from the green to the yellow skin color. However, the development of the skin yellow color was very irregular at 15 °C storage. On the other hand, 1-MCP treatment resulted in a more intense skin yellow color development for fruits kept at room temperature.

P136

Physiological response to chilling temperature of banana fruit (*Musa acuminata* cv. Dwarf Cavendish)

Maria Andrea Trejo-Márquez[1], *M. Vendrell*[2]
[1]Universidad Nacional Autónoma de México, Facultad de Estudios Superiores Cuautitlán, Laboratorio de Postcosecha de Productos Vegetales, México, andreatrejo@correo.unam.mx
[2]Departamento de Fisiología y Biodiversidad Molecular, Instituto de Biología Molecular de Barcelona, CSIC, Barcelona, España

Bananas are tropical fruits sensitive to chilling injury (CI). The purpose of this study was to evaluate the effect of low storage temperatures of bananas on respiration, ethylene production, 1-aminocyclopropane-1-carboxylic acid (ACC) and malonyl-ACC (MACC) contents, ACC oxidase activity, quality parameters, and chilling injury (CI) index. Banana fruits from the Canary Islands were stored at 4ºC for 1, 3 and 5 days and then rewarmed at 20ºC until ripening. Bananas subjected to 4ºC for 1 day and transferred at 20ºC developed slight damage by the end of storage (CI index=0.3), showing dull yellow color on the peel. Neither physiological nor quality parameters were affected. Bananas subjected to 4 ºC for 3 days presented moderate damage by the end of storage (CI index=2.25). These bananas presented browning on the peel, increase in the production of CO_2, stimulation of ethylene production, increase in ACC oxidase activity and decrease in ACC and MACC contents, compared to undamaged bananas. Bananas subjected to 4ºC for 5 days developed severe peel damage by the end of storage (CI index=3). Several chilling turns the peel brown to black and presented abnormal ripening.

P137

Starch degradation: phosphorylase behavior and 1-MCP effect

Janaina A. Mainardi, E. Purgatto, W.A Bastos, B.R. Cordenunsi, F M. Lajolo
Universidade de São Paulo, Faculdade de Ciências Farmacêuticas, Departamento de Alimentos e Nutrição Experimental, Av. Prof. Lineu Prestes 580, Butantã, SP, Brazil, CEP 05508-900, jmainard@usp.br
Financial support*:* FAPESP/CAPES

It is believed that, amongst the various existing forms of phosphorylases, the plastidial form is involved in both synthesis and degradation of banana (*Musa accuminata* AAA cv. Nanicão) starch (Mota et al, 2002). These authors also estimated the activity and expression of starch phosphorylases during ripening. To verify if phosphorylase regulation involves ethylene, in this work, the activity of this enzymatic form, as well as its expression and translation were followed in bananas treated both, with ethylene and by its antagonists, the 1-MCP (100nL/L). Several ripening parameters were measured such as: e-thylene and CO_2 production (by gas chromatography), starch concentration (enzymatic method described by Arêas and Lajolo, 1981) and sugars (glucose, fructose and sucrose - by HPLC-PAD). In spite of fluctuations observed for activity and phosphorylase transcripts, western blottings was kept constant during ripening. The results showed that before climateric, the activity of phosphorylase was almost constant in both no treated and 1-MCP treated bananas. After that a decrease in activity, parallel to starch degradation was observed. In ethylene treated fruits this process was accelerated. The conclusion is that ethylene decreases the phosphorylase activity and 1-MCP delays this event.

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Quality of c*ajuí* (*Anacardium* spp.) apple from Piauí State Coast vegetation, Brazil

Maria do Socorro Moura Rufino[1], Maria Pinheiro Fernandes Correa[1], Ricardo Elesbão Alves[1], Carlos Farley Herbster Moura[1], Jardel Ygor da Silva Almeida[1]
Embrapa Agroindústria Tropical, CP 3761, CEP 60511-110, Fortaleza-CE, Brazil, elesbao@cnpat.embrapa.br
Financial support: CNPq

This work aimed to evaluate the quality of apple *cajuí* from Piauí State coastal vegetation, Brazil, to fresh consumption or industrialization. It was selected and georeferenced 23 genotypes of native *cajuí* in the municipalities of Ilha Grande and Parnaíba, Piauí, Brazil. Is was used a genotype *cajuí* (*A. microcarpum*) as a control. This genotype belongs to the Germplasm Bank of Cashew (BAG-Caju) and is located at Embrapa Agroindústria Tropical Experimental Station in Pacajús, Ceará, Brazil. The *cajuí* apples fruits harvested from the 23 genotypes were evaluated considering the following characteristics: Soluble Solids (SS), Titratable Acidity (TA), SS/TA, pH, Vitamin C, Soluble Sugars, Reducing Sugars, Phenolics, Pectin, Anthocyanin, Yellow Flavonoids, Anthocyanin/Flavonoids and Carotenoids. The experiment was carried out as completely randomized design with 3 repetitions. Each repetition was composed by the pulp obtained from at least 20 apples. The results obtained from the characterization of different genotypes of *cajuís* shows that it exist a great variability of this specie in Piauí coastal vegetation. The apple of the majority of the *cajuí* tree genotypes presented superior quality, especially related with the patterns established by the Brazil Agriculture Ministry. Besides this consideration, the genotypes 3 and 19 presented high firmness, indicating a potential for the fresh fruit market and, consequently, higher postharvest life.

P139

Cold storage of cashew apple of the BRS 189, CCP 76, END 183 and END 189 early dwarf clones under different modified atmospheres

Carlos Farley Herbster Moura[1], *Raimundo Wilane de Figueiredo*[2], *Ricardo Elesbão Alves*[1], *Ebenézer de Oliveira Silva*[1], *Paolo Germanno Lima de Araújo*[1], *Vlayrton Tomé Maciel*[1]

[1]Embrapa Agroindústria Tropical, CP 3761, CEP 60511-110, Fortaleza, CE, Brazil, elesbao@cnpat.embrapa.br

[2]Universidade Federal do Ceará, Av. Mister Hull s/n Pici, 60455-760, Fortaleza, CE, Brazil, figueira@ufc.br

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The objective of this work was to verify the postharvest storability of cashew apples under refrigeration and different modified atmospheres. Cashew apples from the early dwarf clones BRS 189, CCP 76, END 183 and END 189 were hand harvested, placed inside boxes lined with foam rubber (1 cm thick) and transported to the Laboratory of Postharvest Physiology and Technology of the Embrapa Agroindústria Tropical, Fortaleza, CE, Brazil. Cashew apples, in number of three, were placed in expanded polystyrene trays, packed with different (2, 4, 6 and 8) layers of Polyvinil Chloride (PVC) extendible film (15 •) and stored under refrigeration (5.03 ± 1.30°C). The experiments, for each clone, were conducted in a completely randomized design, in a factorial arrangement (atmosphere x time), with three replications (trays). The peduncles were evaluated on the harvested day and on 7, 14, and 21 day, for: soluble solids (SS), titratable acidity (TA), SS/TA, pH, vitamin C, sugars, phenolics and anthocyanin. The atmosphere modification resulted in an increased CO_2 concentration inside the packages and lower mass loss of the cashew apple. The external appearance was a limiting factor for cashews postharvest conservation, mainly for those with red color. The postharvest life for cashews apple from CCP 76 clone was 16 days. For the other clones, it was observed a variation on the postharvest life depending on the package: 16 to 19 days for the BRS 189; 17 to 20 days for the END 183 and 13 to 14 days for the END 189.

P136

Postharvest conservation of camu-camu (*Myrciaria dubia* McVaugh) fruits in response to maturation stages

Jerusa Souza Andrade, *Jânio Silva Silveira*, *Sidney Alberto do Nascimento Ferreira*

Instituto Nacional de Pesquisas da Amazônia, CP 478, CEP 69011-970, Manaus-AM, Brasil, andrade@inpa.gov.br

In Amazonia State, the harvest and marketing of fresh Camu camu fruits from wild or non-flooded land plantations is hindered by the lack of synchrony on the ripening and by the inefficiency of the refrigeration structure. In order to assess the effect of the conditions available in the Amazon and of the maturation stage on the conservation of camu-camu harvested from crops grown on floodplains were separated into five maturation stages based on skin coloring S1 (25% red-spotted fruit skins), S2 (50% red-spotted fruit skins), S3 (75% red spotted fruit skins), S4 (100% red-colored fruit skin) and S5 (100% dark-red colored fruit skin) stored at 21ºC (80% RH) and 28ºC (87% RH). Every two days they assessed as to weight loss, moisture, soluble solids, titratable acidity, pH, reducing sugar, anthocyanins, flavonoids and ascorbic acid. The anthocyanins increased in the immature stages and decreased in the ripe stages in the two storing temperatures. The ascorbic acid present in camu camu is highly stable and remained constant. Given the low concentration of anthocyanins and wrinkling in the immature stages (E1 and E2) the higher degradation rate of anthocyanins in the mature stage (E5) the fruits in the intermediate stages (E3 and E4) presented better conservation ability in the studied conditions.

P141

Use of modified atmosphere to extend shelf life of fresh-cut star fruit (*Averrhoa carambola* L. cv. Fwang Tung)

Gustavo H.A. Teixeira[1], *J.F. Durigan*[1], *R.E. Alves*[2], *B. Sarzi*[1], *J. Donadon*[1], *T.J. O'Hare*[3]
[1]FCAV/UNESP, Departamento de Tecnologia, Via Prof. Paulo Donato Castellane s/n, CEP 14.883-900, Jaboticabal, SP, Brazil, bacupari@fcav.unesp.br.
[2]Embrapa Agroindústria Tropical, Fortaleza-CE, CP 3761, CEP 60.511-110, Brazil
[3]DPI Gatton Research Station, Locked bag 7, Mail service 437, Gatton, 4343 Qld, Australia
Financial Support: FAPESP (00/13237-9)

Fresh-cut fruit products, including star fruit (*Averrhoa carambola* L.), have limited marketability. The objective of this study was to evaluate postharvest changes of carambola slices in three different packaging. Carambola fruit (cv. Fwang Tung) were picked from the orchard of Estação Experimental de Citricultura de Bebedouro at mature-green stage. Fruit were washed, dipped in NaOCl solution (200 $mg.L^{-1}$ for 5 minutes), and stored overnight at 10°C. Fruit were manually sliced in to pieces approximately 1 cm. Slices were rinsed with NaOCl solution at 20 $mg.L^{-1}$, drained for 3 minutes, and packaged in polyethylene terephthalate (PET) trays (Neoform N94); polystyrene trays covered with PVC 0.017 mm (Vitafilm - Goodyear); and vacuum sealed polyolefin bags (PLO, Cryovac PD900). The packages were stored at 6.8°C and 90% RH for 12 days and samples taken every 4 days. PET trays and PVC film did not significantly modify internal atmosphere, and the high water permeability of PVC led to more rapid slice desiccation. PPO activity was lower when slices were packaged in PLO vacuum sealed bags, which reduced discoloration and led to better appearance maintenance for up to 12 days.

P142

Postharvest conservation of cbiu (*Solanum sessiliflorum* Dunal) fruits in response to passive modified atmosphere associated to refrigeration

Jerusa Souza Andrade, Euricleia Gomes Coelho, Danilo Fernandes da Silva Filho
Instituto Nacional de Pesquisas da Amazônia - INPA, CP 478, CEP 69011-970, Manaus, AM, Brazil, andrade@inpa.gov.br

Cubiu (*Solanum sessiliflorum* Dunal) is a fruit with a high potential for being used in the food processing industry in Amazonia State, however, it shows to be troublesome when being conserved and processed, on account of its enzymatic darkening. This work was carried out to verify the effect of modified atmosphere associated with refrigeration on postharvest conservation of cubiu fruits. Ripe fruits were stored in polystyrene trays under passive modified atmosphere (covered with polyvinyl chloride film) and stored under refrigeration (9ºC and ± 85% RH), whereas control was stored without film protection. Fruits were analysed as to weight loss, soluble solids, pH, titratable acidity, ascorbic acid, and pectin, every 4 days. Both atmosphere and storing time exert no significant difference on most chemical compounds, but for ascorbic acid value decrease and weight loss, during storage time (more than 20 days). By this time, weight loss value on control fruits decreased 15%, whereas on fruits under the passive modified atmosphere the weight loss was only 5%. In both atmospheres, the ascorbic acid value only lowered in the first eight days, yet the decrease was sharper on control fruits. The findings of the present study point out lower ascorbic acid and weight loss values on fruits stored under modified passive atmosphere associated with refrigeration.

P143

Effects of 1-methylcyclopropene on durian fruit dehiscence

Jingtair Siriphanich[1], Jaruwat Rojanapattrakul[1], Wouter G. Van Doorn[2]
[1]Kasetsart University, Kampengsan Campus, Nakhon Pathom, Thailand 73140, agrjts@ku.ac.th
[2]Wageningen University and Research Center, 6700 AA Wageningen, The Netherlands

The dehiscence zone in durian fruit (*Durio zibethinus* Murr) may be one of the largest in the plant kingdom. Treatment with 750 ppb 1-MCP could delay ripening process and inhibited dehiscence in durian fruit, showing that cell separation during dehiscence is regulated by ethylene. Cell separation in the dehiscence zone therefore resembles that of durian pedicel abscission, which was also delayed by 1-MCP. Since precocious dehiscence often limits the storage and shelf life of the fruit, its prevention allows better quality to be provided especially to distant markets. 1-MCP also delayed fruit (pulp) softening and pulp yellowing, and it delayed peel yellowing and browning. This shows that these processes are also regulated by ethylene. The 1-MCP treatment also delayed sweetening of the pulp, but when the fruit was ripe there was no clear difference in fruit sweetness or aroma.

P144

Studies of physical and chemical characteristics of white and red guavas (*Psidium guajava* L.) cv. Cortibel

Romário Delbons Mendonça[1], Karla Silva Ferreira[1], Cláudio Teixeira Lombardi[1], Leandro Marelli de Souza[1]
Universidade Estadual do Norte Fluminense, Av. Alberto Lamêgo 2000, Parque Califórnia, CEP 28013-000, Campos dos Goytacazes, RJ, Brasil, karlasf@uenf.br, souzamar@uenf.br
Financial support: FAPERJ

Temperature of 24.1 ± 1ºC and relative humidity of the air of 74.1 ± 4.3%. Were studied 160 fruits white pulp and 160 fruits red pulp. It was observed to the white pulp fruits variations in the following parameters in the 2nd and 16th days: soluble solids (8.40/12.10°Brix), pectin (1.02/2.44%), cellulose and lignin (3.86/5.18%), hemicellulose (1.10/1.53%), color (ΔE) in agreement with Hunter parameters variations "L", "a" and "b" (11.70/29.18), citric acid percentage (0.50/1.00%), humidity (87.21/80.27%), pulp thickness (11.92/7.85 mm), texture (148.19/42.29 N) and pH (3.70/3.67). Regarding to the guavas of red pulp fruits it The physical and chemical characteristics of a new and promising cultivate of guavas, "Cotibel", was monitored during sixteen days of storage at was observed the following variations: soluble solids (8.36/11.88°Brix), pectin (1,34/2.30%), cellulose and lignin (3.86/5.18%) hemicellulose (1.29/2.19%), color (ΔE) in agreement with variations Hunter parameters "L", "a" and "b" (9.89/16.43), pH (3.65/3.70), citric acid percentage (0.53/0.90%), humidity (86.91/79.80%), pulp thickness (10.88/7.56 mm) and texture (137.87/34.47 N). Its good texture and fiber concentration within other characteristics make this cultivate a good option for the food industry and also for the consumption *in natura*. It also presents important aspects for the exportation, once its postharvest live is high.

P145

Postharvest quality of green dwarf coconut produced in Rio do Fogo-RN

Miécio de Lima Almeida, Josivan Barbosa Menezes, Klígio Nunes Solon, Michelle Damasceno Ribeiro, Aurélio Paes Barros Júnior, Anne Katherine de Araújo Barros, Mayara Kelly Martins de Medeiros, Lindomar Maria da Silveira, Marta de Oliveira Mendes, Jean Carlos de Andrade
Escola Superior de Agricultura de Mossoró, CP 137, CEP 59625-900, Mossoró, RN, Brazil, michelleesam@bol.com.br

This work had the objective to evaluate postharvest quality of dwarf green coconut produced in Rio do Fogo-RN. The experiment was developed at Escola Superior de Agricultura de Mossoró. Fruits were treated at postharvest with Sportak fungicide and then involved in a PVC film (10µm). The experimental design was completely randomized blocks, with factorial arrangement 3 x 2 x 3 and two replications. The factorial treatments were three orchard ages (3, 5 and 7 years), two harvest period (6 and 7 months) and three storage times (31, 34 and 37 days). The fruits were cold stored for 28 days (12 ± 1°C and 90 ± 5% RH) and then for 3, 6 and 9 days at ambient (20 ± 1°C and 60 ± 5% RH). External appearance, solid soluble contents and weight loss were evaluated. There was a triple interaction for weight loss, where the greater storage periods and greater orchard age reduced the weight loss. The fruits with 6 months and 7 years lost less weight. There were interactions for soluble solids contents among harvest period and orchard age. The greater orchard age reduced the soluble solids content, and 6 months-old fruits obtained better results. Fruits stored for greater periods showed reduced external appearance and soluble solids contents. The greater orchard age had negative influence on external appearance of fruits.

P146

Influence of storage temperature on ascorbic acid metabolism in guavas: activities of related enzymes

Maria Luiza P.A Gomez, F.M. Lajolo
Depart. de Alimentos e Nutrição Experimental, Faculdade de Ciências Farmacêuticas-USP, São Paulo-SP, Brazil, malusp@usp.br, Financial Support: FAPESP, CAPES

Ascorbic acid (AsA, vitamin C) is an ubiquitous compound which plays important roles in plant cells, such as enzymatic co-factor, antioxidant, other antioxidants protective, cell cycle regulator, etc. Despite its importance, AsA biosynthesis is poorly understood and only in 1998, a pathway was presented and proved to be highly effective in plants. In this work, the influence of low temperature storage (6^{o}C and 16^{o}C) on the AsA and dehydroascorbic acid (DHA) contents and on the activities of enzymes related to the AsA synthesis (L-galactono-1,4-lactone dehydrogenase - GLDHase), degradation (ascorbate oxidase -AO, and ascorbate peroxidase -APX) and regeneration (monodehydroascorbate reductase - MDHAR, and dehydroascorbate reductase - DHAR) in guavas white pulp (*Psidium guayava* L., cv. Paloma) were studied and compared to room temperature (25^{o}C) storage. Results showed that low temperature storage did not affect the final AsA content, but had influence on enzyme activities, especially on APX, MDHAR and DHAR activities. It was concluded that, during the cold storage, AsA content is regulated by changes in the synthesis/degradation enzymatic activities ratio and possibly form a compensatory mechanism for the maintenance of the AsA content.

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Postharvest treatments with milk as attempt to control antrhacnose in guava

Renata Morelli Alves[1], *Luis Felipe Paes de Almeida* [2], *Ricardo Alfredo Kluge*[1]
[1]Universidade de São Paulo, Escola Superior de Agricultura "Luiz de Queiroz", Piracicaba, SP, Brazil, remalves@esalq.usp.br
[2]Depto. de Produção Vegetal, ESALQ-USP, Piracicaba, SP, Brazil

Milk does not contaminate the product with harmful residues to human health. Its application is not harmful to the environment, and it can be used with relative efficiency in the control of diseases in plants. Pulverizations of cow milk solution already come being done in farms of organic production aiming at the control of diseases. Despite the proved efficiency, the way of action of milk is not clearly yet. In the present research the efficiency of treatments with milk was evaluated for postharvest control of *Colletotrichum gloeosporioides* in guava cv. Paluma. Three kinds of milk had been used: raw milk of cow (pure, diluted in water 50% and 20%), dust milk (dilution 50% and 20% of the recommended one) and raw milk of goat (dilution 50% and 20%), in comparison with the fungicide prochloraz (0.25 mg.L^{-1}). Fruits were storade at 11ºC and 85% RH during 16 days, being evaluated each 4 days of storage (+2 days in room temperature). Soluble solids, firmness, titratable acidity, vitamin C content and respiratory rate; and everyday to appearance of symptoms were also evaluated. Prochloraz inhibited appearance of symptoms until the end of storage. There was no effect of milk treatment in control of anthacnose in guava.

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Physico-Chemical Changes and Shelf Life of Litchi as Influenced by Postharvest Treatments.

M. F. Mondal, A. C. Roy
Department of Horticulture, Bangladesh Agricultural University, Mymensingh, Bangladesh, saieef@bttb.net.bd

The study was conducted to evaluate the effects of seven postharvest treatments on the storage behavior of litchi. The treatments were: control (with leaves), fruits preserved in unperforated polyethylene bag with or without leaves, perforated polyethylene bag without leaves, oil coating with or without polyethylene bag and fruits without leaves kept in unperforated polyethylene bag at low temperature. The two-factor experiment was laid out in a CRD with three replications. There was significant variation between the cultivars used. Total weight loss, dry matter and pulp pH increased and pulp/peel ratio, sugar content and TSS initially increased and decreased later on. On the other hand, moisture content, titratable acidity and vitamin C content decreased during storage. Unperforated polyethylene bag at low temperature caused minimal weight loss, whereas, the untreated fruits exhibited maximal weight loss. The pericarp turned brown within 3 days of storage in the untreated fruits, while polyethylene bags helped keep its bright red colour up to the end of the storage period. The treatments showed highly significant variation in the shelf life of litchi. Among the treated and untreated fruits, polyethylene bag at low temperature treatment exhibited better storage performance. The fruits without leaves kept in unperforated polyethylene bag at low temperature showed the highest shelf life followed by polyethylene bag with leaves, and it was the lowest in the control fruits.

P149

Most important characteristics of quality of two types of fruits of mamey sapote (*Pouteria sapota]*) harvested at the Península of Yucatán, México

Enrique Sauri-Duch, Sara A. González-Novelo, Lourdes Vargas-Vargas, Jorge A. Tamayo Cortes, Alma R. Centurión-Yah

Instituto Tecnológico de Mérida, México. Km. 5, Carr. Mérida-Progreso, Mérida, Yucatán, México. almacy@itmerida.mx; esauri@itmerida.mx

The mamey sapote is a fruit original from tropical America; they have a very great acceptance in zones of production. In the Peninsula of Yucatán, México, there are established 500 ha of mamey plants of different varieties, with different times of production through the year. The market of the tropical fruits has been incremented significantly during the last years. In order to compete with advantage in the international markets, it is necessary to offer products with good quality. The information about behavior of mamey fruits during postharvest management, of its changes of quality and of its shelf life it is insufficient. In this work we evaluated the principal characteristics of quality and shelf life of two types of fruits of mamey named like M1 of round shape and M2 longer shape. Ripe mameyes were harvested, they were allowed ripening at 26 ±2 ºC and when they ripening their principal characteristics of quality were evaluated. The 100% of fruits of both types matured satisfactorily after 4 and 6 days after the crop, respectively. Mature fruits of both types were significantly different in size and weight. The fruits of type M1 had less content of total soluble solids (ºBrix), and reducing sugars and they were less firmness, but its acidity were higher than fruits of M2 type. All fruits of both Mameyes types had good acceptance by consumers, with good red color of the pulp, pleasant aroma and characteristic flavor. The shelf life at room temperature (26 ±2 ºC) of M2 type fruits after ripening was 2 days and 1 day M1 type fruits.

P150

Ripening behavior of mangaba (H*ancornia speciosa* Gomes) fruits stored at different temperatures

Marcelo Augusto Gutierrez Carnelossi, Hildo Costa de Sena, Waleska Fernanda Ferreira, Daniele Aragão Souza, Rosângela Maia dos Santos, Paula Yaguiu, Gabriel Francisco da Silva, Narendra Narain, Pedro Roberto de Almeida Viégas

Universidade Federal de Sergipe, CEP 49000-100, São Cristóvão, SE, Brazil, carnelossi@ufs.br

The ripening pattern of mangaba (*Hancornia speciosa* Gomes) fruit during its post-harvest storage at different temperatures was studied. Fruits which attained full development at half-ripe stage were harvested and initially stored at 6, 8, 10 and 12^{o}C ± 1^{o}C in chilled rooms for 4 days. After this period, the fruits were transferred to an acclimatized room (24±2^{o}C) and maintained for 5 days for monitoring their ripening behavior. For control purposes, recently harvested fruits were stored to an acclimatized room (24±2^{o}C) for 6 days. After the transference and storage of fruits at 24^{o}C, fruits were analyzed daily for their vitamin-C, soluble solids (^{o}Brix), titratable acidity, pH and firmness contents. In fruits directly stored at 24^{o}C, there was a sharp fall in vitamin C and acid contents, however, soluble solids increased after second day of storage. The fruit firmness decreased, leading to the ripeness of the fruits and after 4 days of storage, the fruits turned totally ripe. Fruits which were initially maintained at 6 or 8^{o}C did not show any significant difference in vitamin C, soluble solids and firmness levels up to 4 days. However, fruits stored at 10 and 12^{o}C presented a sharp fall in their firmness and an increase in soluble solids on storage. These results indicate that fruits storage at 10 and 12^{o}C did not retard the fruit ripening as was verified in fruits initially stored at 6 and 8^{o}C. It was observed that independent of temperature, mangaba fruits ripen normally after removal from low-temperature storage.

P151

Application of 1-Methylcyclopropene on mango fruit during cold storage

Maria Auxiliadora Coêlho de Lima[1], *Adriane Luciana da Silva*[1,2], *Polyane de Sá Santos*[3], *Suellen Soraia Nunes Azevedo*[4], *Joston Simão de Assis*[1]

[1]Embrapa Semi-Árido, PO Box 23, 56.302-970, Petrolina, PE, Brazil, maclima@cpatsa.embrapa.br

[2]Scholarship FAGRO/AgroFresh

[3]Scholarship PIBIC/CNPq, University of Pernambuco, BR 203 Km 02, 56.300-000, Petrolina, PE, Brazil

[4]Scholarship PIBIC-FACEPE/CNPq, University of Pernambuco

Mango fruits 'Tommy Atkins' were harvested at the stage 2 of maturation objecting to evaluate the effect of doses and times of 1-MCP application during cold storage. 1-MCP was tested as control, one application of 900 nl L^{-1}, one application of 1.200 nl L^{-1} and two applications of 900 nl L^{-1}. A completely randomized design was used with four replicates. When 1-MCP was applied once, the application was done in the beginning of the storage. The second application was performed at the last twelve hours of the cold storage. Evaluations were carried out at 0, 7, 15, 18, 20, 22, 25 and 26 days. The fruits were kept under refrigeration until the 15th day (11.0±1.6ºC and 88±7% RH), when they were transferred to ambient temperature (26.3±2.1ºC and 44±6% RH). Mass loss, skin color and total titratable acidity were not affected by 1-MCP. The increase on soluble solids content was lightly slower in fruits treated with 1-MCP. Pulp firmness of fruits treated with one application of 1.200 nl L^{-1} and two applications of 900 nl L^{-1} was twice higher than control at the 20th day. However, the softening increased rapidly from the 22th day, indicating a transitory action of 1-MCP.

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Incidence of anthracnose in mango fruits cv. Tommy Atkins treated with wax and fresh seal

Andréa Mendonça dos Santos Peixoto[1], *Mayara Kelly Martins de Medeiros*[1], *Aurélio Paes Barros Júnior*[1], *Andressa Marcolly Nunes Duarte*[1], *Anne Katherine de Araújo Barros*[1] *Janilson Kleber Menezes Mota*[2], *Ronialison Fernandes Queiroz*[1], *Maria José Tôrres Câmara*[1]

[1]ESAM, CP 137, CEP 59600-900, Mossoró, RN, Brazil, andreamsp@bol.com.br

[2]Empresa Finobrasa Agroindustrial, CEP 59508-000, Ipanguaçu, RN, Brazil

An experiment was carried out in Empresa Finobrasa Agoindustrial S.A., Ipanguaçu-RN, to evaluate the incidence of Anthracnose (*Colletotrichum gloeosporioides*) in mango fruits cv. Tommy Atkins. After fruits harvest, these were selected, washed, and submitted to both hydrothermal treatment at 47 ± 0.5ºC for 90 minutes and 'hydrocooling' for 10 minutes. The experimental design used was entirely randomized with two treatments (wax and Fresh Seal) and six replications. Two fruits were assigned to each treatment. Mango fruits were stored at 10 ± 1ºC and 90 ± 5% relative humidity for 31 days. Evaluation for anthracnose incidence was made. There were significant differences between the tested treatments on the incidence of anthracnose. Mango fruits treated with wax had 20% more incidence of anthracnose than another treated with Fresh Seal.

P153

Chilling injury in 'Kensington Pride' mango fruit in relation to activities of peroxidase, polyphenol oxidase and catalase enzymes

Zora Singh[1], *Huang Zhuolie*[2], *A.U. Malik*[3]
[1]Muresk Institute, Curtin University of Technology, GPO Box U1987, Perth, WA 6845, Australia, zora@muresk.curtin.edu.au
[2]College of Biotechnology, South China Agricultural University, Guangzhou, China
[3]Institute of Horticultural Sciences, University of Agriculture, Faisalabad, Pakistan

Uniformly mature mango fruit (*Mangifera indica* L. cv. Kensington Pride) were stored at 5 °C or 20 °C for 1, 5, 10, 20 days and allowed to ripen at 22 ±1 °C to eating soft stage to assess the development of chilling injury (CI) and activities of peroxidase, polyphenol oxidase and catalase enzymes in pulp were estimated at two days interval during ripening period to underpin their role in chilling injury. Chilling injury symptoms were also recorded during ripening. In the second experiment, mature mango fruit were stored at 5 °C or 20 °C and removed after 0, 2, 4, 6, 8, 10 days after storage. The incidence of chilling injury on mango fruit stored under low temperature (5 ºC) increased with the increase in the storage period. The chilling injury symptoms progressively developed with the advancement of ripening process. There was no significant difference among the activities of peroxidase, polyphenol oxidase and catalase enzymes with increased duration of storage at chilling temperature. However with the advancement of ripening, the activities of all three enzymes increased in fruit both with and without chilling injury. In conclusion, the incidence of CI was not positively related with the activities of peroxidase, polyphenoloxidase and catalse enymes in the pulp of 'Kensington Pride' fruit and a reduction in the activities of these enzymes in chill-injured fruit compared to non-chilled ones may be due to retardation of ripening process.

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Influence of different coatings and wrappings on chilling injury development, fruit ripening and quality in 'Kensington Pride' mango

Suresh Nair, Zora Singh, on Chye Tan
Horticulture, Muresk Institute, Division of Resources and Environment, Curtin University of Technology, GPO Box U1987, Perth, WA 6845, Australia

Mature green 'Kensington Pride' mango fruits were coated with Carnauba natural (0.1%), Mango Poly (0.1%) and Semperfresh (0.6%) or wrapped in three different types of polyethylene bags of film thickness 30 (μm) and oxygen transmission ratio (OTR) 12700, 15000 and 16700 mL bag^{-1} $day.atm^{-1}$ and stored at 5ºC for 4 weeks to evaluate their effects on chilling injury (CI) development, fruit ripening and quality. CI index, respiration rate and ethylene production were recorded from day 1 to day 9 during ripening at 22±1ºC. CI index was significantly reduced with all treatments of coating and wrapping and carnauba natural appeared to be most effective in reducing CI. Respiration rate and ethylene production were decreased with coating and wrapping treatment during ripening. Physiological weight loss, TSS and total sugars decreased while fruit firmness increased with all the treatments of coatings and wrappings as compared to control. Acidity increased, whilst TSS/acid ratio decreased with carnauba coating and bag 2 and bag 3 wrapping as compared to the control fruits. In conclusion all the coatings and wrappings ameliorated CI development and coating with mango poly and Semperfresh improved fruit quality.

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Effects of exogenous application of polyamines on chilling injury, respiration, ethylene production and fruit quality in 'Kensington Pride' mango fruit

Suresh Nair, Zora Singh, Soon Chye Tan
Horticulture, Muresk Institute, Division of Resources and Environment, Curtin University of Technology, GPO Box U1987, Perth, WA 6845, Australia

Mature green mango fruit were dipped in na aqueous solution containing different concentrations (0, 0.25, 0.5 or 0.75 mM) of putrescine, spermidine and spermine and Tween 80 (0.01%) to evaluate their role in chilling injury, fruit ripening and quality. Fruit were allowed to ripen at 22±1ºC after 4 weeks storage at 5ºC. CI index, respiration rate and ethylene production were recorded during ripening period from 1 to 9 days. Fruit firmness, acidity, TSS, total sugars and taste were recorded from fully ripe fruits. All the treatments of polyamines significantly (P<0.05) reduced CI and spermine (0.50 mM) proved to be most effective in reducing CI among various treatments of polyamines. Fruit respiration rate was enhanced whilst; ethylene production was suppressed with all the treatments of polyamines. Fruit softening was enhanced with the polyamine treatments. Acidity and TSS were increased with the treatment of 0.50 mM polyamines. Treatment of spermine (0.50 or 0.75 mM) has significantly increased total sugars as compared to control. Taste improved with all the treatments of polyamines except with 0.75 mM spermine. In conclusion, presto rage exogenous application of polyamines has reduced CI and improved fruit quality of 'Kensington Pride' mango.

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Nondestructive prediction of internal quality of heat-treated 'Irwin' mango by near infrared spectroscopy

R. Hasbullah[1], T. Tanabe [2], T. Akinaga[3]
[1]FATETA, Bogor Agricultural University, Bogor 16002, Indonesia, hasbulah@ipb.ac.id
[2]FANTEC Research Institute Inc., Kosai, Shizuoka 431-0401, Japan, tanabe@nir-fantec.co.jp
[3]University of the Ryukyus, Nishihara, Okinawa 903-0213, Japan, akinaga@agr.u-ryukyu.ac.jp

This paper presents a study of near infrared (NIR) spectroscopy of FT20 produced by FANTEC Research Institute Inc. in the range of 600-1000 nm for its feasibility to predict the internal quality attributes such as moisture content, hardness, soluble solid content (SSC), acidity, and pH of the 'Irwin' mango following heat treatment. A total of 63 samples were used as the calibration models and 124 samples collected from 62 heat-treated mangos were used as the prediction models using partial least squares regression (PLS) and principal component regression (PCR) method. The results show that the models using the PLS method with preprocessed spectra using second derivative resulted in the best calibration model. The statistic measures, indicated by correlation coefficients (R) and standard error of prediction (SEP), show that the near infrared spectroscopy is able to predict the moisture content and sugar content with high accuracy as shown by correlation coefficients of 0.94. While for the other attributes perform moderately high with correlation coefficients in the range of 0.80-0.87.

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Polyphenol oxidase and peroxidase activities in mangoes storage at chilling temperature

Maria Andrea Trejo-Márquez, G. Ramírez- Villatoro, N. Camacho
Universidad Nacional Autónoma de México, Facultad de Estudios Superiores Cuautitlán, Laboratorio de Postcosecha de Productos Vegetales, México, andreatrejo@correo.unam.mx

Mangoes are tropical fruits and therefore chilling-sensitive. Prolonged storage is difficult since temperatures low enough to delay ripening injure these fruits. Since peroxidase (POD) and polyphenol oxidase (PPO) are involved in the metabolism of phenolic compounds and, in the development of several physiological disorders, as chilling injury (CI), we have undertaken to study the effect of low temperature storage on the activation of these enzymes in mangoes. Some characteristics of PPO and POD were investigated. Maximum activities of PPO were found at pH 8.0-8.5 and 7.5-8.0 for skin and pulp respectively. In both cases the optimum temperature was 40°C. Maximum activities of POD were found at pH 4.0-5.0, while the optimum temperatures were 60 and 30°C for skin and pulp. 'Kent' and 'Keitt' mangoes were stored at 5°C during 25 days and rewarmed at 20ºC until ripening. Quality parameters (firmness, pH, acidity, color and soluble solids), phenol content and respiration were evaluated during ripening. CI symptoms in skin were more severe that in the pulp. PPO activity increased in skin of mangoes stored at 5°C, whereas in pulp showed lower activity. No correlation was found between CI index and POD activities in mangoes.

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Shelf Life and Quality of Mango as Influenced by Different Postharvest Treatments.

G. *Barua , M. F. Mondal*
Department of Horticulture, Bangladesh Agricultural University, Mymensingh, Bangladesh, saieef@bttb.net.bd

ABSTRACT: An experiment was conducted to study the shelf life and quality of fruits. Different postharvest treatments viz., control, hot water treatment (55^{o}C), low temperature storage (15^{o}C), polythene bag, and hot water treatment followed by polythene bagging and stored at low temperature (hot water treatment + polythene bag + low temperature storage). Two mango varieties namely Fazli and Amrapali were used. Some of the fruit attributes such as pulp to peel ratio, total weight loss, dry matter content, sugar content, total soluble solids and pulp pH increased while moisture content, titratable, acidity, vitamin C decreased with increase in the duration of storage. Hot water treatment followed by polythene bagging and then storage at low temperature (15^{o}C) treatment exhibited minimal weight loss during storage. Highly significant differences in respect of shelf life between the varieties were observed in the investigation. The postharvest treatments also showed highly significant variations in the shelf life of mango. The longer shelf life (18.63 days) was observed in variety Fazli than Amrapali (17.03 days). Further, hot water treatment + polythene bag + low temperature (15^{o}C) stored mangoes appeared to be the best for extending shelf life (28.52, 27.42 days in Fazli and Amrapali, respectively), followed by low temperature storage of fruits (22.45, 19.58 days in Fazli and Amrapali, respectively), whereas, the control fruits had the shortest shelf life (11.13 days).

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Conservation of noble melons under modified atmosphere

Ana Luiza Xavier Carlos, Josivan Barbosa Menezes, Michelle Damasceno Ribeiro, Mayara Kelly Martins de Medeiros
Escola Superior de Agricultura de Mossoró-ESAM, Núcleo de Pós-Graduação, C.P. 137, CEP 59625-900, Mossoró, RN, Brasil, analuizaesam@hotmail.com

An experiment was carried out at the Fruit Postharvest Laboratory, Escola Superior de Agricultura de Mossoró-ESAM, to evaluate the efficiency of *FreshSeal*® coating for extending the shelf-life of noble melons (*Galia, Charentais, Cantaloupe*), utilizing fruits harvested from commercial fields located in the Agro-industrial Mossoró-Assu area, Rio Grande do Norte State, Northeastern Brazil. The treatments were arranged in a completely randomized 2 x 4 factorial scheme with 15 replications. The postharvest treatments were the combinations of *FreshSeal*® spray coating and *Xtend*® plastic bags packaging with storage periods (14, 21, 28 and 35 days). Galia melons genotype Solar king, treated with *FreshSeal*® maintained good external and internal appearances until the end of the storage period, while those kept in *Xtend*® bags were unsuited for consumption after 21 days, showing spots and depressions and were attacked by fungi. With regards to internal appearance of Cantaloupe melons coated with *FreshSeal*®, these fruits had higher scores than those kept in *Xtend*® bags until 21 days, even though fruits with both treatments decreased in quality after that period. Fruits coated with *FreshSeal*® lost more mass than those stored in *Xtend*® bags. Fruits of Charentais melons coated with *FreshSeal*® lost more weight than those stored in *Xtend*® bags.

P160

Effect of geometrical shape and storage temperature on quality changes of fresh-cut papaya (C*arica papaya* l. cv. Maradol)

Y.Pacheco-Montiel[1]; J.Rivera-López[1,2]; F.Ayala-Zavala[1], Gustavo A.González-Aguilar[1]
[1]CIAD, AC, DTAOV. Carretera a la Victoria Km 0.6, La Victoria, Hermosillo, Sonora (83000) México, gustavo@cascabel.ciad.mx
[2]Instituto Tecnológico de Los Mochis. Bátiz y Belisario Domínguez S/N, Fraccionamiento El Parque, Apartado Postal 766, CP 81240, Los Mochis, Sinaloa, México

The effect of storage temperature (5°C, 10°C and 20°C) and cutting in two geometrical shapes (cubes and slices) on shelf life of fresh-cut papaya was investigated. At 3 days intervals, CO_2 production, color, firmness, total soluble solids (TSS), weight loss and overall quality index were evaluated. The CO_2 production increased after processing being higher for cubes than slices with an average of 100 and 150 mL/kg/h, respectively. However, it decreased during the storage period in a similar manner. The higher the temperature the higher the CO_2 production and firmness loss. Fresh-cut papayas stored at 10°C maintained for longer periods the initial color than that observed in fresh-cut papayas stored at 5 or 20°C. Total soluble solids (TSS) and weight loss was significantly affected by temperature and storage period. Fresh-cut papaya stored at 20°C showed the lowest TSS value and the higher weight losses. The storage shelf-life measured as overall quality of fresh-cut papaya was 2 and 3 days at 20°C, 7 to 9 days at 10°C and 12 and 14 days at 5°C, for cubes and slices, respectively. We concluded that geometrical shape significantly affected the physiological response and shelf life of fresh-cut papayas.

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Quality of c*antaloupe* 'Gália' melons after postharvest treatment with 1-MCP, chitosan and freshseal™

Adriano da Silva Almeida; Carlos Farley Herbster Moura; Ebenézer de Oliveira Silva; Ricardo Elesbão Alves; José Luiz Mosca; Maria Raquel Alcântara de Miranda
Embrapa Agroindústria Tropical, CP 3761, CEP 60.511-110, Fortaleza, CE, Brazil, elesbao@cnpat.embrapa.br, raquel@cnpat.embrapa.br

'Galia' melons were submitted to postharvest treatments with 1-MCP (1-methylciclopropene) and with waxes Chitosan and Freshseal™ to enhance their quality. Experiments used fruits harvested on November of 2003 at a commercial farm in Mossoró in northeastern Brazil, that were then transported to Embrapa Agroindustria Tropical located at Fortaleza, three hours distant. Upon arrival at Embrapa, fruits were sorted and treated with 1-MCP 600 ppb, Chitosan 1% and Freshseal™ 8%. Treatments were applied isolated from one another or in combination. Fruits were then cold stored (5ºC and 90% RH) for 18 days when they were removed and kept under ambient conditions (25ºC and 90% RH) for more 9 days. Fruits were analyzed immediately after removal from cold storage and at each third day at ambient condition for internal and external appearance, firmness, skin color and weight loss. Only those fruits apt for consumption were analyzed. Results showed that 'Galia' melons treated only with 1-MCP and with 1-MCP followed by Chitosan kept a better external appearance for a longer period of time. Treatment with 1-MCP associated to Freshseal™ increased weight loss although maintained flesh firmness longer.

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Analysis of antioxidant enzymes during cold storage of 'Valência' oranges

Salete A. Gaziola[1], Ricardo A. Kluge[2], Ricardo F. Fornazier[3], Priscila L. Gratão[1], Ricardo A. Azevedo[1]
[1]USP/ESALQ - Dep. Genética e Melhoramento de Plantas, CP 83, CEP 13418-900, Piracicaba, SP, Brazil, sagaziol@esalq.usp.br
[2]USP/ESALQ- Dep. Ciências Biológicas
[3]UNICAMP-Dep. Genética e Evolução, CEP 13083-970, Campinas, SP, Brazil
Financial support: FAPESP (proc. 01/13433-5)

Fruit of many citrus cultivars become injured when exposed to low, non-freezing temperature. The objective of this study was to verify the changes of antioxidant enzymes in response to ethylene production and their relation with the development of chilling injury of 'Valência' oranges during cold storage. The treatments applied were: temperature conditioning, intermittent warming (IW), application of 2-chloroethylfosfonic acid (ethephon), 1-methylcyclopropene (1-MCP), aminoethoxyvinilglicine (AVG) and fruit without treatment (control). Fruit were stored at 1°C and 90-95% RH during 90 days being evaluated each 15 days. Peel tissue of each treatment were extracted for gluthathione reductase (GR), catalase (CAT), guaiacol-dependent peroxidase (GPX) and superoxide dismutase (SOD) activity assays. SOD izoenzymes were separated in PAGE. It was observed alterations in the activity pattern of CAT, GPX and GR. Three SOD isoenzymes FeSOD, MnSOD and CuZnSOD, were detected after 45 days and only FeSOD and MnSOD isoenzymes were observed in the 30 days fruit cold storage. SOD activity increased during fruit storage in all treatments. The synthesis of GSH through GR enzyme is evident during all exposure time treatments, with CAT and GPX taking over the oxidative responses in different times, with GPX acting against H_2O_2 in the beginning exposure and CAT in the last one. These results suggest that the main defense system to stress is variable during the exposure time.

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Levels of polyamines of 'Valência' orange during storage in chilling temperature

Ricardo Alfredo Kluge[1], Maria Carolina Dario Vitti[1], Silvio Tavares[1], Angelo Pedro Jacomino[2], Suraya Abdallah da Rocha[3], Giuseppina Pace Pereira Lima[3]

[1]USP/ESALQ–Dept. Ciências Biológicas, CP 9, CEP 13418-900, Piracicaba-SP, Brazil, rakluge@esalq.usp.br

[2]USP/ESALQ – Dept. Produção Vegetal

[3]UNESP/IB –Dept. Química e Bioquímica, CP 545, CEP 18618-000, Botucatu- SP, Brazil

Financial support: FAPESP (proc. 01/13433-5)

Polyamines can be used as biochemical marker of some physiological events as development of chilling injury in fruit, because its importance of maintenance of integrity of cellular membrane. Both polyamines and ethylene are derived from SAM (S-adenosyl-methionine), so competition is possible. The objective of this study was to verify the change of polyamines production during cold storage in chilling temperature. 'Valência' oranges were treated with two ethylene blockaders: 1-methylciclopropene (1-MCP) and salycilic acid (SA), and stored at 1°C and 90-96% RH during 90 days. Respiratory rate and levels of putrescine, spermidine and spermine were evaluated each 15 days of storage (plus 5 days at 25°C). Putrescine levels in control fruit showed reduction until 45 days of cold storage followed of increase after this period. For others treatment this reduction was observed after 60 days. A peak of spermidine was verified in control fruit after 60 days while in others treatments this peak occurred after 75 days, followed by decrease after 90 days of cold storage. Control fruit presented constant decline on amount of spermine during storage while peaks of this polyamine were observed in treated-fruit. Low temperature and blockaders of ethylene appear to increase levels of polyamines during storage of fruit and can to protect the cellular membranes against chilling injury.

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Conservation of papaya (*Carica papaya* l.) submitted to combined treatments of irradiation and chitosan edible film

Rita Junqueira de Camargo, Susy Frey Sabato

Instituto de Pesquisa Energética Nuclear – IPEN, Av. Lineu de Prestes 2242, CTR, Cidade Universitária, São Paulo-SP, Brazil. rjcamar@ipen.br

Financial Support: CNPq

Overcoming tropical fruits export barriers due to exotic flies represents a major challenge. The treatment being used, fumigation with methyl bromide, as established by the Montreal Protocol, will be banned on January 1st, 2005 in developed countries and by 2015 in developing countries. Even on areas where the pest is controlled, as the Linhares-ES, a thermal treatment (48°C, 20 min) is still required for exports. Irradiation has proved to be an efficient method for quarantine treatment as well as in the improvement of shelf-live of several fruits. A second treatment is needed once the dose for delaying fruit ripening, 0.75 kGy, it is not enough for controlling fungi decay. Thermal treatment is also used for this goal, but some enzymes can be inactivated by temperatures above 40°C, disturbing the ripening of fruits. In this study an edible coating of chitosan (2%) is tested as a fungi static agent. The combined treatment of irradiation and chitosan was evaluated during papaya ripening; physical-chemistry analyses were done in more then 500 samples characterizing ripening and fruit quality.

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Effect of hot water treatment on the control of papaya postharvest diseases

D. M. S. Martins, L. E. B. Blum, J. B. Dutra, L. F. Freitas, L. F. Lopes, Mariana C. Sena, L. Lima, Osvaldo K. Yamanishi, A. C. Dianese
Universidade de Brasília, Departamento de Fitopatologia, CEP 70910-900, Brasília- DF, Brazil, denizem@unb.br

Two of the most common postharvest pathogens in papaya (*Carica papaya*) are *Colletotrichum gloeosporioides* (anthracnose) and *Phoma caricae-papayae* (stem rot). Two isolates of *C. gloeosporioides* (Cg32 e Cg78) and one of *P. caricae-papayae* (P725) were inoculated on fruits of both 'Solo' and 'Formosa' groups in two different types of trials: (1) Fruits submerged at 48°C at 10, 15, 20, 25 and 30 min; (2) Fruits submerged at 44°C, 46°C, 48°C and 50°C for 20 min. Afterwards, the fruits were cooled down in water (13 ± 1 °C / 20 min) and stored for 14 days in a cold chamber (13 ± 1 °C e RH. 85-100%). A physical-chemical analysis of the fruits was done (firmness, total soluble solids, pH and titratable acidity) and no significant difference between the control (no treatment) and the treatments was observed on this analysis. On the trials with hot water treatment period variation, the 10 min. treatment did not significantly reduce disease severity (Cg78 e P725), while the other treatments did. The 10 and 15 min treatments were not efficient in reducing disease caused by Cg32. On the trials with temperature variation, the 48 and 50°C treatments significantly reduced disease severity (Cg32 and P725). Fruits ('Solo' group) inoculated with Cg78 and submerged at 50°C had significant disease reduction.

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Enzymatic activity during storage of papaya 'Golden' under chilling injury conditions

Silva, H.R.F.[2], Martins, M.L.L.[2], Resende, E.D.[2], Almeida, R.F[2]., Vitorazi, L.[2], Pinto, L.K.A.[2]

[1] Financial support: CAPES, FAPERJ, FINEP

[2] Laboratório de Tecnologia de Alimentos / Centro de Ciências e Tecnologias Agropecuárias / Universidade Estadual do Norte Fluminense Darcy Ribeiro. Avenida Alberto Lamego, 2000. Parque Califórnia, Campos dos Goytacazes/RJ, Brasil. CEP 28013-600. e-mail: eresende@uenf.br

This work investigated the behavior of the enzymes polygalacturonase (PG) and phenylalanine ammonialiase (PAL) in papaya fruits, regarding to the sun fruit face exposition and storage temperature. Fruits were sorted in the packaging line of the Caliman Agrícola S.A. (Linhares-ES), in May/2003, after chemical and heat treatments, presenting 10% to 15% fruit skin yellowing. They were wrapped in a low-density polyethylene (PEBD) plastic film and stored in an incubator (BOD) for 33 days at temperatures of 13°C and 6°C (85-95% RH). At time intervals, six fruits were collected from the BOD and its external mesocarp analyzed. The parameters evaluated were skin color and the activities of the enzymes Phenylalanine ammonialiase (PAL) and Polygalacturonase (PG). The fruits stored at 6°C presented skin scald symptoms between six and twelve days of storage and failure to ripen after thirty-three days, as measured by the Hunter **L**, **a**, **b**. Browning was detected by Hunter **L** in the area of the fruits exposed to solar radiation, starting from the 12th day of storage. This was confirmed by the PAL activity which was higher after twelve days of storage at 6°C, showing an increment on the area of the fruits exposed to the sun, indicating chilling injury occurrence. On the other hand, fruits stored at 13°C presented higher values of PG activity in comparison to fruits stored at 6°C.

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Evaluation of thiabendazol and prochloraz on postharvest quality of papaya 'Formosa'

Andréa Mendonça dos Santos Peixoto[1], *Mayara Kelly Martins de Medeiros*[1], *Selma Rogéria Carvalho Nascimento*[1], *Aurélio Paes Barros Júnior*[1], *Janilson Kleber Menezes Mota*[2], *Cassiano Libório Cavalcante*[2]

[1]ESAM, CP 137, CEP 59600-900, Mossoró, RN, Brazil, andreamsp@bol.com.br.

[2]Empresa Finobrasa Agroindustrial, CEP 59508-000, Ipanguaçu, RN, Brazil.

Papaya fruits (*Carica papaya* L.) cv. 'Formosa' were harvested from the orchard of the Empresa Finobrasa Agroindustrial S.A. Afterwards, these fruits were selected, washed, and submitted to both hydrothermal treatment at 46 ± 0,5ºC for 20 minutes and 'hydrocooling' for 10 minutes. A 3 x 3 factorial scheme was used in an entirely randomized design with five replications. Two fruits were assigned to each plot. The treatments of the factorial consisted of the combination of three fungicide treatments (Thiabendazol 0.3%, Thiabendazol 0.5% and Prochloraz 0,25%) with three storage periods (7, 14 and 21 days). Papaya fruits were stored at 10 ± 1 ºC and 90 ± 5% relative humidity. Evaluations for external and internal appearance, pulp firmness and total soluble solids were made. There was not a significant interaction between fungicide treatments and storage periods in any assessed trait. The fungicide treatments with Thiabendazol did not differ statistically on content of total soluble solids, although they stood out for Prochloraz fungicide treatment. There was a decrease on external and internal appearance and pulp firmness as storage periods increased.

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Hurdle technology to delay ripening and maintain postharvest quality of 'Golden' papaya (*Carica papaya* L.) to export

Andréa Cristina Fialho Molinari[1], *Roberto Hermínio Moretti*[2], *Rachel Elisabeth Domarco*[1]

[1]Centro de Energia Nuclear na Agricultura, Universidade de São Paulo, CEP 13400-961, Piracicaba-SP, Brazil, molinari@cena.usp.br

[2]Departamento de Tecnologia de Alimentos, Faculdade de Engenharia de Alimentos, Universidade Estadual de Campinas, Campinas-SP, Brazil

'Golden', an important papaya cultivar produced in Brazil, was submitted to a combination of techniques to extend the postharvest life with quality maintenance. Looking for attending the world claim for life preservation, no chemicals were used in this work. To inhibit fungal development, all fruits suffered thermal treatment. Plastic bags of LDPE film and LDPE with ethylene absorbent were used to delay ripening and to prevent loss of firmness and weight loss. Since the target of the 'Golden' production is the international market, a quarantine treatment is necessary. For that, it was selected the gamma-radiation process (at 0.4 and 0.7 kGy), which besides promoting insect control, it retards maturation and senescence of some fruits. With the purpose of investigating the feasibility and the synergy of the chosen methods, subjective and objective quality variables, such as, skin and flesh color, firmness, disease incidence, pH, total soluble solids and titratable acidity, were evaluated. The treatments with non-irradiated fruits resisted no longer than 20 days at 10ºC. An unexpected skin color change was observed just after irradiating papayas at 0.7 kGy, they became more yellow. Probably, this fact contributed to the poor quality verified on those samples. Under the same storage conditions, the best results were obtained for fruits packed in LDPE + ethylene absorbent and exposure to 0.4 kGy, which reached 30 days, with no significant quality loss.

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Influence of ethylene absorber on shelf life of papaya

Paulo César Côrrea, Fernando Luiz Finger, Deise Menezes Ribeiro, Luciana de Castro Silveira Marques
Universidade Federal de Viçosa-UFV, CEP 36571-000, Viçosa-MG, Brazil, copace@ufv.br

This work had the goal to evaluate the influence of ethylene absorber on shelf life of papaya cv. Sunrise Solo stored under modified atmosphere for nine days at 25°C. The fruits were separated in two sets and put inside of a low density polyethylene (0.025 mm thick) bag, containing or not commercial Retarder® ($KMnO_4$ based product) at dose of 8 g/kg of fruit. The degree on ripening and quality were evaluated based on pulp firmness, skin color and loss of fresh matter. The data showed that the absorber was able to retard the process of ripening, keeping the fruits firmer and with less intensity of color changes after nine days of storage, when compared to the fruits wrapped without the Retarder®. The presence of the Retarder® inside the polyethylene bag did not affect the fresh matter loss during the experiment.

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Occurrence of chilling injury in papaya fruit cv 'Golden'

Robson F. Almeida, E.D. Resende, L. Vitorazi, Luciana Konda, L.A. Carlos, M.L.L. Martins
Laboratório de Tecnologia de Alimentos-CCTA-UENF, Av. Alberto Lamego 2000, Campos dos Goytacazes-RJ, Brazil. CEP 28013-600, eresende@uenf.br, rfdealmeida@yahoo.com.br
Financial support: CAPES, FAPERJ, FINEP

This work investigates the changes in chemical and physical characteristics of the papaya fruit related to depth of fruit mesocarp and storage temperature, aimed to better understand the chilling injury. Fruits were sorted in the package line of the Caliman Agrícola S.A (Linhares-ES), in November 2002, after chemical and heat treatments, presenting 10% to 15% fruit skin yellowing. They were wrapped in Xtend™ plastic film and stored in BOD for 30 days at temperatures of 13°C and 6°C (85-95% RH). At time intervals, six fruits were evaluated into two parts: the upper and lower mesocarp halves, after taken of properly fruit extremities. Fruits stored at 6°C presented skin scald symptoms between six and twelve days of storage and failure to ripen after thirty days, as measured by the Hunter L, a, b. The sunken areas were observed after twenty-four days of storage. The firmness was higher in the outer mesocarp up to the eighteenth day of storage at 13°C. At 6°C the fruits presented higher firmness, with an increment in both mesocarp halves between the sixth and eighteenth days of storage. The outer mesocarp halves presented higher values of titrable acidity, during thirty days of storage at 6°C and 13°C. However, the total soluble solids were higher in the inner mesocarp halves until eighteen days of storage at 13°C, but staying higher during thirty days of storage at 6°C. The inner mesocarp halves also presented higher values of dry matter during twelve days of storage at 6°C.

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Postharvest conservation of papaya 'Formosa' produced on Vale do Açu-RN stored under modified atmosphere

Mayara Kelly Martins de Medeiros, Josivan Barbosa Menezes, Edna Maria Mendes Aroucha, Klígio Nunes Solon, Aurélio Paes Barros Júnior, Marta de Oliveira Mendes, Damiana Cleuma de Medeiros, Ana Luiza Xavier Carlos, Djalma Lins de Oliveira
Núcleo de Pós-Graduação, ESAM, CP 137, CEP 59600-900, Mossoró-RN, Brazil, aroucha@esam.br

It was instaled a experiment in the fruits Postharvest Laboratory of ESAM (Escola Superior de Agricultura de Mossoró) with objective to evaluate the quality and postharvest shelf life of papaya 'Formosa' produced on Vale do Açu-RN, stored under modified atmosphere. The fruits were picked from Enterprise Finobrasa Agroindustrial S.A., Ipanguaçu-RN. The experimental design was completely randomized in 3 x 4 factorial arrangement, with five replications and two fruits per plot. The factorial consisted of three treatments (Polyethylene Film Xtend 815-PP28, wax, and without modified atmosphere) and four storage times (17, 24, 31 and 38 days). The fruits passed 14, 21, 28 and 35 days stored in a temperature 10 ± 1°C and relative humidity 90±5%. After every time, passed to a chamber 20 ± 1°C and 60 ± 5%, where was simulated the shelf life of 3 days. The characteristics evaluated were: external and internal appearance, pulp firmness, total soluble solid contents, titrable acidity, vitamin C and loss weight. The increase of the storage time had influence negative in external appearance and total soluble solid contents.

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Postharvest evaluation of green dwarf coconut under modified atmosphere grown in Touros, RN

Miécio de Lima Almeida, Josivan Barbosa Menezes, Klígio Nunes Solon, Mayara Kelly Martins de Medeiros, Aurélio Paes Barros Júnior, Lindomar Maria da Silveira, Marta de Oliveira Mendes, Eduardo Rodrigues de Souza Neto
Escola Superior de Agricultura de Mossoró, CP 137, CEP 59625-900, Mossoró, RN, Brazil, mayarakellydias@bol.com.br

The objective of this work was to evaluate the shelf live of dwarf green coconut under different types of modified atmosphere grown in Touros-RN county. An experiment was carried out at the Irrigated Agricultural Laboratory of the Escola Superior de Agricultura de Mossoró-ESAM with fruits from a commercial orchard of Touros-RN county, in an entirely randomized experimental design in 3 x 3 factorial scheme with five replications of two fruits per plot. The treatments consisted of the combination of three modified atmosphere (Polyvinyl chloride film (PVC) of 20µm of thickness, plastic bag of polyethylene X-tend and control, no modified atmosphere) with three storage times (24, 31 and 38 days). The fruits were stored for 21, 28 and 35 days at 12±1ºC upheld at 90±5% RH and 3 days of shelf live after each time in chamber at 20±1 ºC and 60±5% RH. Evaluations for external appearance, total soluble solids, and fresh matter loss were made. There were not significant differences for external appearance and total soluble solids content. For fresh matter loss, film (PVC) of 20µm of thickness promoted the less loss in relation the other treatments, keeping up to 38 days the quality of the fruits.

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Sensorial characteristics of papaya 'Formosa' fruits after modified atmosphere storage

Edna Maria Mendes Aroucha, Mayara Kelly Martins de Medeiros, Klígio Nunes Solon, Josivan Barbosa Menezes, Aurélio Paes Barros Júnior, Andréa Mendonça dos Santos Peixoto
Escola Superior de Agricultura de Mossoró, CP 137, CEP 59625-900, Mossoró, RN, Brasil, aroucha@esam.br

This work aimed to verify sensorial characteristics of papaya 'formosa' fruits after modified atmosphere storage under refrigeration condition (10ºC) plus three days at 20ºC. Fruits were packed in: Polyethylene Film Xtend 815- PP26, Xtend 815-PP27, Xtend 815-PP28, wax and without modified atmosphere. The quality attributes of: fresh appearance and color and, flavor were evaluated by forty people (25 women and 25 men). In the sensorial test was utilized the hedonic scale of nine points, varying of extremely like to extremely dislike. A completely randomized design was used with five treatments (types of packing) and 50 replications. The mean comparisons were made using the Tukey Test at 5% of probability. There was significant difference in the sensorial test for the characteristic analyzed. The fruits packed in Polyethylene Film Xtend 815-PP28 and wax had better appearance, color and flavor, however, this traits had a score corresponding in the slightly like. There wasn't difference for aroma in all evaluated treatments. In general, low acceptance of papaya 'Formosa' fruits was observed in the sensorial test it could probably be relationship with the physiology stage of fruit.

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Storage of papaya associated the modified atmosphere and 1-methylcyclopropene

Michelle Damasceno Ribeiro, Ana Luiza Xavier Carlos, Djalma Lins de Oliveira, Maria Zilderlânia Alves, Giany Paiva Pedrosa Preston, Damiana Cleuma de Medeiros
Escola Superior de Agricultura de Mossoró-ESAM, Núcleo de Pós-Graduação, C.P. 137, CEP 59625-900, Mossoró, RN, Brasil, analuizaesam@hotmail.com

The papaya (*Carica papaya* L.) is a highly perishable fruit due to fast maturation after harvest. The search for techniques that enlarge the conservation period and reduce the postharvest losses is desirable. This study had as objective the evaluation of quality of papaya stored under refrigerated temperature (10 ± 1°C, 90 ± 5% RH) associated to modified atmosphere and under ambient temperature and atmosphere (25 ± 3°C, 65 ± 5% RH), submitted or not to treatment with 1-methylcyclopropene. They were evaluated for the following characteristics: pulp firmness, weight loss, external and internal appearances and soluble solids content. The obtained results suggest the fruits treated with 1-methylcyclopropene stored under refrigerated temperature had better quality. These treatments were efficient in the control of the loss of firmness and mass loss and 1-metilciclopropeno may be used as an alternative.

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Effect of maturation stages on the chemical characteristics of the yellow passion fruit

Tavianna Vianna Silva, E.D. Resende, S.M.F. Pereira, L. Vitorazi, C.S. Vasconcellos
UENF/CCTA/LTA - Av. Alberto Lamego 2000, Campos dos Goytacazes-RJ, Brazil, CEP 28013-600, tavianna@uenf.br

This work investigated the influence of harvesting season and ripening stages on the chemical characteristics of yellow passion fruit (*Passiflora edulis* f. *flavicarpa* Degener), during maturation. The experiment was conducted at the commercial orchard located in Campos dos Goytacazes-RJ (Brazil). It was used a completely randomized design with treatment in a 2 x 7 factorial scheme referring to season (May/September and October/December) and different developmental stages, with ten replications. It was observed a progressive increasing in Hunter L, b parameters as the fruits ripened, with lower lightness and higher yellowness index in upper region of fruits, for both seasons. However, greenness index (Hunter a) was not different for fruit regions, there was a reduction on green color after ripening stages of 40%. It was developed a common color scale using seven maturation stages to compare harvest season behavior. The TSS and dry matter content was lower in the October/December when fruits showed up to 40% yellow color peel, increasing through ripening from 40% to approximately 60% yellowish peel, for both seasons. There was no difference in TSS content among seasons or maturation stages. Titrable acidity and pH had a small accumulation of organic acids in the beginning, but during ripening, there was a slight consumption of these acids. In addition, it was observed higher levels of titrable acidity in the season of lower temperature and precipitation. The TSS/TA ratio was 33% lower in the October/December harvested fruits with up to 40% yellow color peel, increasing through ripening 40% to 60%, being 12% higher when fruit were completely yellow. Results indicate that fruit with 60% yellow peel has optimum juice yield and good chemical qualities.

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Impacts recorded on peaches packing lines

Marcos David Ferreira[1], Paulo Roberto Ferrari[2], Anita Souza Dias Gutierrez[2]
[1]FEAGRI/UNICAMP, CP 6011, CEP 13083-875, Campinas-SP, Brazil, marcos.ferreira@agr.unicamp.br
[2]Centro Qualidade Horticultura, CQH, CEAGESP, São Paulo-SP, Brazil

In some growing areas in Brazil, peaches have been sorted and classified mainly in packinghouses. The goal of this research was to determine the levels an frequency of occurrence of impacts in three commercial peach packing lines using the instrumented sphere (IS) Techmark, Inc., Lansing, 70 mm in diameter. The IS can measure impact intensities at each of the transfer points. Impacts are measured as maximum acceleration (MA) in G (Gravity = 9.81 m/s^2) and velocity change (VC) in m/s. The IS was carried with the fruit over the packing line replicated 8 times, then the IS was removed and the data was transferred to a portable computer. The threshold on the IS was set to record impacts from 15 to 500 G. Means of the 8 maximum levels were determined for each transfer point (MA and VC) since these parameters most accurately describe impact intensities. Scatter plots of MA versus VC were made for all impacts recorded for each handling operation. It was found differences among the packinghouses for G levels. One packing line showed MA over 100 G, and the two others showed values below 80 G. Transfer points with greatest potential for causing damage were those with high drop heights.

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Rind color and quality of 'Pérola' pineapple treated pre-harvest with ethephon

Domingo Haroldo Reinhardt[1], *Ranulfo Corrêa Caldas*[1], *Rodrigo Fernandes Herrera Estevam*[2]
[1]Embrapa Mandioca e Fruticultura, C.P. 7, CEP 44.380-000, Cruz das Almas-BA, Brazil, dharoldo@cnpmf.embrapa.br
[2]UFBA, Cruz das Almas-BA, Brazil

Ripe 'Pérola' pineapples present mostly green rind. Many growers have applied ethephon to accelerate fruit yellowing, causing often negative impact to fruit quality. The effects of ethephon, applied at five days before harvest, on rind color and other quality attributes of 'Pérola' fruits, were studied at harvest and during post-harvest storage under environmental conditions (25 to 28ºC, > 60% RH). The experimental design was a completely randomized one, with factorial scheme 2 x 2 + 1 and four to 14 replications (fruits). Treatments studied were control (water), concentrations (6000 and 12000 mg L^{-1}) and application forms (small jet spraying through a fine hole in the cap of a plastic bottle; spraying with a garden sprayer – 0.5 liter tank), as practiced by growers. Evaluations were done at harvest, two, three and seven days after harvest. Ethephon treated fruits showed fast yellowing (> 60% of rind area at harvest), without statistical differences between concentrations and applications forms studied. Control fruits started yellowing from three days after harvest. At 12000 mg L^{-1}, fruits started becoming reddish from two to three days after harvest and crown dehydration was accelerated. In spite of relatively low impacts of ethephon treatments on the other quality attributes studied, there could be observed some tendencies in comparison to the control: reduction of rind firmness and pulp acidity, increase of pulp translucence, yellowing and sugar/acidity ratio.

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Microbial quality of 'Pérola' pineapple grown under good agricultural practices system

Silvanda Melo Silva[1], *Jandira Pereira Costa*[1], *Rejane Maria N. Mendonça*[1], *Rafaela Emília Dantas*[1], *Ricardo Elesbão Alves*[2]
[1]CCA/UFPB, CEP 58397-000, Areia-PB, Brazil, silvasil@cca.ufpb.br
[2]Embrapa Agroindústria Tropical, Rua Dra. Sara Mesquita 2270, CEP 60511- 510, Fortaleza-CE, Brazil

Pineapple is one of the most appreciated fruit by Brazilian's consumers. Despite its extensive production in Northeastern Brazil, trade has been limited to the domestic market mostly because current production systems do not meet the required safety standard for international markets. The Good Agricultural Practices (GAP) system has been used as a tool that provides further assurance that produce meets the highest health and safety standards. The objective of this work was to evaluate microbial quality aspects of Pearl pineapple harvested in the maturity stage green, grown under GAP and traditional management systems in the Santa Rita County, Paraíba State, Brazil. The experimental design was the completely randomized, with three replications of 12 fruits. Total coliform counts were significantly lower (P> 0.05) for pineapple grown under GAP as compared with fruit from conventional management system. No fecal coliform was detected in pineapple produced under GAP system; however mold and yeast counts did not differ between treatments. Collectively the results lead to conclusion that pineapple grown under GAP system showed superior microbial quality as compared with fruits grown under traditional system, probable due to rational use of agricultural resources.

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Quality changes and shelf life of fresh-cut pitahaya slices (H*ylocereus undatus*) through packaging and low temperature storage

Lourdes Vargas-Vargas[1], Elsy Tamayo-Canul[1], Alma R. Centurión-Yah[1], Jorge A. Tamayo Cortes[1], Crescenciano Saucedo Veloz[2], Enrique Sauri-Duch[1]

[1]Instituto Tecnológico de Mérida, México, Km. 5 Carr. Mérida-Progreso, Mérida, Yucatán, México, esauri@labna.itmerida.mx, acras_99@yahoo.com

[2]Colegio de Postgraduados, Texcoco, México

Pitahaya (*Hylocereus undatus*), is a tropical fruit from Mexico and Tropical America, and its market is growing rapidly. It is a spherical or slightly oval red skin berry, about 8-10 cm diameter. Through refrigerated storage at 4-8 °C, after 15 to 18 days, decay, and diminish the quality of fruit, however, pulp have not significantly changes, but this limit marketing. Otherwise, fresh-cut fruits (minimally processed) are a rapidly growing segment of the retail and food service horticultural industry. Product quality and shelf live are very important in the distribution chain of these products. The objective of this work was to evaluate changes of some physical and chemical characteristics that are important in the quality and shelf life of pitahaya slices fresh-cut. Pitahayas were harvested with red color in 70% of its skin, washed; hand peeled and cut in slices about 1 cm thickness. Slices were dipped in 500 and 1000 ppm chlorine solutions during 5 minutes and then they were stored at 4, 8 and 20°C. The results indicate the necessity of use of chlorine to diminish the microbial populations of slices, also, the storage temperature influences significantly in changes of weight loss and quality characteristics, acidity, pH, and firmness of pulp. The pitahaya slices fresh-cut stored at 4°C they were able to maintain the shelf life until for 25 days, having a good sensorial acceptance and maintaining its microbiological stability during the whole study.

P180

Maturation and conservation of sapodilla (*Manilkara zapota L.*) submitted to postharvest treatment with 1-Methycilopropene

Patrícia Lígia Dantas de Morais[1], Luís Carlos de Oliveira Lima[1], Ricardo Elesbão Alves[2], Heloisa Almeida Cunha Filgueiras[2], José Donizeti Alves[1], Adriano da Silva Almeida[2]

[1]Universidade Federal de Lavras, CP 37, CEP 37200-000, Lavras, MG, Brasil, plmorais@ufla.br

[2]Embrapa Agroindústria Tropical, CP 3761, CEP 60511-110, Fortaleza, CE, Brasil

The sapodilla is an exotic fruit adapted to edafo-climatic conditions to Northeastern region of Brazil with great export potential. Although, it is perishable and needs technologies to increase the postharvest life. Based in these facts, this paper aims to evaluate the use of ethylene action blocker (1-MCP) in ripening control of sapodilla. The fruits were harvested at physiological maturation stage, treated with 100, 200 and 400 $nL.L^{-1}$ of 1-MCP by 12 hours in well closed chambers with temperature at 25 ± 2ºC and relative humidity at 70 ±5%. After chamber opening, the fruits were stored in the same conditions by 23 days. The parameters analyzed were: loss of mass, external appearance, firmness, pulp color, total titratable acidity, pH, total soluble solids (TSS), total soluble sugar (SS) and phenolic compounds. The experimental design was fully randomized with three replicates of four fruits each. There were significant differences between control and fruits treated with 1-MCP for all characteristics analyzed, except TSS, SS, pH and pulp chroma. The fruits treated with 1-MCP showed an increase in six days in postharvest life, being 200 $nL.L^{-1}$, the recommended dosage for sapodilla, because it was more efficient and economical in the ripening control.

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Methyl jasmonate in conjunction with ethanol treatments increase antioxidant capacity, aroma compounds and postharvest life of strawberry fruit

J. Fernando Ayala-Zavala[1], *Shiow Y. Wang*[1], *Chien Y. Wang*[1], *Gustavo. A. González-Aguilar*[2]
[1]Plant Sciences Institute, Agricultural Research Service, U. S. Department of Agriculture, Beltsville, MD 20705-2350, U.S.A, fernando@estudiantes.ciad.mx
[2]Centro de Investigación en Alimentación y Desarrollo (CIAD), Carr. la Victoria Km 0.6, La Victoria, Hermosillo, Sonora (83000) México

The antioxidant capacity (measured as oxygen radical absorbance capacity, ORAC), total anthocyanins, total phenolics, aroma compounds, and postharvest quality of strawberry fruit (*Fragaria x ananassa* cv. Allstar) were evaluated after treatment with several natural volatile compounds and storage at 7.5 °C. Strawberry fruit treated with methyl jasmonate (MJ) or its combination with ethanol (MJ-ETOH) showed higher antioxidant capacity, total phenolics, and anthocyanins than those treated with ethanol or the control fruit. However, MJ-ETOH and ethanol treatments increased aroma compounds during storage period. The postharvest life based on overall quality was longer for those berries treated with MJ-ETOH and MJ than those treated with ethanol or control fruit. The production of aroma compounds was markedly influenced by storage time and treatments. Individual aroma compounds were affected differently. For example, methyl acetate, isoamyl acetate, ethyl hexanoate, butyl acetate, and hexyl acetate increased, while ethyl butanoate, 3-hexenyl acetate, and methyl hexanoate decreased during storage. In general, strawberries treated with MJ or MJ-ETOH produced higher levels of these volatiles than those untreated. In conclusion, strawberries treated with MJ-ETOH retained an acceptable overall quality for the longest storage duration; however, berries treated with MJ showed the highest antioxidant capacity during the postharvest period.

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Determination of harvesting maturity of sugar apple (A*nnona squamosa* L.) fruits

Marlon Cristian Toledo Pereira, Lílian Caren Bráz, Silvia Nietsche, Valdeir Dias Gonçalves, Claudinéia Ferreira Nunes, Wagner Ferreira da Mota
Universidade Estadual de Montes Claros, Departamento de Ciências Agrárias, CP 91, CEP 39440-000, Janaúba, MG, Brazil, marlon.pereira@unimontes.br

The goal of this work was to characterize the harvest maturity of sugar apple fruits. The experiment was carried out in a commercial orchard, under irrigation system conditions, in Nova Porteirinha, MG, Brazil. A randomized block design was used with four replications, seven harvest dates and five fruits per plot. The fruits were artificial pollinated and marked. The characteristics evaluated were percentage of pulp fruit, fruit firmness, total soluble solids and ripening time. From 78 days after artificial pollination (DAP), the gathered fruits already showed a decrease in firmness, allowing separation to pulp, seed and peel; however, they were still not ready for consumption. It was verified a pattern of sigmoid curve to total soluble solids contents, tending to stabilization from 100 DAP with average values of 29 ºBrix. The sugar apple fruits showed good features to consumption *in natura* from 104 DAP, which ripped at six days after harvest; whilst fruits reaped at 108 presented shelf life of only three days. Though the harvest at 104 DAP double the shelf life, the weight of pulp of the fruit increased about 50 g, when reaped at 108 DAP, which represented about 7 % de percentage of pulp of fruits.

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Identification of volatile compounds with characteristic fruit aroma of umbu (*Spondias tuberosa*)

Mércia de Sousa Galvão[1], *Narendra Narain*[2], *Marta Suely Madruga*[1]
[1]Departamento de Tecnologia Química e de Alimentos, Universidade Federal da Paraíba, CEP 58059-900, João Pessoa, PB, Brasil, merciagalvao@hotmail.com, msmadruga@uol.com.br
[2]Departamento de Engenharia Química, Universidade Federal de Sergipe, CEP 49100-000, São Cristóvão, SE, Brasil, narendra@ufs.br

Volatile compounds from the pulp of umbu fruit were extracted by using Likens and Nickerson's apparatus. Two sets of experiments were designed: one for the identification of volatile compounds using a system of high resolution gas chromatograph coupled with mass spectrometer and another was concentrated on sensorial sniffing of compounds at the exit of column on gas chromatograph. One-hundred gram of umbu pulp mixed with 100 mL of water was extracted with 20 mL of hexane for 80 min, and the extracts obtained were concentrated to a final volume of 0.3 mL. The separation of compounds was achieved better by the usage of a polar capillary column (HP-INNOWax 30 m x 0.25 mm x 0.25 μm). Compounds were identified in the pulp of ripe fruit when the mass spectrum and retention index data of the identified compound matched with that of the authentic standard run under identical conditions. The two sets of results were combined together to identify the characteristic aroma compounds which possessed fruity aroma attribute. A total of 53 volatile compounds were diagnosed with characteristic aroma attributes. The principal volatile compounds which could be responsible for the characteristic aroma of umbu fruit pulp were β-cis-ocimene, methyl-pyrazine, 2-butyl-thiophene, methyl octanoate, 2-hexyl furan, 2-octanol; E)-2-ciclohexen-1-one, 3-bromo-cyclohexene, 1-heptanol, 2-nonanol and 1-octanol.

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Purge and trap capture of volatile compounds in Umbu-Cajá (*Spondias spp*.) fruits

Mércia de Sousa Galvão[1], *Narendra Narain*[2], *Marta Suely Madruga*[1]
[1]Departamento de Tecnologia Química e de Alimentos, Universidade Federal da Paraíba, CEP 58059-900, João Pessoa-PB, Brasil, merciagalvao@hotmail.com, msmadruga@uol.com.br
[2]Departamento de Engenharia Química, Universidade Federal de Sergipe, CEP 49100-000, São Cristóvão-SE, Brasil, narendra@ufs.br

The fruits of umbu-cajá (*Spondias* sp.) are native to the northeastern region of Brazil and their pulp possesses a refreshing and sour flavour. The tree, known as umbu-cajazeira in Brazil, is considered to be a natural hybrid of two fruits pertaining to the trees of cajazeira (*Spondias lutea*) and umbuzeiro (*Spondias tuberosa*). The volatile compounds captured by Purge & Trap technique were identified from the fruit pulp at two stages (half ripe and ripe) of maturity. The extracting conditions for different parameters used in the Purge & Trap apparatus (Tekmar concentrator, model 3000) were: Fifteen mL of fruit pulp was purged for 50 min at the rate of 40 mL/min of helium over a tenax/silica gel/charcoal trap and the volatiles were desorbed onto a polar column of gas chromatograph/mass spectrometer system. In the volatile extracts obtained from the half ripe umbu-caja fruit pulp, sixty-seven volatile compounds were identified among which the principal components were: 2,2-dimethyl 4-octenal (22.15%); 2-methyl butane (19.26%), 2-hexanol (18.56%), ethyl butyrate (7.64%), α-cariophylene (3.90%) while in the ripe umbu-caja fruit pulp, seventy volatile compounds were detected, among which the principal compounds were 2-methyl butane (28.35%), 2-hexanol (14.95%), 2,2-dimethyl 4-octenal (14.08%), ethyl butyrate (6.13%) and α-cariophylene (2.41%).

P185

Postharvest conservation of the umbu-caja fruit in different stages of maturity under modified atmosphere

Silvanda de Melo Silva[1], Verônica de Moura Barbosa[1], Walter Esfrain Pereira[1], Rejane Maria N. Mendonça[1], Juliana Zomazete dos Santos[1], Jandira Pereira Costa[1], Heloísa A Cunha Filgueiras[2] Ricardo Elesbão Alves[2]

[1]CCA/UFPB, CEP. 58397-000, Areia-PB, Brazil, silvasil@cca.ufpb.br

[2]Embrapa Agroindústria Tropical, C.P. 3761, CEP. 60.511-110, Fortaleza-CE, Brazil, elesbao@cnpat.embrapa.br

Fruit and products of several *Spondias* species are widely consumed in Brazil, although they are not intensively cultivated. Umbu (*Spondias tuberosa*) and caja (*Spondias mombin*) fruit is a natural hybrid of umbu and caja trees, which is growing in social-economical importance and consumers' acceptance in Northeastern Brazil. The purpose of this work was to evaluate postharvest changes in fruits, harvested in the stages of maturity 1/3 ripen e ½ ripen. Fruits were kept under modified atmosphere (MA) by PVC film and ambient atmosphere (AA) at room temperature (23 ± 1°C) and 10 ± 1°C, during 10 days. The experiment was carried out in a completely randomized design, in a 2x2x5 factorial arrangement, with 3 replications. The use of MA resulted in lower fresh mass loss, as compared with fruits under AA, mainly when kept at 10°C. Total vitamin C was higher and appearance (1-inacepetable; 9-excelent) kept above the critical limit (score 4) during 10 days, for ½ ripen fruit stored under MA and 10°C. Soluble solids increased during storage at room temperature, independent on maturity stages and atmospheres. Refrigeration combined with MA reduced SS and kept fruit appearance acceptable, mainly for ½ ripen fruits.

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Antioxidants, quality and shelf life of sanitized and stored rabbiteye blueberries (*Vaccinium ashei*)

Jelena Stojanovic, Juan L. Silva, Chonthida Kaewplang, Youkai Lu*

Department of Food Science, Nutrition, and Health Promotion, Mississippi State University, Mississippi State 39762, jls@ra.msstate.edu

Fresh and processed blueberries contain a high microbial load, including yeasts and molds. Temperature abuse and time may influence the microbial growth and amount and activity of the native antioxidant compounds. This makes them very perishable and susceptible to rapid spoilage. The objective of this study was to evaluate sanitation treatments and storage temperature on microbial load and quality/antioxidants of rabbiteye (*Vaccinium ashei*) blueberries. Fresh picked blueberries were packed untreated (control) or treated with 100ppm chlorine (CaHOCl) solution or Tsunami® (40 ppm peroxyacetic acid) for 30s, air dried and placed in plastic clamshells. Samples were stored at 2°C-3°C (RF) or at 21°C (RT), and evaluated every five days for up to 30 days. Color, texture and firmness changes were more prominent on RT berries. Sanitation treatments did not influence texture of the RF berries. The RT berries lost 24%-36% and RF berries lost 10-15% of their weight after 25 and 30 days, respectively. Total phenolics increased from 472 to 629 mg/100g during 30 d in RF berries, while there were no changes in anthocyanins over time or by storage temperature. A 2-log increase in microbial counts was recorded for RT berries regardless of treatment after 5 days (end of acceptable quality). Chlorine solution was most efficient in reducing microbial counts on berries. Pretreatment will not aid in delaying spoilage of berries by temperature abuse. Refrigeration of blueberries seems to be more important than pretreatment in extending shelf-life and maintaining quality of blueberries.

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Quality and shelf life of rabbiteye blueberries (*Vaccinium ashei*) stored under controlled atmospheres

Angsana Tokitkla[1], Taejo Kim[2], Juan L. Silva[2], Frank B. Matta[1], James O. Garner[3]
[1]Department of Plant and Soil Sciences, Department of Food Science, Nutrition and Health Promotion, Mississippi State University, MS 39762, USA, jls@ra.msstate.edu
[3]Department of Agriculture, University of Arkansas at Pine Bluff, Arkansas, USA

'Tifblue' blueberries (*Vaccinium ashei)* were placed in plastic clamshell boxes, simulating fresh market packs. These packages were loaded into hermetically-sealed containers, and gas fumigated before storage and after every sampling time with either 15.5% of ozone (O_3), 200 ppm sulfur dioxide (SO_2), 18.8% of carbon dioxide (CO_2), or normal air. Boxes with fruit were then stored at 2°C and sampled periodically over a period of 48 days. Percentage fruit decay, weight loss, and moisture were higher for berries stored in the control treatment than for berries stored under either ozone, SO_2 or CO_2. Berry firmness was higher under 15.5% ozone storage. Increased acidity and anthocyanin content of the berries exposed to 200 ppm SO_2 resulted from a decrease in pH of the berries. Phenolic content increased at the beginning of storage, but decreased by the end of the experiment. The color of the blueberries was similar in berries stored under normal air, ozone and CO_2, while color of berries under SO2 shifted from blue to blue red. Microbial growth increased rapidly in berries stored under normal air and CO_2, but only a slight increase was found under O_3 and SO_2.

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Evaluation of a mixture of tropical fruits with added caffeine

Paulo Henrique Machado de Sousa[1], Geraldo Arraes Maia[1], Henriette Monteiro Cordeiro de Azeredo[2], Anália Maria Pinheiro[1], Manoel Alves de Sousa Neto[2], Aline Gurgel Fernandes[1]
[1]Departamento de Tecnologia de Alimentos, UFC, Fortaleza, CE, Brasil, phmachado@uol.com.br
[2]Embrapa Agroindústria Tropical, Rua Dra. Sara Mesquita 2270, CEP 60511-110, Fortaleza-CE, Brazil
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Nectar is a ready-to-drink beverage formulated with fruit juice or pulp, water and sugar. The nectars can be produced from one or more types of fruits. Fruit blends present a series of advantages, as the combination of different aromas and flavours, as well as nutrients. Besides the mixture of fruits, the addition of stimulating components to beverages has also been studied. Caffeine, known by its stimulating effects on central nervous system, has been frequently used. The objective of this study was to develop a beverage by combining cashew apple, papaya, guava, acerola and passion fruit pulps, with added caffeine. A beverage having 35% pulp blend, 10% sucrose, and 0.01% caffeine was prepared, packed in disinfected glass bottles and heat processed at 90°C for 10 min. Physicochemical, microbiological and sensory analyses of the beverage were performed initially (time zero) and after six months of storage at room temperature (20-30°C). The acidity and vitamin C content decreased significantly throughout storage time, but the other parameters (microbiological counts, pH, total soluble solids, sugars, caffeine, colour L*a*b*) remained stable throughout the storage. The product presented good sensory acceptance, suggesting its potential for commercial use.

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Sensory evaluation of canned orange segments and melon pieces in orange juice syrup

Dulce Ma. Sánchez-Díaz Lima, Lourdes Yánez, Adalid Bautista, Samantha Martínez, Gabriela Salcedo, Elia Sandoval and Rosario Valentino
Universidad Autónoma Metropolitana, Iztapalapa, México, D.F. México, dusa@xanum.uam.mx

Tropical fruit innovative products allow market diversification and gives new opportunities to consumers, as well as to fruit processors who enjoy new preservation alternatives. In this study orange segments with melon pieces were processed with orange juice as syrup, which was standardized with sucrose. Orange juice concentration was made up to three levels: 15°Brix, 20°Brix and 25°Brix, it was packed in 401 x 411 cans. The developed formulation was of 35% orange segments, 30% melon pieces and 35% standardized orange juice syrup. Sensory evaluation consisted on descriptive and affective tests application. The objective was to find differences among formulations, flavour profile, preference and acceptance level. Tests results showed there was no difference among the three tests to the panelists' opinion. In descriptive tests (QDA) the product has a good acceptability, freshness and sweetness being the main acceptability features. Preference tests resulted in a 71.66% preference for 20°Brix standardized orange syrup and 38.34% panelists preferred the traditional syrup.

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Frozen pulp storability of six acerola (*Malpighia emarginata*) clones

Paolo Germanno Lima Araujo[1], Raimundo Wilane Figueiredo[1], Ricardo Elesbão Alves[2], João Rodrigues de Paiva[2], Carlos Farley Herbster Moura[2], Márcia Régia Souza da Silveira[2]
[1]CCA/UFC, CP 6012, CEP 60541-970, Fortaleza-CE, Brazil, figueira@ufc.br
[2]Embrapa Agroindústria Tropical, CP 3761, CEP 60511-110, Fortaleza, CE, Brazil, elesbao@cnpat.embrapa.br
Financial support: CNPq, CAPES e Embrapa

The objective of this work was to evaluate the storability potential of frozen pulp conservation of from fruits of six acerola clones. Fruits from the clones BRS 152 (Sertaneja), FP 19, I 6/2, II 37/1, III 56/4, and III 78/1 were hand harvested in the commercial maturity stage in Limoeiro do Norte, Ceará State, Brazil. Fruits were transported to the Laboratory of Postharvest Physiology and Technology of the Embrapa Agroindústria Tropical, where pulp was obtained (pulp extractor), packed inside polyethylene bags (100 g), frozen and kept in a domestic freezer at -20°C during four months. Samples were removed one day after processing and, following, monthly for quality evaluation: color (L, C, H), soluble solids (SS), titratable acidity (TA), SS/TA, pH, Vitamin C, anthocyanins and • -carotene. The experiments was conducted in a completely randomized design, in a factorial arrangement (clone x time), with three replications (100 g polyethylene bags). It was not observed changes for SS, TA, SS/TA, and pH. Among the clones evaluated, two of them (II 37/1, III 56/4) maintained the vitamin C content closely the same throughout storage, while the others presented losses varying from 10 to 15% approximately. The red color, evaluated as the anthocyanins, was kept much stable for the FP 19 clone, whose content did not change with storage. On the other hand, the anthocyanins content presented the largest decline (43.86%) for the Sertaneja clone following 4 months frozen storage.

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Optimization of processing conditions for wine production from acerola (*Malpighia glabra*)

Sheyla dos Santos Almeida[1], *José Carlos Curvelo Santana*[2], *Narendra Narain*[1], *Roberto Rodrigues de Souza*[1]

[1]Departamento de Engenharia Química, Universidade Federal de Sergipe, CEP 49100-000, São Cristóvão, SE, Brazil, rrsouza@ufs.br, narendra@ufs.br

[2]DESQ/FEQ/UNICAMP, C.P 6066, CEP 13083-970, Campinas, SP, Brazil

In the present work, an attempt has been made to standardize the processing conditions for the manufacture of wine from acerola (*Malpighia glabra* L.). The acerola fruit possesses extremely high vitamin-C content and is characterized by an attractive red color. The fruit is very much appreciated in the northeast region of Brazil. A central point design was used to evaluate the effect of soluble solids (°Brix) and the concentration of fruit pulp on sensorial quality attributes (color, flavor and aroma) of wine which were measured on hedonic scale (0 to 10). The soluble solids content was varied from 22, 24 and 26°Brix while the fruit pulp and the total volume of wine varied from 1/6, 1/4 and 1/3 (w/v). *Saccharomyces cerevisiae* yeast was used for fermentation. Acerola wines were found to be suave, sweet and had 10°GL of alcohol concentration. Flavor and color of wines were characteristic of acerola fruit. Sensorial analysis revealed that the wines produced with 1/4 and 1/3 (w/v) of fruit mass and 26°Brix were the best products. This work supports the usage of acerola for obtaining high quality wines which possess pleasing aroma and shiny red color.

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Kinetics of the osmotic dehydration of guava

Elis Regina de Vasconcelos Norões[1], *Janice Ribeiro Lima*[2], *Michelle del Bianchi*[3], *Thel Guilherme Taú*[3], *Isabella Montenegro Brasil*[1]

[1]CCA/UFC, CP 12168, CEP 60356-000, Fortaleza, CE, Brazil, elisreginanoroes@yahoo.com.br

[2]Embrapa Agroindústria Tropical, CEP 60511-110, Fortaleza, CE, Brazil, janice@cnpat.embrapa.br

[3]Centro Regional Universitário de Espírito Santo do Pinhal, Brazil

Osmotic dehydration represents a technological alternative to reduce postharvest losses of fruits. The purpose of this work was to evaluate the influence of the osmotic solution concentration on kinetics of the osmotic dehydration of guava. It was used 45ºBrix, 55ºBrix and 65ºBrix sucrose solutions at 65ºC, and 1:2 and 1:4 fruit to syrup ratios. The osmotic treatments were carried out under atmospheric pressure for 5h. Results showed that water loss and solid gain were higher in the beginning of the osmosis, being highest at 3.5h. Treatment at 65ºBrix and 1:2 ratio achieved highest water loss and less solid gain.

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Chemical and sensorial quality parameters of dehydrated lemon fruit

Vahideh Rahnemaye Rabbani Jalali, Narendra Narain, Glecenir Ramos dos Santos, Valdira Batista dos Santos

Departamento de Engenharia Química, Universidade Federal de Sergipe, CEP 49100-000, São Cristóvão, SE, Brasil, vahideh@ufs.br, narendra@ufs.br

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Two varieties of lemon, Taiti (*Latifólia citrus*) and galician (*Aurantifolia citrus*), fruits were dehydrated in the forms of entire lemon or their rinds. The main objective of the present work was to verify the presence of bitterness in the dehydrated product. The effect of fruit variety, maturation stage, concentration of salt solution used for brining, and the fruit and brine ratio were evaluated while dehydration was carried out in a cabin drier. Salt concentration varied from 10%, 20%, 30%, 35% and 40% and contact period from 1, 2, 3 and 4 days while fruit and brine solution was varied from 1:2, 1:3 and 1:4. The fruits were immersed initially in cold water followed by a hot water treatment to remove the salt and dried later. Through detailed sensorial and visual tests, it was concluded that the Galician lemon fruits in the mature stage when treated with 30% salt solution for four days, having a fruit/brine ratio of 1:4 presented best results. The optimum dehydration temperature in a cabin drier with air circulation was 60ºC. The dehydrated product, triturated in the form of a powder, retained the characteristic flavour and aroma attributes of lemon and it could well serve as a condiment source.

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Processing parameters for the extraction of essential oil from orange rinds

Alex Ferreira Evangelista[1], Narendra Narain[1], José Carlos Curvelo Santana[2], Roberto Rodrigues de Souza[1]

[1]Departamento de Engenharia Química, Universidade Federal de Sergipe, CEP 49100-000, São Cristóvão, SE, Brazil, rrsouza@ufs.br, narendra@ufs.br

[2]DESQ/FEQ/UNICAMP, C.P 6066, CEP 13083-970, Campinas, SP, Brazil

The present work was designed to use orange rinds for essential oil extraction which may serve to valorize orange processing industry. A central composite rotatable design (CCRD) was applied to study the influence of solvent concentration, time and temperature of extraction on the oil yield. The solvent concentrations used were 30%, 50% and 70% (v/v), extraction times were 90, 105 and 120 min and extraction temperatures were 150°C, 175°C and 200°C. The extracts were transparent (without any noticeable color) but they retained the characteristic orange flavor. ANOVA analysis showed that the square empirical model was the more fitting-one to the experimental results obtained. RSM methodology proved that the extracts obtained with 50 % alcohol for 105 min at 150°C temperature represented the best zone for essential oil extraction. At these conditions, the oil yield was found to be about 5.0%. The data obtained from this research leads to conclude that the orange rind could be a viable source for manufacture of essential oil of relatively high quality in color and orange flavor attributes. The processing procedure may further add to aggregate the subsidiary products which could be commercialized by orange processing industries.

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Vitamin C and oxidative enzymes of uvaia fruit (*Pseudo myrcianthes pyriformis,* Camb. Klaus)

Edmar Clemente
Laboratório de Bioquímica de Alimentos-DQI/UEM, Av. Colombo 5790, CEP 87020-900, Maringá – PR, Brazil, eclemente@uem.br

Many research works have been carried out with objective of improving the commercialization (conservation, transportation, etc.) as a fresh fruit and also condition for the fruit to be industrialized. The uvaia fruit is a yellow, velvety, pyriform and edible berry. It is appreciated for its juice, and that is why this species has been extensively grown in orchards for domestic use. The flowering season of this species comprises August-September and November-December in southern Brazil. The maturation of the fruits occurs in September through January. The present study was carried out in the first stage to characterize the physical-chemical composition of uvaia fruit and quality of freezing pulp during storage, in order to ameliorate its commercialization and industrialization conditions, and its adaptation to the consuming market both in natural and in industrialized form. The pulp was prepare from ripe fruits with an industrial blend and packed into polyethylene bags (100 g capacity) and stored at –18^{o}C during 60 days. The chemical composition of the pulp was carried out each twenty days. The pH remained constant. A little variation were verified at the Brix/acidity ratio and vitamin C. Assays for enzyme activity for peroxidase (E.C. 1.11.1.7) and polyphenoloxidase (E.C.1.10.3.1) were carried out in the fruit (green, yellow–green and ripe) also in the pulp which was storage under –18^{o}C.

AUTHORS INDEX

TECHNICAL TOURS

17/09/2004 – Friday

Coordinators
Dr. Fernando Antonio Souza de Aragão (Embrapa Vegetable Crops, Brazil)
Dr. Carlos Farley Herbster Moura (Embrapa Agroindústria Tropical, Fortaleza-CE, Brazil)

TECHNICAL TOUR 1: Cashew Production, Postharvest and Processing and Tropical Fruit Juice

TIME	PLACE	ACTIVITY
06:30	Seara Praia Hotel	Leave hotel
08:30 - 10:30	AGM	Commercial growing and postharvest operations for precocious dwarf cashew
11:30 - 12:30	*Lunch - Adega Casa Grande Restaurant - (Regional cuisine)*	
13:00 - 14:30	Jandaia Agroindustry	Tropical fruit juice processing (cashew, acerola, guava, passion fruit and others)
15:00 - 16:00	Pacajus Experimental Station - Embrapa Agroindústria Tropical	Small scale processing of nut, nut nursery and clonal orchard of tropical and exotic fruits
18:00	Seara Praia Hotel	Estimated arrival in Fortaleza

TECHNICAL TOUR 2: Exotic fruit orchard and Pecém Port Terminal

TIME	PLACE	ACTIVITY
07:00	Seara Praia Hotel	Leave hotel
08:30 - 10:30	Paraipaba Experimental Station - Embrapa Agroindústria Tropical	Irrigated fruit growing (sugar apple, cashew, coconut and soursop) and clonal orchards of exotic fruits (Annonaceae, Spondias, tamarind, starfruit, murici, palm trees, coconut, mango, papaya and others)
11:30 - 12:30	*Lunch - Isca do Sol Restaurant - (Regional cuisine)*	
13:00 - 15:00	Pecém Port Terminal	Visit to the Pecém Port
17:00	Seara Praia Hotel	Estimated arrival in Fortaleza

TECHNICAL TOUR 3: Irrigation project Tabuleiro de Russas (Apodi region)

TIME	PLACE	ACTIVITY
06:00	Seara Praia Hotel	Leave hotel
09:00 - 10:00	Frota Farm	Commercial production, irrigation management, processing of soursop and guava
10:00 - 11:00	Bessa Farm	Packing house e commercial production of melon
11:00 - 12:00	Frutacor Farm (1)	Irrigated fruit growing of papaya (field and packing house)
12:30 - 13:30	*Lunch - Berro D´água Restaurant Restaurant - (Regional cuisine)*	
14:00 - 16:00	Frutacor Farm (2)	Irrigated fruit growing of banana, soursop, table grapes, sapodilla (field and packing house)
19:00	Seara Praia Hotel	Estimated arrival in Fortaleza

Empresa Brasileira de Pesquisa Agropecuária
Centro Nacional de Pesquisa de Agroindústria Tropical
Ministério da Agricultura, Pecuária e Abastecimento
Rua Dra. Sara Mesquita, 2270 Pici 60511-110 Fortaleza - Ceará
Telefone (0xx85) 299.1800 Fax (0xx85) 299.1833
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