

PROGRAMME & BOOK OF ABSTRACTS

International symposium on sustainable fruit production

March 21-24, 2016

Donja Stubica, Croatia

Hotel Terme Jezerčica

LIFE SU.SA.FRUIT project

“Integrated pest management in sustainable and safe fruit production”

LIFE13 ENV/HR/000580



International symposium on sustainable fruit production (Action D 6.2)

March 21-24, 2016

Donja Stubica, Croatia

Hotel Terme Jezerčica



Impressum

Published by

University of Zagreb Faculty of Agriculture (Croatia)

Editor in Chief

Tomislav Jemrić

Technical Editors

Martina Skendrović Babojelić

Goran Fruk

Printed by

University of Zagreb Faculty of Agriculture
(Zagreb, Croatia)

This project is financially supported by LIFE financial instrument of the European Union for the project “Low pesticide IPM in sustainable and safe fruit production” (Contract No. LIFE13 ENV/HR/000580).

LIFE SU.SA.FRUIT project
“Integrated pest management in sustainable and safe fruit production”

International symposium on sustainable fruit production
(Action D 6.2)

March 21-24, 2016

Donja Stubica, Croatia

Hotel Terme Jezerčica

Organizers

University of Zagreb Faculty of Agriculture (Croatia)
Alma Mater Studiorum – University of Bologna (Italy)
University of Turin (Italy)
Agra d.o.o. (Croatia)
Apofruit Italija Soc. Coop. Agricola (Italy)
Xeda International S.A. (France)

in collaboration with

The ICA Regional Network for Central and South Eastern Europe (CASEE)



Scientific Committee

Tomislav Jemrić, Faculty of Agriculture University of Zagreb
Božena Barić, Faculty of Agriculture University of Zagreb
Goran Fruk, Faculty of Agriculture University of Zagreb
Martina Skendrović Babojelić, Faculty of Agriculture University of Zagreb
Davide Spadaro, University of Turin
Luciana Tavella, University of Turin
Rosemarie Tedeschi, University of Turin
Marta Mari, University of Bologna
Marina Collina, University of Bologna

Organizing Committee

Mladen Fruk, Faculty of Agriculture, University of Zagreb
Josip Buhin, Faculty of Agriculture, University of Zagreb
Goran Fruk, Faculty of Agriculture, University of Zagreb
Tomislav Jemrić, Faculty of Agriculture, University of Zagreb

SECTIONS

1
SUSTAINABLE PRE-HARVEST TECHNOLOGY

2
SUSTAINABLE POST-HARVEST TECHNOLOGY

3
IPM IN SUSTAINABLE FRUIT PRODUCTION

SYMPOSIUM PROGRAMME

Monday, March 21, 2016

Participant registration

CONGRESS HALL

Executive Committee: Tomislav Jemrić, Marta Mari, Davide Spadaro

10:00 OPENING CEREMONY

Welcome speech of organizers and guests

11:00 Coffee break

Section: SUSTAINABLE PRE-HARVEST TECHNOLOGY

Moderators: Tomo Milošević, Martina Skendrović Babojelić, Ghulam S. Markhand

11:30 Invited lecture

Michele Bravetti

“Technical use of photo-selective anti-hail nets in Italy”

12:00 Mladen Fruk, Marko Vuković, Goran Fruk, Josip Buhin, Martina Skendrović Babojelić, Tomislav Jemrić

“The influence of different color nets on yield and fruit quality of apple cv. ‘Braeburn’ under Croatian agro-climatic conditions”

12:20 Marko Vuković, Mladen Fruk, Mushtaque A. Jatoi, Goran Fruk, Josip Buhin, Tomislav Jemrić

“Comparison effect of different photo-selective anti-hail nets on yield and fruit quality of peach cv. ‘Suncrest’ in northern Croatia”

12:40 Tomo M. Milošević, Nebojša T. Milošević, Ivan P. Glišić

“The possibility of sustainable sweet cherry production on heavy and acidic soil”

13:00 Maria Pinte

“Evaluation of apricot assortment for sustainable production in the conditions of Republic of Moldova”

13:20 Lunch break

14:30 Nebojša T. Milošević, Ivana S. Glišić, Milan M. Lukić, Milena R. Đorđević, Žaklina M. Karaklajić Stajić

“Properties of some late season plum hybrids from Fruit Research Institute Čačak”

14:50 Nikola Mičić, Gordana Đurić, Miljan Cvetković

“Canopy management practices in modern plum (*Prunus domestica* L.) production on vigorous rootstocks”

- 15:10 Sisir Kumar Mitra
“Sustainable Lychee (*Litchi chiniensis* Sonn.) production in India”
- 15:30 Ghulam S. Markhand, Nazir A. Soomro, Adel A. Abul-Soad, Mushtaque A. Jatoi and Najamuddin Solangi
“Field evaluation of eight Balochistani Date Palm (*Phoenix dactylifera* L.) cultivars under agro-climatic conditions of Khairpur, Sindh”
- 15:50 Lovro Sinkovič, Vladimir Meglič, Dragan Žnidarčič, Nataša Kunstelj, Emil Zlatić, Rajko Vidrih
“The effects of different growing media on selected nutritional parameters in sweet potatoes (*Ipomoea batatas*)”

Tuesday, March 22, 2016

CONGRESS HALL

Section: SUSTAINABLE POST-HARVEST TECHNOLOGY

Moderators: Janez Hribar, Tomislav Jemrić, Lluís Palou

- 10:00 Invited lecture
Goran Fruk, Tomislav Jemrić, Martina Skendrović Babojelić
“Woolliness development during peach and nectarine storage and pectins”
- 10:30 Doris Kokalj, Grega Bizjak, Janez Hribar, Blaž Cigić, Emil Zlatić, Rajko Vidrih
„Influence of UV light emitting diodes on colour development and antioxidant potential of apple peel”
- 10:50 Davide Spadaro, Karin Santoro, Maria Lodovica Gullino
“Use of biocontrol agents and essential oils for postharvest disease control”
- 11:10 Karin Santoro, Marco Maghenzani, Valentina Chiabrando, Giovanna Giacalone, Maria Lodovica Gullino, Angelo Garibaldi, Davide Spadaro
“Effect of fumigation with essential oils on postharvest quality and health of stone fruit”
- 11:30 Mushtaque Ahmed Jatoi, Josip Buhin, Mladen Fruk, Goran Fruk, Marko Vuković, Tomislav Jemrić
Postharvest application of lecithin to prolong the Goji Berry (*Lycium barbarum* L.) storage life
- 11:50 Coffee break**
- 12:10 Nenad Magazin, Zoran Keserović, Biserka Milić, Marko Dorić
“I_{AD} index as a possible tool for apricots optimal harvest time prediction“
- 12:30 Branka Levaj, Predrag Putnik, Danijela Bursać Kovačević, Korina Herceg, Božidar Matijević, Robert Piskač, Maja Repajić, Verica Dragović-Uzelac, Sanja Lončarić, Zoran Zorić, Sandra Pedisić, Ivona Elez Garofulić, Damir Ježek, Jasna Mrvčić, Lucija Hlupić, Mateja Kobeščak
“Fresh cut” fruits and vegetables in Croatia

- 12:50 Merav Zaaroor, Sharon Alkalai-Tuvia, Daniel Chalupowicz, Yohanan Zutahy, Marina Beniches and Abraham Gamliel, Elazar Fallik
„Relationship between rootstock, soil disinfection and plant density on pre and postharvest grafted watermelon quality (*Citrullus lanatus*)“
- 13:10 Zoran S. Ilić, Ljubomir Šunić, Jasna Mastilović, Žarko Kevrešan
“Strategy to reduce losses and maintain quality of root vegetables during prolonged cold storage”
- 13:30 Muhammad Tayyab Rashid, Malik Muhammad Hashim, Ma Haile
“Development and quality analysis of diet guava squash”
- 13:50 Jasna S. Mastilović, Žarko S. Kevrešan, Nenad Magazin, Zoran Keserović, Dario Danojević, Gordana Ostojić, Stevan Stankovski, Zoran Ilić, Andrea Vuković
“Needs and directions for enforcement and integration of fresh produce related research”
- 14:10 Lluís Palou, Cristiane Fagundes, Alcilene R. Monteiro, María B. Pérez-Gago
“Cherry tomato quality preservation and black spot reduction with edible composite coatings containing antifungal GRAS salts”

14:30 Lunch break

POSTER HALL

Moderators: Goran Fruk, Ivana Pajač Živković, Lovro Sinković

15:00 Poster presentations (all sections)

Questions and discussion on poster

1. Boris Pašalić, Vida Todorović, Ivana Koleška, Borut Bosančić, Nikolina Đekić
“Effects of salinity on color changes, sugar concentration and acid concentration in tomato fruit”
2. Milan M. Lukić, Slađana A. Marić, Nebojša T. Milošević, Ivana S. Glišić, Marijana I. Pešaković
“Evaluation of introduced apple cultivars grown in the western Serbia region”
3. Mia Brkljača, Jasna Rumora, Tomislav Jemrić
“Yield and fruit quality of Cripps Pink variety under different color insect-protecting nets in Baštica, Croatia”
4. Luka Gašpar, Mislav Kaučić, Goran Fruk, Tomislav Jemrić
“Apple cv. 'Cripps Pink' skin colour depending on growing location”
5. Martina Skendrović Babojelić, Jasmin Lesičar, Tomislav Jemrić, Sandra Voća, †Zoran Šindrak
“Influence of fruit thinning and summer pruning on fruit quality of peach variety 'Royal Gem”
6. Nenad Magazin, Zoran Keserović, Biserka Milić, Marko Dorić
“Yield and quality of two strawberry cultivars from one and two year bearing systems”
7. Jasna Rumora, Stošija Klanac, Mia Brkljača
“Pomological and chemical quality of strawberry (*Fragaria* spp.) grown on locality “Kobatuša” near Posedarje”
8. Marko Vuković, Petra Pilipović, Josip Buhin, Goran Fruk, Tomislav Jemrić
“Growth, flower and fruit quality of black elder (*Sambucus nigra* L.)”

9. Marko Vuković, Goran Fruk, Tomislav Jemrić
“Rootstock effect on growth, production and fruit quality of fruit trees: A review”
10. Petra Škrlec, Boris Duralija
“The usage of mulch foils in horticulture”
11. Nataša Duduk, Miljan Vasić, Aleksandra Žebeljan, Rade Radojević, Ivana Vico
“Postharvest pathogens of apple fruit in Serbia”
12. Žarko S. Kevrešan, Jasna S. Mastilović, Alena Tomšik, Miona Belović, Nenad Magazin, Zoran Keserović
“Postharvest properties some of plum (*Prunus domestica* L.) and apricot (*Prunus armeniaca* L.) varieties”
13. Josipa Mikulić, Goran Fruk, Marko Vuković, Josip Buhin, Mladen Fruk, Tomislav Jemrić
“Effect of hot water dip duration on heating and cooling rate of apple cv. 'Idared' ”
14. Vladimir Sabadoš, Jana Konjević Mrđenović, Olivera Sekulić, Zoran Boca
“Impact of sweet cherry varieties on quality parameters during storage period”
15. Ellaine Grace Nagpala, Michela Guidarelli, Mattia Gasperotti, Domenico Masuero, Paolo Bertolini, Urska Vrhovsek, Elena Baraldi
“Polyphenols variation and gene expression in strawberry fruits during ripening and upon pathogen infection”
16. Rukie Agic, Zvezda Bogevska, Gordana Popsimonova, Margarita Davitkovska
“Storage condition and losses of different types of onion in Republic of Macedonia”
17. Sikiru Olowofola
“Fruit grading water easily purified with active carbon filter”
18. Gordana Forgić, Vladimir Sabadoš, Tatjana Veselinović, Jelena Perenčević, Gordana Mrdak
“Three-year results of experiment aimed to suppression of gray mold (inducer *Botryotinia fuckeliana*) using software of meteorological station”
19. Claudia Sánchez, João Cavalheiro, Paula Vasilenko, Mário Santos, Rui Maia de Sousa, Maria M. Ferreira-Pinto
“Preharvest application of *Aureobasidium pullulans* to control postharvest decay of ‘Rocha’ pears”
20. Tina Fazinić, Dario Ivić, Zoran Lovrek, Tihomir Miličević
“Management and potential impact of *Monilinia fructicola* on peach in Croatia”
21. Amirkulova Arailym Zhubaevna, Gianfranco Romanazzi, Kurbanova Gulnar Vapahanovna, Rvaydarova Gulnisam Olakaevna, Utarbaeva Aizhan Sharelevna
“Decomposition and residual amounts of fungicides on spring wheat”
22. Ivana Pajač Živković, Božena Barić, Tomislav Kos, Darija Lemić, Helena Suda, Tomislav Jemrić, Mladen Fruk
“The ground beetle fauna (*Coleoptera*) in apple orchard in Croatia“

Wednesday, March 23, 2016

CONGRESS HALL

Section: IPM IN SUSTAINABLE FRUIT PRODUCTION

Moderators: Marta Mari, Božena Barić, Rosemarie Tedeschi

- 10:00 Invited lecture
Rosemarie Tedeschi, Marco G. Pansa, Luciana Tavella
“*Halyomorpha halys*, a new threat to crops in Europe: distribution, damage and control perspectives“
- 10:30 Vesna Tomaš, Mirjana Brmež, Krunoslav Dugalić, Ines Mihaljević, Marija Viljevac Vuletić, Domagoj Šimić, Božena Barić
“Monitoring and fruit protection of codling moth in integrated apple production”
- 10:50 Ivana Pajač Živković, Božena Barić, Josip Buhin, Mladen Fruk, Tomislav Jemrić
“Influence of different netting structures on codling moth and apple fruit damages in northwest Croatia“
- 11:10 Valentina Candian, Marco G. Pansa, Luciana Tavella, Rosemarie Tedeschi
“Exclusion nets for the control of fruit pests in NW Italy“
- 11:30 Coffee break**
- 11:50 Irene Cameldi, Massimiliano Menghini, Daria Ventrucchi, Gianni Ceredi, Marta Mari
“Integrated postharvest strategy to control the bull’s eye rot of ‘Cripps Pink’ apple”
- 12:10 Ceren Turan, Massimiliano Menghini, Gianni Ceredi, Marta Mari, Marina Collina
“Molecular identification of *Venturia asperata* from atypical scab-like symptoms on apples in Italy”
- 12:30 Gianfranco Romanazzi
“Use of resistance inducers to control pre and postharvest diseases of grapes and fruit plants”
- 12:50 Ines Pohajda, Katarina Lukšić, Ana Vrankulj, Slavica Dudaš, Ana Šalinović
“Integrated production of sour cherry (*Prunus cerasus*) in Croatia”

13:10 Lunch break

15:00 ROUND TABLE

Moderators: Zoran Ilić, Tomislav Jemrić, Elazar Fallik

Topic: Sustainable postharvest technologies in South Eastern Europe

19:00 Gala dinner at the hotel restaurant (optional, depending on number of interested participants)

Thursday, March 24, 2016

9:00 - 11:00 Visit to Museum of Peasants' Revolved

11:00 - 16:00 Technical visit to AGRA orchard where Life SUSAFRUIT project is implemented

16:00 - 17:00 Conclusions from the Symposium

CONTENT

SYMPOSIUM PROGRAMME	1
SECTION 1	11
Michele Bravetti Technical use of photo-selective anti-hail nets in Italy	13
Mladen Fruk, Marko Vuković, Goran Fruk, Josip Buhin, Martina Skendrović Babojelić, Tomislav Jemrić The influence of different color nets on yield and fruit quality of apple cv. 'Braeburn' under Croatian agro-climatic conditions	14
Marko Vuković, Mladen Fruk, Mushtaque A. Jatoi, Goran Fruk, Josip Buhin, Tomislav Jemrić Comparison effect of different photo-selective anti-hail nets on yield and fruit quality of peach cv. 'Suncrest' in northern Croatia	15
Tomo M. Milošević, Nebojša T. Milošević, Ivan P. Glišić The possibility of sustainable sweet cherry production on heavy and acidic soil	16
Maria Pintea Evaluation of apricot assortment for sustainable production in the conditions of Republic of Moldova	17
Nebojša T. Milošević, Ivana S. Glišić, Milan M. Lukić, Milena R. Đorđević, Žaklina M. Karaklajić Stajić Properties of some late season plum hybrids from Fruit Research Institute Čačak	18
Nikola Mičić, Gordana Đurić, Miljan Cvetković Canopy management practices in modern plum (<i>Prunus domestica</i> L.) production on vigorous rootstocks	19
Sisir Kumar Mitra Sustainable lychee (<i>Litchi chinensis</i> Sonn.) production in India	20
Ghulam S. Markhand, Nazir A. Soomro, Adel A. Abul-Soad, Mushtaque A. Jatoi and Najamuddin Solangi Field evaluation of eight Balochistani Date Palm (<i>Phoenix dactylifera</i> L.) cultivars under agro-climatic conditions of Khairpur, Sindh	21
Lovro Sinković, Vladimir Meglič, Dragan Žnidarčič, Nataša Kunstelj, Emil Zlatić, Rajko Vidrih The effects of different growing media on selected nutritional parameters in sweet potatoes (<i>Ipomoea batatas</i>)	22
Boris Pašalić, Vida Todorović, Ivana Koleška, Borut Bosančić, Nikolina Đekić Effects of salinity on color changes, sugar concentration and acid concentration in tomato fruit	23
Milan M. Lukić, Slađana A. Marić, Nebojša T. Milošević, Ivana S. Glišić, Marijana I. Pešaković Evaluation of introduced apple cultivars grown in the western Serbia region	24

Mia Brkljača, Jasna Rumora, Tomislav Jemrić Yield and fruit quality of Cripps Pink variety under different color insect-protecting nets in Baštica, Croatia	25
Luka Gašpar, Mislav Kaučić, Goran Fruk, Tomislav Jemrić Apple cv. 'Cripps Pink' skin colour depending on growing location	26
Martina Skendrović Babojelić, Jasmin Lesičar, Tomislav Jemrić, Sandra Voća, †Zoran Šindrak Influence of fruit thinning and summer pruning on fruit quality of peach variety 'Royal Gem'	27
Nenad Magazin, Zoran Keserović, Biserka Milić, Marko Dorić Yield and quality of two strawberry cultivars from one and two year bearing systems	28
Jasna Rumora, Stošija Klanac, Mia Brkljača Pomological and chemical quality of strawberry (<i>Fragaria</i> spp.) grown on locality "Kobatuša" near Posedarje	29
Marko Vuković, Petra Pilipović, Josip Buhin, Goran Fruk, Tomislav Jemrić Growth, flower and fruit quality of black elder (<i>Sambucus nigra</i> L.)	30
Marko Vuković, Goran Fruk, Tomislav Jemrić Rootstock effect on growth, production and fruit quality of fruit trees: Review	31
Petra Škrlec, Boris Duralija The usage of mulch foils in Horticulture	32
SECTION 2	33
Goran Fruk, Tomislav Jemrić, Martina Skendrović Babojelić Woolliness development during peach and nectarine storage and pectins	35
Doris Kokalj, Grega Bizjak, Janez Hribar, Blaž Cigić, Emil Zlatić, Rajko Vidrih Influence of UV light emitting diodes on colour development and antioxidant potential of apple peel	36
Davide Spadaro, Karin Santoro, Maria Lodovica Gullino Use of biocontrol agents and essential oils for postharvest disease control	37
Karin Santoro, Marco Maghenzani, Valentina Chiabrande, Giovanna Giacalone, Maria Lodovica Gullino, Angelo Garibaldi, Davide Spadaro Effect of fumigation with essential oils on postharvest quality and health of stone fruit	38
Mushtaque Ahmed Jatoi, Josip Buhin, Mladen Fruk, Goran Fruk, Marko Vuković, Tomislav Jemrić Postharvest application of lecithin to prolong the goji berry (<i>Lycium barbarum</i> L.) storage life	39
Nenad Magazin, Zoran Keserović, Biserka Milić, Marko Dorić <i>I</i>_{AD} index as a possible tool for apricots optimal harvest time prediction	40
Branka Levaj, Predrag Putnik, Danijela Bursać Kovačević, Korina Herceg, Božidar Matijević, Robert Piskač, Maja Repajić, Verica Dragović-Uzelac, Sanja Lončarić, Zoran	

Zorić, Sandra Pedisić, Ivona Elez Garofulić, Damir Ježek, Jasna Mrvčić, Lucija Hlupić, Mateja Kobešćak “Fresh cut” fruits and vegetables in Croatia	41
Merav Zaaroor, Sharon Alkalai-Tuvia, Daniel Chalupowicz, Yohanan Zutahy, Marina Beniches and Abraham Gamliel, Elazar Fallik Relationship between rootstock, soil disinfection and plant density on pre and postharvest grafted watermelon quality (<i>Citrullus lanatus</i>)	42
Zoran S. Ilić, Ljubomir Šunić, Jasna Mastilović, Žarko Kevrešan Strategy to reduce losses and maintain quality of root vegetables during prolonged cold storage	43
Muhammad Tayyab Rashid, Malik Muhammad Hashim, Ma Haile Development and quality analysis of diet guava squash	44
Jasna S. Mastilović, Žarko S. Kevrešan, Nenad Magazin, Zoran Keserović, Dario Danojević, Gordana Ostojić, Stevan Stankovski, Zoran Ilić, Andrea Vuković Needs and directions for enforcement and integration of fresh produce related research	45
Lluís Palou, Cristiane Fagundes, Alcilene R. Monteiro, María B. Pérez-Gago Cherry tomato quality preservation and black spot reduction with edible composite coatings containing antifungal GRAS salts	46
Nataša Duduk, Miljan Vasić, Aleksandra Žebeljan, Rade Radojević, Ivana Vico Postharvest pathogens of apple fruit in Serbia	47
Žarko S. Kevrešan, Jasna S. Mastilović, Alena Tomšik, Miona Belović, Nenad Magazin, Zoran Keserović Postharvest properties some of plum (<i>Prunus domestica</i> L.) and apricot (<i>Prunus armeniaca</i> L.) varieties	48
Josipa Mikulić, Goran Fruk, Marko Vuković, Josip Buhin, Mladen Fruk, Tomislav Jemrić Effect of hot water dip duration on heating and cooling rate of apple cv. 'Idared'	49
Vladimir Sabadoš, Jana Konjević Mrđenović, Olivera Sekulić, Zoran Boca Impact of sweet cherry varieties on quality parameters during storage period	50
Ellaine Grace Nagpala, Michela Guidarelli, Mattia Gasperotti, Domenico Masuero, Paolo Bertolini, Urska Vrhovsek, Elena Baraldi Polyphenols variation and gene expression in strawberry fruits during ripening and upon pathogen infection	51
Rukie Agic, Zvezda Bogevska, Gordana Popsimonova, Margarita Davitkovska Storage condition and loses of different types of onion in Republic of Macedonia	52
Sikiru Olowofola Fruit grading water easily purified with active carbon filter	53
SECTION 3	55
Rosemarie Tedeschi, Marco G. Pansa, Luciana Tavella <i>Halyomorpha halys</i>, a new threat to crops in Europe: distribution, damage and control perspectives	57

Vesna Tomaš, Mirjana Brmež, Krunoslav Dugalić, Ines Mihaljević, Marija Viljevac Vuletić, Domagoj Šimić, Božena Barić Monitoring and fruit protection of codling moth in integrated apple production	58
Ivana Pajač Živković, Božena Barić, Josip Buhin, Mladen Fruk, Tomislav Jemrić Influence of different netting structures on codling moth and apple fruit damages in northwest Croatia	59
Valentina Candian, Marco G. Pansa, Luciana Tavella, Rosemarie Tedeschi Exclusion nets for the control of fruit pests in NW Italy	60
Irene Cameldi, Massimiliano Menghini, Daria Ventrucci, Gianni Ceredi, Marta Mari Integrated postharvest strategy to control the bull's eye rot of 'Cripps Pink' apple	61
Ceren Turan, Massimiliano Menghini, Gianni Ceredi, Marta Mari, Marina Collina Molecular identification of <i>Venturia asperata</i> from atypical scab-like symptoms on apples in Italy	62
Gianfranco Romanazzi Use of resistance inducers to control pre and postharvest diseases of grapes and fruit plants	63
Ines Pohajda, Katarina Lukšić, Ana Vrankulj, Slavica Dudaš, Ana Šalinović Integrated production of sour cherry (<i>Prunus cerasus</i>) in Croatia	64
Gordana Forgić, Vladimir Sabadoš, Tatjana Veselinović, Jelena Perenčević, Gordana Mrdak Three-year results of experiment aimed to suppression of gray mold (inducer <i>Botryotinia fuckeliana</i>) using software of meteorological station	65
Claudia Sánchez, João Cavalheiro, Paula Vasilenko, Mário Santos, Rui Maia de Sousa, Maria M. Ferreira-Pinto Preharvest application of <i>Aureobasidium pullulans</i> to control postharvest decay of 'Rocha' pears	66
Tina Fazinić, Dario Ivić, Zoran Lovrek, Tihomir Miličević Management and potential impact of <i>Monilinia fructicola</i> on peach in Croatia	67
Amirkulova Arailym Zhubaevna, Gianfranco Romanazzi, Kurbanova Gulnar Vapahanovna, Rvaydarova Gulnisam Olakaevna, Utarbaeva Aizhan Sharelevna Decomposition and residual amounts of fungicides on spring wheat	68
Ivana Pajač Živković, Božena Barić, Tomislav Kos, Darija Lemić, Helena Suda, Tomislav Jemrić, Mladen Fruk The ground beetle fauna (<i>Coleoptera</i>) in apple orchard in Croatia	69
NOTES	71

SECTION 1

SUSTAINABLE PRE-HARVEST TECHNOLOGY

Technical use of photo-selective anti-hail nets in Italy

Michele Bravetti*

Agronomist, H&B Agri-services, Meknes, Morocco
Research and Development dpt., Agritenax srl, Eboli (SA) Italy (e-mail: bravo_brv@hotmail.com)

Abstract

Increasing hailstorms frequency makes the use of anti-hail nets more frequent in Italy. Photo-selective anti-hail nets change light availability, spectrum and scattering, modifying the orchard microclimate. Therefore, they can affect plant photosynthesis, photomorphogenic processes and, finally, fruit harvest quantity and quality. Several studies have been carried out on many sites in Italy to investigate the influence of photo-selective nets (yellow, red, pearl and blue) on many different crops compared with black, gray or white nets. Higher photosynthesis levels were measured under photo-selective nets compared to black or gray nets in all sites and species. Lower photosynthetic levels were never measured under photo-selective nets even if compared with white nets. On apple, pearl and yellow nets allowed increased color of fruit skin and higher sugar levels in northern Italy in bi-color varieties, and after a four-year trial the fruit production in red apple. Pearl net increased weight and caliber of fruits compared with black net and un-netted control on apple in southern Italy.

On nectarine, blue net tended to reduce vegetative growth. Yellow and red nets increased fruits number and weight compared with blue and black nets. On table grapes, red net affected sugar content and precocity, pearl net anti-oxidant content compared with white net control. On kiwifruit, yellow net increased number of fruit per tree and dry matter in green kiwi; flesh firmness and color in yellow kiwi. Photo-selective anti-hail nets can lead to additional benefits on crops reducing some chemical inputs and allowing to overcome climate deficiencies.

Key words: spectrum, visible light, light filter, skin color, sugar content.

The influence of different color nets on yield and fruit quality of apple cv. 'Braeburn' under Croatian agro-climatic conditions

Mladen Fruk^{*}, Goran Fruk, Marko Vuković, Josip Buhin, Martina Skendrović Babojelić, Tomislav Jemrić

University of Zagreb, Faculty of Agriculture, Department of Pomology, 10000, Zagreb, Croatia
(e-mail: mladenfruk@agr.hr)

Abstract

The usage of photo-selective anti hail nets is recently being studied because of its ability to reduce damages from hailstorms and flying pests. Moreover, by reducing ratio of damages from flying pests it is also consequently reducing the number of chemical treatments. It represents a new, innovative and ecofriendly approach that is being tested on various fruit crops worldwide. In this study nets were used on apple orchard in northern Croatia in order to evaluate their efficacy on fruit quality and yield apart from their anti-hail and pest damage protection properties. Four different colored nets were used, three (red, white and yellow) from Tenax (Italy) and Stop Drosophila Normal from Artes Politecnica (Italy). The fruits were harvested on 12th October 2015. Among all tested nets no significant differences were recorded for parameters: firmness, TSS, TA, SSC/TA and TCSA. Significant difference in fruit weight existed between red, white and yellow nets (188,88 g, 183,28 g, 181,73 g, respectively) on the one hand and drosophila nets and control (157,34 g, 159,78 g, respectively) on the other hand. Trees under red and drosophila nets had significantly higher yield (12,6 and 10,33 kg per tree, respectively) than under yellow (9,73 kg per tree), and white nets (5,93 kg per tree) as well in control (5,68 kg per tree). Trees under yellow nets had significantly higher yield than white nets and control. Yellow, red and drosophila nets had significantly higher yield (0,52 kg/cm² TCSA, 0,51 kg/cm² TCSA, 0,48 kg/cm² TCSA, respectively) efficiency than white nets and control (0,29 and 0,27 kg/cm² TCSA, respectively). Color index was higher in fruit under drosophila and red nets than under white and yellow nets. No significant difference was between fruit under control, red and drosophila nets on the one hand, and control, white and yellow nets on the other hand.

Key words: apple fruit quality, photo-selective netting, production

Comparison effect of different photo-selective anti-hail nets on yield and fruit quality of peach cv. 'Suncrest' in northern Croatia

**Marko Vuković^{1*}, Mladen Fruk¹, Mushtaque A. Jatoi^{1,2}, Goran Fruk¹, Josip Buhin¹
Tomislav Jemrić¹**

¹University of Zagreb, Faculty of Agriculture, Department of Pomology, 10000, Zagreb, Croatia
(e-mail: mvukovic@agr.hr)

²Shah Abdul Latif University, Date Palm Research Institute, 66020, Khairpur, Sindh, Pakistan

Abstract

The photo-selective anti hail netting has been an emerging innovative way to reduce the damages from solar radiation, hailstorms and flying pests. Nowadays it is being tested on various fruit crops worldwide. The use of these nets on peach orchards in northern Croatia is totally a new approach employed in current study to evaluate their efficacy on quality and yield of peaches apart from their anti-hail and pest damage protection properties. Four different colored nets were used, three (red, white and yellow) from Tenax (Italy) and Stop Drosophila Normal from Artes Politecnica (Italy). They were tested with control treatment at Vratišinec, Northern Croatia. The fruits were harvested at two different times due to the difference in maturation time period. On 04 august 2015 yellow, drosophila nets and control fruit were harvested and on 07 august 2015, red and white net fruit were harvested. The findings indicate that all the tested nets significantly influenced the yield (26.80 – 29.56 t/ha) as compared to control (21.64 t/ha). Significant difference in firmness existed between fruit under yellow and drosophila nets (4,77 and 5,20 kg·cm⁻², respectively) on the one hand and red and white nets (3,79 and 3,73 kg·cm⁻², respectively) on the other hand. Lower fruit firmness in fruit under red and white nets was due to delayed maturation in comparison with white and drosophila nets. The control trees appeared with significantly smaller yield efficiency than white and red nets, while no significant difference was showed between control trees and trees under yellow and drosophila nets. There were no significant differences for SSC, TA, SSC/TA ratio, fruit weight, and TCSA among all tested nets. The control fruit resulted with significantly smaller color value “b” than fruit grown under all other nets. Control fruit had significantly smaller color value “C” than fruit grown under all other nets had except for white net.

Key words: peach, fruit quality, photo-selective netting, maturation

The possibility of sustainable sweet cherry production on heavy and acidic soil

Tomo M. Milošević^{1*}, Nebojša T. Milošević², Ivan P. Glišić¹

¹Departement of Fruit Growing and Viticulture, Faculty of Agronomy, 32000 Cacak, Serbia
(e-mail: tomomilosevic@kg.ac.rs)

²Department of Pomology and Fruit Breeding, Fruit Research Institute, 32000 Cacak, Serbia

Abstract

Over 60% Serbian soils are heavy, shallow and acidic, especially in west part of this country. Basically, Serbian fruit production is mainly represented in these conditions which are not favorable for intensive fruit growing. However, repair of these soils is a long and very expensive process. Regarding to this, one of the real ways to overcome this problem faster and cheaper is to grow tolerant fruit genotypes on adequate rootstock in order to sustainable and economically justified production. Therefore, from 2008 to 2015, we investigated behavior of eight sweet cherry cultivars on Mazzard rootstock on heavy and acidic soil, i.e. their tree vigor, productivity and fruit quality attributes under high density planting system (1,250 tree ha⁻¹). Results showed that 'New Star' generally had the highest tree vigor, yield per tree and hectare, fruit thickness, sphericity, flesh rate and ripening index values. 'Sunburst' had the lowest tree vigor alongside with 'Stark Hardy Giant', and the highest cumulative yield and yield efficiency. 'Summit' had the highest fruit width and the poorest yield per tree, cumulative yield and yield efficiency, whereas 'Lapins' had the lowest fruit weight and all three fruit dimensions. The highest fruit weight and fruit width was found in 'June Early', and soluble solids content (SSC) and titratable acidity (TA) in 'Hedelfinger'. The lowest SSC was observed in 'June Early' and TA in 'Stark Hardy Giant'. The best financial result was shown by 'New Star' and the poorest by 'Summit'.

Key words: sweet cherry, rootstock, tree vigor, fruit quality

Evaluation of apricot assortment for sustainable production in the conditions of Republic of Moldova

Maria Pintea*

Reproductive biology, biotechnology, fruit growing, fruit quality development, resilience in Horticulture, Str. Costiujeni 14, Chişinău MD2019., Moldova (e-mail: mariapintea@yandex.ru)

Abstract

In the Republic of Moldova cultivation of apricot have secular traditions. But apricot production has many risks, mainly manifested during the post-dormancy (frost damages) and flowering periods (moniliosis). For improvement production stability it is necessary to develop (breeding, implementation and promotion) new varieties with high adaptability and large plasticity to variable local micro climatic and edaphic conditions. Actually there are sophisticate apricot varieties which are characterized genetic resistance to frost, fluctuations of winter and spring unfavorable temperatures; physiologic potential of equilibration of growth and fructification, especially high excitability of vegetative buds with the possibility of rehabilitation of crown after drastic manifestation of moniliosis. Therefore in the apricot programs of varieties amelioration regarding enlargement and modernization of fruit varietal conveyer there are studied and evaluated different genitors, including comparative studies of more than new 30 selections, obtained from experimental pollinations, 357 introduced perspectives varieties from international assortment. The results of biological and agronomical investigations demonstrated that more than 40% of introduced genotypes conserve the capacity of high productivity, good resistance of flower buds and flowers to winter and spring unfavorable temperatures. Most of them are very susceptible (in comparison with moldavian ones) to moniliosis. Actually in the Moldovan Catalog of Plant Varieties (edition 2015) there are registered 20 varieties, including 8 local and 12 introduced ones. For temporary testation in the local conditions of production there are included varieties: Bebeco, Big red, Faralia, Farbaly, Litoral, Olimp, Precoce de Tiryntos. The medium season of fruit ripening comes from 06 June to 20 August.

Key words: apricot, varieties, moniliosis, production conditions

Properties of some late season plum hybrids from Fruit Research Institute Čačak

Nebojša T. Milošević^{1*}, Ivana S. Glišić¹, Milan M. Lukić¹, Milena R. Đorđević¹, Žaklina M. Karaklajić Stajić²

¹Fruit Research Institute Department of Pomology and Fruit Breeding, 32000 Cacak, Serbia
(e-mail: mnebojsa@ftn.kg.ac.rs)

²Fruit Research Institute Department of Fruit Growing Technology, 32000 Cacak, Serbia

Abstract

Since 1979 to 2012 fifteen plum cultivars were named and released in Fruit Research Institute Čačak. Some of these cultivars, such as Čačanska Lepotica, Čačanska Rodna and Čačanska Najbolja are grown in most important plum growing countries in Europe. Also, these cultivars are used as parent cultivars in many plum breeding programs. In addition cultivars, large number of promising hybrids are created in Fruit Research Institute Čačak and some of them, in this moment, are candidates for new cultivars. Therefore, in 2014 and 2015, we investigated the most important properties of four promising late season hybrids and standard cultivar Stanley. All four hybrids were harvested since beginning of September (34/41/87) until the beginning of the third decade of September (10/23/87). The earliest flowering onset was recorded in hybrid 34/41/87 and the latest in cultivar Stanley. Hybrids 10/23/87 and 26/54/87 generally had the highest fruit weight and all three fruit dimensions. Also these hybrids had the highest content of total sugars and saccharose and highest pH value, but poorest total acid content. The highest content of invert sugars and total acids was recorded in hybrid 22/17/87. This hybrid also, had the highest yield per tree and per hectare while the hybrid 34/41/87 had the lowest these values. Standard cultivar Stanley had the largest stone weight and the highest amount of soluble solids.

Key words: plum, cultivar, fruit quality, breeding

Canopy management practices in modern plum (*Prunus domestica* L.) production on vigorous rootstocks

N. Mičić^{1,2}, Gordana Đurić^{1,2}, Miljan Cvetković^{1*}

¹University of Banja Luka, Faculty of Agriculture (e-mail: miljancvetkovic@yahoo.com)

²University of Banja Luka, Genetic Resources Institute

Abstract

Intensive high-density plantings (HDP) of plum trees in the Republic of Srpska in general and the Potkozarje region in particular involve the use of Myrobalan (*Prunus cerasifera* Ehrh.) seedling as the predominant and, in most cases, the only rootstock. Using Myrobalan as a vigorous rootstock is a serious challenge in growing plums at higher planting densities. Although Myrobalan seedling rootstock increases the vigour of grafted cultivars, plum trees trained to the spindle system on Myrobalan rootstock can also be grown at very high plant densities ranging from 1,500 to 2,500 trees per hectare, depending on the cultivar/rootstock combination and central-leader inclination. The most common training system for plums in high density plantings is the slender spindle or the spindle bush system. Successful training and maintenance of spindle systems in intensive cultivation on high-vigour rootstocks is not possible without the consistent use of canopy management practices, particularly during the first three years after planting, when these practices are most intensive for proper training of both the central leader and the main lateral branches. Canopy management practices require a professional attitude and substantial manual labour.

Particular importance in training spindle systems for plums as well as in maintaining the training system (replacement of spur-bearing branches) is given to the following specific canopy management practices: notching, shoot bending, shoot twisting, undercutting and replacement of spur-bearing branches.

This paper outlines major canopy management practices and their effect on plum growth and development, focusing on cultivar-specific responses to treatments.

Key words: plum, canopy management practices, cultivar

Sustainable lychee (*Litchi chinensis* Sonn.) production in India

Sisir Kumar Mitra*

Chairman, Section Tropical and Subtropical Fruits, International Society for Horticultural Science (ISHS)
(*email: sisirm@vsnl.net)

Abstract

Lychee is an important subtropical fruits growing in India since 18th. Century. India ranks second after china producing about 600,000 MT of lychee annually. In the past 65 years the planting area under lychee increased from 9,400 hectares in 1950 to 83,000 hectares in 2014. The important lychee growing states in India are Bihar, Uttar Pradesh, West Bengal and Uttaranchal. However, it is also growing in Assam, Tripura, Punjab, Himachal Pradesh and in some north eastern states. Different state agricultural universities, Indian Council of Agricultural Research and National Research Centre on Litchi made significant contributions in developing sustainable production technology for Lychee for different litchi growing states of India. In India about 60 lychee varieties are grown of which 5-6 varieties are grown commercially. Production of quality planting materials, high density planting, canopy management, integrated nutrient water and pest management, control of fruit drop and fruit cracking, flower induction by use of chemicals, delayed harvesting technology, organic lychee production, method of harvesting, grading, packing and postharvest management have be standardized for different lychee varieties. The growing demand from EU and middle-east and high domestic demand of lychee makes it a profitable crop with sustainable income. It is estimated that about 3.0 million peoples are directly involved in lychee production and trade. The Government of India has developed a number of lychee export zone in the country and has created necessary infrastructures like pack house, refrigerated transport system, cool chambers etc. in this zones for encourage lychee export. The production, productivity and income from lychee cultivation increased substantially over the years. This paper will discuss the sustainable production technology of lychee in India.

Keywords: lychee, cultivation, growing technology, productivity, income

Field evaluation of eight Balochistani Date Palm (*Phoenix dactylifera* L.) cultivars under agro-climatic conditions of Khairpur, Sindh

Ghulam S. Markhand^{1*}, Nazir A. Soomro¹, Adel A. Abul-Soad², Mushtaque A. Jatoi¹, Najamuddin Solangi¹

¹Date Palm Research Institute, Shah Abdul Latif University, Khairpur, Sindh, Pakistan
(email: gmarkhand@gmail.com)

²Horticulture Research Institute, Agriculture Research Center, Cairo, Egypt.

Abstract

Off shoots of eight date palm cultivars from Balochistan namely Aab-e-Dandan, Begum Jangi, Gogna, Halini, Koozanabad, Muzawati, Peshna and Shakri were brought and cultivated in 2004 to test the adaptability of these cultivars under the agro-climatic conditions of Khairpur, Sindh. The vegetative growth, flowering characteristics, fruit physical and chemical properties at various maturity stages i.e. Kimri, Khalal, Rutab and Tamar, bunch number and yield per palm were recorded during 2012 and 2013. Cv. Aab-e-Dandan, cv. Shakri and cv. Gogna emerged as early harvesting varieties in first and second week of July while cv. Begum Jangi, cv. Halini and cv. Muzawati recorded as late harvested varieties in mid of September. An appropriate performa was designed to drop the scientific and commonly used physical properties such as fruit length and diameter, seed length and diameter, flesh weight & chemical properties such as moisture content, pH, total soluble solids, total sugars, reducing sugars and non-reducing sugars at different maturity stages. It is worth to mention that there is no any published data available on these cultivars regarding their vegetative and fruit characteristics before. It was concluded from the study that the climatic conditions of Khairpur are very much suitable for planting of Balochistani date palm cultivars.

Key words: Balochistan, cultivars, field evaluation, Khairpur, *Phoenix dactylifera* L.

The effects of different growing media on selected nutritional parameters in sweet potatoes (*Ipomoea batatas*)

Lovro Sinkovič^{1*}, Vladimir Meglič¹, Dragan Žnidarčič², Nataša Kunstelj³, Emil Zlatič⁴, Rajko Vidrih⁴

¹Crop Science Department, Agricultural Institute of Slovenia, Hacquetova 17, SI-1000 Ljubljana, Slovenia (e-mail: lovro.sinkovic@kis.si)

²Biotechnical Centre Naklo, Strahinj 99, SI-4202 Naklo, Slovenia

³Department of Agronomy, Biotechnical faculty, University of Ljubljana, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia

⁴Food Science and Technology, Biotechnical faculty, University of Ljubljana, Jamnikarjeva 101, SI-1000 Ljubljana, Slovenia

Abstract

Sweet potato (*Ipomoea batatas* L.) is one of the seven major world staple crops and is being cultivated in more than 100 countries. The aim of this study was to assess the effects of different growing media on selected nutritional parameters (antioxidant potential, AOP, total phenolic compound, TPC; and vitamin C) of sweet potato tubers. Three genotypes with different skin/flesh colour (orange/orange, white/white, purple/white) were included in the experiment. Tubers were produced under greenhouse conditions in five different growing media (perlite, vermiculite, expanded clay, peat, garden soil). The determination of TPCs were carried out by Folin-Ciocalteu method, AOP using DPPH free radical scavenging method and vitamin C content by HPLC. The following range of parameters were detected: TPC (16 – 25 mg GAE/100 g FW), AOP (0.2 – 0.6 mg TE/g FW), and vitamin C content (14 – 24 mg/100 g FW). The highest TPCs between genotypes were detected in orange/orange grown in expanded clay, and the lowest in the white/white grown in peat. The highest AOP was seen in purple/white grown in perlite, whereas the lowest for the same genotype grown in peat. The highest vitamin C content was found in orange/orange grown in perlite, and the lowest in purple/white grown in vermiculite. Significantly higher TPC and vitamin C contents among genotypes were found in orange/orange, and significant higher AOPs in white/white.

Key words: Antioxidant potential, *Ipomoea batatas*; growth media; phenolic compounds; vitamin C.

Effects of salinity on color changes, sugar concentration and acid concentration in tomato fruit

Pašalić Boris^{2,1*}, Vida Todorović¹, Ivana Koleška¹, Bosančić Borut¹, Nikolina Đekić¹

¹Faculty of agriculture university of Banja Luka (e-mail: boris.pasalic@agrofabl.org)

²Ministry of agriculture, forestry and water, Government of Republic of Serpska

Abstract

Tomato (*Lycopersicon esculentum*, Mill) is vegetable which is relatively resistant to salt concentration in growing substrate. However, research has shown that salinity stress causes changes in the quality of the fruit, which indirectly affects the yield. So the aim of this research was to determine the change in color of ripening fruits, the amount of sugar and acid in the fruit, as indicators of the quality of the fruit. Tests were conducted in a greenhouse on tomato cv. Buran F1, where were two varieties of seedlings, grafted and non grafted, grown in the control substrate (EC = 1.7 dS/m) and substrate with EC = 6.8 dS/m. The quality of fruit is observed by a difference in the maturing of the first fruit of the first and second branches of tomatoes, and through the concentration of sugar and acid in the fruit, depending on the position of the plants. So, the fruits of which were affected by salinity stress are ripened faster, had higher sugar level (1-2%) than in the control substrate, regardless of whether it is a grafted or not grafted variants. The acids are varied, the differences in concentration of 0.1-0.2%. At the same time, grafted varieties had shown better values of all parameters examined in relation to not grafted. Based on this we can conclude that the the grafting is one of the ways to overcome the stress caused by increased levels of salt in the substrate.

Key words: tomato, salinity, grafted, nongrafted

Evaluation of introduced apple cultivars grown in the western Serbia region

Milan M. Lukić^{1*}, Slađana A. Marić¹, Nebojša T. Milošević¹, Ivana S. Glišić¹, Marijana I. Pešaković²

¹Fruit Research Institute, Department of Pomology and Fruit Breeding, 32000 Čačak, Serbia
(e-mail: milanmlukic@yahoo.com)

²Fruit Research Institute, Department of Fruit Growing Technology, Serbia

Abstract

Apple (*Malus × domestica* Borkh.) occupies the second position in the structure of fruit growing in the Republic of Serbia, with the total production of 255,395 tonnes per year (2005–2014 average). The modern apple production requires that a cultivar has commercial-quality fruit and consistent yield. This paper presents the results of a three-year study on pomological properties of two darker-red mutants of ‘Gala’ and ‘Elstar’ (‘Gala Must’ and ‘Red Elstar’, respectively) and two scab resistant (‘Rajka’ and ‘Topaz’) apple cultivars which were grown in the western Serbia region. The pomological traits of the introduced cultivars were determined based on the assessment of morphometric (fruit weight, height and width, shape index, stalk length and seed number) and organoleptic properties (relative area and intensity of the over colour, attractiveness, flavour, aroma, and consistency). The highest fruit weight, height, shape index and stalk length were found in ‘Gala Must’ (157.6 g, 61.3 mm, 0.88 and 30.8 mm, respectively). The lowest value of the shape index (0.77) and largest number of seeds (10.2) were determined in ‘Topaz’ fruit. Based on the overall evaluation of the examined organoleptic properties, ‘Topaz’ and ‘Gala Must’ fruits were singled out (total organoleptic assessment – 20.5 and 19.4, respectively). The assessed introduced cultivars can greatly contribute to the advancement of the apple assortment in the Republic of Serbia, whilst ‘Gala Must’ and ‘Topaz’ can be recommended for commercial growing.

Key words: *Malus × domestica*, cultivar, sport, morphometric properties, organoleptic properties

Yield and fruit quality of Cripps Pink variety under different color insect-protecting nets in Baštica, Croatia

Mia Brkljača^{1*}, Jasna Rumora¹, Tomislav Jemrić²

¹ University of Zadar, Department for Ecology, Agronomy and Aquaculture, Kneza Višeslava 9, 23000 Zadar, Croatia (e-mail: mbrkljaca@unizd.hr)

² University of Zagreb Faculty of Agriculture, Department of Pomology, Svetošimunska cesta 25, 10000 Zagreb, Croatia

Abstract

It was important to determine the possibility to use insect-protecting nets in apple orchard by measuring its effect on fruit quality of apple variety Cripps Pink grown in Baštica. The trial with four types of nets (white with wide mesh size (WW), and red (R), white (WN) and yellow (Y) color nets with narrow mesh size) and control (C), covering four trees each, was set from June until harvest of 2015 (1st harvest on Sept. 2nd for WW and R and 2nd harvest on Sept. 11th for WN and Y). Yield was higher at WW, R and WN (5.28-8.83 kg/tree) than at Y and C (3.41 kg, 3.79 kg). The portion of 70-80 mm diameter fruits for WW, R and C were similar (58-76%), while WN and Y (35%, 41%) had less than C (53%). Portion of fruits having 50-75% of skin color (3rd class fruits) was higher at WW (51%) than R (37%) and C (38%) and WN, Y and C were similar (17-27%) while 75-100% of skin color (4th class fruits) were higher at C (46%) than WW (11%) and R (21%) and C (46%) was higher than Y (18%), and WN (39%) similar to Y and C. Total acids (TA) were similar at WW, R and C (0.63-0.71%) and lower at Y (0.535%) than at WN and C (0.67%, 0.61%). Sugar content was higher at C (15.84%) than at WW and R (14.81%, 15.11%), and C (16.34%) was higher than WN (15.31%) and Y (15.81%). Sugar/TA was similar at WW, R and C (22.63-24.18), and Y (32.26) was higher than WN and C (23.55, 27.54). Color development, total acids and ripening stage was similar under nets and control and yield was higher under nets than control, except for yellow net, but sugar accumulation was higher in control.

Key words: insect nets, Cripps Pink, fruit color, sugar/TA

Apple cv. 'Cripps Pink' skin colour depending on growing location

Luka Gašpar^{1*}, Mislav Kaučić², Goran Fruk³, Tomislav Jemrić³

¹Moslavina voće d.o.o., Trnošćica b.b., 10370 Dugo Selo, Croatia (e-mail: luka.gaspar@fragaria.hr)

²Paying Agency for Agriculture, Fisheries and Rural development, Ulica grada Vukovara 269d, 10000 Zagreb, Croatia

³University of Zagreb, Faculty of Agriculture, Department of Pomology, 10000, Zagreb, Croatia

Abstract

Apple cv. 'Cripps Pink' originates from Australia and its club name is "Pink Lady™". Red colour development is important parameter for achieving club standard. The main goal of this study is to compare coloration quality of apples cv. 'Cripps Pink' grown in three locations (Bjelovar, Požega and Vrgorac) in Croatia. Fruit were harvested in optimal maturation stage. Colour from harvested fruit was measured by colorimeter (Color TEC PCM, USA). Climatic data for growing sites were taken from Croatian Meteorological and Hydrological Service. Significant difference was shown in "a" value of base colour between Bjelovar (where "a" value was negative) and Požega and Vrgorac (where "a" value was positive). Additional colour (red colour) parameter "a" also showed significantly lower value between Bjelovar and both Požega and Vrgorac. Although it is one-year preliminary study, it shows importance of growing site selection in achieving maximum colour potential of apple cv. 'Cripps Pink'.

Key words: apple, cv 'Cripps Pink', coloration, fruit quality

Influence of fruit thinning and summer pruning on fruit quality of peach variety 'Royal Gem'

Martina Skendrović Babojelić^{1*}, Jasmin Lesičar¹, Tomislav Jemrić¹, Sandra Voća², †Zoran Šindrak¹

¹University of Zagreb Faculty of Agriculture, Department of Pomology, Svetošimunska 25, Zagreb, Croatia (e-mail: mskendrovic@agr.hr)

²University of Zagreb Faculty of Agriculture, Department of Agricultural Technology, Storage and Transport, Svetošimunska 25, Zagreb, Croatia

Abstract

Peach is one of the most important fruit species and food for human consumption whose consumption because of its range of time maturation possible throughout the summer. The cultivation of peaches spend many pomotechnical treatments, and some of the more interesting are summer pruning and fruit thinning. Exactly these pomotechnical treatments achieved higher quality fruit which is nowadays very important for the market value of the fruit. In this paper the influence of thinning and summer pruning on the quality of the peach cultivar 'Royal Gem' has been studied. Conducted treatments (treatment 1 - thinning without summer pruning, treatment 2 - thinning and summer pruning, treatment 3 – summer pruning without thinning and control - without thinning and summer pruning) significantly influenced the increase in average fruit weight, increase firmness and the diameter of the fruit. Chemical quality parameters did not show significant changes. Smallest fruit mass was found in the control (75.74 g), while the biggest mass in treatment 3 (92,93g). The largest fruit diameter was in treatment 3 (57.69 mm) and lowest in the control (52.59 mm). Maximum firmness was found after treatment 2 (4.14 kg / cm²). Pomotechnical treatments in this study were found to be effective for improving the fruit quality, and the best results showed fruit thinning.

Key words: peach, fruit, fruit thinning, summer pruning, fruit quality

Yield and quality of two strawberry cultivars from one and two year bearing systems

Nenad Magazin*, Zoran Keserović, Biserka Milić, Marko Dorić

University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia
(e-mail: nmagazin@polj.uns.ac.rs)

Abstract

Strawberry production in Serbia is oriented to open field culture with two and three years bearing systems. If „frigo“ plants are used, those are planted in summer (July-August) with full productivity in spring next year. Some plants are productive following year(s) too, but with significant decrease in fruit size and yield. Our trial was set up in commercial strawberry field in Rumenka, near Novi Sad, northern Serbia in 2015. Cultivars included in trial were ‘Jolly’ and ‘Alba’. A part of the field was planted in 2013 (second year of productivity) and another part was planted in 2014 (first year of productivity). At two stages, beginning and mid season, sample of 10 kg of fruits was taken from harvested fruits for laboratory analysis. The analysis comprised of weight measure, total soluble solids, titratable acidity, firmness and shape estimation. Also, at the end of harvest period, yield was calculated from the producer’s records. The results show great difference in yield and quality of both cultivars depending on bearing year but also harvest date. Fruits from first productivity year and first harvest date of both cultivars were much larger than other fruits. Firmness showed different pattern in two cultivars. ‘Jolly’ fruits from first productivity year were significantly softer than from second productivity year, while with ‘Alba’, fruits in first productivity year were much firmer. Total soluble solids were much more affected by harvest date than by productivity year. Our findings confirmed that second productivity year of strawberry plants is characterized by small size fruits with other quality attributes dependant of cultivar.

Key words: *Fragaria x ananassa*, fruit weight, firmness, shape

Pomological and chemical quality of strawberry (*Fragaria* spp.) grown on locality “Kobatuša” near Posedarje

Jasna Rumora, Stošija Klanac, Mia Brkljača*

University of Zadar, Department for Ecology, Agronomy and Aquaculture, Kneza Višeslava 9, 23000 Zadar, Croatia (e-mail: mbrkljaca@unizd.hr)

Abstract

In Northern Dalmatia strawberry production in spite optimal ecological conditions is not spread yet. Therefore, it was important to determine the quality of fruits from that area. The experiment was set in Posedarje, locality Kobatuša, in 2015. for cultivars Clery and Alba grown on high beds in two rows, covered with black foil. In experiment were 90 plants per cultivar divided in three blocks, northern (B1), middle (B2) and southern (B3) side of the plantation. Fruit weight was lower for Clery in B1 (10.2 g) than other blocks (11.9-13.0 g), except in B3 for Alba (11.4 g). Fruit thickness was higher in B1 for Clery (22.3 mm) than other blocks (23.9-28.8 mm). Fruit height was lower in B3 for Alba (27.4 mm) than in other blocks (29.7-31.2 mm), except in B1 for Clery (28.9 mm) which had similar fruits than Clery in B3 (31.6 mm) and Alba in B2 (31.2 mm). Clery and Alba had similar pH (3.55), total soluble solids (9.28) and total acids (6.09 g l⁻¹). Cultivar Clery had lower weight, height and width compared to Vrgorac locality that traditionally grown strawberry. Clery at Vrgorac region had higher amount of total acids by 1 g⁻¹ but total soluble solids were higher than in Zagreb area. Cultivar Alba had lower weight, height and width than on Kosovo region. Smaller fruits of both cultivars produced are probably affected by atmospheric conditions, suggesting that production need to be adjusted in other cultivars would be able to express its biological characteristics.

Key words: strawberry, total soluble solids, total acids, pomology, fruit quality

Growth, flower and fruit quality of black elder (*Sambucus nigra* L.)

Marko Vuković^{1*}, Petra Pilipović², Josip Buhin¹, Goran Fruk¹, Tomislav Jemrić¹

¹University of Zagreb, Faculty of Agriculture, Department of Pomology, Svetošimunska cesta 25, 10000, Zagreb, Croatia (e-mail: mvukovic@agr.hr)

²Croatian Centre for Agriculture, Food and Village, Department for Plant Protection, Svetošimunska cesta 25, 10000 Zagreb, Croatia

Abstract

Black elder (*Sambucus nigra* L.) is widespread species which grows on sunny positions throughout whole Europe, Africa (Algeria, Tunisia), Asia (Iran, Iraq, Turkey, Armenia, Azerbaijan, Georgia, Russia) and North America (USA). It is a shrub or a tree that grows up to 8 m high or more and it usually grows in the wilderness. It is one of the most versatile plants since it can be used in many ways, for example as an ornamental plant or as a raw material for the production of food and beverages. Due to the lack of different varieties of black elder it is necessary to conduct a breeding program in order to overcome current problems in the cultivation and to respond to industry and market demands. The main goal of this study was to evaluate three different promising genotypes (“Prigorje”, “Korčula”, “Zagreb”) and to compare them with cv. 'Haschberg'. Studied parameters were: diameter of inflorescences, number of inflorescences per one-year shoot, length of one-year shoots, density of flowering, mass of cluster, mass of the stem, berry/steam mass ratio, mass of 10 berries and total soluble solids. Study was conducted in two years (2014 and 2015). Genotype “Korčula” (11.26 ± 1.5 cm) had significantly smaller inflorescence diameter than genotypes “Prigorje”, “Zagreb” and standard variety 'Haschberg' (16.81 ± 2.38, 18.05 ± 2.39, 17.5 ± 2.23 cm, respectively). Genotype “Korčula” (0.09 ± 0.03 flowers/cm²) had significantly smaller flowering density than genotypes “Prigorje”, “Zagreb” and standard variety 'Haschberg' (0.15 ± 0.07, 0.15 ± 0.04, 0.16 ± 0.04 flowers/cm², respectively). Genotype “Korčula” (26.84 ± 11.87 g) had significantly smaller cluster mass than genotypes “Prigorje”, “Zagreb” and standard variety 'Haschberg' (54.07 ± 22.09, 56.24 ± 22.76, 67.29 ± 24.56 g, respectively). Genotype “Zagreb” (89.51 ± 3.49 %) had significantly smaller berry/steam mass ratio than genotypes “Korčula”, “Prigorje” and standard variety 'Haschberg' (92.29 ± 1.68, 91.7 ± 2.09, 92.24 ± 2.48 %, respectively). Standard variety 'Haschberg' (1.35 ± 0.2 g) had significantly higher mass of 10 berries than genotype “Zagreb” (1.15 ± 0.17 g). For this parameter no significant difference was showed between standard variety 'Haschberg' and genotypes “Korčula” and “Prigorje” on the one hand, and on the other hand between genotype “Zagreb” and genotypes “Prigorje” and “Korčula”. 'Haschberg'. There was no significant difference in length of one-year shoot and SSC among studied genotypes and standard variety.

Key words: *Sambucus nigra* L., black elder, elderberry, berry, fruit quality

Rootstock effect on growth, production and fruit quality of fruit trees: Review

Marko Vuković*, Goran Fruk, Tomislav Jemrić

University of Zagreb, Faculty of Agriculture, Department of Pomology, 10000, Zagreb, Croatia,
(e-mail: mvukovic@agr.hr)

Abstract

Rootstock selection is one of the most important factors for successful fruit production. Its use enables adaptation of fruit trees to climatic, soil and technological conditions in which otherwise they can not be grown. Rootstock can effect scion in various ways such as: its adaptability to climatic conditions, resistance and tolerance to diseases and pests, vegetative growth, yield, size and weight of fruits, coloring of fruits, chemical compositions of fruits, fruit ripening time, postharvest loss of fruit weight. Rootstock effect on fruit quality should not be overlooked, and this aspect has been receiving more attention in recent studies. The goal of this paper is to review recent studies, systematize results, give practical recommendations and suggest future research on rootstock use in fruit production.

Key words: rootstock, vigor, adaptability, quality, fruit

The usage of mulch foils in Horticulture

Petra Škrlec*, Boris Duralija

University of Zagreb, Faculty of Agriculture, Department of Pomology, Svetošimunska cesta 25, 10 000 Zagreb, Croatia (e-mail: pskrlec@gmail.com)

Abstract

The aim of this paper is to present the mulch foils in horticulture, and their effect on the growth and productivity of horticultural species on the basis of previous studies. Mulch films are composed of linear low density polyethylene molecules which are used as direct soil covers. This article shows the effect of mulch foils through influence on abiotic and biotic factors of growth and fertility. Abiotic factors that were observed are the effect on soil temperature, soil moisture content and the adoption of nutrients. Biotic factors there were watched are the effect on pathogens and pests and impact on weed growth control. It was concluded that mulch foils can contribute to increased moisture content in the soil and prevent its evaporation. Mulch foils can favorably affect the increase in soil temperature. They represent a barrier and thus prevent the harmful effects of pests and pathogens. There was no apparent positive impact on the adoption of nutrients in all observed species. The usage of mulch foils has a positive effect on prevention of weed growth and it could be considered as a substitute to herbicides in horticultural production. Above facts have impact on growth and yield and are important factors in yield increase. Some vegetable crops recorded yield increase 50% higher than usual values, while in some fruit species this percentage ranges up to 110%. It was concluded that biodegradable mulch foils can replace the application of PE foils and thereby relieve or solve a disposal problem and harmful environmental effect of PE foils.

Key words: abiotic factors, biodegradable mulch foils, biotic factors, horticulture, PE foils

SECTION 2

SUSTAINABLE POST-HARVEST TECHNOLOGY

Woolliness development during peach and nectarine storage and pectins

Goran Fruk*, Tomislav Jemrić, Martina Skendrović Babojelić

University of Zagreb Faculty of Agriculture, Department of Pomology, Svetošimunska cesta 25, HR – 10 000 Zagreb, Croatia (e-mail: gfruk@agr.hr)

Abstract

Great problem during peach and nectarine cold storage are chilling injuries, which includes internal flesh deterioration such as woolliness, mealiness, leatheriness, flesh browning, internal reddening, and flesh or pit cavities. Woolliness manifests as a lack of juiciness and a dry ‘woolly’ texture of the fruit flesh. Its occurrence is correlated with pectin metabolism and is controlled directly or indirectly by the pectolytic enzymes (i.e., polygalactouronase, pectin esterase, cellulase, lipoxygenase). Changes in the fruit physiology and cell anatomy are also consequences of chilling injuries in these fruit. Post-harvest treatments, such as heat treatments (which must be carried out carefully), calcium, ethylene (blocking or producing), nitrogen monoxide, or a controlled atmosphere can reduce woolliness development in peaches and nectarines. The role of pectin metabolism, temperature and postharvest treatments on occurrence of woolliness is discussed. The role of some enzymes, such as pectin esterase, and postharvest treatment with 1-MCP still remain unclear and further research is needed to elucidate physiological mechanisms that lead to development of woolliness.

Key words: peach and nectarine, ethylene, chilling injury, pectin, cell anatomy, temperature

Influence of UV light emitting diodes on colour development and antioxidant potential of apple peel

Doris Kokalj^{1*}, Grega Bizjak², Janez Hribar¹, Blaž Cigić¹, Emil Zlatič¹, Rajko Vidrih¹

¹Food Science and Technology, Biotechnical faculty, University of Ljubljana, Jamnikarjeva 101, 1000 Ljubljana, Slovenia (e-mail: doriskokalj@gmail.com)

²Faculty of Electrical engineering, Tržaška cesta 25, 1000 Ljubljana, Slovenia

Abstract

Light has influence on a variety of biological processes and can act as stressor for plants. Photo stress can evoke antioxidant defence system and consequently induce the synthesis of phytochemical compounds. The purpose of research was to investigate the influence of UV light on surface colour and selected bioactive compounds in apple peel. The LEDs were positioned *ca.* 13 cm from the fruit surfaces and the average irradiance on the fruit surface was 4,6 microW/cm². Four fruits of two cultivars (three 'Elstar', one 'Jonagold') were included in the experiment. Half of non coloured (green) part of each fruit was shaded with aluminium foil in order to compare irradiated and non-irradiated parts of apple peels. Apples were then stored at + 8.5 °C for 13 days under constant lightning of UV light emitting diodes with wavelength of 310 nm. The studied parameters include determination of antioxidant potential, ascorbic acid content and total phenolic content. These analyses were carried out after 13 days of storage. Beside bioactive compounds colour parameters (L*, a*, b*) were also investigated. Measurements of colour parameters were performed on the marked points before and after 7, 10 and 13 days of irradiation. Irradiated fruits started to develop red colour. Peel exposed to UV light irradiation had significantly more total phenols and higher antioxidant potential as compared to shaded peel. On the other hand, ascorbic acid content showed mixed results. Tendency of higher ascorbic acid content is observed on irradiated part of fruit.

Key words: AOP; ascorbic acid; phenolic content; UV irradiation

Use of biocontrol agents and essential oils for postharvest disease control

Davide Spadaro^{1,2*}, Karin Santoro¹, Maria Lodovica Gullino^{1,2}

¹Dipartimento di Scienze Agrarie, Forestali e Alimentari DISAFA - Università di Torino - Grugliasco (TO) – ITALY (e-mail: davide.spadaro@unito.it)

²Centro di Competenza per l’Innovazione in campo agro-ambientale (AGROINNOVA) - Università di Torino - Grugliasco (TO) – ITALY

Abstract

Many strategies have been developed to control postharvest decays on pome and stone fruit. They include good storage practice and good hygienic practice. Biological control using antagonists has emerged as one of the most promising strategies. Many biocontrol mechanisms have been suggested to operate on fruit including competition, biofilm formation, production of diffusible and volatile antibiotics, parasitism, induction of host resistance. Also essential oils (EOs) show great interest for their potential use to control postharvest pathogens of pome and stone fruit. Most essential oils have been studied for their efficacy *in vitro* but only few of them have been investigated *in vivo*. EOs have a large spectrum of action, thus they can be used to control postharvest pathogens. The mechanism of action of the essential oils has not been fully explained yet, but their efficacy in the control of fungal pathogens is often due to the synergy of different chemical components. EOs can be applied by spraying or dipping on the fruit surface or through fumigation. Main drawbacks in the use of essential oils are represented by application costs and intense aroma that can modify organoleptic characteristic of food products. None of these methods used alone provided satisfactory levels of decay control, although some of them were useful when applied in combination, resulting in additive or even synergistic levels of decay control, in an integrated vision of disease management.

Key words: antagonists, biological control, botanicals, integrated disease management, postharvest rots.

Effect of fumigation with essential oils on postharvest quality and health of stone fruit

Karin Santoro^{1*}, Marco Maghenzani¹, Valentina Chiabrando¹, Giovanna Giacalone¹, Maria Lodovica Gullino^{1,2}, Angelo Garibaldi², Davide Spadaro^{1,2}

¹Dipartimento di Scienze Agrarie, Forestali e Alimentari DISAFA - Università di Torino - Grugliasco (TO) – ITALY (e-mail: karin.santoro@unito.it)

²Centro di Competenza per l'Innovazione in campo agro-ambientale (AGROINNOVA) - Università di Torino - Grugliasco (TO) - ITALY

Abstract

Nowadays international policy and consumer attention are focusing on environmental-friendly production practices. Essential oils are considered a powerful tool to control biotic postharvest disease on fruit. They are composed by several molecules with strong antimicrobial and fungicidal activities, which can be used to preserve fruit quality and reduce waste. The use of essential oils is well accepted by consumer and they can be applied during fruit storage, while synthetic pesticides are banned. Here we performed biofumigation on cherries and peaches with *Thymus vulgaris* and *Satureja montana* essential oils. During the assay, we examined the effect of biofumigation on rot development and fruit quality. Fruits were stored in refrigerated conditions and periodically controlled to evaluate mold incidence and to analyze colour, firmness, acidity and soluble solids content. After storage, fruits were maintained at 23°C in order to test fruit behavior during shelf-life. Results are encouraging and show a high efficacy of essential oils in reducing post-harvest rots on both peaches and cherries. The implementation of essential oil adoption through biofumigation avoids the direct contact with the fruit, preventing possible phytotoxic reactions. The evaluation of quality parameters does not indicate any negative effect due to the treatment.

Key words: natural fungicides, *Thymus vulgaris*, *Satureja montana*, nectarine, cherry

Postharvest application of lecithin to prolong the goji berry (*Lycium barbarum* L.) storage life

Mushtaque Ahmed Jatoi^{1,2*}, Josip Buhin¹, Mladen Fruk¹, Goran Fruk¹, Marko Vuković¹, Tomislav Jemrić¹

¹University of Zagreb, Faculty of Agriculture, Department of Pomology, 10000, Zagreb, Croatia

²Shah Abdul Latif University, Date Palm Research Institute, 66020, Khairpur, Pakistan
(e-mail: mushtaq.jatoui@salu.edu.pk)

Abstract

Goji berries are rich in bioactive compounds usually consumed in dried form or as a juice because of no available method to prolong its storage life. The application of lecithin with 3 dosages (1, 5 and 10 g·L⁻¹) with two storage time durations (8 and 16 days) to improve the fruit quality and storage life is completely a new approach employed in current study. The storage time was appeared as highly significant in terms of total weight loss%, total decaying%, SSC, TA as malic acid and SSC/TA. However, there was no significant levels for weight loss% among means, where 5 g·L⁻¹ lecithin appeared with lowest weight loss % in 8 (3.30%) and 16 (8.23%) days of storage. Surprisingly, all treatments of lecithin reduced the total decay, and 1g·L⁻¹ of Lecithin appeared with lowest total decaying% with 4.34% as compared to control (8.08%). Whereas, exceeding storage time to 16 days all treatments were proven non-significant in reducing the decaying%. The highest but not significant SSC ratio was recorded using lecithin 10 g/l (18.57) in 8 days and 5 g·L⁻¹ Lecithin (19.20) in 16 days of storage. Similarly, there was not much difference recorded among means of treatments in terms of TA as mallic acid. Whereas, lecithin showed significant differences regarding SSC/TA ratio with lecithin applied at 10 g·L⁻¹ (18.36) in 8 days and control (16.96) in 16 days of storage. The concentration and storage time was proven as influential factors appeared with significant different levels in terms of Lightness, a, b and Hue angle except Chroma.

Key words: Lecithin, Goji berries, decay, post-harvest storage, weight loss, color index

I_{AD} index as a possible tool for apricots optimal harvest time prediction

Nenad Magazin*, Zoran Keserović, Biserka Milić, Marko Dorić

University of Novi Sad, Faculty of Agriculture, Trg Dositeja Obradovića 8, 21000 Novi Sad, Serbia
(e-mail: nmagazin@polj.uns.ac.rs)

Abstract

Apricot harvest is usually done on the basis of visual assessments of fruit colour what is subjective and unreliable method. A delayed harvest often leads to losses in the retail chain as apricots undergo rapid ripening and soften quickly if harvested after reaching maturity. On the other hand, fruits picked too early can better withstand handling but often without reaching desired organoleptic characteristics. The trial was set up at the Experimental station for fruitgrowing, Rimski Sančevi, University of Novi Sad. Selected fruits from three trees of two apricot cultivars, NS-4 and NS-6, were monitored close to the harvest with DA-meter which gives an index of absorbance (I_{AD}) of chlorophyll. This measurement gives an indication of the ripeness state. All fruits from selected trees were harvested at subjectively estimated harvest time and were sorted in 5 categories according to I_{AD} index values. The 5 kg samples of each category were pre-cooled and stored in MAP bags for 18 days at 2 °C and 2 days at 21 °C. Along with I_{AD} index, assessments of firmness, total soluble solids and titratable acidity were done before and after storage. Additionally, fruits were sorted after harvest into two groups: marketable and unmarketable. The results show significant differences in percentage of marketable fruits depending on I_{AD} index, along with differences in other quality attributes. Fruits of both cultivars with I_{AD} index over 0.41 prove to be most suitable for medium term storage.

Key words: *Prunus armeniaca*, quality, firmness, storage

“Fresh cut” fruits and vegetables in Croatia

Branka Levaj*, Predrag Putnik, Danijela Bursać Kovačević, Korina Herceg, Božidar Matijević, Robert Piskač, Maja Repajić, Verica Dragović-Uzelac, Sanja Lončarić, Zoran Zorić, Sandra Pedisić, Ivona Elez Garofulić, Damir Ježek, Jasna Mrvčić, Lucija Hlupić, Mateja Kobešćak

Faculty of Food Technology and Biotechnology, Pierottijeva 6, 10000 Zagreb (e-mail: blevaj@pbf.hr)

Abstract

“Fresh cut” (FC) fruits and vegetables (F&V) are products obtained by washing, peeling and cutting if necessary, packaging in modified atmosphere (MA) and keeping at low temperature but above freezing point, tissue is still alive and its freshness expressed. Their advantage in comparison to „ordinary“ F&V is convenience but disadvantage is very short shelf life. Due to high FC perishability, hygiene in whole production chain and low temperature have a key role to maintain quality and to ensure safe products at least 4 - 7 days what is required in retail. Latterly in Croatia such products, mostly various types of lettuce, have become more popular due to their convenience but there are several limiting factors for wider use. Appearance, as a consumers' primary criterion of FC acceptance, and safety is extremely dependant on cold chain what in some cases could be a problem to maintain. At FFTB project “Vending machine for dispensing minimally processed F&V stored in a MA”, funded by BICRO, was implemented with aim to improve conditions of keeping FC products in food services. Prototype of a vending machine for taking out from chamber certain portion of FC F&V without changing controlled atmosphere and temperature inside the chamber was constructed and successfully tested with FC apples. Further, market analysis were done and results indicate consumers' concern for safety of FC F&V on the Croatian market nowadays but also growing interest for their better offer and availability.

Key words: fresh cut fruit and vegetables, apples, Croatian market, consumers, vending machine

Relationship between rootstock, soil disinfection and plant density on pre and postharvest grafted watermelon quality (*Citrullus lanatus*)

Merav Zaaroor¹, Sharon Alkalai-Tuvia¹, Daniel Chalupowicz¹, Yohanan Zutahy¹, Marina Beniches² and Abraham Gamliel², Elazar Fallik^{1*}

¹Department of Postharvest Science of Fresh Produce and

²Department of Growing, Production and Environmental Engineering, Agricultural Research Organization – The Volcani Center, Bet Dagan 50250, Israel (e-mail: efallik@volcani.agri.gov.il)

Abstract

Grafting of vegetable seedlings is a unique horticultural technology, which was adapted from perennial crops. The major advantages of grafting include high tolerance to soil-borne pathogens and nematodes, and increased yield. However, rootstock/scion combinations may affect and alter the final size, yield, and quality of fruits of grafted plants, both immediately postharvest and during prolonged storage. We evaluated the effect of two rootstocks (TZ148 and Nurit [commercial *Cucurbita* spp. hybrids]) grafted on one scion (seedless watermelon cv. 1262) in two plant densities (2500 and 5000 plant/ha), on plant viability, number of marketable fruit (fruit weight above 5 kg) and fruit quality after one week storage at 20°C, in non- or disinfected soil. Soil disinfection significantly improved the viability of non-grafted plants. All grafted plants had significantly better vine vigor, with no symptoms of wilt or vine decline in either disinfected or nontreated soil, regardless of rootstock. Plant density did not affect plant viability. The number of marketable watermelon fruit per plant was 75 to 700% higher in grafted plants than in non-grafted. Grafting on Nurit produced significantly more marketable fruit than grafting on TZ148. The quality of fruit harvested from grafted plants was significantly better than non-grafted fruit in both plant densities and soils. Watermelons harvested from Nurit-grafted plants had significantly better taste and texture at high plant density compared to control and TZ148-grafted fruit.

Key words: grafting, watermelon, fruit quality, storage

Strategy to reduce losses and maintain quality of root vegetables during prolonged cold storage

Zoran. S. Ilić^{1*}, Ljubomir Šunić¹, Jasna Mastilović², Žarko Kevrešan²

¹Faculty of Agriculture, Priština-Lešak, 38219 Lešak, Serbia (e-mail: zoran.ilic63@gmail.com)

²Institute of Food Technology, University of Novi Sad, Novi Sad, Serbia

Abstract

Root vegetables are generally storage organs which should gain them an important part in the human diet, they are relatively cheap and can be locally produced and stored for a long time. The objective of this study was to develop postharvest techniques and technology of the most important root vegetables: carrots, celery and parsnip. Investigations included the effect of harvest maturity (harvest at November or January) and postharvest washing treatments (hot water, H₂O₂ and NaOCl and non-washed-control), of carrots (*Daucus carota* 'Bolero F₁'), celeriac (*Apium graveolens* var. *rapaceum* 'Mentor') and parsnip (*Pastinaca sativa* 'Banatski dugi') roots and effects on the quantitative and qualitative changes during different storage conditions (S-1; 0°C and 98% RH or S-2; 0-5°C and 85-92% RH). Water loss (WL) and quality changes in these vegetables roots were monitored after 120 and 180 days of storage period (SP).

At the end of SP the percentage of WL ranged from 3.20% (from first harvest inside the S-1 with H₂O₂ treatment) in carrot to 39.29% (from first harvest inside the S-2 in control) in celeriac root. The dry matter (DM) values of carrot roots varied from year and harvest time (9.57 -12.22%) and increase during storage period. DM in celeriac (10.60-12.40%) increased gradually during cold storage up to 49.41% (in S-2 at first harvest with NaOCl treatment). DM in parsnip roots varied from year and harvest time (21.36-23.83%). The DM content increased gradually during cold storage up to 33.3% (in S-2 with hot water treatment).

Total sugar content (TSC) in the roots of carrots was from 5.78% to 5.83%. The content of reducing sugars was 2.48% to 2.99%. Non-reducing sugar content in the roots of carrots was 3.30% to 2.88%, from the first and the second harvest, respectively. Sucrose content was 3.21% to 2.79%. The sucrose content increases during storage, depending on storage conditions for 8.4 to 57.7%.

TSC in celeriac depends on year and harvest time was 1.74-3.03%. During SP, total sugar content increased more in S-2 cooling room. Sucrose is the predominant sugar in celeriac roots (1.67-2.67%). Content of glucose (0.05-0.15%) and fructose (0.03-0.09%) is much smaller. Depend on storage condition and postharvest treatment, glucose and fructose concentrations also increased significantly during SP but to a much lower level than sucrose.

TSC in parsnip is highly dependent on year and harvest time (9.57-10.69%). During storage, sugar content increased more in S-2 cooling room. Reducing sugar to non-reducing sugar (R/NR) ratio was from 1:10 to 1:19 and showed an increasing trend during SP. Starch concentrations (4.50-5.43% at harvest time) during first month in cold storage declined of their initial level. The total conversion of starch into sucrose occurs after the second month of storage and starch level almost completely depleted (0.04%). Accumulation of sucrose may raise the culinary quality of stored parsnip.

The most effective method of maintaining quality of root vegetables is optimal harvest time followed by prestorage washing treatments (H₂O₂ or NaOCl) and storage at optimum temperature (0 °C) with a high relative humidity 95-98%.

Key words: root vegetables, harvest time, postharvest treatment, storage condition, quality

Development and quality analysis of diet guava squash

Muhammad Tayyab Rashid^{1,2}, Malik Muhammad Hashim^{1*}, Ma Haile

¹Department of Food Science and Technology, Gomal University, D.I.Khan, Pakistan
(email: mhmalick@gmail.com)

²School of Food Science and Biological Engineering, Jiangsu University, Zhenjiang, China

Abstract

Consumption of sugary drinks is linked with obesity, poor health, poor diet, and tooth decay. A study was conducted to evaluate the guava squash prepared from two different non-nutritive sweetener saccharin and sucralose during storage. The squash was filled in sterilized plastic bottles, and stored at room temperature (~35° C) for 90 days. The ascorbic acid content, acidity, pH, total soluble solids (TSS) and organoleptic evaluation were carried out after every 15 days of storage interval. Internal comparison of the samples showed significant differences for all physicochemical parameters. The ascorbic acid content and acidity of the squash decreased, whereas pH and TSS increased during the storage. On the basis of organoleptic evaluation, guava squash prepared from 50% saccharin and 50% sucralose was found to be the most acceptable product by a panel of judges.

Key words: Guava, saccharin, squash, sucralose

Needs and directions for enforcement and integration of fresh produce related research

Jasna S. Mastilović^{1*}, Žarko S. Kevrešan¹, Nenad Magazin², Zoran Keserović², Dario Danojević³, Gordana Ostojić⁴, Stevan Stankovski⁴, Zoran Ilić⁵, Andrea Vuković⁶

¹University of Novi Sad, Institute of Food Technology, Novi Sad, Serbia
(e-mail: jasna.mastilovic@fins.uns.ac.rs)

²University of Novi Sad, Faculty of Agriculture, Novi Sad, Serbia

³Institute of field and vegetable crops, Novi Sad, Serbia

⁴University of Novi Sad, Faculty of technical Sciences, Novi Sad, Serbia

⁵Faculty of Agriculture, Lešak

⁶Economics institute, Belgrade, Serbia

Abstract

The South East Europe (SEE) region is characterized with excellent climatic conditions for production of variety of different fruit and vegetable products. In spite of this fact, international trade balances for fresh produce point out that for the majority of fresh commodities the countries in SEE region are net importers of fresh produce commodities with minor improvements or even deterioration of situation over long term period. Comprehensive, multidisciplinary analysis of present situation in fresh produce supply chains in Serbia was conducted in order to identify existing weaknesses and barriers in the fresh produce supply chain. Obtained findings were contrasted with current state of art in research, extension and education practice in the field of fresh produce technology with the aim to identify the needs and directions for enforcement and integration of research in this field. The proposed model for integration and enforcement of multidisciplinary fresh produce related research will be presented with the overview of activities realized so far in Serbia.

Key words: fresh produce, postharvest technology, cultivars, supply chain, traceability

Cherry tomato quality preservation and black spot reduction with edible composite coatings containing antifungal GRAS salts

Lluís Palou^{1*}, Cristiane Fagundes², Alcilene R. Monteiro², María B. Pérez-Gago¹

¹Centre de Tecnologia Postcollita (CTP), Institut Valencià d'Investigacions Agràries (IVIA), Apartat Oficial, 46113 Montcada, València, Spain (e-mail: palou_llu@gva.es)

²Departamento de Engenharia Química e Engenharia de Alimentos, Universidade Federal de Santa Catarina, Campus Universitário-Trindade, Florianópolis, SC, Brazil

Abstract

GRAS (generally regarded as safe) salts were preliminary selected in *in vitro* tests against *Alternaria alternata*, the causal agent of tomato postharvest black spot, and added at 2% wet basis (wb) to emulsion matrixes prepared with hydroxypropyl methylcellulose (HPMC) and glycerol (ratio 3:1 dry basis, db), beeswax (BW) and oleic acid (ratio 5:1 db), and tween 80 (1.5% wb). The final emulsion solid concentration was modified to 7-10% wb in order to obtain formulations with a viscosity range of 100-150 cp. Selected stable coatings were tested *in vivo* against black spot on cherry tomatoes cv. Josefina artificially inoculated with *A. alternata* 24 h before coating (curative activity) and incubated at 20°C for 6 days. Among these edible coatings, the most effective were those containing sodium benzoate (SB), sodium methylparaben (SMP) and sodium ethylparaben (SEP), and they were further tested *in vivo* on inoculated fruit stored at 5°C for up to 21 days. The antifungal activity of the coatings was fungistatic rather than fungicidal. Additionally, weight loss, respiration, peel color and firmness, soluble solid concentration, titratable acidity, and volatile accumulation were determined on non-inoculated tomatoes coated and stored at 5°C for up to 15 days plus 5 days of shelf life at 20°C. Overall, the HPMC-BW coating formulated with SB was selected as the most promising edible coating for cherry tomato postharvest preservation and black spot control.

Key words: *Solanum lycopersicum* L., postharvest diseases, antifungal edible coatings, fruit quality

Postharvest pathogens of apple fruit in Serbia

Nataša Duduk*, Miljan Vasić, Aleksandra Žebeljan, Rade Radojević, Ivana Vico

University of Belgrade Faculty of Agriculture, Nemanjina 6, 11080 Belgrade, Serbia
(e-mail: natasadukic@yahoo.com)

Abstract

During a research study conducted from 2010 to 2015 in Serbian storage facilities and local markets postharvest apple fruit pathogens belonging to genera *Penicillium*, *Botrytis*, *Monilinia*, *Alternaria*, *Stemphylium*, *Colletotrichum*, *Fusarium*, *Botryosphaeria* and *Neofabraea* were determined based on morphological characteristics. Further identification of *Monilinia* spp. causal agents of brown rot, *Penicillium* spp. causing blue mold, *Botryosphaeria* sp. causing white rot and *Neofabraea* sp. causing bull's eye rot was based on morphological (colony patterns and growth on different media, presence of reproductive organs, stromata formation, morphology of conidiophores and conidia and conidial size) and molecular features (species specific PCR products and sequences of ITS1-5.8S-ITS2 rDNA and β -tubulin gene region). Among brown rot fungi, *M. fructigena* was prevalent on apple fruit, while *Monilia polystroma* and *M. fructicola* were recorded for the first time in Serbia in 2011. *M. laxa* was also present on stored apple fruit. Comparative study of *M. fructigena* and *M. polystroma* morphological features, RFLP analysis of ITS rDNA region, pathogenicity and histopathology on apple fruit was performed. The main blue mold fungus was *P. expansum* and in 2013 *P. crustosum* was described for the first time on apple fruit in Serbia. Morphological and virulence study on cv. Idared has shown that *P. expansum* isolates from decayed apple fruit exhibit morphological variability on artificial media and have different virulence potential. *B. dothidea* was reported for the first time as causal agent of white rot of apple fruit cv. Idared in Serbia in 2010 and in 2015 white rot was present more frequently on apple fruit cv. Golden Delicious. In 2015 *N. alba* was identified as the causal agent of bull's eye rot on apple fruit collected from a Serbian market.

Key words: brown rot, blue mold, white rot, bull's eye rot, storage, identification

Postharvest properties some of plum (*Prunus domestica* L.) and apricot (*Prunus armeniaca* L.) varieties

Žarko S. Kevrešan¹, Jasna S. Mastilović^{1*}, Alena Tomšik¹, Miona Belović¹, Nenad Magazin², Zoran Keserović²

¹University of Novi Sad, Institute of Food Technology, Novi Sad, Serbia
(e-mail: jasna.mastilovic@fins.uns.ac.rs)

²University of Novi Sad, Faculty of Agriculture, Novi Sad, Serbia

Abstract

Balkan is characterized with convenient conditions for stone fruits product. The areas under the stone fruits orchards are expanding and export of fresh stone fruits is increasing. However, the knowledge about postharvest properties of stone fruit varieties spread in production in the Balkan region is unavailable or incomplete. In present research postharvest properties of plum (Čačanska Rodna, Top Taste, Jojo, Presenta) and apricot (NS rodna, NS kasnocvetna, NS 4, NS 6, SK 1 and SK 3) varieties grown in Balkans were tested. Fruits were harvested in full maturity ripening stage (DA<0.8) in the orchards of Department for fruit and horticulture of Faculty of Agriculture in Novi Sad. The same pre-harvest production technology was applied for all tested plum and apricot varieties. Fruits were stored under controlled recommended conditions (T=0°C±1, RH>80%) for 4 weeks. Weight loss and changes in total soluble solids, pH, color (L*a*b*) and texture during storage were compared among analyzed varieties. After storage, properties of fruits during shelf life at 24°C were tested. Ethylene production, respiration rate, color and texture properties changes and sensorial acceptability were compared for tested varieties. Based on obtained results advantages and challenges in respect to prolonged storage of tested varieties were emphasized.

Key words: plum, apricot, varieties, cooling, postharvest properties

Effect of hot water dip duration on heating and cooling rate of apple cv. 'Idared'

Josipa Mikulić*, Goran Fruk, Marko Vuković, Josip Buhin, Mladen Fruk, Tomislav Jemrić

¹University of Zagreb, Faculty of Agriculture, Department of Pomology, 10000, Zagreb, Croatia
(e-mail: mikulicka123@hotmail.com)

Abstract

Thermography is a non-contact method for measurement of temperature and its distribution on the objects surface. Infrared thermography measures radiation of object surface in specific area of the infrared spectrum. Hot water dips (HWD's) are used for maintenance of postharvest fruit quality as well as control of decay. Beside these beneficial effects, they can cause heat damage. This study was conducted on apple cv 'Idared' treated with three HWD's: 50° C 2 min, 50° C 4 min and 50° C 6 min and stored for 4 months at 0 ° C and kept at room temperature for 7 days. Infrared thermography measurements were performed after HWD's at one minute intervals till 12 min after the treatment. Significant differences between treatments were recorded in fruit maximal and minimal temperatures. Fruit from HWD at 50° C for 6 min had the highest temperature, followed by fruit from HWD's at 50° C for 4 and 2 min. Maximal temperatures among all three HWD's were significantly different till 6th minute after treatment, then again in 10th and 11th minute of fruit cooling. Heat damage occurred only in fruit treated with HWD at 50° C for 6 min.

Key words: apple, fruit quality, thermography, temperature damage

Impact of sweet cherry varieties on quality parameters during storage period

Vladimir Sabadoš*, Jana Konjević Mrdenović, Olivera Sekulić, Zoran Boca

PSS “Sombor” doo, Staparski put 35, Sombor 25000, Serbia (e-mail: agroso@mts.rs)

Abstract

Sweet cherry is on the 6th place in the world of all fruit species production and 44% of total production is based in Europe. Sweet cherry fruits are among earliest fruit on the market on which they achieve relative high price. That is one of the reasons this species is in increase trend production in Vojvodina. Extension service Sombor (PSS Sombor) has set the trial orchard with three varieties of sweet cherry – Kordia, Ferrovia and Regina, on rootstock Gisela 5.

The study included evaluation of the quality parameters and sensory characteristics of the fruits with the aim of a longer preservation of the quality that would guarantee a successful placement in the market. Quality parameters which were studied are sugar content, soluble solids content, loss of weight and the visual evaluation of fruit before storing, as well as after the storage period. In addition to this are described pomological characteristics of fruits of all three varieties after harvest. Results of two- year testing have shown differences between quality parameters of varieties after 7, 14 and 20 days of storage. The aim of the two-year research, planed to continue in the future, is monitoring and collecting quality parameters in Postharvest which will help agricultural producers engaged in the production and marketing of sweet cherries in the selection of varieties and to preserve highest fruit quality.

Key words: sweet cherry, variety, quality, storage

Polyphenols variation and gene expression in strawberry fruits during ripening and upon pathogen infection

Ellaine Grace Nagpala¹, Michela Guidarelli¹, Mattia Gasperotti², Domenico Masuero², Paolo Bertolini¹, Urska Vrhovsek², Elena Baraldi^{1*}

¹CRIOF-Department of Agricultural Science (DIPSA), University of Bologna, Viale G. Fanin 46, 40127, Bologna, Italy (e-mail: elena.baraldi@unibo.it)

²Research and Innovation Centre, Foundation Edmund Mach (FEM), Via E. Mach, 38010, San Michele all' Adige, Trento, Italy

Abstract

Phenolic compounds play important role in strawberry (*Fragaria x ananassa*) for the fruit ontogenic tolerance to fungi. Only red ripe stages are susceptible to infection of the two major strawberry fungal pathogens, *Colletotrichum* spp. and *Botrytis cinerea*, since immature fruits are tolerant to diseases. The variation of 47 polyphenols in the surface of unripe and ripe strawberry fruits upon 24 and 48 H of *C. acutatum* and *B. cinerea* infection or mock-inoculation was analysed in this work. Significant alteration in phenolic content was detected only in white infected fruit, with differences specific for each pathogen. Phenylpropanoid, flavonoid and shikimate pathway genes expression showed only in few cases a correlation with the relative metabolite abundance.

Key words: *Fragaria x ananassa*, metabolome analysis, *Botrytis*, *Colletotrichum*, fungal infection, fruit ripening

Storage condition and losses of different types of onion in Republic of Macedonia

Rukie Agic*, Zvezda Bogevska, Gordana Popsimonova, Margarita Davitkovska

Ss. Cyril and Methodius University in Skopje, Faculty of Agricultural Sciences and Food, Blvd. Aleksandar Makedonski bb, 1000 Skopje, Macedonia (e-mail: rukieagic@yahoo.com)

Abstract

Onion is one of the most important vegetable in Republic of Macedonia. It is mainly grown in the region of Polog, Pelagonija, Skopsko-Kumanovski and Valandovski-Gevegeliski region. The storage of onion is in uncontrolled condition.

In this study is given long time research of the way of storage, condition and losses during storage of different types of onion.

During storage of different types of onion in warehouses the losses were from 30,79% to 68,97 % in pungent types while in sweet types the losses were higher from 50,15% to 83,37%. Another research was done on losses during storage of semi-pungent types of onion. The total losses were from 60,12% until 93,86 %. The usage of retardants can avoid losses (especially sprouting) during storage thus the experiment was done with sweet onion type `gostivarska arshlama`. The losses were 20% with usage of retardant and 40% without usage of retardant. Resent research was done with sweet type of onion `buchinska arshlama` which was stored on traditional way and in cold room. The total losses were 72,82 and 27,3% respectively.

In our country with appropriate selection of onion type and growing period onion can be successfully stored in traditional way. Prolong storage which will cover the marketing gap in cold rooms is necessary.

Key words: onion types, storage, losses

Fruit grading water easily purified with active carbon filter

Olowofola Sikiru*

Federal University of Technology, PMB 1526, Owerri, 234083 IMO State, NIGERIA
(e-mail: olowofola@yahoo.com.au)

Abstract

Fruit grading water so clean that it may be discharged into the sewage system. This is possible with the system developed by Applied Plant Research (PPO). Legal recognition is the next step.

It is a recurring problem: during the grading period a fruit grower needs to dispose of some 5 to 10 cubic metres of grading water each week. Discharging into the sewage system or into a ditch is no option because the water is too polluted with pesticides residues from the fruits. Discharging into the orchard is possible but this results in the orchard getting too wet. Filter installation cleans the water. The scientists of PPO have developed a simple method suitable for use by any fruit grader. The installation consists of a plate separator, an ozone installation and an active carbon filter. The plate separator removes the largest possible part of the sludge and organic matter from the water. This is followed by decomposition of the crop protection products in the ozone installation. Purification in the ozone units happens in separate flows. The fruit does not get into direct contact with the ozone water. During the grading period the plate separator and the ozone installation are running continuously. The carbon filter is only used during final discharge and removes the last residues of the crop protection products from the grading water.

The end of the grading tray is fitted with a unit through which the grading water is passing continuously. This is an active carbon filter that filters all organic matter, such as slurry, from the water. And dissolved pesticides and organic matter disappear by oxidation in the ozone installation.

With this method the fruit grader only needs to replace the grading water once every 4 to 8 weeks. And this water is so clean that it could be discharged into the sewage system.

The active carbon filter itself needs to be replaced about once every two years.

Key words: water quality, fruit postharvest management, ozone, water purification

SECTION 3

IPM IN SUSTAINABLE FRUIT PRODUCTION

***Halyomorpha halys*, a new threat to crops in Europe: distribution, damage and control perspectives**

Rosemarie Tedeschi*, Marco G. Pansa, Luciana Tavella

Dipartimento di Scienze Agrarie, Forestali e Alimentari (DISAFA) - ULF Entomologia Generale e Applicata, University of Torino, largo P. Braccini 2, 10095 Grugliasco (TO), Italy
(e-mail: rosemarie.tedeschi@unito.it)

Abstract

The brown marmorated stink bug, *Halyomorpha halys* (Stål) (Heteroptera: Pentatomidae), is a pest native to eastern Asia, which was recently introduced into North America and Europe. It is a highly polyphagous insect able to feed and develop on a wide variety of plants, including many economically important crops, in particular fruit trees and woody ornamentals, but also field crops. Damage is caused by nymphs and adults feeding on leaves, fruits and seeds. In addition, *H. halys* can act as a nuisance pest in urban landscapes because it aggregates in residential buildings seeking overwintering sites. In North America, it has become a major agricultural pest especially in peach and apple orchards since 2010. In Europe, *H. halys* has been reported since 2004, but it was primarily considered as an urban and household pest. Only recently, it became worrisome due to economic damage recorded on pepper in Switzerland and on pome and stone fruits in North Italy. Integrated pest management (IPM) strategies for *H. halys* that combine various control measures have been currently investigated. The chemical control is not always feasible, and the most effective insecticides are broad-spectrum vanifying the IPM programmes largely adopted. Diverse native generalist egg parasitoids (Scelionidae and Eupelmidae) are able to attack the exotic *H. halys*, but their actual effectiveness must be still assessed. European pest risk potential and recent trends in *H. halys* research are described.

Key words: brown marmorated stink bug, emerging pest, fruit trees, egg parasitoids.

Monitoring and fruit protection of codling moth in integrated apple production

Vesna Tomaš^{1*}, Mirjana Brmež², Krunoslav Dugalić¹, Ines Mihaljević¹, Marija Viljevac Vuletić¹, Domagoj Šimić¹, Božena Barić³

¹Agricultural institute Osijek, Južno predgrađe 17, 31000 Osijek, Croatia
(e-mail: vesna.tomas@poljininos.hr)

²Josip Juraj Strossmayer University of Osijek, Faculty of Agriculture, Ulica kralja Petra Svačića 1d, 31000, Osijek, Croatia

³University of Zagreb, Faculty of Agriculture, Department for Agricultural Zoology, Svetošimunska cesta 25, 10000, Zagreb, Croatia

Abstract

Codling moth *Cydia pomonella* L. is one of the most important apple pests whose population is growing from year to year. The aim of this study was to determine the effectiveness of four treatments (1.- based on baculovirus CpGV 2.- based on deltamethrin, beta cyfluthrin and alpha -cipemetrin (from the group of synthetic pyrethroids), 3.- on the basis of kaolin, 4.- control treatment), applied on the basis of the catch on the pheromones on the three apple varieties (Melrose, Jonagored, and Golden Delicious clone B). The experiment was performed at the Agricultural Institute Osijek. The results of the efficiency according to Abbott (1925) are as follows; the efficacy of treatments 1. (baculovirus) ranged from 78% to 95%, the efficiency of treatment 2. referring to the affect of three preparations from the group of synthetic pyrethroids ranged from 96% - 97%, the efficiency of treatment 3. in which we used ground kaolin clay, ranged between 21.5 to 57%. On the basis of carried out research the control of codling moth in Eastern Croatia we conclude that the decision for controlling could be made on the basis of pheromones monitoring and summarizing effective temperatures as codling moth's life stages depend on climate conditions and vary from year to year. It is very important to make the best choice of preparations and at the same time be sure of their positive effect on the environment and human health.

Key words: *Cydia pomonella* L., effectiveness, CpGV, kaolin

Influence of different netting structures on codling moth and apple fruit damages in northwest Croatia

Ivana Pajač Živković^{1*}, Božena Barić¹, Mladen Fruk², Josip Buhin², Tomislav Jemrić²

¹University of Zagreb, Faculty of Agriculture, Department for Agricultural Zoology, Svetošimunska cesta 25, HR-10000 Zagreb, Croatia (e-mail:ipajac@agr.hr)

²University of Zagreb, Faculty of Agriculture, Department of Pomology, Svetošimunska 25, HR-10000 Zagreb, Croatia

Abstract

During the vegetation season of 2015 three different types of exclusion nets were set up in IPM apple orchard in Krapina (Croatia) to test their effectiveness in preventing the attack of codling moth to apple fruits. Nets the same in mesh size (2.4x4.8 mm) but different in color (white, red, yellow) were set up on three neighbouring apple trees in a single row. To assess the presence of pest, weekly sampling of codling moth on pheromone traps in protected and unprotected (control) net rows was conducted. Single row netting structures resulted in a highly significant reduction of codling moth catches on pheromone traps in comparison to the unprotected rows in the experimental orchard. The percentage of codling moth infested fruits during the harvest time was statistically significant, in the protected net rows in comparison with unprotected rows. The lowest percentage of damaged the fruit was recorded under the red net (0.96%), followed by white net (1.04%) and yellow net (2.86%). Percentage of damaged fruits in unprotected row amounted 11.39%. Considering the fact that all netting structures were not full exclusion nettings (e.g. in some cases it was impossible to hermetically seal the nets) their use has successfully protected the fruits of apples from codling moth attack.

Key words: *Cydia pomonella*, crop protection, anti-hail nets, physical control

Exclusion nets for the control of fruit pests in NW Italy

Valentina Candian*, Marco G. Pansa , Luciana Tavella, Rosemarie Tedeschi

Dipartimento di Scienze Agrarie, Forestali e Alimentari (DISAFA) - ULF Entomologia Generale e Applicata, University of Torino, largo P. Braccini 2, 10095 Grugliasco (TO), Italy
(e-mail: valentina.candian@unito.it)

Abstract

In the last years, many chemical products disappeared from the European market, introducing new challenges for the control of crop pests. In this context, insect exclusion nets represent a promising eco-friendly alternative strategy for plant protection.

In the frame of the LIFE+ SU.SA.FRUIT project (LIFE13 ENV/HR/000580), experimental trials were carried out in NW Italy in order to assess the efficacy of different kinds of net in containing key and emerging insect pests. Three anti-hail photo-selective nets (red, yellow, pearl; mesh 2.4×4.8 mm) and a specific anti-drosophilid net (mesh 0.9×1.0 mm) were tested in an apple and in a peach orchard. In each orchard, three cages per net (containing three plants each) were set up while three sets of plants without any coverage were used as control. The cages were put up at petal fall and removed at the end of the harvest time. The population dynamics of key pests, such as *Cydia pomonella* L. and *Grapholita molesta* (Busck), as well as of new exotic pests, such as *Drosophila suzukii* Matsumura, were assessed inside and outside the cages. At harvest time, a sample of fruits inside and outside the cages were checked for damage by the moths and other pests; moreover, the quality of the production was evaluated. In this report, the preliminary results obtained during the first year of the trials are presented.

Key words: apple, peach, moths, emerging pests.

Integrated postharvest strategy to control the bull's eye rot of 'Cripps Pink' apple

Irene Cameldi¹, Massimiliano Menghini¹, Daria Ventrucci², Gianni Ceredi², Mari Marta^{1*}

¹Criof, DipSA, Univeristy of Bologna, Via Fanin, 46 40127 Bologna, Italy (e-mail: marta.mari@unibo.it)

²Apofruit, Viale della Cooperazione, 400 47522 Pievesestina di Cesena (FC) – Italy

Abstract: Bull's eye rot, caused by several species of *Neofabraea* spp. frequently develops on apple after 3-4 months of storage at 0°C. 'Cripps Pink' apple a late-maturing and long-storing cultivar is highly susceptible to disease. The control of rot is mainly achieved by repeated chemical treatments in the field; however, because of their partial effectiveness other means have to be investigated. The aim of the present work was to develop an integrated control strategy taking into consideration the chemical approach but also sustainable measures to prevent the disease. For this reason 'Cripps Pink' apple were postharvest treated with hot water and/or 1-methylcyclopropene (1-MCP) alone or integrated with the preharvest chemical treatments based on a premixed formulation of pyraclostrobin and boscalid. Fruit were stored at 0°C in normal refrigeration and evaluated for bull's eye rot after 90 days. Results showed as two preharvest treatments (at 14 and 7 days before harvest) reduced the incidence of disease around the 35%. While fruit treated in postharvest only with hot water (45°C for 10 min) or 1-MCP (600 $\mu\text{l l}^{-1}$) revealed a reduction of bull's eye rot incidence of 87% and 80% respectively. The best reduction of disease (-95%) was achieved in fruit preharvest treated with fungicide mixture and postharvest treated with hot water and 1-MCP. These results showed for the first time the possibility to control bull's eye rot with an integrated strategy, however more investigation are needed in order to set up the best conditions for disease management.

Key words: 1-methylcyclopropene, hot water, *Neofabraea* spp., fungicide.

Molecular identification of *Venturia asperata* from atypical scab-like symptoms on apples in Italy

Ceren Turan^{1*}, Massimiliano Menghini¹, Gianni Ceredi², Marta Mari¹, Marina Collina¹

¹DipSA, University of Bologna – Viale G. Fanin, 46, 40127 Bologna, Italy
(e-mail: ceren.turan2@unibo.it)

²Apofruit Italia - Viale della Cooperazione, 400, 47522 Cesena (FC)

Abstract

Similar apple scab symptoms were first observed at the end of July in 2012 in the Northern Italy (Cesena) on fruits of apple cultivar Modì carrying the *Rvi6* major resistance gene to *Venturia inaequalis*. The aim of this work was to identify the causal agent of the atypical scab-like symptoms by molecular techniques. Symptomatic fruits were collected during May in one orchard in 2015. Ten monoconidial isolates were obtained through recovering the conidia from about 10 fruits. Conidial suspension was then streaked on Petri dishes of water agar amended with streptomycin sulfate. After 24 h of incubation at 20°C, single germinated spores were selected under stereomicroscope, then picked up and placed on PDA amended with three antibiotics. The isolates were cultivated at 20°C until molecular characterization together with the reference strain of *Venturia asperata*. Amplification of ITS fragments was carried out for specifically amplify rDNA of *V. asperata*, *V. inaequalis* and *Venturia pirina*. Approximately 4-5 hyphae were removed from each isolate and transferred without DNA extraction to the PCR tube *with the addition of* BSA. DNA amplification was obtained for all isolates by primers specific for *V. asperata*, while no amplification was observed using primers specific for *V. inaequalis* and *V. pirina*. These results point out the presence of *V. asperata* from the atypical scab-like symptoms but further studies are in progress to have a more precise identification of the pathogen.

Key words: “Modì”, ITS fragments, *Venturia inaequalis*, *Venturia pirina*

Use of resistance inducers to control pre and postharvest diseases of grapes and fruit plants

Gianfranco Romanazzi*

Department of Agricultural, Food and Environmental Sciences, Marche Polytechnic University, Via Breccie Bianche, 60131 Ancona, Italy (e-mail: g.romanazzi@univpm.it)

Abstract

Induction of resistance relies in the increase of plant defenses, which makes the tissues more reactive to following biotic and abiotic stress. Plant defenses can be elicited by biotic (microorganisms) or abiotic (physical stress, agronomical practices, application of natural or synthetic compounds) factors. The induction of resistance can be linked to elicitation of different metabolic pathways (SAR, ISR, BABA-ISR). A long list of natural and synthetic compounds is known to have an effect on the host, which can also be coupled with an inhibitory effect on the pathogen. Among these, chitosan and benzothiadiazole (BTH) are well known. Chitosan is produced from chitin partial deacetylation. It is a biopolymer able to produce a film on treated surface, that can have antimicrobial activity, increase host resistance and reduce gas exchanges. Those properties lead to plants with higher resistant to pathogen infections, both in the field (e.g. grapevine downy mildew and gray mold) and after harvest, on different commodities (table grapes, sweet cherries, strawberries). BTH is a light protected analogues of salicylic acid, that is the resistance mediator molecule in SAR. BTH was successful in the protection of sweet cherries and strawberries from postharvest decay, and it also reduced the incidence of Bois noir, the main Phytoplasma disease of grapes in Europe. With Directive 128/2009 on sustainable use of pesticides, in all EU it is mandatory the application of integrated approach in plant protection, and one of the possibilities to reduce the use of chemical fungicides consists in the application of resistance inducers

Key words: grapes, fruits, disease, resistance inducers, chitosan and benzothiadiazole (BTH)

Integrated production of sour cherry (*Prunus cerasus*) in Croatia

Ines Pohajda^{1*}, Katarina Lukšić¹, Ana Vrankulj¹, Slavica Dudaš², Ana Šalinović³

¹Advisory Service, Savska cesta 41, 10000 Zagreb, Croatia (e-mail: ines.pohajda@savjetodavna.hr)

²Polytechnic of Rijeka, Agricultural Department, Carla Huguesa 6, 52440 Poreč, Croatia

³Faculty of Science, Department of Biology, Rooseveltov trg 6., 10000 Zagreb, Croatia

Abstract

The integrated sour cherry production in Croatia was monitored over a three year period. It was found that in the continental Croatia dominates Oblačinska cherry cultivar, followed by Csengőd and Gipsy cultivars, while in Mediterranean are present Maraska cherry clones. Number of producers and production areas varied depending on purchase possibilities of cherries from the integrated production. Most common integrated sour cherry production in the continental Croatia is in Osijek – Baranja County, while in the Mediterranean area is in Zadar County. Results have shown that the majority of cherry producers produce in accordance with prescribed Technical Guidelines for the integrated production. Within the integrated cherry pest management (IPM), control of aphids, was performed by pirimicarb and neonicotinoides. *Rhagoletis cerasi* was controlled by dimethoate. Diseases *Stigmina carpophila* and *Blumeriella jaapii* were commonly controlled by active substances: captan, copper hydroxide – Ca-chloride complex + zinc sulfide and dodine. *Monilinia laxa* was controlled mainly by the: boscalid, cyprodinil and carbendazim, while copper oxide was the most common substance in controlling *Pseudomonas mors-prunorum*. Weed control included total herbicides application: glyphosate and glufosinate. The occurrence of mentioned harmful organisms was expected due to favorable climate conditions characterized by above – average temperatures and variations of extreme precipitation and droughts.

Key words: IPM, sour cherry cultivars, cherry producers

Three-year results of experiment aimed to suppression of gray mold (inducer *Botryotinia fuckeliana*) using software of meteorological station

Gordana Forgić*, Vladimir Sabadoš, Tatjana Veselinović, Jelena Perenčević, Gordana Mrdak

PSS “Sombor” doo, Staparski put 35, Sombor 25000, Serbia (e-mail: agroso@mts.rs)

Abstract

Strawberry is plant species attacked by a large number of disease and pests, one of the most important diseases which significantly affect the yield and fruit quality is *Botryotinia fuckeliana*, inducer gray mold. For its suppression are used fungicides which application in practice is based mainly on developmental stages of strawberries without taking into account the biology of pathogens and weather conditions that influence the occurrence and development of pathogens.

The aim of testing is to check the software that is based on recording the temperature, the length of leaf and which, basis of these data, shows the risk of a possible realization of pathogen infection by *Botryotinia fuckeliana*. Our objective was to determine the optimal time to protect strawberries from gray mold in relation to risk that software provides and phenophase of strawberry and thus reduce the number of treatments.

Key words: *strawberry, disease, risk*

Preharvest application of *Aureobasidium pullulans* to control postharvest decay of ‘Rocha’ pears

Claudia Sánchez^{1,2*}, João Cavalheiro³, Paula Vasilenko¹, Mário Santos¹, Rui Maia de Sousa¹, Maria M. Ferreira-Pinto⁴

¹Instituto Nacional de Investigação Agrária e Veterinária (INIAV), Oeiras, Portugal
(e-mail: claudia.sanchez@iniav.pt).

²GeoBioTec, Faculdade de Ciências e Tecnologia (FCT/UNL), Lisboa, Portugal.

³Biotrend S.A., Biocant Park, Cantanhede, Portugal.

⁴DRAT – Instituto Superior de Agronomia (ISA) /Universidade de Lisboa (ULisboa), Lisbon, Portugal.

Abstract

In pome fruits, fungal diseases are the main responsible for limiting storage period. Biological control using microbial antagonists has proved to be a viable alternative to the use of synthetic fungicides. Since fungal infections often occur in the field, preharvest treatments with biocontrol agents would be advantageous to reduce initial infection and to suppress pathogens development during postharvest storage.

This work reports the use of an *Aureobasidium pullulans* isolated from Rocha pears leaves and fruits. The efficacy of the antagonist was tested in preharvest treatments. In a first up-scaling attempt, trials for *A. pullulans* cultivation were conducted in a 10L bioreactor operated in batch mode under controlled temperature, pH and DO conditions. Five times more biomass in half of the time resulting in a ten-fold increase of productivity was attained, when compared to the former shake-flask cultivations. After suitable dilution (10^8 CFU/mL), the biomass was used for the preharvest treatments. Rocha pear trees were sprayed with the antagonist suspension 1month before harvest. *A. pullulans* population was evaluated 2h after field treatments, at the harvest time and during the storage. The percentage of decayed fruit was evaluated after 3 months of storage at 1°C and 90%RH. Preliminary results showed that the antagonist was able to survive under field conditions and the preharvest application provides a significant level of protection against rots during postharvest storage.

Key words: postharvest rots, biological control, microbial antagonists, fungal pathogens, antagonist formulation

Management and potential impact of *Monilinia fructicola* on peach in Croatia

Tina Fazinić^{1*}, Dario Ivić¹, Zoran Lovrek⁴, Tihomir Miličević³

¹Institute for Plant Protection, CCAFRA, Gorice 68b, Zagreb, Croatia (e-mail: tina.fazinic@hcphs.hr)

²Agra d.o.o., Dr. Ivana Novaka 1, 40 000 Čakovec, Croatia

³University of Zagreb, Department of Plant Pathology, Svetošimunska cesta 25, 10 000 Zagreb, Croatia

Abstract

Monilinia fructicola is considered the most aggressive *Monilinia* species on stone fruits worldwide. Until 2014 it was regulated as a quarantine pathogen in the European Union, but during the last 15 years it became obvious that it has established across Europe. In 2013 it was recorded for the first time in Croatia. To assess the potential impact and control of this new brown rot pathogen, development of pre-harvest and post-harvest brown rot was monitored during 2014 and 2015 in a peach orchard where integrated pest management measures are implemented. At the moment of harvest in 2014, brown rot incidence on fruits was 6.6 %. Out of 40 isolates collected, 27 % were *M. fructicola*, 30 % were *Monilinia laxa*, and 43 % were *Monilinia fructigena*. Twenty-one days after the harvest, *Monilinia* spp. developed on 73 % experimentally stored fruits. *M. fructicola* was identified on 28 % of fruits, while the rest were infected with *M. laxa* or *M. fructigena*. In 2015, the pressure of brown rot was very low and almost no fruits affected with brown rot were found at the moment of harvest. Twenty-one days after the harvest, *Monilinia* spp. was found on only 8 % fruits. *M. fructicola* was found on all fruits with brown rot symptoms. *M. laxa* was isolated from two fruits, and *M. fructigena* only from one fruit. Results are indicating that common measures against indigenous *M. laxa* and *M. fructigena* within integrated pest management on peach may be suitable for the control of invasive *M. fructicola*. It could be expected that all three *Monilinia* species on peach in Croatia shall commonly occur in mixed populations, and that the overall impact of *M. fructicola* on Croatian stone fruit production shall be relatively low.

Key words: brown rot, *Monilinia* spp., disease incidence, population structure

Decomposition and residual amounts of fungicides on spring wheat

Arailym Z. Amirkulova^{1*}, Gianfranco Romanazzi², Gulnar V. Kurbanova³, Gulnisam O. Rvaydarova⁴, A. Sharelevna Utarbaeva¹

¹Institute of Molecular Biology and Biochemistry, M.A. Aitkhozhina, 86 st, Dosmuhamedov, Almaty, 050012, The Republic of Kazakhstan (e-mail: araika88a@mail.ru)

²Department of Agricultural, Food and Environmental Sciences, Marche Polytechnic University, Via Breccia Bianche, 60131 Ancona, Italy

³Kazakh National Technical University named after K.I. Satpayev

⁴The Kazakh Research Institute for Plant Protection and Quarantine

Abstract

The use of pesticides is an integral part of the modern agriculture to prevent food losses. The production of competitive products is the main purpose of the agro-industrial complex, that is one of the leading sectors of Kazakhstan's economy. A use not appropriate of pesticides could lead to the accumulation of toxic substances in plants and consequently in crops and livestock. To avoid possible negative effects linked to the use of pesticides, it is important to monitor the toxic residues in the environment.

We conducted field and laboratory experiments on the use of two fungicides used to control fungal diseases of spring wheat in southeastern Kazakhstan. The aim of our study was to determine the residual amount of two formulations applied before harvest: A) mefenoxam (20 g/l) + tebuconazole (30 g/l), and B) spiroxamine (250 g/l) + tebuconazole (167 g/l) + triadimenol (43 g/l). Stems, soil and ears were sampled 30, 40 and 60 days after treatment and at harvest. Thirty days after treatment with the formulation A, mefenoxam was present in trace amounts in stems of spring wheat, while tebuconazole in stalks and ears decomposed quickly. Forty and 60 days after treatment, tebuconazole and mefenoxam decomposed rapidly, and they were not found at the harvest and in the straw. Following application of formulation B, tebuconazole and triadimenol were not found at harvest, while spiroxamine was recovered in traces in the stems.

In our trials, where the two fungicides were applied according to the regulation, their residual amounts on spring wheat were not found at harvest or recovered in amounts not exceeding the established threshold (MRLs and MPC).

Key words: fungicide residuals, mefenoxam, tebuconazole, spiroxamine, triadimenol

The ground beetle fauna (*Coleoptera*) in apple orchard in Croatia

Ivana Pajač Živković^{1*}, Božena Barić¹, Tomislav Kos¹, Darija Lemić¹, Helena Suda¹, Tomislav Jemrić², Mladen Fruk²

¹University of Zagreb, Faculty of Agriculture, Department for Agricultural Zoology, Svetošimunska cesta 25, HR-10000 Zagreb, Croatia (e-mail: ipajac@agr.hr)

²University of Zagreb, Faculty of Agriculture, Department of Pomology, Svetošimunska 25, HR-10000 Zagreb, Croatia

Abstract

The ground beetle fauna was studied in IPM apple orchard in northwest part of Croatia (Krapina). Carabids were sampled by pitfall trapping in the year of 2015 from July 1st until October 15th. A total of 183 individuals belonging to 17 species and 9 genera were collected. The most abundant species, with the proportion almost 55% in the total catch, was *Pterostichus melas melas* followed by *Carabus coriaceus coriaceus* (18.03%) and *Calathus fuscipes graecus* (4.92%). This three species account for about 80% of the total catch. The species, which dominated the carabid assemblage in the apple orchard habitat (with the total scores), were *Pterostichus melas melas* (100), *Carabus coriaceus coriaceus* (33), *Calathus fuscipes graecus* (9), *Harpalus dimidiatus* (7) and *Harpalus atratus* (6). This work presents new insights into the ground beetles fauna in the system of integrated fruit production.

Key words: Carabidae, pitfall trap, diversity, IPM

