AMAHLS V Conference , December 13-14, 2022, Tangier, Morocco

American Moroccan Agricultural, Health, and Life Sciences Conference

The Fifth International American Moroccan Agricultural, Health, and Life Sciences Conference

AMAHLS V Conference

The First Cannabis & Hemp Sciences and Entrepreneurship Day (CHSE I)

December 13-14, 2022
Tangier, Morocco

Promoting Cooperation in Scientific Research and Education Between USA and Morocco

ORGANIZING, SCIENTIFIC, AND JUDGING COMMITTEES

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Moulay Abdelmajid Kassem, Professor, Fayetteville State University, USA

In Partnership With:

Abdelmalek Essaâdi University, Tangier, Morocco
Dr. Bouchta El Moumni, President

And Collaboration With:

National Institute of Agricultural Research (INRA), Rabat, Morocco
Dr. Faouzi Bekkaoui, Director

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Abdelhafid Bendahmane, Research Director, INRA/CNRS, Paris-Saclay, France
Alan Walters, Professor, Southern Illinois University; USA
John Groninger, Professor, Southern Illinois University; USA
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Ikram Blilou, King Abdullah University of Science and Technology (KAUST), Saudi Arabia
Ahmed Elamrani, Professor, University Mohamed Premier, Oujda, Morocco
Adnane Boualem, INRA/CNRS, Paris-Saclay, France
Badr Benjelloun, INRA, Tadla, Morocco
Abdelhamid El Mousadik, Professor, University Ibn Zohr, Agadir; Morocco
Noureddine El Aouad, Polydisciplinary Faculty of Larache; University AbdelMalek Essaadi
Mohamed Bendahmane; UMR INRA CNRS ENSL; Ecole Normale Supérieure, Lyon, France
Fatiha El Hilali, Faculty of Medicine and Pharmacy, Laayoune, Morocco
Hassan Ghazal; National Center for Scientific and Technical Research (CNRST), Rabat, Morocco

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Mohamed Addi, University Mohamed I, Morocco
Noureddine El Aouad, University Abdelmalek Essaadi, Morocco
Fatima Zahra Ouassou, University Ibn Zohr, Morocco
Badr Benjelloun, INRA, Morocco

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Agricultural, Health, and Life Sciences

December 13, 2022

TUESDAY DECEMBER 13, 2022

[Agricultural, Health, and Life Sciences Day]

7:30-9:00 am **Registration**

7:30-6:00 pm **Registration Desk Open**

8:30-8:50 am **Conference Official Opening**
Khalid Meksem, Southern Illinois University, USA
Bouchta El Moumni, University Abedelmalek Essaadi, Morocco
Faouzi Bekkaoui, National Instiute of Agricultural Research, Morocco
Moulay Abdelmajid Kassem, Fayetteville State University, USA
Local, Regional, and Governmental Officials

9:00-10:15 **Session I Plant Sciences I (Large Room 1)**
Co-Chair: Alan Walters, Southern Illinois University, USA
Co-Chair: Ahmed Elamrani, University Mohamed I, Morocco

9:00-9:15 ***Valorization of Moroccan Saffron (Crocus sativus L.) by Plant Biotechnology***
Mohammed Amine Seghini*
Ibn Zohr University, Agadir, Morocco.

9:15-9:30 ***Effect of Different Substrates on Growth, Development, and Corm Production of Saffron (Crocus sativus L.)***
Abdelghani Tahiri*; CRRA, INRA, Agadir, Morocco.

9:30-9:45 ***Effect of Fruit Thinning on Fruit Development and Fruit Size of Cactus Pear [Opuntia ficus-indica (L.) Mill.]***
Siham Farhat*
National Office of Food Products Safety and Health, Sidi Slimane, Morocco.

9:45-10:00 ***The Effect of Earthworm-Associated Bacteria on Plant Metabolism Under Abiotic Stress Conditions***
Lamia Yakkou*
Mohammed V University, Rabat, Morocco.

10:00-10:15 ***Genetic Diversity and Population Structure of Almond Genotypes from Eastern Morocco assessed by SSR Markers***
Malika Abid*
University Mohammed I, Oujda, Morocco.

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9:00-10:15 **Concurrent Session II Water and Irrigation (Small Room 2)**
Co-Chair: Bouchta El Moumni, Abdelmalek Essaadi University, Morocco
Co-Chair: Hamid El Amri, University Mohamed V, Morocco

9:00-9:15 ***Water Resources in Tetouan Region of Morocco: Opportunities and Challenges***
Stitou El Messari Jamal Eddine[1*] and Mostafa Stitou[2*]
[1] Department of Geology; [2] Department of Chemistry, Faculty of Sciences, University Abdelmalek Essaadi, Tétouan, Morocco

9:15-9:30 ***Using Spatial Data in Water Resources Management in Semi-Arid Areas***
Abdelhakim Amazirh[1*] and Abdelghani Chehbouni[1,2]
[1] Center for Remote Sensing Applications (CRSA), Mohammed VI Polytechnic University (UM6P), Morocco; [2] International Water Research Institute (IWRI); Mohammed VI Polytechnic University, Morocco.

9:30-9:45 ***New Concepts in Water Resources Management - Towards Nexus WFEE***
Khalid Temssamani[*]
Faculty of Sciences, University Abdelmalek Essaadi, Tétouan, Morocco.

9:45-10:00 ***Water and Irrigation Systems***
Abdes Samed d Bernoussi[*] and Mina Amharref
Faculty of Science and Technology, University Abdelmalek Essaadi, Tanger, Morocco.

10:00-10:15 ***Climatic and Environmental Risks and Trends in the Mediterranean Region***
Adil Salhi[*]
Geography and Development Group, FLSH, Abdelmalek Essaadi University, Martil, Morocco.

9:00-10:15 **Concurrent Session III Health Sciences (Small Room 3)**
Co-Chair: Amorette Barber, Longwood University, Farmville, USA
Co-Chair: Hassan Ghazal, CNRST, Morocco

9:00-9:15 ***Digital Health in Morocco: Integration of New Technologies in Access to Medical Care***
Fatima Zahra Ouassou[*]
Ecole Supérieure de Technologie de Laâyoune, University Ibn Zohr, Agadir, Morocco.

9:15-9:30 ***Plant-Based Ingredients for formulation of Healthy Snack Recipes***
Mohamed Addi[*]
University Mohammed I, Oujda, Morocco.

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9:30-9:45 ***The Need for a Biosocial-Agriculture Approach to Improve Maternal and Child Health Nutrition in Mali***

Drissa Toure, Karen Stoelzle Midden*, Jack Turman, Jr, Rachel Redington-Noble
Division of Epidemiology and Community Health, University of Minnesota of Public Health, Minneapolis, MN, USA.

9:45-10:00 ***Insight into Antidiabetic and Antiglycation Effects of Polyphenols Extract From Schinus terebinthifolius Raddi in Alloxan-Induced Diabetic Mice***

Zouaoui Zakia*
University Abdelmalek Essaadi, Tangier, Morocco.

10:00-10:15 ***Autosomal Dominant Intellectual Development Disorder-6 (MRD6) Linked to a novo Mutation in the grin2b Gene Revealed by Exome Sequencing: A Case Report***

El Mouhi Hinde[1,2,3*], Leila Bouguenouch[1,2], Hanane Sayel[2], Said Trhanint[2], Brahim El Hejjioui[1,2,3], Abdelhafid Natiq[7], Youssef Ahmadi[2,6], and Sana Chaouki[1,5]
[1] Laboratory of Biomedical and Translational Research, Faculty of Medicine and Pharmacy, Sidi Mohammed Ben Abdellah University, Fez, Morocco; [2] Unit of Medical Genetics and Oncogenetics, University Hospital Hassan II, Fes, Morocco; [3] Engineering Science & Technology, Faculty of Sciences and Technologies, Sidi Mohammed Ben Abdellah University, Fez, Morocco; [4] Research Team in Genomics and Molecular Epidemiology of Genetic Diseases, Genomics Center of Human Pathology, Faculty of Medicine and Pharmacy, Mohammed V University in Rabat, Morocco; [5] Department of Pediatrics CHU Hassan II, Fez, Morocco; [6] Faculty of Medicine and Pharmacy and Dental Medicine, Sidi Mohammed Ben Abdellah University of Fez, Morocco; [7] Faculty of Medicine and Pharmacy, Mohammed V University, Rabat, Morocco.

10:20-11:20 Session IV Animal Sciences and Zoology (Large Room 1)
Co-Chair: Amer AbuGhazaleh, Southern Illinois University, USA
Co-Chair: Badr Benjelloun, INRA, Morocco

10:20-10:35 ***Towards a Sustainable Management of Farm Animal Genetic Resources: The Case of Sheep and Goats***

Badr Benjelloun[1,2*] and François Pompanon[2] on behalf of the Nextgen Consortium[3]
[1] Livestock Genomics Laboratory, Regional Center of Agricultural Research Tadla, National Institute of Agricultural Research, INRA, Rabat, Morocco; [2] Univ. Grenoble Alpes, Univ Savoie Mont Blanc, CNRS, LECA, F-38000 Grenoble, France; [3] https://www.epfl.ch/labs/nextgen/consortium/.

10:35-10:50 ***Effect of Adding Bromoform to Ruminant Animal Diet on Methane Gas Emission invitro***
Mohamed Embaby*
Southern Illinois University, Carbondale, IL, USA.

10:50-11:05 ***Molecular and Phylogenetic Analysis of H9N2 Avian Influenza Viruses Isolated from Moroccan Poultry Flocks Between 2021 and 2022***
Oumayma Arbani[1*], Faiçal Salamat[1], Mariette Ducatez[2], Mohammed El Houadfi[1], and Siham Fellahi[1]
[1] Avian Pathology Unit, Department of Veterinary Pathology and Public Health, Agronomy and Veterinary Institute Hassan II, Rabat B.P. 6202, Morocco; [2] IHAP, Toulouse University, INRAE, ENVT, Toulouse, France.

11:05-11:20 ***Epidemiological and Pathological Findings of Gizzard Erosion and Ulceration Syndrome (GEUS) in Moroccan Poultry Between 2014 and 2022***
Ikram Ouchhour[1*], Mourad Mastour[1], Faouzi Kichou[1], Oumayma Arbani[2], and Siham Fellahi[2]
[1] Histology and Pathology Unit, Department of Veterinary Pathology and Public Health, Hassan 2nd Institute of Agronomy and Veterinary Medicine, B.P. 6202, Rabat, Morocco; [2] Avian Pathology Unit, Department of Veterinary Pathology and Public Health, Hassan II Institute of Agronomy and Veterinary Medicine, B.P. 6202, Rabat, Morocco.

10:20-11:20 Concurrent Session V Environmental Sciences and Land Restoration (Small Room 2)
Co-Chair: John Groninger, Southern Illinois University, USA
Co-Chair: Hamid Mazouz, University Moulay Ismail, Morocco

10:20-10:35 ***Research Supporting Wetlands Forest Restoration in Midwestern USA***
John W. Groninger*
Southern Illinois University, Carbondale, IL, USA.

10:35-10:50 ***Overview of Fertility Management in Extensive Green Roof Food Production Systems***
Karen Midden* and S. Alan Walters
Southern Illinois University, Carbondale, IL, USA.

10:50-11:05 ***Fertility Management of Vegetables Grown in a Greenroof Environment***
Alan S. Walters*, Richard A. Little, Victoria Vogt Thomas, and Karen Midden.
School of Forestry and Horticulture, Southern Illinois University, Carbondale, IL 62901 USA.

11:05-11:20 ***Growth, Yield and Macronutrients Requirement of Quinoa Crop Under Arid Conditions of Morocco***
Nawal Taaime[1*], Khalil El Mejahed[1], Rachid Bouabid[2], Abdallah

Oukarroum[3], Redouane Choukr-Allah[1], and Mohamed El Gharous[1]
[1] Agricultural Innovation and Technology Transfer Center, Mohammed VI Polytechnic University, Ben Guerir, Morocco; [2] Department of Agronomy, National School of Agriculture, Meknes; [3] Plant Stress Physiology Laboratory, Agrobiosciences, Mohammed VI Polytechnic University, Ben Guerir, Morocco.

10:20-11:20 **Concurrent Session VI Biochemistry & Molecular Biology (Small Room 3)**
Co-Chair: Elmostafa El Fahime, CNRST, Morocco
Co-Chair: Mark Byrd, Southern Illinois University, USA

10:20-10:35 ***Biochemistry and Chemistry Discovery Using Simulations on a Quantum Computer***

Mark Byrd*, Ali Abu-Nada, and Lian-Ao Wu
School of Physics and Applied Physics, Southern Illinois University, Carbondale, USA.

10:35-10:50 ***Effect of Extract from the Algae Ulva lactuca on the Alleviation of Salt Stress in Common Bean, Phaseolus vulgaris L***

Nada Nhhala[1*], Reda Ben Mrid[1,2], Abdelhamid Ennoury[1], Zoulfa Roussi[1], Zakia Zouaoui[1], Anass Kchikich[1], and Mohamed Nhiri[1]
[1] Laboratory of Biochemistry and Molecular Genetics, Faculty of Sciences and Technologies of Tangier, Abdelmalek Essaadi University, Tetouan, Morocco; [2] Institute of Biological Sciences, Mohammed VI Polytechnic University, Ben Guerir, Morocco.

10:50-11:05 ***Effect of Methanolic Plant Extract Against Penicillium digitatum***

Salahddine Chafiki[1,2*], Redouan Qessaoui[1], Ahmed Boumair[1,3], Yassine Imlil[1], Naima Chabi[1,4], Abdelmalek Mahroug[1,3], Abdelhadi Ajerrar[1], Abdellah Oukarroum[2]; Mohamed Alouani[3], and Rachid Bouharroud1
[1] Regional Center of Agricultural Research of Agadir, National Institute of Agricultural Research, Rabat, Morocco; [2] AgroBioSciences Department (AgBS), Mohammed VI Polytechnic University (UM6P), Ben Guerir, Morocco; [3] Laboratory of Biotechnologies and Valorization of Natural Resources Faculty of Sciences - Agadir, Ibn Zohr University, Agadir, Morocco; [4] Center of Agrobiotechnology and Bioengineering, Cadi Ayyad University (UCA), Marrakech, Morocco.

11:05-11:20 ***Chemical Characterization, Antioxidant Activity, and Phenolic Compounds of Moroccan Opuntia dillenii Fruits Species for Potential Use in Food Applications***

Sofia Zazouli[1,2*] and Ahmed Jouaiti[1]
[1] Laboratory of Sustainable Development, Faculty of Science and Technology, University Sultan Moulay Slimane, Beni Mellal, Morocco; [2] Laboratory of Bio-Organic an Analytical Chemistry, Faculty of Science and Technology, University Sultan Moulay Slimane, Beni Mellal, Morocco.

TUESDAY DECEMBER 13, 2022

11:30-1:00 **Session VII. Plenary Session: Health, Climate Changes and Food Security (Large Room 1)**
Co-Chair: Khalid Meksem, Southern Illinois University, USA
Co-Chair: Moulay Abdelmajid Kassem, Fayetteville State University, USA

11:30-11:50 ***Impact of Changing Environment on our Health: What Environment?***
Srini Kaveri[1,2*]
[1] INSERM, Paris, France; [2] CNRS Bureau, New Delhi, India

11:55-12:15 ***PD1-Targeted CAR T Cells as a Therapy for Lymphoma and Solid Tumors***
Amorette Barber[*]
Department of Biological and Enviriironmental Sciences, Longwood University, Farmville, VA, USA.

12:20-12:40 ***Breeding by Design for Healthy Plant Products from Soybean***
Khalid Meksem[*]
Department of Plant, Soil, and Agricultural Sciences, Southern Illinois University Carbondale, IL 62901, USA

12:40-1:00 **Improving Plants Specialized Metabolites**
Adnane Boualem[*]
Institute of Plant Sciences Paris-. Saclay (IPS2), INRAE, University Paris-Saclay, CNRS, 91405 Orsay,. France

1:05-2:10 **Lunch, Exhibit, and Posters Setup**

2:15-3:30 **Session VIII Soil Fertility and Fertilizers (Large Room 1)**
Co-Chair: Abdelaziz Nilahyane, Mohammed VI Polytechnic Univ., Morocco
Co-Chair: Rachid Bouharroud, INRA, Morocco

2:15-2:30 ***Soil CO_2 Flux and Active Carbon Across Soil Salinity Gradient Have Promising Implications for Revival of Arid-Saline Soils Subjected to Forage Grass-Legume Mixtures***
Dennis S. Ashilenje[*], Abdelaziz Hirich, Lamfeddal Kouisni, Krishna Devkota, and Abdelaziz Nilahyane
African Sustainable Agriculture Research Institute, Mohammed VI Polytechnic University, Laâyoune, Morocco.

2:30-2:45 ***Cellulose/Nanoclay Biocomposites Coated Phosphate Fertilizer: Novel Slow-Release Fertilizer for Reducing Phosphorus Leaching and Promoting Plant Growth***
Ihsane Kassem[1*], El-Houssaine Ablouh[1], Fatima-Zahra El Bouchtaoui[1], Soumia Boukind[1], Manal Mhada[2], Salma Mouhib[2], Houssine Sehaqui[1], and Mounir El Achaby[1]
[1] Materials Science, Energy and Nanoengineering Department (MSN),

Mohammed VI Polytechnic University, Benguerir, Morocco; [2] AgroBioSciences Department (AgBS), Mohammed VI Polytechnic University, Benguerir, 43150, Morocco.

2:45-3:00 ***Bacillus circulans TC7 Mediated the Alleviation of Metal Stress and the Decrease of Metal Accumulation in Spinach Tissues***

Sofia Houida[1*], Lamia Yakkou[1], Leyla Okyay Kaya[2], Serdar Bilen[2], Mohamed Raouane[1], Abdellatif El Harti[1], and Souad Amghar[1]
[1] Research Team « Lumbricidae, Improving Soil Productivity and Environment, Centre: Eau, Ressources Naturelles, Environnement et Développement Durable, Ecole Normale Supérieure (ENS), Mohammed V University, Rabat, Morocco; [2] Department of Soil Science and Plant Nutrition, Faculty of Agriculture, Atatürk University, Erzurum 25240, Turkey

3:00-3:15 ***Exploration of the Diversity and Function of Bacterial Community in Maize Rhizoplane Across Moroccan Agro-Systems: Towards a Microbiome Facilitated Agriculture in Morocco***

Dounia Nkir[1*], Tessa Reid[3], Brahim Benbrik[1], Meryem Haddine[1], Ibn Yasser Ammar[1], Rachid Ghani[1], Ian Clark[3], Tim H. Mauchline[3], Jim Harris[4], Zineb Rchiad[2], and Adnane Bargaz[1]
[1] Plant and Soil Microbiome Sub-program, AgroBioSciences, Mohammed VI Polytechnic University, Ben Guerir, Morocco, [2] African Genome Center, Mohammed VI Polytechnic University, Ben Guerir, Morocco, [3] Rothamsted Research, Sustainable Soils and Crops, Harpenden, UK; [4] Cranfield University, School of Water, Energy and Environment, Cranfield, UK

3:15-3:30 ***Organic Amendments to Restore sandy Soils to Produce Organic Vegetables Under Arid Conditions***

Azim Khalid[1*], Mostapha Ajrari[2], Fouad Elame[1], Rachid Aboutayeb[3], and Jamal Hallam[1]
[1] Integrated Crop Production Research Unit, Regional Center of Agricultural Research of Agadir, National Institute of Agricultural Research, Rabat, Morocco; [2] Institut Agronomique et Vétérinaire Hassan II-Complexe Horticole Agadir, Morocco; [3] Regional Center of Agricultural Research of Settat, National Institute of Agricultural Research, Rabat, Morocco.

2:15-3:30 Concurrent Session IX Plant Sciences II (Small Room 2)
Co-Chair: Miguel Botella, University of Malaga, Spain
Co-Chair: Mohamed Nhiri, University Abdelmalek Essaadi, Morocco

2:15-2:30 ***Genetic Diversity of Walnut (Juglans regia L.) Genotypes Across Middle and High Atlas Moroccan Mountains using ISSR Markers***

Ghizlane Kabiri*, Said Bouda, Mohammed Elhansali, and Abdelmajid Haddioui
Laboratory of Biotechnology and Valorization of Plant Genetic Resources,

Faculty of Sciences and Techniques, Sultan Moulay Slimane University, Beni Mellal, Morocco

2:30-2:45 ***In Situ Production and Multiplication of Saffron Corms (Crocus sativus L.) in Taliouine, Morocco***
Youssef Karra*
Centre Regional de la Recherche Agronomique, INRA, Agadir, Morocco

2:45-3:00 ***Cultivar Resistance as a Main Tool for Restoration of Cactus Industry Damaged by Cochineal Dactylopius opuntiae***
Rachid Bouharroud*
Centre Regional de la Recherche Agronomique, INRA, Agadir, Morocco

3:00-3:15 ***Evaluation of Agronomic Performance of Legumes in an Agroforestry System Based on Olive Trees in the South of the Mediterranean Sea***
Asmae Amassaghrou*
Centre Regional de la Recherche Agronomique, INRA, Meknes, Morocco

3:15-3:30 ***Red Fruits in the Souss-Massa Region***
Redouan Qessaoui*
Centre Regional de la Recherche Agronomique, INRA, Agadir, Morocco.

2:15-3:30 Concurrent Session X Genomics and Genetics (Small Room 3)
Co-Chair: Mohcine Bennani Mechita, Univ. Abdelmalek Essaadi, Morocco
Co-Chair: Mohammed El Hassouni, Mohammed V University, Morocco

2:15-2:30 ***QTL and Candidate Genes that Control Several Seed Composition Traits (Sugars and Isoflavones) in Soybean [Glycine max (L.)]***
Moulay Abdelmajid Kassem[1*] and Khalid Meksem[2]
[1] Plant Genomics and Biotechnology Lab, Fayetteville State University, Fayetteville, NC, USA; [2] Department of Plant, Soil, and Agricultural Systems, Southern Illinois University, Carbondale, IL 62901, USA.

2:30-2:45 ***Deciphering Protein and Oil Biosynthesis Pathway using TILLING-by-Sequencing+: An Effective Platform for High-Throughput Gene Functional Analysis***
Naoufal Lakhssassi*, Abdelhalim El Baze, and Khalid Meksem
Department of Plant, Soil, and Agricultural Systems, Southern Illinois University, Carbondale, IL 62901, USA.

2:45-3:00 ***Genetics and Genomics of Fruit Color in Strawberry (Fragaria spp.)***
Cristina Castillejo[1], José F. Sánchez-Sevilla[1,2], and Iraida Amaya[1,2*]
[1] Instituto Andaluz de Investigación y Formación Agraria y Pesquera, (IFAPA), Centro de Málaga, Málaga, Spain; [2] Unidad Asociada de I+D+i IFAPA-CSIC Biotecnología y Mejora en Fresa, Málaga, Spain.

3:00-3:15

QTL and Candidate Genes for Seed Tocopherol Content in 'Forrest' by 'Williams 82' Recombinant Inbred Line (RIL) Population of Soybean

Dounya Knizia[1,2*], Jiazheng Yuan[3], Naoufal Lakhssassi[1], Abdelhalim El Baze[1], Mallory Cullen[1],Tri Vuong[4], Hamid Mazouz[2], Henry T. Nguyen[4], Moulay Abdelmajid Kassem[3], and Khalid Meksem[1]

[1] School of Agricultural Sciences, Southern Illinois University, Carbondale, IL 62901, USA; [2] Laboratoire de Biotechnologies & Valorisation des Bio-Ressources (BioVar), Department de Biologie, Faculté des Sciences, Université Moulay Ismail, Meknes 50000, Morocco; [3] Plant Genomics and Biotechnology Laboratory, Department of Biological and Forensic Sciences, Fayetteville State University, Fayetteville, NC 28301, USA; [4] Division of Plant Science and Technology, University of Missouri, Columbia, MO 65211, USA.

3:15-3:00

Mapping QTL for Soybean Seed Protein and Amino Acids in the Forrest By Williams82 RIL Population

Jiazheng Yuan1[*], Nacer Bellaloui[2], My Abdelmajid Kassem[1], Dounya Knizia[3,6],Tri Vuong[4], Naoufal Lakhssasi[3], Mariola Usovsky[4], Qijian Song[5], Sonia Viera[1], Layla Rashid[1,] Frances Betts[1], Teresa Register[1], Earl Williams[1], Hamid Mazouz[6], Henry T. Nguyen[4], and Khalid Meksem[3]

[1] Plant Genomics and Biotechnology Lab, Department of Biological and Forensic Sciences, Fayetteville State University, Fayetteville, NC, USA; [2] USDA, Agriculture Research Service, Crop Genetics Research Unit, 141 Experiment Station Road, Stoneville, MS 38776, USA; [3] Dept. of Plant, Soil, and Agricultural Systems, Southern Illinois University, Carbondale, IL 62901, USA; [4] Division of Plant Science and Technology, University of Missouri, Columbia, MO 65201, USA; [5] Soybean Genomics and Improvement Laboratory, USDA-ARS, Beltsville, MD 20705, USA; [6] Laboratoire de Biotechnologies & Valorisation des Bio-Ressources (BioVar), Faculté des Sciences, Department de Biology, Université Moulay Ismail, Meknès, Morocco.

3:40-4:40

Session XI Plant Products and Bioactive Compounds (Large Room 1)
Co-Chair: Abdelfettah Maouni, Abdelmalek Essaadi University, Morocco
Co-Chair: Katelyn Kesheimer, Auburn University, USA

3:40-3:55

Bioactive Compounds, Antioxidant Activity and Fatty Acids Composition of Fruits of Ten Moroccan Pomegranate Cultivars (Punica granatum L.)

Sarah Loukhmas[1,2*], Meriem Outaki[3], Ebrahim Kerak[1], and Hasnaâ Harrak[2]

[1] Hassan II Casablanca University, Faculty of Science and Techniques, Laboratory of Virology, Microbiology, Quality and Biotechnology, Mohammedia, Morocco; [2] Agro-Food Technology and Quality Laboratory, Plant Improvement and Quality Research Unit, Regional Center of Agricultural Research of Marrakesh, National Institute of Agricultural Research, Rabat, Morocco; [3] Laboratory of Applied Chemistry and Environment,

Faculty of Sciences and Technologies, University Hassan I, Settat, Morocco.

3:55-4:10

Anticancer Activity and Characterization of Secondary Metabolite Compounds from Dichloromethane Fraction of Zizyphus lotus

Sofia Zazouli[1,2*], Mohammed Chigr[2], Patrícia A. B. Ramos[3,4], Daniela Rosa[5,6], Maria M. Castro[5], Ahmed Jouaiti[1], Maria F. Duarte[5,6], Sónia A. O. Santos[3], and Armando J. D. Silvestre[3];
[1] Laboratory of Sustainable Development; [2] Laboratory of Bio-Organic and Analytical Chemistry, Faculty of Science and Technology, University Sultan, Moulay Slimane, Beni-Mellal, Morocco; [3] CICECO-Aveiro Institute of Materials, Department of Chemistry, Campus de Santiago, University of Aveiro, Aveiro, Portugal; [4] LAQV REQUIMTE, Department of Chemistry, Campus de Santiago, University of Aveiro, 3810-193 Aveiro, Portugal;
[5] Alentejo Biotechnology Center for Agriculture and Agro-Food (CEBAL), Polytechnic Institute of Beja (IPBeja), Beja, Portugal; [6] Mediterranean Institute for Agriculture, Environment and Development, Beja, Portugal.

4:10-4:25

Sorghum (Sorghum bicolor (L.) is a Potent Medicinal Food as an Antioxidant, Antiglycation, and Anti-Diabetic

Ben El Mahdi Nora[1*], Laurent Lemée[2], and Mohamed Nhiri[1]
[1] Laboratory of Biochemistry and Molecular Genetics, Faculty of Sciences and Technologies, University Abdelmalek Essaadi, Tangier, Morocco;
[2] Institut de Chimie des Milieux et Matériaux de Poitiers, Université de Poitiers, Poitiers Cedex 9, France.

4:25-4:40

The Effect of Moroccan Seaweeds from Mediterranean Coast (Halopteris scoparia, Gracilaria dura, and Entermorpha compressa) on Medicago sativa Plant Growth

Oumaima Ouala[1*], Soukaina El Amrani Zerrifi[1], El Mahdi Redouane[1], Richard Mugani[1], Asmae Aknaf[2], Ouafa Cherifi[1], Fatima El Khalloufi[1,3], and Brahim Oudra[1]
[1] Water, Biodiversity and Climate Change Laboratory. Phycology, Biotechnology and Environmental Toxicology Research Unit, Faculty of Sciences Semlalia Marrakech, Cadi Ayyad University, Marrakech, Morocco;
[2] Observatoire de la Lagune de Marchica de Nador et Région Limitrophes (Labo. OLMAN-RL), Faculté Pluridisciplinaire de Nador, Université Mohamed Premier, Selouane, Nador, Morocco; 3 Polydisciplinary Faculty of Khouribga (FPK), University Sultan Moulay Slimane of Beni-Mellal, Khouribga, Morocco.

3:40-4:40 **Concurrent Session XII Soil Sciences and Soil Resilience (Small Room 2)**
Co-Chair: Eric Brevik, Southern Illinois University, USA
Co-Chair: Rachid Moussadek, INRA & ICARDA, Morocco

3:40-3:55 ***Eastern Red Cedar as a Bioenergy Crop to Improve Soil Quality in the Great Plains, USA***
Thomas J. Sauer[1], Ken Wacha[2], Eric C. Brevik[3*], and Diomides Zamora[4];
[1] USDA-ARS, National Laboratory for Agriculture and the Environment, Ames, IA, USA; [2] USDA-ARS, National Soil Erosion Research Laboratory, West Lafayette, IN, USA; [3] College of Agricultural, Life, and Physical Sciences, Southern Illinois University, Carbondale, IL, USA; [4] USDA, National Institute of Food and Agriculture, Kansas City, MO, USA

3:55-4:10 ***Soil-Human Health-Nexus: with Focus on Dimensions of Soil-Water-Plant-Microbes and Human***
Hassan El-Ramady[1,2*], József Prokisch[2], Tamer Elsakhawy[3], Alaa El-Dein Omara[3], Megahed Amer[4], and Eric C. Brevik[5]
[1] Soil and Water Dept., Faculty of Agriculture, Kafrelsheikh University, 33516 Kafr El-Sheikh, Egypt; [2] Institute of Animal Science, Biotechnology and Nature Conservation, Faculty of Agricultural and Food Sciences and Environmental Management, University of Debrecen, Debrecen, Hungary; [3] Agriculture Microbiology Department, Soil, Water and Environment Research Institute (SWERI), Sakha Agricultural Research Station, Agriculture Research Center, Kafr El-Sheikh, Egypt; [4] Soil Improvement and Conservation Dept., Water and Environment Research Institute, Agricultural Research Center, Giza, Egypt; [5] College of Agricultural, Life, and Physical Sciences, Southern Illinois University, Carbondale, IL 62901 USA

4:10-4:25 ***Status of Macronutrients in Selected Valencia orange orchards in the Gharb Region of Morocco***
Zhor Abail[1*], Rania Brital[1,2], Mohamed Ibriz[2], Rachid Aboutayeb[1], and Hamid Benyahia[1]
[1] National Institute of Agricultural Research, Rabat, Morocco; [2] Faculty of Science, Ibn Tofail University, Kenitra, Morocco.

4:25-4:40 ***Estimating Actual Abundance of European Sousliks: UAV Imagery, Pixel Based Imaging, and Random Forest Classification for Counting Surface Burrow Openings and GPR for Identifying Subsurface Burrows***
Csongor I. Gedeon[*]
Institute for Soil Sciences, Budapest, Hungary

3:40-4:40 **Concurrent Session XIII Plant Sciences III (Small Room 3)**
Co-Chair: Mohammed Amine Seghrini, University Ibn Zohr, Morocco
Co-Chair: Nicole Gauthier, University of Kentucky USA

3:40-3:55 ***Peripheral Membrane Proteins Modulate Stress Tolerance by Safeguarding Cellulose Synthases***

Christopher Kesten[1,2], Álvaro García-Moreno[3], Vítor Amorim-Silva[3], Alexandra Menna[2], Araceli G. Castillo[4], Francisco Percio[3], Laia Armengot[5], Noemi Ruiz-Lopez[3], Yvon Jaillais[5], Clara Sánchez-Rodríguez[2], and Miguel A Botella[3*]
[1] Department of Biology, ETH Zurich, 8092, Zurich, Switzerland; [2] Department for Plant and Environmental Sciences, University of Copenhagen, Frederiksberg C, Denmark; [3] Instituto de Hortofruticultura Subtropicaly Mediterránea, Universidad de Málaga-Consejo Superior de Investigaciones Científicas (IHSM-UMA-CSIC), Dept. Biología Molecular y Bioquímica, Campus de Teatinos, Málaga E-29071, Spain; [4] Instituto de Hortofruticultura Subtropical y Mediterránea, Universidad de Málaga-Consejo Superior de Investigaciones Científicas (IHSM- UMA-CSIC), Dept. Biología Celular, Genética y Fisiología, Campus de Teatinos, Málaga E- 29071, Spain; [5] Laboratoire Reproduction et Développement des Plantes, Université de Lyon, ENS de Lyon, CNRS, INRAE, F-69342, Lyon, France.

3:55-4:10 ***Breeding Programs in Argane Tree: Microsporogenesis Study and Cytogenetic Approach***

Ait Aabd Naima*, Abdelghani Tahiri , Redouan Qessaoui, Abdelaziz Mimouni, and Rachid Bouharroud.
National Institute of Agronomic Research, Regional Center of Agronomic Research, INRA, Agadir, Morocco.

4:10-4:25 ***The Efficacy of Pheromone Traps in Controlling Tomato leafminer, Tuta absoluta***

Sabbahi Rachid[1*] and Khalil Azzaoui[2]
[1] Higher School of Technology, Quartier 25 Mars, P.O. Box 3007, Laayoune, Morocco; and Laboratory of Plant Biotechnology BiotecV, Faculty of Science, University of Ibn Zohr, P.O. Box 8106, Hay Dakhla, Agadir, Morocco; [2] Laboratory of Applied Chemistry and Environment LCAE, Faculty of Science, First Mohammed University, Oujda, Morocco.

4:25-4:40 ***Assessment of East Moroccan Almond Germplasm and Selection of Promising Accessions Based on Screw-Pressed Seed Oil Quality and its Potential for Micropropagation***

Souhayla Kodad*, Reda Melhaoui, Hana Serghini Caid, Ahmed El amrani, Malika Abid, and Aatika Mihamou. Laboratory of Agricultural Production Improvement, Biotechnology and Environment (LAPABE), Faculty of Sciences, Mohammed Premier University, Oujda, Morocco.

TUESDAY DECEMBER 13, 2022

4:45-5:30 **Session XIVA Studies in the USA: Undergraduate and Graduate Levels (Large Room 1)**
Co-Chair: Moulay Abdelmajid Kassem, Fayetteville State University, USA
Co-Chair: Khalid Meksem, Southern Illinois University, USA

4:45-5:00 ***Attending The Graduate School at Southern Illinois University***
Dounya Knizia
School of Agricultural Sciences, Southern Illinois University, Carbondale, IL, USA

5:00-5:15 ***Undergraduate and Graduate Studies in the USA***
Moulay Abdelmajid Kassem*
Department of Biological and Forensic Sciences, Fayetteville State University, Fayetteville, NC, USA

5:15-5:30 ***Open Discussion / Q&A Related to Attending US Universities***
US Academic Team (Drs. Meksem, Kassem, Groninger, Walters, and others) / Moroccan-American Commission for Educational and Cultural Exchange (MACECE), Rabat, Morocco

4:45-7:00 **Coffee Pause, Posters Session I (P01-P25), Exhibit, and Students Oral Presentations I & II**

5:00-6:30 **Session XV Students Oral Presentations I (Small Room 2)**
Co-Chair: Naoufal Lakhssassi, Southern Illinois University, USA
Co-Chair: Fatima Zahra Ouassou, University Ibn Zohr, Morocco

5:00-5:15 ***Biocontrol potential of Phosphate-solubilizing rhizobacteria isolated from Astragalus armatus rhizosphere against Fusarium oxysporum***
Mounia Bakkali Bouarrakia*, Anas Elyemlahi, Ouiam Elgaliou, Mounir Hassani Zerrouk, Amin Laglaoui, Mohammed Bakkali, and Abdelhay Arakrak
Biotechnology and Biomolecular Engineering Research Team, Faculty of Sciences and Technology, Abdelmalek Essadi University, Tetouan, Morocco.

5:15-5:30 ***Effect of Provenance on Yield and Secondary Metabolite Content of Extracts of Juniperus thurifera in Morocco***
Khalid Benhssaine[1*], Jamal Aabdousse[2], Nora Salim[2], Ilias Oussif[2], Mohamed Elhabty[2], M'hamed Ramchoun[3], Younes Abbas[1], and Hicham Berrougui[1]
[1] Polyvalent team in research and development, Department of Biology and Geology, Polydisciplinary Faculty, Sulatn Moulay Slimane University, Beni Mellal, Morocco; [2] Environmental, Ecological and Agro-industrial Engineering Laboratory, Department of Life Sciences, Faculty of Sciences and Techniques, Sulatn Moulay Slimane University, Beni Mellal, Morocco; [3] Biotechnology and Sustainable Development of Natural Resources Team,

Department of Biology and Geology, Polydisciplinary Faculty, Sultan Moulay Slimane University, Beni Mellal, Morocco.

5:30-5:45

Actinobacteria-based Biofertilizer Improve Cereal Plant Growth and Nutrient Acquisition Under Rock Phosphate/Potassium Fertilization

Kenza Boubekri[1,2*], Abdoulaye Soumare[1], Ilham Mardad[1], Karim Lyamlouli[1], Yedir Ouhdouch[1,2], Mohamed Hafidi[1,2], and Lamfeddal Kouisni[1,3]
[1] AgroBioSciences Program, Mohammed VI Polytechnic University, Benguerir, 43150, Morocco; [2] Laboratory of Microbial Biotechnologies Agrosciences and Environment, CNRST Labelled Research Unit N°4, Faculty of Sciences Semlalia, Cadi Ayyad University, Marrakech, Morocco; [3] African Sustainable Agriculture Research Institute, Mohammed VI Polytechnic University, Laayoune, Morocco.

5:45-6:00

Sustainable Soybean [Glycine max (L.) Merr.] Production Through the Use of Rhizobium Inoculation and Different Sources of Phosphate Fertilizer in Ghana

Alfred Balenor Buernor[1*], Muhammad Rabiu Kabiru[1], Noura Bechtaoui[1], Edwin K. Akley[2], Michael Asante[2], and Martin Jemo[1]
[1] AgroBioscience Program, University Mohammed VI Polytechnic, Benguerir, Morocco; [2] Council for Scientific and Industrial Research, Savanna Agricultural Research Institute (SARI), Tamale, Ghana.

6:00-6:15

A Moroccan Comparative Study of Urban Landscapes And Farming Lands in Bird Species: evidence from Morocco

Ikram Douini[1*], Mohamed Mounir[1], El Mostafa Benka[1], Mohamed Dakki[2], and Soumaya Hammada[1]
[1] Agro-Industrial and Medical Biotechnology Laboratory, Faculty of Scienc es and Technology, Sultan Moulay Slimane University of Beni Mellal, Morocco; [2] Geo-Biodiversity and Natural Patrimony Laboratory, Scientific Institute, University of Mohammed V, Rabat, Morocco.

6:15-6:30

Ethnobotanical Survey on Traditional Uses of Saffron By-products by Local People from Taliouine Center and Regions in Morocco

Zineb Khadfy[1*], S. M Jadouali[1,3], Hajar Atifi[1], Rachid Mamouni[1], Youssef Karra[2], and Abdelghani Tahiri[2]
[1] Team of Materials Catalysis and Valorization of Natural Resources, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco; 2 Research Unit Natural Resources and Terroirs Products UR RN&PDT-INRA-CRRA, Agadir, Morocco; [3] Laboratory of Biotechnology, Bioresources and Bioinformatics, EST Khenifra, Université Sultan Moulay Sliman, Khénifra, Morocco.

5:00-6:30 **Concurrent Session XVI. Students Oral Presentations II (Small Room 3)**
Co-Chair: Karen Midden, Southern Illinois University, USA
Co-Chair: Mohamed Addi, University Mohamed I, Morocco

5:00-5:15 ***Morphological and Physiological Analysis of Botrytis cinerea Field Isolates from Vineyard***

Faical Aoujil[1,2*], Majida Hafidi[1], Hiba Elyahyaoui[1,2], Abdellatif Benbouazza[2], and Khaoula Habbadi[2]
[1] Laboratory of plant Biotechnology and Bio-Resources Valorization, Faculty of Sciences, Moulay Ismail University, Meknes, Morocco; [2] Laboratory of Phyto-Bacteriology and Biocontrol, Plant Protection Unit National Institute of Agronomic Research INRA, Meknes, Morocco.

5:15-5:30 ***Preliminary Results of Chilling and Heat Requirements Estimation of Several Olive (Olea europaea L.) Cultivars: A Statistical and Expermental Approach***

Omar Abou-Saaid[1,2,3*], Hayat Zaher[1], Sara Oulbi[1], Magalie Delalande[3], Ahmed El Bakkali[6], Adnane El Yaacoubi[5], Cherkaoui El Modafar[2], and Bouchaib Khadari[3,4]
[1] INRA, UR Amélioration des Plantes, Marrakech, Morocco; [2] Université Cadi Ayyad, Centre d'Agrobiotechnologie et Bioingénierie, Unité de Recherche Labellisée CNRST (URL-CNRST 05), Marrakech, Morocco; [3] AGAP, Université de Montpellier, CIRAD, INRA, Montpellier SupAgro, Montpellier, France; [4] Conservatoire Botanique National Méditerranéen de Porquerolles, UMR AGAP, Montpellier, France; [5] University Sultan Moulay Slimane, École Supérieur de Technologie, Khenifra, Morocco; [6] INRA, UR Amélioration des Plantes et Conservation des Ressources Phytogénétiques, Meknès, Morocco.

5:30-5:45 ***Mitigation of Drought and Phosphorus Deficiency Stresses in Intercropped Wheat and Faba bean Plants Through Rhizobium-PGPR-Based Consortia Inoculation***

Bouchra Benmrid[1*], Hicham Oukfi[1], Said Cheto[1,2], Ammar Ibn Yassar[1], Meryem Haddine[1], Joerg Geistlinger[3], Youssef Zeroual[4], Lamfeddal Kouisni[1], Cherki Ghoulam[1,2], and Adnane Bargaz[1]
[1] Mohammed VI Polytechnic University, AgroBiosciences, Plant-Microbe Interaction, Benguerir, Morocco; [2] Center of Agrobiotechnology & Bioengineering, Research Unit Labeled CNRST, FST, Cadi Ayyad University, Marrakech, Morocco, [3] Anhalt University of Applied sciences, Bernbourg, Germany, [4] OCP-Innovation, Jorf Lasfar El Jadida, Morocco.

5:45-6:00 ***Does Phosphogypsum Application Affect Salts, Nutrients, and Trace Elements Displacement from Saline Soils?***

Outbakat MBarka[1*], Redouane Choukr-Allah[1], Mohamed EL Gharous[1], Kamal EL Omari[2], Aziz Soulaimani[1], and Khalil EL Mejahed1

[1] Agricultural Innovation and Technology Transfer Center, Mohammed VI Polytechnic University, Benguerir, Morocco; [2] OCP S.A., Sustainability & Green Industrial Development, Casablanca, Morocco.

6:00-6:15 ***Effect of PGPRs and Water-Hope on Potato Growth***

El Allaoui Nadia[1,2*], Allal Douira[2], Abdellatif Benbouazza[1], El Hassan Achbani[1], and Khaoula Habbadi[1]
[1] Laboratory of Phytobacteriology and Biological Control, URPP, INRA, Meknes, Morocco; [2] Plant, Animal and Agro-industrial Production Lab, Department of Life and Earth Sciences, Faculty of Sciences, Kenitra, Morocco.

6:15-6:30 ***Genome-Wide Association Study of Hessian Fly Resistance in Bread Wheat (Triticum aestivum L.)***

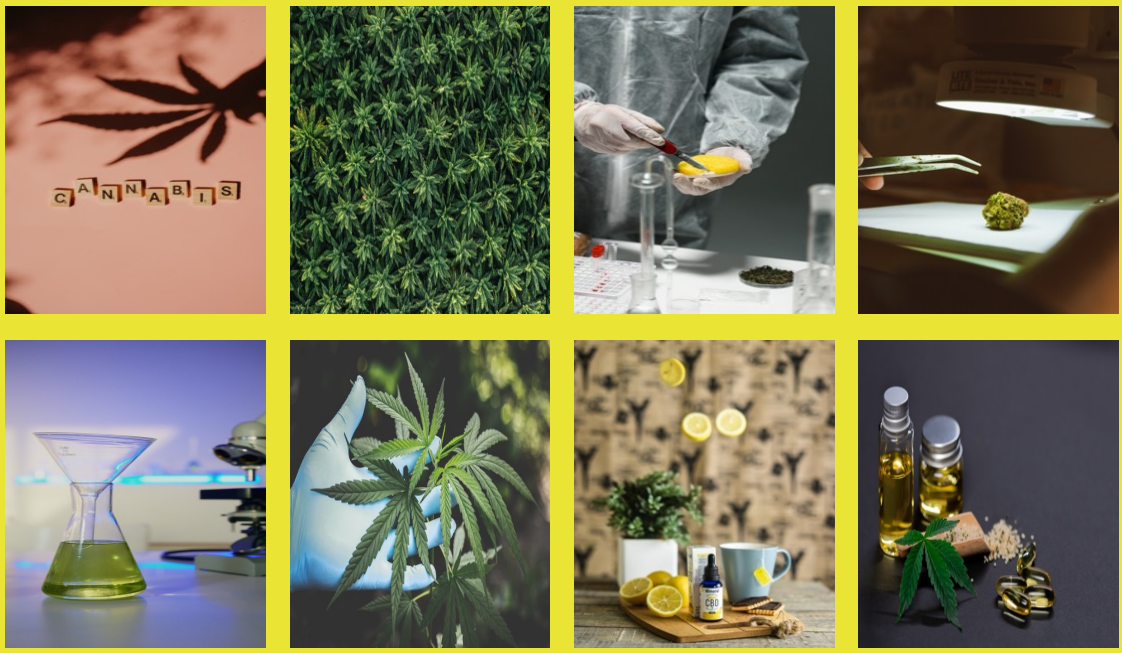
Imseg Imane[1,2*]
[1] International Center for Agricultural Research in the Dry Areas (ICARDA), Rabat, Morocco ; [2] Faculty of Sciences Ben Msik, University Hassan II, Casablanca, Morocco.

7:00 PM **Adjourn and Dinner on Your Own**

CHSE I Day, December 14, 2022, Tangier, Morocco

Cannabis and Hemp Sciences and Entrepreneurship Day (CHSE I)

December 14, 2022



WEDNESDAY DECEMBER 14, 2022

[First Cannabis & Hemp Sciences & Entrepreneurship Day - CHSE I]

8:00-4:00 pm **Registration Desk Open**

8:30-8:40 am **Official Opening of the CHSE I**
Khalid Meksem, Southern Illinois University, USA
Local, Regional, and Governmental Officials

8:40-10:20 **Session I. Hemp and Cannabis Production (Large Room 1)**
Co-Chair: Karla Gage, Southern Illinois University, USA
Co-Chair: Jose Leme, Southern Illinois University, USA

8:40-9:00 ***Effect of Biostimulants on Cannabis Productivity and Soil Microbial Activity Under Outdoor Conditions***
Jose Leme*
School of Forestry and Horticulture, Sothern Illinois University, Carbondale, IL 62901, USA

9:00-9:20 ***Fusarium Species Threaten Postharvest Cannabis***
Gauthier Nicole*, D Szarka, H Smith, E Dixon, M Munir, and M Rahnama.
Department of Plant Pathology, University of Kentucky, Lexington, KY, USA

9:20-9:40 ***Hemp and Cannabis Insect Pest Management***
Katelyn Kesheimer*
Department of Entomology and Plant Pathology, Auburn University; USA

9:40-10:00 ***Weed and Crop Interactions in Cannabis Production***
Karla Gage*
Department of Plant, Soil and Agricultural Systems, Sothern Illinois University, Carbondale, IL 62901, USA

10:00-10:15 ***The Problem with PPFD: Advances in Cannabis Lighting Technology and Terminology***
Brian Gandy*
Valoya Corporate, Southern Illinois University, Carbondale, IL 62901, USA

10:20-12:05 **Session II Hemp and Cannabis Programs Initiatives In Morocco (Room 2)**
Co-Chair: Noureddine El Aouad, Abdelmalek Essaadi University, Morocco
Co-Chair: Mouad Chentouf, INRA, Morocco

10:20-10:35 ***INRA Hemp and Cannabis Initiative***
Mouad Chentouf* and Faouzi Bekkaoui
INRA, Morocco

10:35-10:50 ***Abdelmalek Essaadi University's Hemp and Cannabis Initiative***

Noureddine El Aouad*
Abdelmalek Essaadi University, Morocco

10:50-11:05 ***New Approach for the Screening for Modulatory Activities of Polymerization Depolymerization of Tubulins by Cannabinoids***

Anissi Jaouad[1*], Khalid Sendide[2], Mohamed El Hassouni[3], and Salim Bounou[1]
[1] School of Engineering BIOMEDTECH, University EUMROMED of Fes, Fes, Morocco; [2] Laboratoty of Biotechnology, School of Science and Engineering, Al Akhawayn university, Ifrane, Morocco; [3] Laboratoire de Biotechnologie, Faculté des Sciences Dhar El Mehrez, Université Sidi Mohamed Ben Abdellah, Fés, Morocco.

11:05-11:20 ***Genetic identification, chemical and biological investigation of Moroccan Cannabis sativa L. Seeds***

Amira Metouekel[1*], Leila Tayeq[3], Salwa Tazi[3], Souad Skalli[3], Hamid Elamri[4], Elmostfa El Fahime[2], Saïd El Kazzouli[1], and Nabil El Brahmi[1]
[1] Euromed Research Center, Euromed Faculty of Pharmacy, Euromed University of Fes (UEMF), Meknes Road, Fez 30000, Morocco; [2] Centre National de la Recherche Scientifique et Technique (CNRST), Rabat, Morocco, [3] Faculté des Sciences, Université Mohamed V, Rabat, Morocco; [4] Institut des Analyses Génétiques de la Gendarmerie Royale, Rabat, Morocco

11:20-11:35 ***Efficient Removal of Eriochrome Black-T Dye Using Activated Carbon of Waste Hemp (Cannabis sativa L.) Grown in Northern Morocco Enhanced by New Mathematical Models***

Fouad El Mansouri[1,2*], Joaquim Esteves da Silva[2], and Jamal Brigui[1];
[1] Research Team: Materials, Environment and Sustainable Development (MEDD), Faculty of Sciences and Techniques of Tangier, University Abdelmalek Assaadi, BP 416 Tangier 90000, Morocco; [2] Chemistry Research Unit (CIQUP), DGAOT, Faculty of Sciences of University of Porto, R. Campo Alegre 697, 4169-007 Porto, Portugal

11:35-11:50 ***UM6P Initiative on Cannabis sativa L Valorization***

Mohamed Hafidi[1], Lamfeddal Kouisni[2], Mohamed El Gharous[3], Khalil El Mejahed[3], Loubna El Fels[1], Rachid Bouharroud[4], Redouan Qessaoui[4], Aziza Tangi[3], Khadija Nasraoui[3], Mohamed Louay Metougui[3], Adil Mazar[2], Abdelaziz Nilahyane[2*], Youssef El Kharrassi[2], and Amine Ezzariai[2]
[1] Cadi Ayyad University, Marrakech, Morocco; [2] Mohammed VI Polytechnic University, African Sustainable Agriculture Research Institute (ASARI), Laayoune, Morocco; [3] Mohammed VI Polytechnic University, African Innovation and Technology Transfer Center (AITTC), Benguerir, Morocco; [4] INRA Agadir, Morocco

WEDNESDAY DECEMBER 14, 2022

11:50-12:05 ***Legalization of Cannabis in Morocco: Valorization of Hemp Seeds for Oil Extraction and their Incorporation into Poultry Feed***

Elamrani Ahmed[1*], Y Taafi[1,3], Y Rbah[1], A Allay[1], C Benkirane[1], A Far-hat[2], E Azeroual[3], K Belhaj[1,4], F Mansouri, R Melhaoui[1], M Addi[1], M Abid[1], A Mihamou[1], and Caid H Serghini[1]

[1] Equipe Agroalimentaire, Faculté des Sciences, Université Mohammed Premier, Oujda, Morocco; [2] Agence nationale de Plantes Médicinales & Aromatiques, Taounate, Morocco; [3] Institut Royal d'Elevage, Fouarat, Kenitra, Maroc ; [4] Laboratoire de Management de l'Agriculture Durable, EST Sidi Bennour, Université Chouaib Doukkali, El Jadida, Morocco.

12:05-1:15 Lunch, Exhibit, and Posters Setup

1:20-2:35 Session III Hemp, Cannabis, and Entrpreneurship (Large Room 1)
Co-Chair: Khalid Meksem, Southern Illinois University, USA

1:20-1:35 ***A Pre-Scientific Expertise, Validating Moroccan Landrace Hemp for Architectural Science and Lightweight Composites***

Monika Brümmer[*]
Coopérative Adrar Nouh, Morocco and Cannatektum Habitat and Materials Science, S.L., Spain.

1:35-1:50 ***Hemp (Cannabis sativa L.) Seed and Its Cake Inclusion in Animal Nutrition***

Kamal Belhaj[1*], Allai Larbi[1], Taaifi Yassine[2], Mansouri Farid[2], Azeroual Embarek[3], Serghini-Caid Hana[2], and Elamrani Ahmed[2]

[1] Laboratoire de Management de l'Agriculture Durable, EST Sidi Bennour, Université Chouaib Doukkali, El Jadida; [2] Equipe agroalimentaire, Laboratoire 'LAPAB E', Faculté des sciences, Université Mohammed Premier, Oujda, Morocco; [3] Institut Royal d'Elevage (IRTSE-F), Fouarat, Kenitra, Morocco.

1:50-2:05 ***Transformation, Valorization, and Commercialization of Cannabis Products***

Aziz Makhlouf[*]
BIO CANNAT Cooperative, Douar Beni Yabta, Bab Berred, Chefchaouen, Morocco

2:05-2:20 ***Broad Access to Safe, Reliable, and Sustainable Cannabis Derived Products***

Brett Goldman[*]
OCan Group, USA

2:20-2:35 ***Midwest Natural Fiber***

Patrick Van Meter[*]
Columbia, MO. USA

WEDNESDAY DECEMBER 14, 2022

2:40-4:15 **Session IV Regulatory Policies of Hemp and Cannabis Production and Compliances (Large Room 1)**
Co-Chair: Oussama Badad, Southern Illinois University, USA
Co-Chair: Khalid Meksem, Southern Illinois University, USA

2:40-2:55 ***The Rif and the Kif Beldiya: Past, Present, and Future***
Abdellatif Adebibe*
Coopérative Adrar Nouh, Valorisation de Chanvre Beldiya pour le Development Socio-Economique Durable de la Region du Haut Rif, Douar Assegzaf, Issaguen, Al Hoceima, Morocco

2:55-3:10 ***Navigating the Evolving Complex Cannabis Legislative and Regulatory Challenges***
Steve Bevan*
The OCan Group; USA

3:10-3:25 ***Foundation of Cannabis Unified Standards***
Lezli Engelking*
FOCUS: The International Cannabis Health & Safety Organization, Scottsdale, AZ, USA

3:25-3:40 ***Cannabis: Innovation and Challenges***
Myriam Lahlou-Filali * and Abdelmoumen Mahly*
Pharma 5, Casablanca, Morocco

3:40-4:00 Panel Discussion

4:00-5:30 **Coffee Pause, Posters Session II (P26-P50), Exhibit, and Students Oral Presentations III and IV**

4:15-5:00 **Session XIIIB Academic Exchange Programs Between Morocco & USA (Large Room 1)**
Co-Chair: Moulay Abdelmajid Kassem, Fayetteville State University, USA
Co-Chair: Khalid Meksem, Southern Illinois University, USA

4:15-4:40 ***Educational and Cultural Exchange Programs Between Morocco and the USA, The Fulbright Programs***
Hafsa El Bastami* (Deputy Executive Director) and Meryem Hammam* (Community Engagement Officer)
The Moroccan American Commission for Educational and Cultural Exchange (MACECE), Rabat, Morocco

4:00-5:00 ***Attending US Universities: Graduate School Application***
Khalid Meksem*
School of Agri. Sciences, Southern Illinois University, Carbondale, IL, USA

4:00-5:30 **Session XVII Students Oral Presentations III (Small Room 2)**
Co-Chair: John Yuan, Fayetteville State University, USA,
Co-Chair: Malika Abid, University Mohamed I, Morocco

4:00-4:15 ***Olive Oil Quality Characteristics of Olive Orchards (Olea Europaea var. Europaea L.) in a Semi-Arid Continental Zone: Case of the Beni Mellal-Khenifra Region in Morocco***
Mohamed Elhabty[1*], Aabdousse Jamal[1], Ait Yacine Zehor[1], Benhssain Khalid[2], Hasib Aziz1, and Boundi abdelhaq[3]
[1] Environmental, Ecological and Agro-industrial Engineering Laboratory, Department of Life Sciences, Faculty of Sciences and Techniques, Sulatn Moulay Slimane University, Beni Mellal, Morocco ; [2] Polyvalent Team in Research and Development, Department of Biology and Geology, Polydisciplinary Faculty, Sulatn Moulay Slimane University, Beni Mellal, Morocco; [3] Regional Office of Agricultural Development, INRA, Tadla Morocco.

4:15-4:30 **Technological Characterization and Exopolysaccharide Production By *Lactococcus lactis* Strains Isolated Raw Milk of Cows in Eastern Morocco**
Nora Hamdaoui[1,2*], Mouncif Mohamed[2], and Mustapha Meziane[1]
[1] Laboratory for the Improvement of Agricultural Production, Biotechnology, and the Environment, Department of Biology, Faculty of Sciences, University Mohammed I, Oujda, Morocco; [2] Process Engineering and Food Technologies Departement, Institute of Agronomy and Veterinary Medicine HassanII, Rabat, Morocco.

4:30-4:45 ***Beneficial Role of Exogenous Silicon and Phosphate-Solubilizing Bacillus subtilis on Yield and Antioxidant Metabolism in Chickpea (Cicer arietinum L.) Under Low Phosphorus Availability***
Habiba Kamal[1*], Mohammed Mouradi[1], Cherki Ghoulam[2], and Mohamed Farissi[1]
[1] Unit of Biotechnology & Sustainable Development of Natural Resource, Polydisciplinary Faculty, Sultan Moulay Slimane University, Beni Mellal, Morocco; [2] Centre of Agrobiotechnology & Bioengineering, Research Unit Labeled CNRST, Cadi Ayyad University, Marrakech, Morocco.

4:45-5:00 ***Chemical Characteristics of Cactus Pear (Opuntia ficus india L.) Seed Oil Grown the Wild in Eastern Morocco***
Ahmed Marhri[1*], Kamal Belhaj[1,3], Reda Melhaoui[1], Mehdi boumediene[1], Aziz Tikent[1], Aatika Mihamou[1], Hana Serghini-Caid[1], Ahmed Elamrani[1], Christophe Hano[2], Malika Abid[1], and Mohamed Addi[1]
[1] Laboratory for Agricultural Productions Improvement, Biotechnology and Environment (LAPABE), Faculty of Sciences, University Mohammed First, BP-717, 60000 Oujda, Morocco; [2] ligneous and Field Crops Biology Laboratory, INRA USC1328, Orleans University, CEDEX 2, 45067 Orléans, France; [3] Laboratory of Sustainable Agriculture Management,

Higher School of Technology Sidi Bennour, University Chouaib Doukkali, Street Jabran Khalil Jabran BP 299-24000 El Jadida.

5:00-5:15 ***Validation of a Composite of Epigenetic Biomarkers for Screening, Early Diagnosis and Precise Prognosis of Colorectal Cancer***
Omayma Mazouji* and Hicham Mansour
GES-LCM2E, FPN, University Mohamed I, Oujda, Morocco

5:15-5:30 ***Optimization of Phenolic Compounds Extraction from Hemp (Cannabis sativa L.) Seeds Using Simplex Lattice Mixture Design and HPLC-DAD/ESI-MS2 Analysis***
Chaymae Benkirane[1*], Abdessamad Ben Moumen[1], Marie-Laure Fauconnier[2], Yassine Taaifi[1], Youssef Rbah[1], Allay Aymane[1], Kamal Belhaj[1], Farid Mansouri[1,3], Malika Abid[1], Hana Serghini Caid[1], and Ahmed Elamrani[1]
[1] Laboratory of Agricultural Productions Improvement, Biotechnology and Environment, Faculty of Sciences, Mohammed I University, Oujda, Morocco; [2] Laboratory of Chemistry of Natural Molecules, Gembloux Agro-Biotech, University ofLiège, Passage des Déportés, 2,5030 Gembloux, Belgium; 3SASEFLaboratory, Higher School ofEducation and Training, Mohammed I University, Oujda, Morocco.

4:00-5:30 Concurrent Session XVIII Students Oral Presentations IV (Small Room 3)
Co-Chair: Abdelghani Tahiri, University Ibn Zohr, Morocco
Co-Chair: Karen Midden, Southern Illinois University, USA

4:00-4:15 ***Dynamics of Soil Nitrates in a Plot Under Onion Cultivation in the Saiss Basin***
Chaimae Nessah[1,2*,] Abdellah El Hmaidi[3], El Faleh El Mâti[2], and Bouhafa Karima[1]
[1] National Institute of Agronomic Research, Soil, Plant, and Water Laboratory, Meknes, Morocco; [2] Department of Geology Faculty of Sciences, Moulay Ismail University, Geosciences: Geodynamics and Georesources, Meknes, Morocco; [3] Department of Geology Faculty of Sciences, Moulay Ismail University, Laboratory of Geo-Engineering and Environment, Meknes, Morocco

4:15-4:30 ***Forest Composition Effect on Carbon Stock Potential and other Soil Physico-Chemical Properties in the Oulmes Central Plateau***
Hicham Ikraoun[1*], Mohamed El Mderssa[2], Laila Nasiri[1], and Jamal Ibijbijen[1]
[1] Environment and Valorization of Microbial and Plant Resources Lab, Department of Biological Sciences, Faculty of Sciences, Moulay Ismail Univesity. Meknes, Morroco; [2] Polydisciplinary Faculty, Soltane Moulay Slimane University, Beni Mellal, Morroco.

4:30-4:45

Concentrations of Arsenic, Cadmium, Mercury, and Lead in Sardina pilchardus from the three Moroccan Mediterranean Coasts

Khaoula Kasmi*, Khaoula Kasmi[1*], Kamal Belhaj[2], and Abdelhafid Chafi[1]
[1] Laboratory for Agricultural Productions Improvement, Biotechnology and Environment, Faculty of Sciences, University Mohammed I, Oujda, Morocco; [2] Laboratory of Sustainable Agriculture Management, Higher School of Technology Sidi Bennour, University Chouaib Doukkali, Street Jabran Khalil Jabran, El Jadida, Morocco.

4:45-5:00

Distribution of Earthworms in a Valencia orange Orchard as affected by Distance to Trees and Soil Properties

Ahmed Mansour Benmrich[1,2*], Zhor Abail[1], Rania Brital[1,2], Mohammed Ibriz[2], Hamid Benyahia[1], and Tarik Essafryouy[1]
[1] National Institute of Agronomic Research, Regional Center of Kénitra, Laboratory of Fertility and Soil Ecology, Route de Sidi Yahia du Gharb, Km9, Kénitra, Morocco; [2] Faculty of Science, Ibn Tofail University, Kenitra, Morocco.

5:00-5:15

Assessment of Performance of five Rootstocks Under Iron and Lime Stress

Rania Brital[1,2*], Zhor Abail[1], Ahmed Mansour Benmrich[1], Mohamed Ibriz[2], Rachid Aboutayeb[1], Hamid Benyahia[1], and Tarik Es-safryouy[1]
[1] National Institute of Agricultural Research, Rabat, Morocco; [2] Faculty of Science, Ibn Tofail University, Kenitra, Morocco.

5:15-5:30

Prevalence, Risk Factors and Multidrug Resistance Profile of Gram-Negative Bacteria Recovered from Patients Admitted to Beni Mellal Regional Hospital

Dihmane Asmaa[1], Barguigua Abouddihaj[1], Aniba Rafik[1], Raqraq Habiba[1], Nayme Kaotar[2], and Timinouni Mohammed[2]
[1] Team of Biotechnology and Sustainable Development of Natural Resources, Polydisciplinary Faculty, Sultan Moulay Slimane University, Beni Mellal, Morocco; [2] Molecular Bacteriology Laboratory, Pasteur Institute of Morocco, Casablanca, Morocco.

5:30-6:15 **Judging Committee Meeting**

Karen Midden, Southern Illinois University, USA (Coordinator)
My Abdelmajid Kassem, Fayetteville State University, USA (Coordinator)
John Yuan, Fayetteville State University, USA
Alan Walters, Southern Illinois University, USA
Naoufal Lakhssassi, Southern Illinois University, USA
Amer AbuGhazaleh, Southern Illinois University, USA
Abdelghani Tahiri, University Ibn Zohr, Morocco
Malika Abid, University Mohamed I, Morocco
Mohamed Addi, University Mohamed I, Morocco
Noureddine El Aouad, University Abdelmalek Essaadi, Morocco

Fatima Zahra Ouassou, University Ibn Zohr, Morocco
Badr Benjelloun, INRA, Morocco

6:15-7:00	**Prizes and Certificates of Attendance**
7:15	**Adjourn and Announcement of AMAHLS VI Venue**
7:30	**Dinner For Invited Guests Only**

Oral Presentations Abstracts

Agricultural, Health, and Life Sciences

December 13, 2022

ORAL PRESENTATIONS ABSTRACTS
December 13 & 14, 2022

Session I: Plant Sciences I

Co-Chair: Alan Walters, Southern Illinois University, USA
Co-Chair: Ahmed Elamrani, University Mohamed I, Morocco

O1. Valorization of Moroccan Saffron (*Crocus sativus* L.) by Plant Biotechnology

Mohammed Amine Serghini*, Soumaya El Merzougui, Khadija Lachguer, Imane Boudadi, Mohamed Ben El Caid, Khalid Lagram, Rachida El Boullani and Mohamed Lachheb

Laboratory of Biotechnologies and Valorization of Natural Resources, Faculty of Sciences, Ibn Zohr University, Agadir, Morocco. *Corresponding and presenting author : m.serghini@uiz.ac.ma.

Abstract

The word saffron refers both to the *Crocus sativus* L. plant and to the spice consisting of the dried stigmas of its flower. Saffron is one of the most important local products in Morocco. Its production in Morocco is around 7 T per year and ranks our country 3rd in terms of producers in the world after Iran and Greece. Almost all Moroccan saffron is produced in the Taliouine and Taznakht regions of the respective provinces of Taroudant and Ouarzazate. Saffron is the most expensive spice, earning it the name 'red gold'. The characterization and valuation of this resource have used plant biotechnologies and are based on different Moroccan accessions and their comparison with accessions from other countries. The conference will focus on (1) The agro-morpho-physiological characterization of Moroccan saffron accessions in order to selecting best accessions; (2) In vitro culture via direct and indirect organogenesis and somatic embryogenesis as a means of rapid multiplication of elite saffron accessions; (3) The fine chemical characterization of saffron (HPLC, CPG, medium IR, colorimetry coupled with chemometrics) with the aim of determining the quality of the product and guaranteeing its authenticity against fraud caused by its high price; (4) The application of molecular markers (SSR & ISSR), sequencing and barcoding to elucidate the genetic diversity of Moroccan saffron, distinguish it from accessions from other countries and assign it molecular identities; and (5) The development of saffron by-products, in particular through the use of the petals of its flower for the production of bio-dyes currently highly coveted in the textile industry and through their antioxidant and antibacterial effects. **Keywords:** Saffron, Crocus sativus L., molecular markers, biotechnologies, bio-dyes.

O2. Effect of Different Substrates on Growth, Development and Corms Production of Saffron (*Crocus sativus* L.)

Abdelghani Tahiri[1*], Youssef Karra[1], Naima Ait Aabd[1], Qessaoui Redouan[2], and Rachid Bouharroud[3]

[1] RNPT unit, National Institute of Agricultural Research– CRRA, Agadir, Av. des FAR, BP. 124, Inezgane, Morocco; [2] R&D unit, National Institute of Agricultural Research– CRRA Agadir, Av. des FAR, BP. 124, Inezgane, Morocco; [2] PIC unit, National Institute of Agricultural Research– CRRA Agadir, Av.

des FAR, BP. 124, Inezgane, Morocco. *Corresponding author: abdelghani.tahiri@inra.ma.

Abstract

Saffron (*Crocus sativus* L.), the most expensive spice in the world derived from stigmas, is a geophyte perennial plant from the Iridaceae family with underground soft corms. It is a sterile autotriploid (2n=3x=24) and autumn flowering geophyte plant. This plant is propagated by vegetative reproduction through the formation of daughter corms from the mother corm as the flowers are sterile and fail to produce viable seeds. A mother saffron corm produces typically one to four cormlets per season through field cultivation. However, many factors affect the efficient propagation of saffron through traditional practice and the low multiplication rates of daughter corms under natural conditions reduce productivity, thereby restraining the availability of planting material. In order to evaluate the effect of some substrates on saffron growth and corms multiplication, a greenhouse experiment was conducted at the National Institute of Agricultural Research– CRRA of Agadir (Morocco). Six combinations of substrates, including compost, perlite, biochar, black, and blond peat and soil as control, were used. The main obtained results of trials indicate that saffron growth and corms production depend on the substrate composition. Indeed, no significant difference was observed in leaf parameters (length and number). However, the dry weight and the chlorophyll a and b rates were improved by the S3 substrate (perlite/soil/compost; 2:1:1). Whereas the corms weight and the average daughter corms number were improved respectively by the substrates S2 (soil/black peat/blond peat; 2:1:1) and S6 (biochar/black peat/blond peat; 2:1:1) as well as S3. **Keywords:** Saffron, *Crocus sativus* L., corm, substrates, vegetative propagation.

O3. Effect of Fruit Thinning on Fruit Development and Fruit Size of Cactus Pear [*Opuntia ficus*-indica (L.) Mill.]

Siham Farhat[1§] and Mohamed Arba[2*]

[1] National Office of Food Products Safety and Health (ONSSA), Sidi Slimane, Morocco; [2] Plant ecophysiology and cultures of arid zones laboratory, Hassan II Institute of Agronomy and Veterinary Medicine, Horticultural Complex of Agadir, Morocco. *Corresponding author: arbamohamed@yahoo.fr. §Presenting author: frht.siham@gmail.com.

Abstract

The aim of this research work was to study the effect of fruit thinning on fruit development and fruit size of cactus pear *Opuntia ficus*-indica (L.) Mill. Trials were carried out on an adult plantation in a semi-arid area in southern Morocco. Fruit thinning consisted of reducing the fruit load of cladodes to 6 or 12 fruits per cladode by removing some floral buds or young fruits at the flowering stage. It was practiced in early May on three types of one-year old cladodes (small cladodes, the medium ones and large cladodes). The control cladodes have an average number of 18 fruits per cladode. Obtained results showed that fruit thinning improved fruit size at ripening stage. In thinned plants to 6 fruits per cladode and for the three types of cladodes average fruit weight was 160.44 g and average fruit length and diameter was 8.44 and 6.38 cm respectively. While in not thinned plants and for the three types of cladodes, average fruit weight was only 74.53 g and average fruit length and diameter was 6.40 and 4.46 cm respectively. Fruit thinning and the type of cladodes and the interaction of the two factors have a significant effect ($p \leq 0{,}001$) on fruit development. On May 10, 2019, the highest right of development was obtained with the combination fruit thinning to six fruits per cladode and large cladodes, with 1.6 cm in fruit length and 1 cm in

fruit diameter. However, the lowest rate of fruit development was obtained with the combination of thinned plants and small cladodes (0.5 cm in fruit length and 0.3 cm in fruit diameter). **Keywords:** Cactus pear; fruit thinning; fruit development; fruit size.

O4. The Effect of Earthworm-Associated Bacteria on Plant Metabolism Under Abiotic Stress Conditions

Lamia Yakkou[1*], Sofia Houida[1], Serdar Bilen[2], Leyla Okyay Kaya[2], Mohammed Raouane[1], Souad Amghar[1], and Abdellatif El Harti[1]

[1] Reserch Team "Lumbricidae, Improving Soil Productivity and Environment (LAPSE)", Centre "Water, Natural Resources, Environment and Sustainable Development (CERNE2D)", Mohammed V University in Rabat, Ecole Normale Supérieure (ENS). Avenue Med Belhassan El Ouazani. BP 5118, Takaddoum-Rabat, Morocco; [2] Soil Science and Plant Nutrition Department, Faculty of Agriculture, Atatürk University, 25000, ERZURUM, Turkey. [*]Corresponding an presenting author: lamia.yakkou@um5s.net.ma

Abstract

Soil-level changes have been shown in various investigations to entail synergistic interactions between earthworms and microorganisms. Knowing the influence of earthworm coelomic fluid (CF) on plant development and defense, we set out to isolate bacteria from this "immune compartment." Bacteria isolated from Aporrectodea molleri were investigated for their effects on maize metabolism under abiotic stress conditions such as alkaline soil and nitrogen, phosphate, and potassium (NPK) deficit. A study of metabolomic profiles by gas chromatography coupled to a mass spectrometer (GC-MS) on leaves of plants treated and untreated with bacteria isolated from CF was carried out to reveal potential metabolites that could explain the effect of different treatments on maize under stress conditions (CFB). After 60 days of growth, plants infected with bacteria isolated from the coelomic fluid of the earthworm Aporrectodea molleri (CFB1,..., CFB7), as well as those not inoculated (control), were used to extract the lipid metabolites at the leaf level. A total of 114 distinct metabolites have been discovered. Fatty acids were the most prevalent class (45 metabolites, 43 %). Different metabolomic fingerprints indicate that various biochemical mechanisms were engaged in plant response to biostimulants. Metabolic reprogramming induced by bacterial treatments was more evident than in the control group. Abiotic stress did not result in a drop in lipid composition and concentration in plants treated with CFB, in contrast to the control, demonstrating the rigidity of defensive mechanisms. Compounds associated with tolerance- building pathways (glyoxylate and dicarboxylate metabolism, as well as the tricarboxylic acid cycle) accumulated greater in bacterial treatments. **Keywords:** Earthworm, coelomic fluid, bacteria, plant, metabolomic.

O5. Genetic Diversity and Population Structure of Almond Genotypes from Eastern Morocco Assessed by SSR markers

Souhayla Kodad[1,2], Christina M. Müller[3], Mohammad Jawarneh[3], Annette Becker[2], Ahmed Elamrani[1], Mihamou Atika[1], and Malika Abid[1,2*]

[1] Equipe Agroalimentaire, 'LAPAB E', Faculté des Sciences, Université Mohammed Premier, Oujda, Morocco; [2] Justus-Liebig-Universität, Institut für Botanik, AG Entwicklungsbiologie der Pflanzen, Heinrich-Buff-Ring 38, 35392 Gießen, Germany; [3] Justus-AG Spezielle Botanik, Heinrich-Buff-Ring

38, D-35392 Giessen, Germany. *Corresponding author: malikaabid213@gmail.com.

Abstract

Almond (*Prunus dulcis* Miller [D. A. Webb] or *Prunus amygdalus* L.) is a major tree nut species and consumed worldwide. Morocco has a long-standing presence of domesticated almonds and harbors a secondary genetic diversity hotspot. This genetic diversity requires protection as it is an important resource for future almond breeding. However, detailed information on genetic diversity is lacking, even more so about the traditionally grown almonds propagated for centuries from seeds ("Beldi") which are representatives of the original cultivar pool. Here, we provide a comprehensive genetic study of 98 Moroccan almond accession including 93 of the Beldi type and five non-Morrocan cultivars by analyzing 12 simple sequence repeat (SSR) markers with high polymorphism information content (PIC). We used population structure and principal coordinates analyses (PCoA), analyzed the molecular variance and described the genetic diversity of the identified subpopulations. We identified five subpopulations with little genetic differentiation between the populations, but two subpopulations with high genetic diversity. Those subpopulations represent promising genetic pools and need to be fully protected. They are a major resource for the development of novel almond varieties that provide high yields in adverse conditions to establish profitable Moroccan breeding programs for sustainable almond agriculture. **Keywords:** Almond genotypes, Geographic origin, SSR-genotyping, genetic diversity, Genetic clusters, analysis of molecular variance (AMOVA), principal coordinates analyses (PCoA).

Concurrent Session II: Water and Irrigation

Co-Chair: Bouchta El Moumni, Abdelmalek Essaadi University, Morocco
Co-Chair: Hamid El Amri, University Mohamed V, Morocco

O1. Water Resources in Tetouan Region of Morocco: Opportunities and Challenges.

Stitou El Messari Jamal Eddine[1*] and Mostafa Stitou[2*]

[1] Department of Geology; [2] Department of Chemistry, Faculty of Sciences, University Abdelmalek Essaadi, Tétouan, Morocco

Abstract

Not provided.

O2. Using Spatial Data in Water Resources Management in Semi-Arid Areas

Abdelhakim Amazirh[1*] and Abdelghani Chehbouni[1,2]

[1] Center for Remote Sensing Applications (CRSA), Mohammed VI Polytechnic University (UM6P), Morocco; [2] International Water Research Institute (IWRI); Mohammed VI Polytechnic University, Morocco. *Corresponding and presenting author: Abdelhakim.Amazirh@um6p.ma

Abstract

The question of availability and access to water is undoubtedly one of the major problems that humanity will face in the coming century. Water is a vital resource for agriculture, for drinking water supply, for the health of populations, and all life on Earth depends on it. Water scarcity is likely to be exacerbated soon under the combined effect of the alteration of the hydrological cycle, climate change, and increasing water demand for agriculture, urban and industry (IPCC, 2009). Countries characterized by an arid climate in the world, such as Morocco, are already experiencing water crises that are getting worse and worse. This is due to several factors that are linked to both human actions "water management" and climate and natural changes. Thus, in these countries, agricultural (mainly cereal) production is dependent on the frequency of rainfall. A small variability in rainfall patterns can have dramatic consequences on agricultural yield. Consequently, irrigation is the only way to stabilize and improve production. A calculation of crop water requirements is necessary to optimize the management of irrigation volumes. To meet this information, satellite remote sensing has shown a powerful potential for monitoring fluxes and water masses for irrigation management at a large scale. This work presents the role of remote sensing data for water management in the Tensift watershed in central morocco.

O3. New Concepts in Water Resources Management - Towards Nexus WFEE.

Khalid Temssamani*

Faculty of Sciences, University Abdelmalek Essaadi, Tétouan, Morocco.

Abstract

Not provided.

O4. Water and Irrigation Systems.

Abdes Samed Bernoussi* and Mina Amharref

Faculty of Science and Technology, University Abdelmalek Essaadi, Tanger, Morocco.

Abstract

To meet a growing demand for agricultural product (FAO, 2018) an efficient agricultural practices and intensification of the production are crucial (Brümmer, 2006). However, agricultural intensification has an important negative impact on environment, among others: ground and surface water pollution, greenhouse gas emissions (IPCC, 2014), biodiversity loss. Also in some situations, the excessive use of irrigation water can have double effects: crop failure and water loss. These negative effects put in danger agricultural production and environmental sustainability. A proper management of agricultural land (plant irrigation, fertilization, etc.) is necessary to ensure food production while minimizing its negative impact on environment and particular protection of water resources. In this paper we present a tool for smart management of the water irrigation using remote sensing data and mathematical algorithms by considering crops as a dynamical systems.
Keyword : Water, irrigation, remote sensing, dynamical systems.
This work is the result of a research project entitled "Al Khawarizmi: Tool for intelligent management of irrigation water and forest heritage" and funded by MESRSFC, CNRST and ADD, Morocco.

O5. Climatic and Environmental Risks and Trends in the Mediterranean Region

Adil Salhi*

Geography and Development group, FLSH, Abdelmalek Essaadi University, Martil, Morocco. *Corresponding and presenting author: asalhi@uae.ac.ma. / https://orcid.org/0000-0001-8756-2484.

Abstract

The Mediterranean is a climate change hotspot where the rate of warming exceeds the global rate and disruptions in precipitation patterns are predicted. Our recent findings confirm this assumption showing a predictive pattern of precipitation likely to lead to prolonged and staggered intra-annual droughts (even in so-called "wet" years) with profound ecological and socio-economic impacts, and repetitive hydroclimatic hazards. The evolution of the Mediterranean towards warmer and drier conditions is heading towards an increase of +2 to +4°C on average in 2080s. By 2050, the lesser average estimates are above the Paris Agreement +1.9°C and the temperature deviation is likely to be wider, and thus heatwaves may be more frequent and harsher. Moreover, a climatic-environmental degradation (except in a few dispersed places of relative abundance) is expected to be more stressed by human activity by 2050. Consequently, long lean periods are likely to alternate with sporadic intense thunderstorms, which means droughts will be more severe. The latter are the main driver of migration as they have a substantial impact on the local ecosystem and agriculture, including reduced crop growth and yield and loss of livestock. Failure to take the issue seriously will exacerbate multi-scale socio-ecological imbalances and the potential spread of social divide, which will intensify with the expected increase in the number of forced migrants arriving in areas of relative abundance. Beyond the challenge of ensuring food and water security, governments must improve collaborative resilience measures to meet hydro-agricultural needs and defuse the sociological conflicts.

Concurrent Session III: Health Sciences

Co-Chair: Mohammed El Hassouni, Mohammed V University, Morocco
Co-Chair: Hassan Ghazal, CNRST, Morocco

O1. Digital Health in Morocco: Integration of New Technologies in Access to Medical Care

Fatima Zahra Ouassou*

Ecole Supérieure de Technologie de Laâyoune (E.S.T.L), Université Ibn Zohr, Agadir, Morocco.
*Corresponding and presenting author : f.ouassou@uiz.ac.ma.

Abstract

The implementation of digital technology in many activities in Morocco is fundamental and reinforced by a national plan of digitalization. The access to health care services as an example, during the pandemic times, was oriented to the use of Platforms reserved to on-line consultations, the collecting of Medical Data on these platforms which can lead to many interrogations and problems related to the protection of the Personal Data and Privacy under the moroccan law. Medical digital health platforms, under which a lot of moroccan patients during the first wave of Covid-19

consulted health practitioners, represent a fertile land to debate about the guarantees of the privacy, the manipulation of the medical or personal data and its impact on the traditional relation between a patient and a health care professional. There is other aspects of the use of new information technologies in health care, but the medical identity accounts escpecially in these platforms and the legal accountability are the main points that will be analyzed in this presentation. **Keywords:** Health care, medical, personal data, transition, digital health, patient, legal accountability, protection of privacy.

O2. Plant-Based Ingredients for formulation of Healthy Snack Recipes

Mohamed Addi[1*], Reda Melhaoui[1], Nadia Houmy[1,2], and Ahmed Elamrani[1]

[1] Laboratoire d'Amélioration des Productions Agricoles, (LAPABE), Equipe agroalimentaire, Faculté des Sciences, Université Mohammed I, BP-717, 60000 Oujda, Morocco; [2] Laboratoire de Technologie et Qualité Alimentaire, CRRAO, INRA, BP-428, 60000 Oujda, Morocco. [*]Corresponding author: m.addi@ump.ac.ma.

Abstract

Junk foods are found to be associated with obesity, because they are high in saturated fat, sodium and added sugar, but low in micronutrients and fiber. The obesity epidemic and all its consequences (such as type 2 diabetes, cardiovascular disease, fatty liver disease, and certain types of cancers) affect almost all countries, but its prevalence appears to be low in the population of Mediterranean countries due to the Mediterranean diet (MD). In fact, MD is essentially a plant-based diet, with a high consumption of fresh fruits and vegetables, grains and legumes as major sources of fiber and antioxidant compounds. This research involves the study of plant-based food ingredients that are rich in bioactive compounds, have health benefits, especially in child and adolescent nutrition, and play (or have played but no longer) an important role in the recipes and food cultures of Mediterranean countries such as Morocco. Thereby, we choose for snack recipes fresh and healthy ingredient readily available, such as nuts, cereals, legumes, fruits, to formulate healthy, weight loss-friendly snacks compositions. As a first step, considering the availability of ingredients, we have started testing a snake recipe (prototype) based on 5 ingredients, namely: almonds, figs, dates, carob and oranges, which are locally produced and widely consumed in Mediterranean countries. These ingredients were analyzed in order to develop novel snack formulations and technologies based on functionally nutritious fruit and vegetable ingredients. **Keywords:** Plant-Based Ingredients, Mediterranean diet, Healthy snacks, Formulation.

O3. The Need for a Biosocial-Agriculture Approach to Improve Maternal and Child Health Nutrition in Mali

Drissa Toure[1*] , Karen Stoelzle Midden[2§] , Jack Turman, Jr[3], and Rachel Redington-Noble[4]

[1] Division of Epidemiology & Community Health, University of Minnesota of Public Health, Minneapolis, MN 55454, USA; [2] School of Forestry & Horticulture, Southern Illinois University, Carbondale, IL 62902, USA; [3] Department of Social and Behavioral Sciences, Richard M. Fairbanks School of Public Health Indiana University, Indianapolis, IN, USA; [4] Department of Social and Behavioral Sciences Richard M. Fairbanks School of Public Health and Department of Pediatrics, School of Medicine Indiana University, Indianapolis, IN, USA. [*]Corresponding author: dtoure@umn.edu; [§]Presenting author: dtoure@umn.edu and kmidden@siu.edu.

Abstract

Women and children are the most affected during times of food insecurity, stemming from undernourishment and malnutrition that leads to poor lifelong physical and mental health and limited, if any, educational and economic opportunities. The lack of proper nutrients in a diet caused by food insecurity greatly affects a child's health, development, and often, life. According to UNICEF 3 nearly half of all deaths of children less than five years of age in Mali are attributable to undernutrition. In 2018, this translated to nearly 37,500 death*s of children under five from factors related to not having enough food. As the number of people suffering from hunger and malnutrition increases each year, much of the country also lacks access to a healthy and nutritious diet. According to the World Health Organization 8, a healthy diet protects against malnutrition in all forms and protects against many non-communicable diseases. A well-balanced diet is crucial for improving maternal and child nutrition, but is often more expensive and unaffordable to many, with the cost exceeding the international poverty line 9. As approximately 49 percent of people residing in Mail live below the poverty line 10, accessing a healthy diet may seem unattainable unless a nutrition-sensitive invention is implemented. In the review of available literature, collaboration between agriculture and public health has been shown to positively affect maternal and child health outcomes in prior circumstances. A biosocial approach incorporates the fields of biomedicine, social sciences, and community involvement to improve health outcomes. To address malnutrition in Mali, an innovative approach proposes the addition of farmers and agricultural scientists, creating a biosocial-agriculture model to improve maternal and child nutrition and allow for more inclusive planning and implementation strategies. This model presents opportunities for global application. **Keywords:** Biosocial-agriculture, maternal and child health nutrition, food insecurity. agriculture and public health.

O4. Insight into Antidiabetic and Antiglycation Effects of Polyphenols Extract from Schinus terebinthifolius Raddi in Alloxan-Induced Diabetic Mice

Zouaoui Zakia[1§], Reda Ben Mrid[1,2*], Najat Bouchmaa[2,3], Imad Kabach[1], Sara El Asri[1], Abdelmounaim Laabar[4], Abdelhamid Ennoury[1], Zoulfa Roussi[1], Nada Nhhala[1], and Mohamed Nhiri[1]

[1] Laboratory of Biochemistry and Molecular Genetics, Faculty of Sciences and Technologies, University Abdelmalek Essaadi, BP 416, Tangier 90000, Morocco; [2] Institute of Biological Sciences (ISSB-P), Mohammed VI Polytechnic University (UM6P), Ben Guerir 43150, Morocco; [3] Team of Experimental Oncology and Natural Substances, Cellular and Molecular Immuno-Pharmacology, Faculty of Science and Technology, Sultan Moulay Slimane University, Beni-Mellal 23000, Morocco; [4] Laboratory of Pharmacology and Toxicology, Biopharmaceutical and toxicological analysis research team, Faculty of Medicine and Pharmacy, University Mohammed V of Rabat, Morocco. [*]Corresponding author: Reda.BENMRID@um6p.ma. [§]Presenting author: zakia.zouaoui@etu.uae.ac.ma.

Abstract

Diabetes mellitus is considered one of the most prevalent metabolic troubles of the 21st century and is accelerating at a menacing rate worldwide. Natural products can be an effective alternative remedy as a treatment. Our study aims to analyze the possible therapeutic potential of Schinus terebinthifolius Raddi leaves (STL), to evaluate their polyphenols' power on oxidative stress, in vitro hyperglycemia, as well as in vitro and in vivo power glycation in alloxan-induced diabetic mice. After induction of diabetes, a significant increase was observed in the levels of blood glucose, total cholesterol (TC), low-density lipoprotein (LDL), hepatic malondialdehyde (MDA), peroxide

(H_2O_2), and the renal advanced glycated end products (AGE) compared to the control. In addition, a reduction in the level of lipoprotein cholesterol (HDL) is associated with the diminution of the corresponding antioxidant enzymes, such as catalase (CAT), glutathione reductase (GR), glutathione peroxidase (GPx), superoxide dismutase (SOD), was observed in all diabetic mice. Furthermore, treatment with STL (150 and 250 mg/kg) for three weeks significantly decreased blood glucose, TC, LDL, hepatic MDA, and H2O2 levels and renal AGE content of diabetic mice. In contrast, it increased serum HDL levels and reactivated the hepatic antioxidant enzymes in diabetic mice. These results demonstrate that the STL extract may have the capacity to inhibit hyperglycemia induced-diabetes. Furthermore, this data suggest that the administration of the extract may be helpful in the prevention of diabetic complications associated with glycation, oxidative stress, and hyperlipidemia. Therefore, we conclude that the extract should be evaluated as a candidate for future studies on diabetes mellitus. **Keywords:** *Schinus terebinthifolius* Raddi, alloxan-Diabetic mice, anti-glycation, antioxidation, polyphenols, antioxidant enzymes.

O5. Autosomal Dominant Intellectual Development Disorder-6 (MRD6) Linked to a novo Mutation in the grin2b Gene Revealed by Exome Sequencing: A Case Report

El Mouhi Hinde[1,2,3*], Leila Bouguenouch[1,2], Hanane Sayel[2], Said Trhanint[2], Brahim El Hejjioui[1,2,3], Abdelhafid Natiq[7], Youssef Ahmadi[2,6], and Sana Chaouki[1,5]

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Abstract

MRD6 is a rare autosomal dominant neurodevelopmental disorder associated with grin2b. It is characterised by psychomotor delay and intellectual disability of varying severity. Other features may include seizures, hypotonia, abnormal movements (e.g. dystonia) and autistic features. Some patients may have structural malformations of cortical development on brain imaging. The phenotype is highly variable, reflecting a range of neurodevelopmental abnormalities, from mild intellectual disability without seizures to epileptic encephalopathy. To date, fewer than 100 individuals with a grin2b- related neurodevelopmental disorder have been reported. We report on a 3-year-old Moroccan child referred to our neuropediatric department for the diagnosis of psychomotor developmental delay, dysmorphia and language absence. given the complex clinical picture of this disease, we performed exome sequencing followed by targeted analysis. A mutation was identified in a known gene for autosomal dominant developmental disorder-6 (MRD6) (OMIM 613970) or early infantile epileptic encephalopathy 27 (OMIM 616139) associated with grin2b. By exome sequencing, we identified a new pathogenic mutation: c.3912C>G (p.Tyr1304Ter) in the grin2b gene. This study demonstrates the impact of a novel homozygous mutation found to be pathogenic in the grin2b gene, diagnosed by exome sequencing approach, on brain development and function in a Moroccan child. **Keywords:** MRD6, Neurodevelopmental disorder, Exome

sequencing, grin2b, novel mutation, Moroccan patient.

Session IV: Animal Sciences and Zoology

Co-Chair: Amer AbuGhazaleh, Southern Illinois University, USA
Co-Chair: Badr Benjelloun, INRA, Morocco

O1. Towards a Sustainable Management of Farm Animal Genetic Resources: The Case of Sheep and Goats

Badr Benjelloun[1,2*], and François Pompanon[2] on behalf of the Nextgen Consortium[3]

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Abstract

The sustainability of breeding systems relies first and foremost on the ability of farm animals to remain productive in the context of climate changes. This ability primarily depends on adaptive traits and standing genetic variation in the raised breeds. The understanding of genetic bases of local adaptation and the accurate assessment of genetic diversity are thus key elements when conceiving management programs aiming at developing sustainably farm animals in a country. Otherwise, sequencing technologies allow now for an unprecedented access to genotyping animals by sequencing. The future programs of farm animal management have to exploit these technological advances to improve their effectiveness and efficiency. By using a wide framework based on whole genome analyses of Moroccan small ruminants, this talk will present outcomes from research by our team aiming at depicting genetic traceability of local breeds as well as genetic bases of local adaption to specific and extreme environments encountered in the country. Based on the results we obtained, we will present: (i) Genomic bases of local adaptation to eco-climatic constraints in Moroccan sheep and goats; (ii) Whole genome traceability of the main local breeds raised in Morocco; (iii) The global genomic diversity in local sheep and goats compared to their wild relatives and a panel of worldwide 'Cosmopolitan' breeds; (iv) The evaluation of whole genome genotyping strategies to assess adaptive and neutral genome diversity; and (v) The possible uses of the obtained results combined for implementing wide-scale programs for a sustainable management of farm animals. Keywords: Local adaptation, farm animals, genome diversity, genotyping strategies, methylation

O2. Effect of Adding Bromoform to Ruminant Animal Diet on Methane Gas Emission invitro

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Abstract

Ruminant's contribution to global greenhouse gas emissions accounts for 6% of the global emissions. scientists have been investigating different strategies to reduce methane emissions as communities became more aware of the climate change negative impacts on the environment. Seaweed is a potential source to reduce methane emission when added to livestock animals' diet due to its bioactive ingredients mainly bromoform that might work as a hydrogen sink and compete with methanogens. The effect of bromoform on methane gas emission from ruminants was investigated in this paper invitro using batch culture technique. Bromoform was added at different inclusion rates of 4%, 2%, 1%, 0.5%, 0.25%, 0.125%, 0.625% per gram of the dry matter intake. Results showed that adding bromoform suppressed the production of methane by 99% ($P<0.05$) compared to control, while no significant effect was observed on dry matter digestibility. Further research required to investigate the effect of adding reduced levels of bromoform, and the effect of bromoform on the microbial community, and rumen fermentation characteristics. **Keywords:** Methane, Ruminants, seaweed, Bromoform.

O3. Molecular and Phylogenetic Analysis of H9N2 Avian Influenza Viruses Isolated from Moroccan Poultry Flocks Between 2021 and 2022

Oumayma Arbani[1*], Faiçal Salamat[1], Mariette Ducatez[2], Mohammed El Houadfi[1], and Siham Fellahi[1]

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Abstract

Over the past two decades, the low pathogenic avian influenza virus H9N2 (LPAIV) has circulated globally in poultry, becoming the most widespread subtype in Asia, Middle East and Africa. Despite their low pathogenicity, H9N2 avian influenza viruses have highlighted global awareness, not only because of their heavy economic losses in poultry industry, but also due to their high zoonotic infection rates and their potential for a worldwide pandemic. The objective of this work was to monitor and assess the presence of avian influenza virus LPAIV in four different regions of Morocco using real-time RT-PCR, and to assess the phylogenetic and molecular characterization of the H9N2 viruses in Morocco during the period between September 2021 and June 2022. 176 filed samples were collected from 115 suspect farms of being infected with LPAIV H9N2 virus and from different types of production (94 broilerfarms, 20-layer farms and 1 breeder farm). Samples were tested for the presence of the LPAI H9N2 genome using real-time RT-PCR. Highly positive samples were subjected to virus isolation and amplified by conventional RT-PCR in order to sequence the HA gene for subsequent phylogenetic analysis. The results of the epidemiological survey revealed a global positivity percentage of 24.35% (28/115). The phylogenetic analysis of the HA gene showed that the circulating strains belonged to the G1 lineage showing great similarity (97-98%) to the strains isolated and characterized in 2018 and 2019 (A/chicken/Morocco/AS14/2018(H9N2)) and cluster with the strains isolated in the Middle East and in West and North Africa. **Keywords:** Avian influenza, H9N2, molecular biology, phylogenetic analysis, Morocco.

O4. Epidemiological and Pathological Findings of Gizzard Erosion and Ulceration Syndrome (GEUS) in Moroccan Poultry Between 2014 and 2022

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Abstract

Gizzard Erosion and Ulceration Syndrome (GEUS), caused by a Fowladenovirus serotype 1 (FAdV-1), has spread globally among poultry during the last two decades and has been associated with important economic losses. In this work, a total of 23 flock-cases with GEUS in Morocco from different types of poultry production (broilers, laying hens, breeder chicks, turkeys, and partridge) were assessed between 2014 and 2022. The suspicion of this condition was based on clinical course and mortality which reached 10% in some cases, and on pathological changes detected in dead necropsied birds. Macroscopic changes included distended gizzard with fluid or hemorrhagic content, and presence of several small to large foci of erosions and/or ulceration of the chitin layer and the surface mucosa with a variable degree of severity. Microscopic lesions were mainly focal to multifocal ulceration and/or erosions, with cuticle loss, necrosis of surface and glandular epithelial cells and a variable degree of inflammatory cell infiltrate of the lamina propria predominantly lympho-plasmacytic. Among the flock-cases investigated, SEUG was diagnosed in 13 broiler cases aged between 10 and 40 days, 6-layer cases with an age range from 17 to 52 weeks, and one case in meat type breeder chicks aged 10 weeks. Moreover, and for the first time, GEUS was observed in 2 flock cases of turkey poults and 1 case of partridge aged 22-23 days and 5 weeks, respectively. In addition to the above-described microscopic changes, pathognomonic viral basophilic and/or eosinophilic intranuclear inclusion bodies within degenerate epithelial cells were identified in birds from 2 broiler cases and 3-layer cases and hence were attributed to FAdV. However, other causes such as mycotoxins and biological amines should not be ruled out hence raised the need for further investigations. Indeed, the involvement of FAdV in the occurrence of SEUG cases in poultry in the country is being further assessed by retrospective virological and molecular investigations in order to identify the FAdV serotypes involved and eventually the characterization of their pathogenicity. **Keywords:** Gizzard erosion and ulceration syndrome, fowl adenovirus, poultry, epidemiology, pathology, Morocco.

Concurrent Session V: Environmental Sciences and Land Restoration

Co-Chair: John Groninger, Southern Illinois University, USA
Co-Chair: Hamid Mazouz, University Moulay Ismail, Morocco

O1. Research Supporting Wetlands Forest Restoration in Midwestern USA

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ing and presenting author: groninge@siu.edu.

Abstract

The mid-20th century saw a rapid and dramatic increase in row crop agriculture at the expense of forested wetlands throughout the Mississippi River Alluvial Valley. However, growing public concern regarding decline of wetlands quality and quantity and changes in agricultural markets contributed to extensive ecosystem restoration, including within the Cache River region of Illinois. Beginning during the early 1990's, marginal row-cropped lands were reforested using native species and with support from government agencies and non-governmental organizations. Presently, many of the locations undergoing reforestation have developed characteristic forest structure and functions associated with natural wetlands forests. Initial post-agricultural research focused on identifying barriers to successful reforestation and developing techniques to establish recalcitrant species. Emergent and underlying stressors on reforestation were then addressed as researchers gained a deeper knowledge of the ecosystem and the role of past human activities on shaping current ecosystem conditions. As forest stands attained broader wildlife habitat functionality, policy makers sought tangible measures for ecosystem restoration success and challenged researchers to identify indicators to guide ecosystem management activities. Current research addresses the roles played by specific vegetation communities and structures within the mosaic of remnant and restored forest stands. The purpose of this presentation is to provide an overview of the Cache River ecosystem, review restoration research, and discuss implications for policy makers and managers. Lessons learned over a career working within a landscape undergoing restoration and how these may apply to other situations will be discussed. I conclude that integrating anticipated management challenges into academic research programs can help inform future ecosystem restoration initiatives to ensure that human, financial, and land resources are efficiently and effectively deployed.

Keywords: Afforestation, land use change, migratory birds, plant succession, water resources

O2. Overview of Fertility Management in Extensive Green Roof Food Production Systems

Karen Midden* and S. Alan Walters

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Abstract

The production of healthy vegetables, fruits and herbs on extensive green roofs serves a valuable role in response to food insecurities by providing nutritional produce in urban and often underserved locations. Many green roof urban farms have made significant positive impacts on their communities by providing educational opportunities, jobs, and a source of local food. Numerous urban farms exist on intensive green roofs which support media depths from 0.2 to 1 m or greater allowing a significantly higher ratio of organic matter in the mix. In comparison, extensive green roofs are those with growing media depths of only 50 to 130 mm that are typically composed of light weight aggregate (which is heat expanded clay) and 4% to 5% organic matter. Unlike traditional agriculture, plants on extensive green roofs are grown in a shallow engineered soil to reduce the weight load on the roof. The primary historic and current uses of extensive green roofs are to provide numerous environmental and economic benefits such as storm water management, reducing energy costs, mitigating urban heat effect, increasing ecological biodiversity,

and improving biophilic and aesthetic design. Plants typically grown in extensive green roofs are generally heat and drought tolerant species, such as Sedum spp. that require minimal fertility. In comparison, horticultural food crops require a continued source of plant available nutrients to optimize their yields, challenging extensive green roof food production. There is sparse research regarding fertility system evaluations for edibles grown on extensive green roofs. This presentation will provide a brief overview of green roof farming as well as fertility research conducted on green roofs to maximize their production.

O3. Fertility Management of Vegetables Grown in a Greenroof Environment

Walters S. Alan*, Richard A. Little, Victoria Vogt Thomas, and Karen Midden

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Abstract

Urban green roof agriculture provides an alternative growing space to supply fresh produce and herbs to local markets or restaurants, which can also help to address food security concerns in cities. Although many vegetables can be grown on extensive green roofs, few studies have evaluated the fertility requirements necessary to optimize productivity. Managing green roof substrate fertility is challenging since they tend to have low amounts of organic matter and provide high permeability with low cation-exchange capacity. Due to the composition of extensive green roof substrates, supplemental nutrient additions are critical to maximize vegetable crop growth and productivity. Therefore, studies were conducted to evaluate different nutrient management systems for 'Sweet Hungarian' peppers (Capsicum annuum L.) and various romaine lettuce (Lactuca sativa L.) cultivars. Results indicated that nutrient management systems are important to optimize both pepper and lettuce production in a stressful rooftop environment. For pepper, multiple, repeated applications are necessary to optimize yields as a complete slow-release fertilizer provided the greatest leaf chlorophyll content, plant vigor and fruit yields. Although two applications were used for other standard conventional (synthetic) and organic fertilizers, these provided lower pepper plant growth and yields. Similarly, for lettuce, a complete fertilizer (N-P-K) applied at weekly intervals throughout the growing season provided plant growth and yields comparable to a complete slow-release fertilizer that was applied only once during the growing season (mixed in the media prior to transplant). Thus, our research indicates that both long- and short-season vegetables require multiple, supplemental fertilizer applications to maintain high nutrient availability throughout the growing season to optimize yields. **Keywords:** extensive green roofs, lettuce, pepper, rooftop gardens, sustainable food production, urban food security, vegetable.

O4. Growth, Yield and Macronutrients Requirement of Quinoa Crop Under Arid Conditions of Morocco

Nawal Taaime[1*], Khalil El Mejahed[1], Rachid Bouabid[2], Abdallah Oukarroum[3], Redouane Choukr-Allah[1], and Mohamed El Gharous[1]

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Abstract

In the context of climate change, quinoa represents a potential alternative crop for increasing agricultural productivity in arid regions. However, appropriate crop management practices under limited water supply are still poorly documented. Quinoa like other cultivated crops, needs sufficient amount of nutrients, especially nitrogen (N), phosphorus (P) and potassium (K) for better growth and higher grain yield. To determine the adequate levels of these nutrients needed and study their effect on quinoa growth and productivity, a field experiment was conducted during two growing seasons at the UM6P experimental farm and consisted of a randomized complete block (RCB) design with three replications. The treatments studied represent the combination of four N rates (0, 40, 80 and 120 kg/ha), three P rates (0, 30 and 60 kg P_2O_5/ha) and three K rates (0, 60 and 120 kg K_2O/ha). Data on quinoa physiological, nutritional, and production parameters were collected and analyzed. The results showed that optimum rates that gave the highest total biomass (3.9 t/ha) and grain yield (0.76 t/ha) under arid and semi-arid region were 40 kg N/ha, 60 kg P_2O_5/ha and 120 kg K_2O/ha. N, P and K application increased plant height, chlorophyll content index, total biomass, grain yield and 1000 seed weight. Among the three macronutrients, N was the most limiting factor, followed by K and P. In terms of nutrients uptake, it was observed that quinoa needed 68 kg N/ha, 18 kg P_2O_5/ha and 182 kg K2O/ha to produce the optimal yield in this experiment. **Keywords:** Nitrogen, phosphorus, potassium, fertilization, quinoa, UM6P Experimental Farm.

Session VI: Biochemistry & Molecular Biology

Co-Chair: Elmostafa El Fahime, CNRST, Morocco
Co-Chair: Mark Byrd, Southern Illinois University, USA

O1. Biochemistry and Chemistry Discovery Using Simulations on a Quantum Computer

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Abstract

Chemistry and biochemistry problems are notoriously difficult to simulate using on a typical computer. However, computers that use quantum mechanics for their operation mechanism can, in principle, simulate such problems efficiently. In this presentation, some introductory comments concerning the operation of quantum computers are made before examining how one would use a quantum computer to simulate molecular interactions including chemical and biochemical interactions. The quantum computing industry is expected to grow into a multibillion-dollar industry in the next few years due, in part, to the investments by the pharmaceutical industry. **Keywords:** Biochemical reactions, quantum computing, simulations

O2. Effect of Extract from the Algae *Ulva lactuca* on the Alleviation of Salt Stress in Common Bean, *Phaseolus vulgaris* L

Nhhala Nada[1*], Reda Ben Mrid[1,2], Abdelhamid Ennoury[1], Zoulfa Roussi[1], Zakia Zouaoui[1], Anass Kchikich[1], and Mohamed Nhiri[1]

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Abstract

The use of seaweed extracts has been proven to provide positive effects on the enhancement of crop quality and resistance to abiotic and biotic stresses, due to their content of multiple active components. Salinity is one of the major abiotic stressors which limits the yield of major crops. The macro algae *Ulva lactuca* (UC) produced naturally creates a huge problem due to its stranding on the local coast, congestion, decomposition, and release of bad smell. To contribute to the mitigation of this environmental problem and find an appropriate valorization alternative, and since it contains commercially valuable components, such as bioactive compounds, UC algae were chosen as a source of bio-stimulant for experiment purposes on common bean plants (*Phaseolus vulgaris* L.) under salt stress. Bio-assay culture experiments of common bean were carried out in the absence and presence of salt stress with two levels (34,2 mM and 68,4 mM) also with and without UC extract treatment using three levels (1%, 3%, and 6%). Results showed that UC extract has a great benefit on common bean growth both in the absence and under salt stress conditions especially at 3%. These results proved that UC extract significantly improved the activities of enzymes involved in the activation of the carbon-nitrogen and antioxidant enzymatic system, osmolytes accumulation, and also improved the morphological parameters. Thus, we can say that UC extract could be successfully used to overcome the negative effects of salt stressors conditions for common bean plants in areas where irrigation water contains some salt content. **Keywords:** Biostimulants, *Ulva lactuca* algae extract, common beans, enzymatic activities, salt stress.

O3. Effect of Methanolic Plant Extract Against *Penicillium digitatum*

Salahddine Chafiki[1,2*], Redouan Qessaoui[1], Ahmed Boumair[1,3], Yassine Imlil[1], Naima Chabi[1,4], Abdelmalek Mahroug[1,3], Abdelhadi Ajerrar[1], Abdellah Oukarroum[2]; Mohamed Alouani[3], and Rachid Bouharroud[1]

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Abstract

Currently, the world agricultural sector has become an intensive production system. This situation has posed many problems related to the environment and human health and has also led to the

development of resistance of pathogens to the chemical pesticides used. Among the measures considered to reduce the negative effects of pesticides, there was the emergence of alternative control methods. Therefore, the use of biopesticides can be an effective alternative to control fruit diseases. In Morocco, the post-harvest diseases present a major constraint for the development of fruit sectors such as citrus which is threatened by the green rot Penicillium digitatum. The main objective of this study is to evaluate the effectiveness of methanolic extract of an aromatic and medicinal plant of the genus Salvia against Penicillium digitatum. This evaluation was carried out by the direct contact method. The results obtained showed that 5mg/ml of this extract inhibited 71% of the mycelial growth of this fungus. This extract can be used as an active ingredient of a biopesticide for the management of this fungus. **Keywords:** Penicillium digitatum, Biopesticide, plant extracts

O4. Chemical Characterization, Antioxidant Activity, and Phenolic Compounds of Moroccan Opuntia dillenii Fruits Species for Potential Use in Food Applications

Sofia Zazouli[1,2*] and Ahmed Jouaiti[1]

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Abstract

This research consisted in carrying out a chemical characterization (total Betalain, total condensed tannins, total phenols, flavonoid and ascorbic acid contents), antioxidant activity (by 2,2-diphenyl-1-picrylhydrazyl (DPPH)), and quantification of some individual phenolic compounds of different morphological part of O. dillenii (seeds, juicy pulp, and peels) collected from Essaouira regions of Morocco was investigated. The total phenolic content of fruit fractions ranges from 202 to 56 g/100 g extract. Total flavonoids range from 185 to 11 mg/100g extract. The total of betalains and condensed tannins ranged respectively from 229 to 5 mg/L and 12 to 8 mg/100g extract, while ascorbic acid was concentrated in the juicy pulp with (580 mg/100 g) and absent in the seeds fraction. A great variety of phenolic compounds were identified in the different extracts using HPLC-ESI-MS, mainly phenolic acids and flavonoids, some of which have been described for the first time. Furthermore, the antioxidant results showed that all Opuntia dillenii parts exhibited an excellent antioxidant activity ranged from 4.5 to 6.2 µg/ml. In conclusion, the different morphological parts of O. dillenii may serve as a potential source of natural antioxidants for food applications and medicinal functions. **Keywords:** Opuntia dillenii, bioactive compounds, chemical characteristics, phenolic compounds, flavonoids.

Plenary Session VII: Health, Climate change and Food Security

Co-Chair: Khalid Meksem, Southern Illinois University, USA
Co-Chair: Moulay Abdelmajid Kassem, Fayetteville State University, USA

O1. Impact of Changing Environment on our Health: What Environment?

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Abstract

Over the last century, we are witnessing a steady and significant changes in the diseases pattern all over the world. Thanks to antibiotcs and vaccination, we have successfully fought over many infectious diseases. However, we are witessing the emergence of many autoimmune, allergic and cardiovascular and metabolic diseases. A healthy status of the body depends largely on how an intricate and delicate homeostasis of the immune system is maintained, via neutralization of microbes on one hand, and maintaining self-tolerance to prevent autoimmunity on the other. Any deviation leading to pathology is governed by three important factors: the genetic background of the individual; the bio-molecular interactions and equally importantly, the environment. The environmental factors include not only our immediate surrounding elements such pollutants and natural fauna and flora, but also the emotional and other stress factors. And one another extremely important and interesting environmental factor is our microbial ecosystem. Investigating the interaction of microbial ecosystem and the host immune system may allow us to understand the molecular and cellular basis of the pathogenesis of several diseases and may also provide indications for the design of novel therapeutic strategies.

O2. PD1-Targeted CAR T Cells as a Therapy for Lymphoma and Solid Tumors

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Abstract

Adoptive transfer of tumor-reactive T cells is a promising anti-tumor therapy for many cancers. While CAR T cells can successfully treat hematopoietic malignancies, CAR T cells have not shown success in treating solid tumors. There are many factors that may enhance CAR T cell efficacy and safety for solid tumor treatment, including addition of costimulatory domains. We developed a novel CAR (chimeric PD-1, chPD1) that targets the programmed death 1 receptor (PD-1) ligands expressed on many types of solid tumors. We also compared the inclusion of CD28, Dap10, 41BB, GITR, ICOS, or OX40 costimulatory domains in our chPD1 receptor to determine which costimulatory domain induced optimal anti-tumor immunity. To determine if this novel CAR could potentially target a wide variety of tumors, the anti-tumor efficacy of chPD1 T cells against lymphoma, melanoma, kidney, pancreatic, liver, colon, breast, ovarian, prostate, and bladder cancer cell lines

was measured. Regardless of the costimulatory domain in the CAR, all of the chPD1 T cells induced similar levels of T cell proliferation and tumor cell lysis. However, differences were observed in the cytokine secretion profiles depending on which costimulatory receptor was included in the CAR. While most of the chPD1 T cell receptor combinations secreted both pro-inflammatory and anti-inflammatory cytokines, chPD1 T cells containing a Dap10 costimulatory domain secreted high levels of proinflammatory cytokines but did not secrete a significant amount of anti-inflammatory cytokines. Furthermore, T cells expressing chPD1 receptors with a Dap10 domain also had the strongest anti-tumor efficacy in vivo. ChPD1 T cells did not survive for longer than 14 days in vivo, however treatment with chPD1 T cells induced long-lived protective host-anti-tumor immune responses in tumor-bearing mice. Therefore, adoptive transfer of chPD1 T cells could be a novel therapeutic strategy to treat multiple types of cancer and inclusion of the Dap10 costimulatory domain in chimeric antigen receptors may induce a preferential cytokine profile for anti-tumor therapies.

O3. Breeding by Design for Healthy Plant Products from Soybean

Khalid Meksem*

Department of Plant, Soil, and Agricultural Systems, Southern Illinois University, Carbondale, IL, USA. *Corresponding and presenting author: meksem@siu.edu.

Abstract

No provided.

O4. Improving Plants Specialized Metabolites

Adnane Boualem*

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Abstract

No provided.

Session VIII: Soil Fertility and Fertilizers

Co-Chair: Abdelaziz Nilahyane, Mohammed VI Polytechnic University, Morocco
Co-Chair: Rachid Bouharroud, INRA, Morocco

O1. Soil CO_2 Flux and Active Carbon Across Soil Salinity Gradient Have Promising Implications for Revival of Arid-Saline Soils Subjected to Forage Grass-Legume Mixtures

Dennis S. Ashilenje§, Abdelaziz Hirich, Lamfeddal Kouisni, Krishna Devkota, and Abdelaziz Nilahyane*

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Abstract

Soil salinity has devastating effects to forage crop productivity in arid lands of Morocco. Field experiments in the randomized complete block design was established in three sites with low, medium and high salinity of Laayoune, Morocco, to test if a 50-50% and 70-30% mixture of alfalfa and blue panicum grass and separately, grass pea and barley can spur microbial activities necessary for buildup of soil organic matter and alleviating salinity (ECe up to 54.4 dS m-1) compared to monocrops. Over a duration of 15 weeks, alfalfa-blue panicum grass mixtures enhanced CO_2-C flux compared to monocrops regardless of background soil salinity. This behavior was divergent in a way that the 70-30 mixture had the highest flux in extreme soil salinity while the 50-50% mixture dominated in medium to low salinity. Near similar effect was witnessed for barley-grass pea mixtures which enhanced soil CO_2-C flux under low salinity, but grass pea succumbed to excessive salinity stress which severely depressed soil CO2-C flux. The 70-30 mixture of alfalfa and blue panicum grass slightly enhanced soil active carbon as much as grass monocrop in high salinity and comparable to alfalfa monocrop in medium salinity. There were slight benefits of the 70-30 mixture of grass pea and barley to soil active carbon across soil salinity platforms. In a series of seven events of soil analysis, there was only slight evidence that mixtures could alleviate initially low soil salinity, but moderate to high salinity persisted across the year of crop establishment. It is however emerging that grass-legume mixtures can sustain microbial activities with promising effects to build up of soil organic matter, despite persistent salinity. **Keywords:** Soil salinity, Grass-legume mixture, Microbial activity, Soil CO_2 flux.

O2. Cellulose/Nanoclay Biocomposites Coated Phosphate Fertilizer: Novel Slow-Release Fertilizer for Reducing Phosphorus Leaching and Promoting Plant Growth

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Abstract

Sustainable phosphorus management (P) is crucial for efficient plant nutrition. Polymer coating of highly soluble P fertilizer is an effective technology that can limit the risks of P- leaching and/or runoff into water systems, thus, increasing P- bioavailability and reducing water pollution. In this context, a novel coated Triple Superphosphate (TSP) fertilizer is developed using a simple process and green materials based on phosphorylated cellulose, methyl hydroxyethyl cellulose and montmorillonite clay. Experimental results showed an improved morphology and hardness of phosphate fertilizer granules after coating as well as a positive impact on the water retention capacity of the soil. P leaching in soil was monitored for 80 days, and a substantial reduction of P leaching up to 80 % was successfully achieved by coated TSP fertilizer. In addition, Common Bean growth was improved by coated TSP treatments that showed a remarkable effect on leaf parameters and roots architecture of beans with increased yield by 28.5 %, P uptake by 23 %, P use efficiency by

37.9 % and agronomic efficiency by 54.5 %. **Keywords:** Slow-release fertilizers, coated fertilizers, Phosphorus leaching, Phosphorylated cellulose, Montmorillonite.

O3. *Bacillus circulans* TC7 Mediated the Alleviation of Metal Stress and the Decrease of Metal Accumulation in Spinach Tissues

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Abstract

The contamination of agricultural soils with heavy metals is one of the primary causes of numerous ecological and environmental issues. It has altered the microbial community, degraded the soil, reduced plant growth and yield, and entered the food chain. The tolerance of plants to heavy metal stress must be enhanced in order to permit the growth of crops with minimal or no accumulation of heavy metals in edible plant parts, thereby satisfying the rapidly expanding global population's demand for safe food. In this study, a pot experiment was performed to determine the effects of HMs-tolerant PGP-bacteria, Bacillus circulans TC7, previously isolated from the chloragogenous tissue of Aporrectodea molleri, on the growth and metal accumulation in Spinacia oleracea cultivated in an alkaline soil highly contaminated (mg Kg-1) with Cadmium 7, along with Nickel 100, Copper 150, Zinc 300, and Manganese 600. The results indicated that HMs stress was significantly alleviated when soil was inoculated with B. circulans TC7 compared to the uninoculated control. Indeed, root length increased significantly by 74.5%, whereas shoot length increased substantially by 106.3%. Additionally, bacterial treatment improved spinach's fresh and dry weights by 5.5 and 3.5 times, respectively, and increased the chlorophyll content (a+b) by 75.6%. Furthermore, soil inoculation with B. circulans TC7 decreased root uptake of Mn, Zn, Cu, Cd, and Ni by 43.3%, 49.9%, 62.00%, 22.03%, and 46.3%, respectively. Moreover, the bacterial isolate limited the uptake of metals in the edible parts as manganese, cadmium, and nickel concentrations in aerial tissues were reduced by 71.1%, 59.9%, and 44.2%, respectively. Analysis of the results revealed that soil inoculation with B. circulans TC7 can stimulate plant growth while limiting metal bioaccumulation, indicating its potential use in mitigating HM stress. **Keywords:** Heavy metal stress, arthworm' isolates, PGP bacteria, Spinacia oleracea.

O4. Exploration of the Diversity and Function of Bacterial Community in Maize Rhizoplane Across Moroccan Agro-Systems: Towards a Microbiome Facilitated Agriculture in Morocco

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Abstract

Maize (*Zea mays* L.) is one of the most important staple food crops grown worldwide to feed an ever-growing world population. To increase crop production, current agricultural practices rely on unsustainable techniques such as the overapplication of fertilizers. To overcome this challenge, there is a need for developing sustainable approaches to increase the agricultural system's production. One applied, eco-friendly approach is bacterial consortia that have been reported in many studies for their beneficial plant growth promotion compared to single strains inoculation. The aim of this work is to map the diversity of the bacterial community in the rhizoplane of the maize plants and to select PGPRs to construct promising bacterial consortia. Despite the low diversity of microbes colonizing the root surface, the PGP activities in this niche are highly dynamic. Bacterial isolation was performed from maize rhizoplane soil from 28 agroecological zones of 7 different regions in Morocco using a novel consortia-oriented isolation approach that aims to isolate and examine consortia constructed from phosphate solubilizing and nitrogen-fixing bacteria, in addition to bacteria with other PGP activities from the rhizoplane soil. A total of 144 bacteria were isolated with 44 PSB, 43 NFB, and 57 other PGPR. Genetic fingerprinting using randomly amplified polymorphic DNA-generated profiles allowed elimination of duplicates before bacterial identification using 16s sequencing. Phylogenetic analysis of 16S rRNA sequences revealed the diversity of the isolates with the main dominant genera belonging to Bacillus, Pseudomonas, and Streptomyces that were reported to have an antifungal and antibacterial activities with salt stress tolerance property. Moreover, candidate novel species were also identified that should be tested afterwards. The constructed consortia will be further screened for their PGP properties both in vitro and in planta to determine their beneficial plant growth effect on maize plants. Thereafter, the most performing consortia will be selected to study their individual strains for better understanding of the functions of promising consortia. **Keywords:** PCR fingerprinting, PGPRs, consortia, nitrogen fixation, phosphate solubilization.

O5. Organic Amendments to Restore sandy Soils to Produce Organic Vegetables Under Arid Conditions

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Abstract

To identify the best compost amendments rate in squash-green bean- melon-pepper cropping system that could maintain better the soil fertility in arid conditions; organic matter, humic fraction, humic acids and micro-nutrient elements were evaluated in sandy soil. This study was conducted at the experimental farm of Melk Zhar INRA-Agadir (Morocco) between 2008 and 2013 to determine the effect of four annual compost amendment rates (10 t ha-1, 15 ha-1, 20 t ha-1, and 25 t ha-1) on soil fertility of four organic vegetables at different soil depth (0.30 m, 0.50 m, 0.70 m and 0.90 m). The results showed that when 25 t ha-1 of annual compost was applied to the amended horizon, the pH level decreased by 4.83% compared to control. In the other hand, for all

depth, the electrical conductivity (ECe) increased by 28.1% and 32% at a rate of 15 and 25 t ha-1, respectively. Soil Organic Matter (SOM) content has obviously increased, reaching a maximum of 1.2% at the amended horizon rate of 25 t ha-1. For all rates at the amended horizon, there was an average increase in the humic fraction (42% of Organic Carbon), fulvic acids (34%), and humic acids (14.5%). For all organic amendments rates and soil depths, the total nitrogen, available phosphorus, exchangeable cations (magnesium and potassium), and micro-nutrient elements (iron and copper) increased. Organic vegetable production has increased by an average of 24% over the control. Therefore, in five growing seasons, there has been an increase in production and improvement of sandy-soil fertility.

Concurrent Session IX: Plant Sciences II

Co-Chair: Miguel Botella, University of Malaga, Spain
Co-Chair: Mohamed Nhiri, University Abdelmalek Essaadi, Morocco

O1. Genetic Diversity of Walnut (*Juglans regia* L.) Genotypes Across Middle and High Atlas Moroccan Mountains using ISSR Markers

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Abstract

The genetic diversity and genotypes structure of walnut (Juglans regia L.) are essential to understand and manage genetic resources of this species, as well as for further progress in breeding programs. ISSR markers were used to assess the genetic diversity of 66 individuals' trees from 11 accessions, representing the main cropping area of walnut belonging to two ranges types of Mountains in Morocco: middle and high Atlas. Eleven ISSR primers rendered a total of 135 bands (91%) with 0.88 polymorphic information content. The utilization of 123 polymorphic bands revealed a high level of genetic variation within and among the examined accessions. The multi-locus values of Ht and Hs were 0.25 and 0.20, respectively. The AMOVA analysis showed that 71.30% of total genetic variability is accounted within accessions and 28.70% between accessions. This was congruent with the coefficient of genetic differentiation (GST=0.16). Bayesian model-based clustering approach identified three gene pools that were not correlated with mountain range type. This is the first application of ISSR markers for the assessment of genetic diversity in Moroccan germplasm of walnut. This information will be useful to define conservation strategies and improvement programs of this species. Keywords: Walnut, ISSR, genetic diversity, differentiation, geographic group, bioclimatic group.

O2. In Situ Production and Multiplication of Saffron Corms (*Crocus sativus* L.) in Taliouine, Morocco

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Abstract

Saffron is a sterile triploid plant that propagates only through the vegetative multiplication of corms, which is an underground stem, it's an organ of storage and asexual propagation. Therefore, the preservation and multiplication of corms is a strategic necessity (in situ conservation), these corms have adapted for several decades in the region of Taliouine, the particular origin of production of 95% of Moroccan saffron. This study is a monitoring-evaluation of the agro-morpho-physiological behavior of saffron corms from 10 origins of Taliouine and Taznakht region, over two consecutive years. The planting was in a specific place, platform Ifri in Taliouine for production and multiplication of corms, it had main objectives: (1) the agronomic characterization of the different clones from different origins (2) the safeguard and conservation of this diversity (3) and the selection and multiplication of performing corms. During this period of monitoring this plant material, we were able to assess the production potential and the agro-morphological variability of these corms from different sources: the observations made led to the identification of two cultivars which group together the corms of different origins in the platform, the first cultivar is made up of corms from provenances belonging to the medium altitude plateau (≈1600m), the 2nd cultivar comes from high altitude mountain areas (≥1900m). These two cultivars have a distinct behavior in terms of the development of replacement corms, this diversity of expression and vegetative development is of great agronomic importance and arouses the valuation of this plant material for new plantations of saffron cultivation. This project is part of an agreement between INRA and FIMASAFRAN for the production and multiplication of saffron corms. **Keywords:** Saffron, corm, Taliouine, multiplication, production, selection.

O3. Cultivar Resistance as a Main Tool for Restoration of Cactus Industry Damaged by Cochineal *Dactylopius opuntiae*

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Abstract

The cactus crop (*Opuntia sp.*) was almost damaged in Morocco by the carmine wild cochineal Dactylopius opuntiae (Cockerell, 1896) (Hemiptera: Dactylopiidae) since its first report in 2014. Cactus species was used for food as fresh fruits or byproducts, as animal feed, land fence and also to prevent erosion and desertification. This CAM photosynthesis types plant is the most profitable crops thanks to its strong adaptation to arid and semi-arid climates. The genetic diversity preserved in the cactus collection at the INRA-Agadir from 1999 to 2022 was used as a baseline to find resistant cultivars for rehabilitation of destroyed cactus lands. The 8 identified resistant cultivars to carmine cochineal are described and their roles to restore the cactus industry crops in Morocco is showed. The 2 scenarios suggested are tuned based on the land uses as for farming production (cultural practices) or to prevent erosion and desertification in natural areas like mountains. These 8 cultivars namely: Bellara (light green flesh), Marjana (red flesh), Melk Zhar, Cherratia, Aakria (carmin flesh), Ghalia and Karama (light red) belong to Opuntia ficus indica, O.

engelmannii, O. robusta and O. dillenii. For each one of these 8 cultivars the resistance mechanism involved, the genetic diversity and specific roles will be discussed. **Keywords:** Cactus, resistance, erosion, beekeeping, animal feed.

O4. Evaluation of Agronomic Performance of Legumes in an Agroforestry System Based on Olive Trees in the South of the Mediterranean Sea

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Abstract

In olive tree-based agroforestry, trees compete with crops for soil resources, but they can also improve crops growing conditions under drought conditions, mainly by providing shade during the growing season. Olive trees provide permanent shade for intercrops with different intensity depending on the season and the orientation of sowing intercrops. In this study, we evaluated three legumes (faba bean, chickpea and lentil) in olive agroforestry in northern Morocco. We compared growths in sole crop or intercrop legumes to examine aboveground competitive interactions and pinpoint the likely response mechanisms. We assessed the effect of shade and distance from trees on crop growth, yield components, and final yields. Plant height, aboveground biomass, and grain yield were all higher in 2016 than 2017, and lower in Agroforestry than sole crop for all the legume species. In average, faba bean had the tallest plants (74.33 cm), the highest biomass (32.30 g.m-2) and yield (17.23 g.m-2), while lentil had the shortest plants (32 cm) and the lowest biomass (13.80 g.m-2) and yield (1.18 g.m-2) amongst the three species. Under olive trees, faba bean grain yield was highest under non-Shaded conditions and declined with increased shade, while lentil recorded the highest yield under the shade, and for chickpea the distance from the trees had no effect on the final grain yield. The number of pods and grains per unit area was the most impacted yield component in both 2016 and 2017. Olive trees limited crop growth and caused a significant reduction in grain yield, whatever in 2016 under drought, olive shade had a significant impact on grain number per unit area and grain yield. Despite lower crop yields, we show how shade may impact the performance of legumes under olive Agroforestry. **Keywords:** Chickpea, Faba bean, Lentil, agroforestry, drought, Tree-crop interaction.

O5. Red Fruits in the Souss Massa Region

Redouan Qessaoui*, Y. Rahal, M. Alouani[2], S. Chafiki[1], A. Ajerra[1], A. Tahiri[1], N. Ait Abd[1], A. Wifaya[1], A. Mimouni[1], and R. Bouharroud[1]

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Abstract

The Souss-Massa region, thanks to its climatic conditions which allow good and rapid adaptation of crops, has recently become a region producing red fruits, in particular raspberries. In order to obtain a phytosanitary inventory of red fruit cultivation in the Souss-Massa region, a survey was conducted in the region. The results showed that all agricultural areas in the Souss-Massa region are currently targeted for the cultivation of red fruits. Raspberry, blueberry and blackberry are respectively the most cultivated in the region. Raspberry cultivation is most popular in all regions with abundance in Ait Amira (45%), followed by Biougra (31%) and Belfaa-Massa (21%). While the cultivation of blueberries is widespread in the regions of Biougra (30%) and Balfaa-Massa (15%). Regarding the cropping system, it is the most widespread integrated crop in the region (95%). The results showed that the soilless mode is mainly used for blackberry and raspberry. However, the raspberry can be grown in full soil. In terms of production, the Yazmin variety is the most productive (900 tons) followed by Carmina (500 tons) and Adelita (350 tons). Then, for the blackberry, the Vectoria and Laurita varieties showed impressive productivity, reaching 441 and 300 tons respectively. For blueberries, the Corina variety showed a high production (722 tons) compared to the others. According to these results, the modified Canarian greenhouses are the most used. According to this survey, Cladosporiosis and gray mold are the most economically important diseases in terms of the damage caused to the cultivation of red fruits in the Souss-Massa region. The results of this survey showed that phytosanitary problems due to diseases constitute a priority subject among producers of red fruits in the region of Souss-Massa. **Keywords:** Red fruits, raspberry, blueberry, blackberry, Souss Massa.

Concurrent Session X: Genetics and Genomics

Co-Chair: Mohcine Bennani Mechita, Univ. Abdelmalek Essaadi, Tangier, Morocco
Co-Chair: Mohammed El Hassouni,

O1. QTL and Candidate Genes that Control Several Seed Composition Traits in Soybean

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Abstract

Soybean seeds are rich in protein, oil, fatty acids, isoflavone, sugars, amino acids and other beneficial compounds. Here, we summarize 8-10 years of findings on genetic mapping of seed composition traits (protein, oil, fatty acids, and sugars contents) using four RIL (recombinant inbred line) populations ['PI 438489B' By 'Hamilton (PIxH, n=50), 'MD 96-5722' By 'Spencer' (MDxS, n=92), 'Hamilton' By 'Spencer' (HxS, n=93), and 'Forrest' By 'Williams 82' (FXW82, n=309) RIL populations] and different environments in North Carolina and Illinois. The new linkage maps are useful tools that will serve the soybean community in genetic mapping of QTL for seed composition and other agronomic traits and in identifying candidate genes controlling these traits. **Keywords:** Soybean, QTL, protein, oil, fatty acids, sugars.

O2. Deciphering Protein and Oil Biosynthesis Pathway using TILLING-by-Sequencing+: An Effective Platform for High-Throughput Gene Functional Analysis

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Abstract

Reverse genetic approaches have been widely applied to study gene function in different crop species; however, these techniques, including gel-based TILLING, present low efficiency to characterize genes in soybeans due to genome complexity, gene duplication, and the presence of multiple gene family members that share high homology in their DNA sequence. Chemical mutagenesis emerges as a genetically modified-free strategy to produce large-scale soybean mutants for economically important traits improvement. We used an optimized high-throughput TILLING-by-sequencing+ technology, coupled with universal bioinformatic tools to identify population-wide mutations in soybeans. An ethyl methanesulfonate mutagenized population (4032 mutant families) have been screened for the presence of induced mutations in targeted genes. The mutation types and effects have been characterized for a total of 138 soybean genes involved in soybean seed composition, disease resistance, and many other quality traits. To test the efficiency of TbyS+ in complex genomes, we used soybeans as a model with a focus on several desaturase gene families, GmSACPD, GmFAD2, and GmFAD3, that are involved in the soybean fatty acid biosynthesis pathway in addition to targeting genes involved in increasing protein content and improving amino acid composition. The use of TbyS+ allows the discovery of novel sources of soybean oil traits, including high saturated, monosaturated fatty acids, low polyunsaturated fatty acid contents, in addition to soybean lines with increased protein content while maintaining steady oil. This technology provides an unprecedented platform for highly effective screening of polyploid mutant populations and functional gene analysis. The obtained soybean mutants can be used in subsequent soybean breeding programs for improved protein and oil composition traits. **Keywords:** GmFAD2; GmFAD3; GmSACPD; CoGy, TILLING by target capture sequencing; TILLING-by-sequencing+; fatty acid desaturases; oil biosynthesis pathway, protein content, and amino acid composition.

O3. Genetics and Genomics of Fruit Color in Strawberry (*Fragaria spp.*)

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Abstract

Fruit color is determined by the accumulation of a variety of secondary metabolites, including carotenoids, anthocyanins and other flavonoids. Apart from contributing to fruit attractiveness, these secondary metabolites provide a wide range of health-promoting benefits and are therefore considered to be bio-active constituents. The characteristic red fruit color of strawberries is the result of anthocyanin accumulation. Using a geographically diverse sample of diploid and octoploid

Fragaria species we have shown that differential anthocyanin content could be explained by independent mutations in MYB10. In the cultivated octoploid strawberry, FaMYB10-2 is the dominant homoeolog regulating anthocyanin biosynthesis. As such, mutations in FaMYB10-2 coding region abolished red color formation. However, some fruits with a wild type FaMYB10-2 copy do accumulate anthocyanins in their epidermis but not in the flesh. We have shown that this white flesh phenotype is associated with the absence of FaEnSpm-2, a CACTA-like transposon inserted in FaMYB10-2 promoter from red-fleshed accessions. Natural variants in yellow/white fruit shades are documented in different strawberries, including Fragaria chiloensis and F. vesca as i.e. the F. vesca 'Yellow Wonder' cultivar. The genetic control of yellow/white flesh variation was analyzed using an interspecific F2 population segregating for the yellow/white trait derived from the cross of 'Senga Sengana' and F. chiloensis ssp. lucida. Quantitative trait loci (QTL) mapping detected a single locus named 'Yellow Flesh' controlling most of the observed variation. White flesh (absence of yellow pigments) was dominant over yellow flesh and fitted the 3:1 expected ratio (p=0.53). The 'Yellow Flesh' locus mapped to a reduced interval where FaCCD4-B, involved in carotenoid metabolism has been detected. Accordingly, yellow fleshed F2 lines showed a downregulation of FaCCD4-B and significantly higher accumulation of a number of carotenoids, such as lutein, as well as a 2.3-fold increase in total carotenoid concentration. The outcome of these genetic analyses allowed us the development of predictive HRM and KASP markers for targeted breeding and marker-assisted selection of strawberry varieties with improved sensorial and nutritional fruit. This work is funded by Agencia Estatal de Investigación (PID2019-111496RR-I00 / AEI / 10.13039/501100011033) and PAIDI P18-RT-4856 (Junta de Andalucía, FEDER funds). Keywords: Strawberry, anthocyanins, carotenoids, QTL, marker-assisted selection.

O4. QTL and Candidate Genes for Seed Tocopherol Content in 'Forrest' by 'Williams 82' Recombinant Inbred Line (RIL) Population of Soybean

Dounya Knizia[1,2§], Jiazheng Yuan[3], Naoufal Lakhssassi[1], Abdelhalim El Baze[1], Mallory Cullen[1], Tri Vuong[4], Hamid Mazouz[2], Henry T. Nguyen[4], My Abdelmajid Kassem[3], and Khalid Meksem[1*]

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Abstract

Soybean seeds are rich in secondary metabolites which are beneficial for human health, including tocopherols. Tocopherols play an important role in human and animal nutrition thanks to their antioxidant activity. In this study, the 'Forrest' by 'Williams 82' (F×W82) recombinant inbred line (RIL) population (n = 306) was used to map quantitative trait loci (QTL) for seed α-tocopherol, β-tocopherol, δ -tocopherol, γ-tocopherol, and total tocopherol contents in Carbondale, IL over two years. Also, the identification of the candidate genes involved in soybean tocopherols biosynthetic pathway was performed. A total of 32 QTL controlling various seed tocopherol contents have been identified and mapped on Chrs. 1, 2, 5, 6, 7, 8, 9, 10, 12, 13, 16, 17, and 20. One major and novel QTL was identified on Chr. 6 with an R^2 of 27.8, 9.9, and 6.9 for δ-tocopherol, α-tocopherol, and total tocopherol content, respectively. Reverse BLAST analysis of the genes that were identi-

fied in *Arabidopsis* allowed the identification of 37 genes involved in soybean tocopherol pathway, among which 11 were located close to the identified QTLs. The identified tocopherol seed QTLs and candidate genes will be beneficial in breeding programs to develop soybean cultivars with high tocopherol contents. **Keywords:** Soybean, QTL, seed, tocopherols, Forrest, Williams82.

O5. Mapping QTL for Soybean Seed Protein and Amino Acids in the Forrest x Williams82 RIL Population

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Abstract

Soybean [Glycine max (L.) Merr.] is an important crop in the America, and a total of 95.2 million metric tons of soybean seeds have been harvested each year with the value of approximately 31 billion dollars. Soybean seeds are the major protein source for animal feed. However, soybean seeds contain limiting amount of some amino acids including cysteine (Cys), lysine (Lys), methionine (Met), and threonine (Thr), Among them, Lys, Met, and Thr are essential amino acids (EAAs). The supplement with the synthetic amino acids in animal feed is expensive. Therefore, the investigation of amino acid dynamics and reveal the genetic contribution of amino acid contents in soybean will help us to develop elite soybean lines with the enriched certain amino acids. The objective of this study was to map the quantitative trait loci (QTL) associated with protein and amino acid contents in the recombinant inbred population derived from Forrest × Williams 82 (FxW82) within two diverse environments, Spring Lake, NC in 2018 and Carbondale, IL in 2020, respectively. In this undergraduate centered research, a total of 63 QTL in Spring Lake and 42 QTL in Carbondale, respectively were identified (LOD>2) for protein and amino acid contents using composite interval mapping (CIM) method in FxW82 RIL population, which was genotyped by soybean 6K Illumina Infinium Beadchips. The range of phenotypic variation explained by the QTL was varying from 3.31- 53% in the dataset. The significant SNPs adjacent to the QTL can be converted into the KASP based PCR assays for marker-assisted selection. The genetic information uncovered in our study will be useful to enhance soybean improvement with better nutritional value.

Session XI: Plant Products and Bioactive Compounds

Co-Chair: Abdelfettah Maouni, Abdelmalek Essaadi University, Morocco
Co-Chair: Katelyn Kesheimer, Auburn University, USA

O1. Bioactive Compounds, Antioxidant Activity and Fatty Acids Composition of Fruits of Ten Moroccan Pomegranate Cultivars (*Punica granatum* L.)

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Abstract

The pomegranate fruit is gaining worldwide increasing interest for its consumption. It is mainly consumed fresh or as juice. This interest in pomegranate is due to its nutritional and therapeutic benefits. In this context, this study aimed to evaluate the characteristics of fruit juice and seed oil of ten pomegranate cultivars grown in the Center of Morocco. Mineral composition, organic acids, total polyphenols, anthocyanins content and antioxidant activity were determined in pomegranate juices. While fatty acid composition and antioxidant activity were determined in pomegranate seed oils. The results showed interesting characteristics for the studied cultivars. For the pomegranate juice, mineral composition showed that iodine was the most abundant macroelement, followed by phosphorus and sulphur. Iron and aluminum were the main microelements. The most dominant organic acid was citric acid with concentrations ranging from 0.11 to 2.92 g/100 mL for the sour cultivar "Lhamdha". Oxalic acid was mostly detected in sweet cultivars with concentrations ranging from 0.04 to 0.10 g/100 mL. The cultivar "Lhamdha" presented the highest total polyphenol concentration with 116.83 mg gallic acid equivalent/100 g followed by the sweet cultivars "Sefri of Beni Meskine", "Lahmer" and "Marrakchia". The highest total anthocyanin content was registered for cultivar "Lahmer" (which means red) and "Marrakchia" with 20.41 and 21.28 mg/100 mL, respectively. The sour cultivar "Lhamdha" and the sweet cultivar "Sefri of Beni Meskine" presented the highest antioxidant activity with 111.24 and 105.99 mg acid ascorbic equivalent/100 g, respectively. Pomegranate seed oil presented high contents of polyunsaturated fatty acids (PUFAs) exceeding 89%. The major fatty acid was punicic acid, which represented more than 80% of fatty acids, while other fatty acids such as linoleic, oleic, and palmitic acids are minor. Oils also showed high antioxidant activity (Inhibitory concentration IC50: 0.69-1.80 mg/mL). This study highlighted the nutritional and functional potential of the studied cultivars and the importance of their valorization, especially in food and pharmaceutical industries. **Keywords:** Morocco, Punica granatum, fruit juice, seed oil, bioactive compounds, antioxidant activity, fatty acids.

O2. Anticancer Activity and Characterization of Secondary Metabolite Compound from Dichloromethane Fraction of *Zizyphus lotus*

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Abstract

The present work investigated the trimethylsilylation dichloromethane extract of different morphological parts of *Zizyphus lotus* (seeds, pulp, leaves, and root barks) by GC-MS and evaluation of their anti-tumor activity and the mechanism of action. In this study, 123 compounds were detected and quantified, from which fatty acids (455-8501 mg/kg dw) and triterpenic acid (248-10230 mg/kg dw) are the major families of lipophilic components present in Z. lotus, followed by sterols, long-chain aliphatic alcohols, aldehydes, monoglycerides, aromatic compounds among other. Moreover, Z. lotus lipophilic extract of root barks demonstrated higher inhibitory effects against human tumor cell lines of MDA-MB-231, MCF- 7, and HepG2. While, the exposing MDA-MB-231 cell for 48h, to the respective IC50 concentration of root barks lipophilic extract, showed its ability to stop cell migration, arrest cell cycle at G2, and processes apoptosis as well as the down regulation of the PI3K/Akt pathway. In summary, Z. lotus has the potential to be exploited as a source of bioactive compounds that can be applied in the formulations of different ingredients for the food and pharmaceutical industry. **Keywords:** *Zizyphus lotus*, lipophilic fraction, triterpenic acid, anticancer activity, apoptosis, cell migration, cell cycle.

O3. Sorghum (*Sorghum bicolor* (L.) is a Potent Medicinal Food as an Antioxidant, Antiglycation, and Anti-Diabetic

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Abstract

Advanced glycation end products (AGEs) generated from glycation might cause diseases such as diabetes. Antioxidants are essential in protecting humans against infections and degenerative diseases due to their ability to neutralize AGEs. Sorghum (Sorghum bicolor (L.) is an ancient plant in the Mediterranean basin known for multiple end-uses such as food and a source of bio-

active compounds that could be used for medical applications. The present research deals with phytochemical screening and the antioxidant properties of both aqueous and ethanolic extracts of seeds from five Sorghum (Sorghum bicolor (L.) ecotypes. Additionally, antidiabetic inhibitory activities (α-amylase and α-glucosidase and inhibitory potential on AGEs formation have been investigated using the ethanolic extract of the five Sorghum ecotypes. The ethanolic extract exhibited a high phenolic and flavonoid content. Furthermore, phenolic composition analysis using LC-MS/MS demonstrated the presence of attractive major compounds. The mineral composition using both ICP-MS and ICP-OES of all ecotypes also showed the valuables potential of the five-sorghum ecotype as a therapeutic food. The ethanolic extract of Sorghum seeds also showed high inhibitory effects on the production of Amadori products and AGEs from albumin in the presence of fructose and a significant inhibitory effect against α-amylase and α-glucosidase. These results suggest the possibility of using sorghum seeds as a source of natural bioactive foods to prevent glycation-associated complications in diabetes and investigate their possible combination effect with conventional drugs of preclinical use. **Keywords:** *Sorghum bicolor* (L.); bioactive compounds; antioxidant effect; antidiabetic activity; antiglycation potential.

O4. The Effect of Moroccan Seaweeds from Mediterranean Coast (*Halopteris scoparia*, *Gracilaria dura*, and *Entermorpha compressa*) on *Medicago sativa* Plant Growth

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Abstract

In agriculture, the use of chemical fertilizers and pesticides causes negative effects to the environment and human health. Therefore, choosing a sustainable agricultural model has become a challenge for agriculture and food security in order to reduce the use of these chemical products. In fact, organic farming has experienced a great development. Hence the interest in natural products of natural origin, such as plants and algae. The main objective of this study was to evaluate the biostimulant effect of extracts of a brown alga (Halopteris scoparia), a red alga (Gracilaria dura) and a green alga (Entermorpha compressa) on germination and growth of Medicago sativa plant. For this purpose, four treatments with the macroalgal extracts (25%, 50%, 75% and 100%) were tested. Then, the determination of the germination rate and the evaluation of the growth of the plant through physiological and biochemical parameters was carried out on the obtained plant biomasses. The results obtained revealed that the treatment of plants by 25%, 50% and 75% of aqueous extracts of Halopteris scoparia, Gracilaria dura and Entermorpha compressa, induced a significant increase in the germination rate and an improvement of the vegetative biomass growth (dry weight). In addition, the application of theses algae extracts studied resulted in an increase in the content of mineral elements and photosynthetic pigments (chlorophyll and carotenoids). In light of the results obtained, it was concluded that the macroalgal extracts studied could be suitable for promoting plant development. Furthermore, they can be an alternative way to develop

sustainable agricultural practices that respect the environment. **Keywords:** *Halopteris scoparia, Gracilaria dura, Entermorpha compressa*, Seaweeds, Biofertilization, Biostimulation, *Medicago sativa*, Growth, Mineral elements, pigment contents.

Concurrent Session XII: Soil Sciences and Soil Resilience

Co-Chair: Eric Brevick, Southern Illinois University, Carbondale, IL, USA
Co-Chair: Rachid Moussadek, Morocco

O1. Eastern Red Cedar as a Bioenergy Crop to Improve Soil Quality in the Great Plains, USA

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Abstract

Eastern red cedar (ERC, *Juniperus virginiana* L.) is commonly found in tree windbreaks in the semi-arid Great Plains of the central USA. ERC has strong potential as a bioenergy feedstock due to its physical and chemical characteristics. This study sought to assess the sustainability of ERC bioenergy plantings by evaluating carbon sequestration and selected soil quality parameters in existing ERC stands across the northern Great Plains. Nine sites were selected in five states with mean annual precipitation (MAP) that ranged from 446 to 999 mm and mean annual temperature (MAT) that ranged from 4.4 to 10.0 °C. Infiltration was measured using the twin ring technique at nine locations in each tree planting and adjacent agricultural field (crop, pasture, or hay) at each site. After infiltration measurements were made, a 4.8 cm-diameter soil core was collected to a depth of 30 cm inside one infiltration ring to collect samples to determine bulk density, texture, pH, aggregate stability, soil organic carbon (SOC), and nitrogen (N). Penetration resistance was measured to 30 cm depth in 2.5 cm increments in the other infiltration ring. Infiltration rate and depth to 2 MPa penetration resistance averaged 55% and 20.3% greater, respectively, under tree cover. Estimated tree aboveground biomass C and SOC were both strongly correlated with MAP. Tree aboveground C stocks were estimated to increase 2.05 Mg ha-1 yr-1 on average. SOC stocks under tree cover were 16.8% greater than in the adjacent agricultural land use. ERC planting for bioenergy feedstock production is likely to increase soil carbon sequestration and improve soil physical and chemical quality, especially for degraded soils or soils with marginal crop production potential. These same ERC plantings may also provide enhanced income potential from areas that currently generate little to no income. **Keywords:** Windbreak; agroforestry; bioenergy feedstock; carbon sequestration; marginal soils.

O2. Soil-Human Health-Nexus: with Focus on Dimensions of Soil-Water-Plant-Microbes and Human

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Abstract

There are a number of strong relationships between soil and human health, both direct and indirect. The soil system is essential for life due to its influence in the provision of clean water, healthy edible foods, feed, fiber, shelter, and fuel. Soil also serves as a repository for components of human culture. The soil-human health nexus should be studied with focus on some crucial dimensions including soil and its components water, plants, and microbes. Water is an essential component of soil, and transports many elements that may be in nutrient form for or present at toxic levels for plant production. Soil water, or the soil solution, represents the theater of interactions for many soil processes. Many nexuses are created among the soil components including different aspects of the soil-water-plant-human nexus (SWPH). The components of this nexus have many combinations such as soil-human, soil-plant, soil-water, soil-water-human, soil-plant-human, etc. nexuses. The ultimate goal of this study is to add to knowledge of the SWPH nexus in a way that incorporates art and culture into our scientific understanding of some of today's major global challenges. Although the soil and its relationship to human health was originally noted several centuries ago, each of the water, plant, and microbe components in soil have many direct and/or indirect impacts on human health. Several open questions concerning each component still need to be answered and will be discussed. **Keywords:** Soil system, Microflora, Microfauna, Soil-Water-Plant-Human nexus.

O3. Status of Macronutrients in Selected *Valencia orange* orchards in the Gharb Region of Morocco

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Abstract

Valencia orange is one of the principal varieties grown in Morocco. In this study, we conducted a field survey to assess the status of essential macronutrients (N, P, K, Ca and Mg) in Valencia orange orchards located in the Gharb region, the second largest citrus growing area in Morocco. Soil (0-20 cm) and leaf samples were collected from 20 Valencia Late orange orchards. Soils of the investigated orchards were medium to heavy in texture. Their content in organic matter varied from 0.6 to 3.1 %, pH ranged from 7.8 to 8.7, EC was between 0.2 and 0.7 dS m-1, and total CaCO3 content varied widely from 0.2 to 25%. Their content of total nitrogen was in the typical range (0.5 to 1.6 g Kg-1) reported for citrus orchards in Morocco. These soils had low to optimum levels in available P (7.5-59.1 mg Kg-1) and optimum to high levels in available K (143-540 mg Kg-1). Available Ca

levels were extremely high in all soils (5.3-9.6 g Kg-1), while Mg levels were very low (4.6-40.6 mg Kg-1). Leaf analysis, in accordance with soil analysis, showed that all orchards were deficient in Mg and most of them had suboptimum levels of N (6.8-21.1 g Kg-1), optimum to high levels of P (0.9 – 2.2 g Kg-1), K (2.8 – 9.0 g Kg-1) and Ca (46 – 96.6 g Kg-1). Generally, the result of this study showed an unsatisfactory nutrient management of the studied Valencia orchards, particularly for Mg, N and P whose fertilization should be carefully implemented to support optimum yields. **Keywords:** *Valencia orange*, Citrus, leaf analysis, soil analysis, macronutrient, Gharb.

O4. Estimating Actual Abundance of European Sousliks: UAV Imagery, Pixel Based Imaging, and Random Forest Classification for Counting Surface Burrow Openings and GPR for Identifying Subsurface Burrows

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Abstract

Soil quality is a compound characteristic that cannot be measured directly. If functions provided by soils are diminished, then quality is decreased. Burrowing mammals frequently play a crucial role in the functioning of grassland ecosystems, maintaining their diversity, functions, services, and high quality. However, the non-destructive estimation of burrowers' population size, spatial and temporal population dynamics is a challenge for conservation. Determining the number of burrow openings and mounds would be a good proxy for estimating actual population sizes when one individual occupies one burrow system and if the ratio of openings per burrow system was known. First, we present an imagery-based method to identify and count animals' burrows semi-automatically by combining remotely recorded RGB images, pixel-based imagery and Random Forest classification. Then we show the sketch of a pilot study where we aimed at identifying and locating artificial burrows with GPR on a natural grassland similar to a ground squirrel or mole-rat habitat. Field images were collected for four colonies, then combined and processed by histogram matching and spectral band normalization to improve the spectral distinction between the categories BURROW, SOIL, TREE, and GRASS. Accuracy index of classification for BURROW kappa (κ) was 95 (precision) and 90% (sensitivity) respectively. A 10-time bootstrapping of the final model resulted in coefficients of variation (CV%) of BURROW κ for sensitivity and precision lower than 5%, moreover CV% values were not significantly different between those scores. The consistency of classification and balanced precision and sensitivity confirmed the applicability of this approach. Our approach provides an accurate, user-friendly and relatively simple approach to count the number of burrow openings, estimate population abundance and delineate the areas of occupancy non-invasively. For the GPR survey we used a Mala system with 160 and 750MHz shielded antennas to identify and locate artificial burrows at different depths from 10 to 165cm. We sketch out the experiment and a few results of the analyses of the radar profiles with special reference to depth limits of GPR surveys and visual representations of air-filled burrows on radar profiles. **Keywords:** Random-forest; ground squirrel; image processing; ground penetrating radar.

Session XIII: Plant Sciences III

Co-Chair: Mohammed Amine Seghrini, University Ibn Zohr, Morocco
Co-Chair: Nicole Gauthier, University of Kentucky USA

O1. Peripheral Membrane Proteins Modulate Stress Tolerance by Safeguarding Cellulose Synthases

Christopher Kesten[1,2], Álvaro García-Moreno[3], Vítor Amorim-Silva3, Alexandra Menna[2], Araceli G. Castillo[4], Francisco Percio[3], Laia Armengot[5], Noemi Ruiz-Lopez[3], Yvon Jaillais[5], Clara Sánchez-Rodríguez[2], and Miguel A Botella[3*]

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Abstract

Cellulose, the main load-bearing component of plant cell walls, constitutes a quarter of all organic material on Earth. This remarkable amount of cellulose is synthesized by Cellulose Synthase Complexes (CSC). CSC propels itself forward through the plasma membrane with its own catalytic activity using cortical microtubules as steering devices. Four components of the CSC machinery have been identified, CESAs, KORRIGAN, CSI1, and CCs, the last members of the complex identified in 2015. We have identified the Tetratricopeptide Thioredoxin-Like (TTL) proteins as new members of the cellulose synthase complex (CSC) and describe their unique and hitherto unknown dynamic association with the CSC under cellulose-deficient conditions. TTLs are essential for maintaining cellulose synthesis under high salinity conditions, establishing a stress-resilient cortical microtubule array, and stabilizing CSCs at the plasma membrane. To fulfill these functions, TTLs interact with Cellulose Synthase1 (CESA1) and engage with cortical microtubules to promote their polymerization. We propose that TTLs function as bridges connecting stress perception with dynamic regulation of cellulose biosynthesis at the plasma membrane. **Keywords:** Abiotic stress tolerance, cellulose biosynthesis, cell wall signaling.

O2. Breeding Programs in Argane Tree: Microsporogenesis Study and Cytogenetic Approach

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Abstract

The cross-pollination is often insufficient to obtain a desirable fruit yield in the absence of compatibility between the orchard's argane trees. Proper pollination design is therefore essential to ensure a supply of compatible pollen. In this study, improvement programs in the argane tree can be facilitated by integrating knowledge of the cytogenetic and microsporogenesis studies. So, during cytological analysis of argane tree meiosis, unreduced pollen has been observed, in parallel with this study, a study on parent chromosomal numbers detects a chromosomal diversity. Evaluations of fertility and sterility levels in mature pollen were done and strongly depend on both of these tools used. Good cross compatibility has been correlated with aberrant microsporogenesis and variation in number of chromosomes. The cross-compatibility rate depends on cross associations and it varies from 0 to 84 %. For argane tree, it was observed, for the first time, that compatible pollinizers have pollen effects on the weight, size and volume of the fruit and not on the ripening period of the fruits. **Keywords:** Argane tree, breeding program, pollinizers, self-incompatible, chromosomal diversity, compatibility, unreduced pollen.

O3. The Efficacy of Pheromone Traps in Controlling Tomato leafminer, *Tuta absoluta*

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Abstract

The development of new operational techniques for monitoring adult populations of tomato leafminer, Tuta absoluta (Meyrick) (Lepidoptera: Gelechiidae) is regarded as a pressing need for surveillance and control of this major pest of tomato crops. Trap design is an important component of a monitoring or mass trapping system, along with the semiochemical attractant. Here we present the results of an experiment carried out in tomato farms to assess the efficacy of a newly designed pheromone trap (i.e., sticky trap) in capturing T. absoluta adults and compare it to traditional pheromone traps. Analysis of variance demonstrated significant differences in the number of captures between the three traps. The mean (± SE) number of captures/trap/week in sticky traps was 70.44 ± 4.57, significantly higher than those captured in delta traps (55.94 ± 4.77) and water pan traps (18.63 ± 1.49). The results showed that the newly designed pheromone trap is a promising solution to lessen T. absoluta populations and thereby protecting tomato crops from infestations. **Keywords:** mass trapping, monitoring, sex pheromone, tomato, trap type, *Tuta absoluta*.

O4. Assessment of East Moroccan Almond Germplasm and Selection of Promising Accessions Based on Screw-Pressed Seed Oil Quality and its Potential for Micropropagation

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Abstract

The almond (Prunus dulcis Mill.) is one of the most important nut crops worldwide and it is largely planted under different environmental conditions. The present research aimed to study the traditional almond trees plantations based on seedlings in three sites in eastern Morocco (Rislane, Bsara, and Ainsfa), which represents an important gene pool, both for breeding programs and selection of superior genotypes adapted to Moroccan conditions. Unfortunately, those trees are generally abandoned or replaced, leading to genetic erosion and regression of indigenous populations of this species, while they have an ability to adapt to the most varied pedoclimatic conditions. Thus, finding and characterizing old genotypes for the conservation of biodiversity is of interest to the diversity of crops in these almond groves. The objective of this study is to assess the quality of screw-pressed seed oil based on tocopherol content (TC), acid value (AV), peroxide value (PV), and oxidative stability (OS). 20 genotypes were selected according to the highest shelling rates of their kernels from more than 150 "Beldi" almond genotype grown in eastern Morocco, with a shelling percentage ranging from 24 to 32%. The highest value of the major homolog α-tocopherol was equal to 555,88 mg/kg using a screw press extraction at a temperature of 100 C°. Genotypes singled out as the most promising for breeding and commercial growing were multiplied by in vitro tissue culture techniques. The results showed multiple shoot initiation using Thidiazuron (TDZ) at the concentration of 1mg/L, singled out as the most effective for in vitro proliferation of the "Beldi" ecotype. While the most significant rooting rate (60.41 % ± 0.81) was achieved with 1 mg / L of Indole-3-butyric acid (IBA) incorporated into MS½ medium. Plantlets were successfully adapted to the in vivo conditions, and they were grown vigorously in the greenhouse without any morphological abnormalities. **Keywords:** Almond, biochemical characterization, oil quality, tocopherol content, in vitro tissue culture.

Session XIVA: Studies in the USA

Co-Chair: Moulay Abdelmajid Kassem, Fayetteville State University, USA
Co-Chair: Khalid Meksem, Southern Illinois University, USA

O1. Attending the Graduate School at Southern Illinois University

Dounya Knizia*

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Abstract

To attend graduate school at Southern Illinois University, the presentation will describe the following steps that a student will follow to facilitate the application process: (1) take your TOEFL test and score of at least 80%, (2) translate your diplomas and transcripts into the English system by doing a course-by-course evaluation, (3) write your research and personal statements and get them ready for submission, (4) contact a professor (supervisor) who is working in the field of your interest, (5) ask for at least three letters of recommendations (LORs) to be sent by your references

upon request, (6) apply online at: https://siu.edu/apply-now/ (It takes about one to two months to get an answer about your application), (7) once your application is accepted, apply for the visa on https://www.ustraveldocs.com/ma/ma-niv-visaapply.asp (complete DS-160 form, pay the visa fee), (8) pay the I-901 SEVIS fee ($350), (9) book your air ticket, travel earlier than the start of the semester, and attend the grad school orientation, (10) start looking for lodging before flying to the US, (11) bring with you enough funds to pay for your living expenses for at least 2 months ($3,000) until you get your first paycheck, and (11) keep your supervisor (Major Professor) always informed by email about each step.

O2. Undergraduate and Graduate Studies in the USA

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Abstract

USA has many of the world's most prestigious colleges, universities, institutes, and institutions of higher education. These institutions of higher education are well funded by US government and educate millions of students from US and many parts of the world. In addition, USA has several national labs funded and run by the Dept. of Defense (DoD), National Institute of Health, and several other agencies. Therefore, thousands of international students come to study in the US and earn their degrees. Here, we summarize the process of attending US institutions of higher education step-by-step at the undergraduate and graduate levels. Opportunities and challenges of living in the US as an international student will also be discussed. **Keywords:** Undergraduate, graduate, higher education, scholarships, USA.

Session XV: Students Oral Presentations I

Co-Chair: Naoufal Lakhssassi, Southern Illinois University, USA
Co-Chair: Fatima Zahra Ouasso, University Ibn Zohr, Morocco

O1. Biocontrol Potential of Phosphate-Solubilizing Rhizobacteria Isolated from *Astragalus armatus* Rhizosphere Against *Fusarium oxysporum*

Mounia Bakkali Bouarrakia*, Anas Elyemlahi, Ouiam Elgaliou, Mounir Hassani Zerrouk, Amin Laglaoui, Mohammed Bakkali, and Abdelhay Arakrak

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Abstract

Plant growth promoting rhizobacteria (PGPR) are defined as root-colonizing bacteria that positively affect plant growth through direct or indirect mechanisms. With the aim to select beneficial bacteria exhibiting several plant growths promoting (PGP) traits, 102 bacteria were isolated

from rhizospheric soil of Astragalus armatus growing wildly in Northeastern region of Morocco, of which 40 bacteria were Tri-calcium phosphate solubilizers (PSB). Based on solubilization halos diameter, ten bacterial strains were selected to explore more activities. Indeed, all tested bacteria were siderophores producers except R29 strain. Only two bacteria, R23 and R32, were positive for indole acetic acid synthesis. For Ammonia, all isolates were able to produce it, while 50% of isolates secrete hydrogen cyanide. Additionally, bacteria ability to secrete lytic enzymes was evaluated. All isolates were amylase and cellulase producers, only two bacteria, R29 and R101 secreted protease, while for urease activity, only R44 strain was negative. All test strains were assessed by tri-calcium phosphate solubilizing quantitative assay in PVK liquid medium. The obtained concentrations were between 212.93 mg L-1 and 265.28 mg L-1. This solubilization was accompanied by a pH decrease of the medium from 7 to 3.86. Fusarium oxysporum was selected to evaluate the antifungal activity of the selected strains due to it high pathogenicity to wide variety of plants. As a result, they could inhibit the fungal growth with significant different percentages. The evaluated strains in this study could be used as biocontrol agents to improve agricultural yield and productivity. **Keywords:** PGPR, PSB, *Fusarium oxysporum*, *Astragamus armatus*.

O2. Effect of Provenance on Yield and Secondary Metabolite Content of Extracts from *Juniperus thurifera* in Morocco

Khalid Benhssaine[1*], Jamal Aabdousse[2], Nora Salim[2], Ilias Oussif[2], Mohamed Elhabty[2], M'hamed Ramchoun[3], Younes Abbas[1], and Hicham Berrougui[1]

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Abstract

Juniperus thurifera is a dioecious tree belonging to the Cupressaceae family. It has important ecological, socio-economic, floristic and cultural interests. It is endemic to the western Mediterranean basin to which belongs Morocco. It is among the Moroccan species less valued and less preserved. Its stands do not cease that has degraded vigorously. It is distributed in areas with semi-arid and sub-humid bioclimates with cold to very cold variants in the Middle Atlas, the Eastern Anti-Atlas and the Eastern and Central High Atlas and on altitudes ranging from 1800 m to 3300 m and on all types of substrates. In traditional medicine, the essential oils of juniper have been used as abortifacient and regulator of menstruation, while the wood tar is used as veterinary remedy. The objective of the present work is to explore the effect of provenance on the yield, phenolic compounds, flavonoids and tannins contents and antioxidant activity of the extracts of the leaves of this species. The results obtained show a significant variability between the samples coming from three different biogeographic zones: the Eastern, Central and Western High Atlas. This allowed us to highlight the effect of the origin on the production of secondary metabolics. In fact, we found that the population of Eastern High Atlas has a good yield in methanolic extracts (9.41% ±0.59) and that the population of El Haouz is the richest in polyphenols (191.30±4.27), as well as it has endowed an important reducing power (IC50 = 0.98 ± 0.05 mg/ml). These results can be exploited

as bioindicators in any program of valorization and conservation of Moroccan juniper thurifer. **Keywords:** *Juniperus thurifera*, provenance, extract, yield, compound, Morocco.

O3. Actinobacteria-based Biofertilizer Improve Cereal Plant Growth and Nutrient Acquisition Under Rock Phosphate/Potassium Fertilization

Kenza Boubekri[1,2§], Abdoulaye Soumare[1], Ilham Mardad[1], Karim Lyamlouli[1], Yedir Ouhdouch[1,2], Mohamed Hafidi[1,2*], and Lamfeddal Kouisni[1,3]

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Abstract

Soil fertility and plant nutrition require an adequate management of essential macronutrients such as potassium (K) and phosphorus (P), which are mandatory for plant development, crop yield and quality. Although abundant in soils, the availability of P and K is too low to meet plant's need as they occur mostly in insoluble forms. Therefore, exploiting soil P and K mineral reserve by using beneficial microorganisms as biofertilizer can improve their availability and, consequently, crops yield in a sustainable way. In this context, greenhouse experiments were conducted to evaluate the capacity of 9 Actinobacteria strains (P13-P14-P15-P161-P17-P18-BC3-BC10 and BC11) belonging to Streptomyces and Nocardiopsis to solubilize P and K rocks. Results showed that rock P and K combined with these selected Actinobacteria strains consistently increased shoot/root dry weights, yields, and enhanced soil mineral availability, suggesting their potential use as biofertilizer. This positive relationship emphasizes the potential importance of managing P/K solubilizing Actinobacteria for improving both P and K acquisition by cereal crops. The most performing strains were P18, BC3, BC10, and BC11 since they have a broad spectrum of RP and RK solubilization as well as the capacity to produce a plethora of beneficial substances such as IAA, HCN, ammonia, and siderophores. Moreover, inoculation with these strains improved soil enzymatic activities such as acid and alkaline phosphatase in plant rhizosphere. Moreover, the mechanism of root colonization was also studied. In fact, in-vitro tests and scanning electron microscopy analysis revealed that the elite Actinobacteria strains not only colonized effectively the roots of cereals plants by also formed a strong biofilm along epidermal tissues which highlight the positive interaction between plants and microorganism. These findings showed that the selected strains are promising candidates for the implementation of an efficient biofertilization strategy and a sustainable solution to valorize low reactive RP and RK in agriculture. **Keywords:** Actinobacteria, Phosphate & Potassium Rock, Biofertilizers, Wheat, Maize, Greenhouse.

O4. Sustainable Soybean [*Glycine max* (L.) Merr.] Production Through the Use of Rhizobium Inoculation and Different Sources of Phosphate Fertilizer in Ghana

Alfred Balenor Buernor[1*], Muhammad Rabiu Kabiru[1], Noura Bechtaoui[1], Edwin K. Akley[2], Michael Asante[2], and Martin Jemo[1]

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Abstract

The relevance of biological nitrogen nutrition of soybean is recognized worldwide but inoculation with rhizobium (Rhz) shows variable results, and the benefit needs to be validated under current crop production practices. Also, we wanted to elucidate the effect of Phosphate fertilizer source in combination with inoculants. A total of 9 field experiments in three different soil types namely, Planosols, Plinthosols, and Acrisols were established in Northern Ghana. The experimental design was a split-plot arranged in a randomized complete block with four replications. The main plot was assigned to different phosphorus sources; control, triple superphosphate (TSP), and 50% TSP + 50% rock phosphate (RP), and the subplots to nitrogen sources; control, Rhizobium phaseoli DSM 30137 (S1), Bradyrhizobium japonicum DSM 30140 (S2), Bradyrhizobium japonicum, USDA 110 (SARIFIX) and urea. TSP + Rhizobium application gave the best yield across all three soil types. The average yield due to inoculation only was 1.4t ha-1 while the average for the control was 0.6 t ha-1 representing an average relative yield increase of 138.6%. Treatments with rhizobium inoculant produced heavier nodules than their respective controls. SARIFIX together with TSP gave the heaviest dry biomass of about 47% relative increase compared to the control. These results demonstrate the potential of improving soybean nodulation, growth, and seed yield profitability using Rhizobia and P fertilizer in Ghana. The strain S2 showed good prospects under all the soil types, further studies will be needed to validate our findings in other to incorporate this strain into the sustainable soybean farming systems in Ghana. **Keywords:** Soybean, phosphate fertilizer, rhizobium, yield, sustainability.

O5. A Moroccan Comparative Study of Urban landscapes And Farming Lands in Bird Species: Evidence from Morocco (Northwest Africa)

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Abstract

Urban expansion leads to modifications of habitat features, organization, and resources. Bird assemblages are known to respond by escaping destructive changes and adapting to sustainable ones. In this study, we investigated for the first time the avian diversity and its variation following the rural-urban gradient in Beni Mellal (Morocco) from 2018 to 2021. We used the line-transect method and multivariate analysis to demonstrate the selection of breeding habitats. Our result revealed a total of 84 species divided into resident breeders (64.28%), passage migrants (17.85%), breeding migrants (26.19%), winter visitors (32.18%) and accidental visitors (1.19%). Two globally vulner- able species counting the European Turtle Dove Streptopelia turtur and the European Goldfinch Carduelis carduelis were recorded. Breeding populations were concentrated in green spaces (9 spe- cies) located in the urban zone, compared with farmlands (7 species), peri-urban (3 species), and rural areas (3 species). Therefore, these results reverse the hypothesis that rural and farming lands are more species-rich because of a higher population size. This is due to the

abundance of breeding and foraging resources in urban green spaces compared to arid lands surrounding cities in this North African area. Furthermore, our study provides a new opportunity for comparative studies of avian diversity in Morocco and Northwest Africa. **Keywords:** Avian diversity, richness, rural-urban gradient, Beni Mellal.

O6. Ethnobotanical Survey on Traditional Uses of Saffron By-products by Local People from Taliouine Center and Regions in Morocco

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Abstract

Crocus sativus (saffron) is common in Morocco, especially in the Taliouine regions due to their multiple climatic and altitude conditions. The aim of our study is to assess the state of the traditional uses of saffron by-products by local populations in Taliouine and regions. An ethnobotanical survey was conducted with 42 local people and in six communities (Taliouine center, Tassousfi, Sidi Hssaine, Taouyalte, Askaouen). The information was obtained from traditional farmers and people in different villages through interviews using structured questionnaires. This study was performed in August 2022. As a result, 64% of the population of Taliouine and regions do not valorize saffron by-products, while 36% of respondents report that these by-products are being exploited, in which 16% who work in cooperatives valorizing local products including saffron, presented use of these biological residues in various areas. Cosmetic uses showed the highest percentage (38%), followed by food uses (26%) and then carpet and tablecloth dyeing (26%). The petals (50%) and stamens (42%) were the main used parts. Saffron byproducts were mostly used in powder form (69%), followed by maceration form (19%). this survey is the first survey on the traditional uses of saffron by-products by the local population of Taliouine and its regions in Morocco. Among the many respondents interviewed, more than 66% of the local population is uneducated, resulting in a low proportion of saffron by-products uses in the six communities. **Keywords:** Ethnobotanical survey, saffron by-products, farmers, traditional uses, Taliouine.

Concurent Session XVI: Students Oral Presentations II

Co-Chair: Karen Midden, Southern Illinois University, USA
Co-Chair: Mohamed Addi, University Mohamed I, Morocco

O1. Morphological and Physiological Analysis of *Botrytis cinerea* Field Isolates from Vineyard

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Abstract

Botrytis cinerea, causing gray mold rot, is the most important necrotrophic fungal pathogen of grapes. It is responsible of significant economic damage in vineyards worldwide. Despite the considerable losses caused by this disease, studies related to evaluate the diversity of B. cinerea populations on grapes in Morocco are restricted to very few published reports. Our study has been conducted to analyze the phenotypic diversity, the aggressiveness and the fungicide resistance of Botrytis cinerea isolated from grapevine in different regions of Morocco. The isolates were collected from 7 vineyards in two regions of Morocco. Seventy-five isolates were obtained and purified by monospore isolation. All the isolates were identified as B. cinerea based on morphological features including mycelia and conidiophores. *Botrytis cinerea* strains collected showed a considerable morphological variability. 72% of the population collected, developed a sclerotial morphology, while 28% belonged to mycelial type. The aggressiveness of isolates was tested on *Vitis vinifera* leaves of two grapevine cultivars. All tested isolates were virulent against grape leaves, with different levels of aggressiveness. We use the natural resistance of Botrytis pseudocinerea against fenhexamid as a phenotypic marker. Six isolates from the collection exhibited a high level of resistance to this fungicide, suggesting that it was Botrytis pseudocinerea. **Keywords:** *Botrytis cinerea, Botrytis pseudocinerea*, Variability, Aggressiveness.

O2. Preliminary Results of Chilling and Heat Requirements Estimation of Several Olive (*Olea europaea* L.) Cultivars: A Statistical and Experimental Approach

Omar Abou-Saaid[1,2,3*], Hayat Zaher[1], Sara Oulbi[1], Magalie Delalande[3], Ahmed El Bakkali[6], Adnane El Yaacoubi[5], Cherkaoui El Modafar[2], and Bouchaib Khadari[3,4]

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Abstract

In the global warming context, knowledge of the dormancy-chilling requirement of olive tree has become a key consideration in orchard planning and management, as well as for breeding programs aiming to select new adapted cultivars. Identifying the period for chilling by pinpointing the exact start and end dates of olive cultivars is still difficult and ultimately based on the researchers' subjective judgment. How could we define chilling and heat periods for olive cultivars? Here, we examine this question by combining statistical and experimental approaches. We applied Partial Least Squares (PLS) regression using blooming data collected on 16 cultivars in the worldwide collection of Marrakech during six years. To determine the time of dormancy breaking for these cultivars, we applied the Tabuenca test under controlled growth conditions. Dates of dormancy breaking delineated by Tabuenca tests were consistent with data derived from PLS outputs for 7

cultivars, while the two approaches show different dates of budburst for the other cultivars. Our investigations highlight the importance to combine statistical and experimental approaches to accurately define chilling and heat phases. **Keywords:** *Olea europaea* L., Global warming, Phenology, PLS regression, Chilling and heat requirements, Tabuenca test.

O3. Mitigation of Drought and Phosphorus Deficiency Stresses in Intercropped Wheat and Faba bean Plants Through Rhizobium-PGPR-Based Consortia Inoculation

Bouchra Benmrid[1§], Hicham Oukfi[1], Said Cheto[1,2], Ammar Ibn Yassar[1], Meryem Haddine[1], Joerg Geistlinger[3], Youssef Zeroual[4], Lamfeddal Kouisni[1], Cherki Ghoulam[1,2*], and Adnane Bargaz[1]

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Abstract

Drought and phosphorus (P) deficiency are among the major challenges facing current agriculture. Phosphorus availability depends on soil water status, both of which have a negative impact on plant productivity. Farming practices like intercropping showed positive facilitative interactions which may contribute to enhancing plants nutritional status, like P, under water deficit condition. Thus, we hypothesized that the application of multibacterial inoculants, presenting some main growth promoting traits, constitutes a promising strategy to improve the performance of associated crops in intercropping system under stress combining drought and P deficiency. Thus, we conducted a greenhouse experiment to evaluate the performance of three rhizobia-containing consortia and single rhizobia inoculation on the growth of intercropped and sole-cropped wheat (Triticum durum) and faba bean (Vicia faba) plants under P-deficient well-watered (rock Phosphate (RP), 80 % field capacity (FC)), or drought P-deficient (RP, 40 % FC) treatments versus a positive control (Monoammonium di-phosphate (MAP), 80% FC). The results showed that consortium 4 (C4) is more likely adapted to well-watered P-deficient conditions. Indeed, shoot dry weight (SDW) of intercropped wheat and faba bean reached up to 4.7 g. 4 plants-1 and 14.35 g. plants-1, respectively. Inoculated faba bean roots were well-nodulated under both well-watered (P deficient) and combined stress conditions compared to non-inoculated controls, with C4 inducing the highest nodule dry weight (NDW) under well-watered and drought stressed conditions, for both faba bean sole crop and intercrop respectively. Additionally, a significant, variable response of the rhizobia-containing consortia was noticed for the morphophysiological root traits, shoot inorganic P content (Pi), and acid phosphatase (APase activity) compared to non-inoculated RP fertilized controls. Additionally, above-ground physiological parameters, notably chlorophyll content, chlorophyll fluorescence, and plant leaf area were also improved following consortia inoculation, compared to the negative controls, whatever the cropping pattern or water regime. The results indicate that the inoculation of intercropped wheat and faba bean with mixed bacterial inoculants may be a promising solution to enhance crops growth under drought and P-deficiency stresses. **Keywords:** Consortia, drought, faba bean, intercropping, phosphate, rhizobacteria, wheat.

O4. Does Phosphogypsum Application Affect Salts, Nutrients, and Trace Elements Displacement from Saline Soils?

Outbakat MBarka[1§], Redouane Choukr-Allah[1], Mohamed EL Gharous[1], Kamal EL Omari[2], Aziz Soulaimani[1], and Khalil EL Mejahed[1*]

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Abstract

Salinity and sodicity are the most agricultural challenges in arid and semi-arid regions. A pot experiment was undertaken, to evaluate the effect of Phosphogypsum (PG) and Gypsum (G), to remove salts, nutrients and trace elements in leached water from saline and saline-sodic soils. In order to determine the efficiency and safety of these amendments, as an affordable strategy, for overcoming salinity and sodicity stress. The PG at 0, 15, 30 and 45 t/ ha and G at 15 t/ha were mixed with the upper 9 cm soil in the pot before being leached. The soils were collected from Sed El Masjoune and Sidi El Mokhtar areas of morocco with ECe of 140.6 mS/cm and 11.7 mS/cm respectively. The highest doses of PG (≥30 t/ha) removed significant amount of salts and nutrients. Calcium sulfate supplies calcium ions to replace salt ions (sodium, especially). The replaced salts are leached from the soil. The PG was more efficient compared to G in terms of salts leaching. Quantities of trace elements in the leachate, for most analyzed elements, were below the recommended limits of drinking and irrigation water. Because the experiment's alkaline conditions (basic water and soil) reduce the solubility and mobility of trace elements. The amendment application did not affect saturation index (SI) of the main minerals. **Keywords:** Soil salinity and sodicity, phosphogypsum, gypsum, leached water, plant nutrients, trace elements, saturation index.

O5. Effect of PGPRs and Water-Hope on Potato Growth

El Allaoui Nadia[1,2§], Allal Douira[2], Abdellatif Benbouazza[1], El Hassan Achbani[1], and Khaoula Habbadi[1*]

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Abstract

The potato is a plant of the nightshade family which is cultivated for its tubers. This reserve organ is a staple food for many populations in the world and more specifically in Morocco. However the potato can be the target of different diseases and pathogens which decrease its growth and consequently its yield, in order to fight or minimize biologically against these, there are bacteria which are beneficial to health and growth plants, and which have the ability to colonize the roots intensely which are the PGPRs (Plant Growth Promoting Rhizobacteria). The objective of this work is to study the effect of two bacterial strains (S1=GAJ222 and S2=GAB111) on potato growth by adding Water-Hope as a water-retaining substrate under form of two different doses (D1=3g and

D2=1,5g), and this carrying out two field trials on two sites AIN-TAOUJTATE and DOUIYAT and over two successive years 2020-2021. On the other hand, the GAJ222 strains showed an efficiency of 75% on the growth of the potato in the presence of Water-Hope with the second dose of 1,5g withe 75%. **Keywords:** Potato, Growth, PGPRs, Water-Hope.

O6. Genome Wide Association Study of Hessian Fly Resistance in Bread Wheat (*Triticum aestivum* L.)

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Abstract

Hessian fly (HF), *Mayetiola destructor* (Say), is an important pest of wheat, causing huge yield losses every year. In Morocco, this insect causes 32–36% wheat yield losses during dry years. The present study was carried out on 210 bread wheat (*Triticum aestivum* L.) genotypes from the International Center for Agricultural Research in Dry Areas (ICARDA) to identify the genomic region and marker-trait associations (MTA) responsible for the hessian fly resistance and putative genes associated with this trait. The screening was carried out in the growth chamber using a population of the hessian fly Mayetiola destructor (Say), collected from Chaouia Ouardigha. The 210 genotypes tested showed various degrees of resistance to the Hessian fly; there were eighty-six accessions with high levels of resistance to the Hessian fly. Genome-wide association studies (GWAS) using a mixed linear model (MLM) identified 20 significant marker-trait associations (MTAs) at $P < 0.001$ associated with hessian fly resistance. The highest number of MTA (10) was recorded in the A sub-genome, followed by B with 9 (MTA). whereas 1 MTA was found with an unknown chromosome position, the most significant marker is AX-95143016 located in chromosome 3B with a LOD of 10,23453. After mapping the 20 significant markers associated with hessian fly resistance, there were 14 potential candidate genes found. This study found highly resistant genotypes and significant markers that could be used in wheat breeding programs in the future. **Keywords:** Hessian fly, GWAS , MTA , Resistance , Breeding , Candidate genes.

Oral Presentations Abstracts

Cannabis & Hemp Sciences & Entrepreneurship Day (CHSE I)

December 14, 2022

Session I: Hemp and Cannabis Production

Co-Chair: Karla Gage, Southern Illinois University, USA
Co-Chair: Jose Leme, Southern Illinois University, USA

O1. Effect of Biostimulants on Cannabis Productivity and Soil Microbial Activity Under Outdoor Conditions

Jose Leme*

School of Forestry and Horticulture, Sothern Illinois University, Carbondale, IL 62901, USA. *Corresponding and presenting author: jose.leme@siu.edu.

Abstract

The illegal status of cannabis (Cannabis sativa L.) post-World War II resulted in a lack of research on agricultural practices. However, there is a resurgence of interest in cannabis due to diverse uses such as a rich source of cellulosic/woody fiber and construction uses, seed oil, bioenergy, and pharmaceutical properties. The fact that few agricultural products are certified for cannabis leaves producers with scarce alternatives to facilitate management and increase productivity. Organic certified plant biostimulants may help cannabis producers increase crop yield and quality. In 2019 and 2020 we investigated the individual and combined effects of two biofertilizers (manure tea and bioinoculant) and one humic acid (HA) product on cannabis biochemical and physiological parameters and soil CO2 evolution under outdoor conditions. Our hypothesis was that HA would increase the microbial activity in the biofertilizers and synergy of both compounds would promote better plant performance and stimulate soil microbial activity. In 2020, the individual and combined application of biofertilizers and HA increased cannabis height, chlorophyll content, photosynthetic efficiency, aboveground biomass, and bucked biomass by 105, 52, 43, 122 and 117%, respectively. Impacts were greater under suboptimal growing conditions caused by planting delay experienced in 2020. In 2019, planting date occurred in-between the most favorable period and chlorophyll content and photosynthetic efficiency were the only parameters influenced by the application of biostimulants. The discrepancies between the two growing seasons reinforce the evidence of other studies that biostimulants efficacy is maximized under stress conditions. This study could not conclusively confirm that the combined use of biofertilizer + HA is a superior practice since affected plant parameters did not differ from application of the compounds singly. Similarly, only one biofertilizer + HA treatment increased soil microbial activity. More research is needed to define optimum rates and combinations of biofertilizer and stimulants for cannabis.

Biography

Dr. Jose Leme is originally from Brazil and started at SIU in the Fall 2021, bringing his expertise in cannabis science and cultivation systems. He has a joint appointment in the School of Agricultural Sciences and Biological Sciences. His lab is developing techniques to maximize cannabinoids, non-cannabinoids (terpenes and flavonoids), fiber, and grain productivity/quality via plant physiological, biochemical, and agricultural approaches. Lab website: www.drleme.com".

O2. Fusarium Species Threaten Postharvest Cannabis

Gauthier Nicole, D Szarka, H Smith, E Dixon, M Munir, and M Rahnama

Department of Plant Pathology, University of Kentucky, Lexington, KY, USA. *Corresponding author: ngauthier@uky.edu

Abstract

As hemp becomes established as a commodity in the US, continued cultivation results in pathogen build up and increased disease severity. This also demands a greater understanding of the pathogens that affect the consumable portions such as flowers and grain. Several Fusarium species that are known to produce mycotoxins have been confirmed pathogenic on hemp in Kentucky. Several of the resulting toxins are regulated in grains used for human and animal consumption (DON, NIV, T-2), therefore Fusarium management is critical. Determining which Fusarium species infect hemp is the first step to producing safe material. While several studies are ongoing regarding field disease, there have been no studies regarding stored hemp. Postharvest material can remain in barns or supersacks for months or years before processing. Harvested and stored floral material for production of cannabidiol (CBD) were collected from 17 field sites across Kentucky from 2019 and 2020 harvests. Material was screened using a Fusarium-selective medium and DNA sequencing. At least 13 different species were confirmed, including known mycotoxin-producers F. equiseti, F. graminearum, F. incarnatum, and F. sporotrichioides. Additional research is essential to determine pathogenicity of these species and whether they can produce toxins dangerous for humans and animals. Such information is crucial to determine how to store hemp, manage infected material, and promote successful production of hemp products. **Keywords:** cannabis, hemp, Fusarium, mycotoxin, postharvest, storage.

O3. Hemp and Cannabis Insect Pest Management

Katelyn Kesheimer*

Department of Entomology & Plant Pathology, Auburn University; USA. *Corresponding and presenting author: kak0083@auburn.edu

Abstract

Not provided

O4. Weed and Crop Interactions in Cannabis Production

Karla Gage*

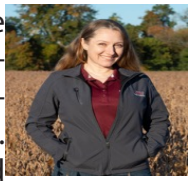
Department of Plant, Soil and Agricultural Systems, Sothern Illinois University, Carbondale, IL 62901, USA. *Corresponding and presenting author: kgage@siu.edu.

Abstract

There is rapid evolution of herbicide resistance in agronomic weeds in US cropping systems. This phenomenon represents the extreme selection pressure caused by a reliance upon herbicides for

weed control. Therefore, there is a need for alternative methods of weed control to incorporate into current production systems. Integrated Weed Management (IWM) is the concept of diversifying weed management to include cultural, mechanical, biological, and chemical weed control tactics in combination. The *Cannabis sativa* L. plant (hemp, <0.03 % tetrahydrocannabinol) could be used in a IWM program in a cultural control tactic, through the practice of crop rotation with maize (Zea mays L.) and soybean (Glycine max L.) in US cropping systems. Federal legislation passed in 2014 allows a new possibility for hemp to be used for fiber and seed production in the US, and hemp has the potential to become a valuable rotational crop if commodity markets develop. Several characteristics of the Cannabis plant may enhance value as a rotational crop. Our work suggests that Cannabis plants produce potentially allelopathic phytochemicals that may suppress the emergence and growth of economically damaging weeds. Allelochemicals may provide value in certain forms of IWM approaches, such as chaff lining, a practice where weed seeds are deposited into crop residue as weeds and crops are harvested at the end of season. Our work also suggests that Cannabis can be a competitive crop in some production situations, where yields were not reduced with heavy weed competition. However, Cannabis for fiber and seed is still a new, potential crop in the US and basic knowledge regarding agronomic production is lacking. Poor agronomic practices that reduce the early establishment of a Cannabis crop in the field will negatively impact the value of the crop for weed suppression. Our research has also documented some agronomic challenges, such as negative impacts of heavy spring rainfalls and soils that have high levels of silt and clay. There is much work to be done to develop Cannabis as a fiber and seed crop in the midwestern US.

Biography



Dr. Karla Gage is an Associate Professor of Weed Science and Plant Biology in the Schools of Agricultural Sciences and Biological Sciences at Southern Illinois University Carbondale (SIUC). She completed BS and MS degrees in Biology at the University of Memphis and a PhD in Plant Biology with a focus on weed ecology at SIUC. Dr. Gage joined the faculty at SIUC in 2015 and enjoys teaching and research in applied management of agricultural systems. Dr. Gage's research focuses on weed control in midwestern US cropping systems in the rotational crops of corn (Zea mays L.), soybean (*Glycine max* L.), wheat (*Triticum aestivum* L.), and sorghum (Sorghum bicolor (L.) Moench), and now industrial hemp (Cannabis sativa L.). The Gage lab focuses on the use of Integrated Weed Management (IWM) to slow the evolution of herbicide resistance and suppress weeds. She has graduated 10 MS students, and currently advises or co-advises 9 MS students and 3 PhD students. She has mentored 28 undergraduate researchers and currently works with 9 undergraduate students. She has 22 published papers, 3 book chapters, and has authored or co-authored 69 conference proceedings. She has served as a reviewer for several journals and as Associate Editor of Frontiers in Agronomy. She lives in Carbondale, Illinois, with her husband and 12-year-old twins and enjoys hiking and botanizing in the Shawnee National Forest.

O5. The Problem with PPFD: Advances in Cannabis Lighting Technology and Terminology

Gandy Brian*

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Abstract

Cannabis cultivation technology and horticultural lighting technologies have been driven by the explosion of growth in the industry. The legalization of cannabis in the United States and other markets along with the evolution of chip and optics technological efficiencies and engineering are combined to offer many new avenues of exploration. Light Emitting Diode (LED)-based lighting technology provides the opportunity to apply wavelengths that target photosynthesis in the Photosynthetically Active Radiation (PAR) range of 400 to 700 nm. In addition, we can now target the Extended PAR (ePAR) range from ~300 to– 780 nm, exploring the morphological and physiological effects of Ultraviolet (UV) and Far-Red (FR or NIR) ranges. LED lighting has been touted for its improvements in efficiency, which on the surface are true. However, the primary benefit (and challenge) to this shift in technology is the de-coupling of heat and light energies to the canopy from the lighting source. The efficiency gains and distance to canopy improvements require more nuanced control of the other environmental parameters to reap the benefits. In particular, the full understanding and utilization of the Vapor Pressure Deficit (VPD) is needed, as well as understanding and automating the quality of light to gain desired yields and results. Terminology for horticultural lighting is an amalgam of radiometric lighting, typically used in to define human perception along with agronomic terminology used to define energy delivered to field crops like corn and soybeans, directly from the sun (i.e. Inverse Square Law and Daily Light Integral (DLI) respectively). Historically, crops grown in controlled environments had a much smaller stature and much more 2-dimensional canopy to design and apply lighting applications toward. The exceptions are vining crops like cucumber and tomato that often utilize inter-canopy lighting and can be grown on their 2-dimensional vertical planes. The morphology of cannabis as a tall, bushy, and flowering plant with a dense canopy provides a unique challenge, and opportunity to further our understanding of the physics, application, and terminology used to specify and optimize horticultural lighting in controlled environments.

Session II: Hemp and Cannabis Programs Initiatives in Morocco

Co-Chair: Noureddine El Aouad, Abdelmalek Essaadi University, Morocco
Co-Chair: Mouad Chentouf, INRA, Morocco

O1. INRA Hemp and Cannabis Initiative. Mouad Chentouf* and Faouzi Bekkaoui. INRA, Morocco

Mouad Chentouf* and Foaouzi Bekkaoui*

INRA, Morocco. *Corresponding and presenting author:

Biography

Dr. Mouad Chentouf received a M.S. degree in Animal Science and a Ph.D. degree in Veterinary Science. He is Director of Research, coordinator of the cannabis research program and head of the Regional Centre of Tangier at the National Institute of Agricultural Research (INRA). His research focus on animal production systems analysis and local animal genetic resources. He has numerous scientific publications on these topics and has coordinated several international research projects. He is also invited professor of animal production and serves as an expert in several scientific committees.

Biography

Dr. Faouzi Bekkaoui is the director of the National Institute of Agronomic Research (INRA), Morocco and the scientific director of the Adaptation of African Agriculture initiative. He is president of the scientific council of MAScIR and member of the administrative council of ICARDA. He was previously director of the school of agriculture and coordinator of the AgroBioSciences research program at the University Mohammed 6 Polytechnic of Benguerir (2017-19). He also worked as Executive Director of National Research Council Canada (NRC) Flagship Wheat Improvement Program (2012-2017), NRC Plant Biotechnology Institute in Molecular Biology and Genomics, ID Biomedical in the field of DNA diagnostics, at GenServe as laboratory manager and at Genome Prairie as project manager. During his career, he has co-published 43 scientific articles in the fields of DNA diagnostics, molecular biology, genomics and plant physiology. He holds three US patents in molecular diagnostics. Bekkaoui holds a master's degree in physiology from the University of Tours (1983) and a doctorate in plant physiology (1986) from the University of the Sorbonne (formerly Paris 6).

O2. Abdelmalek Essaadi University's Hemp and Cannabis Initiative

Noureddine El Aouad*

Polydisciplinary Faculty of Larache. University Abdelmalek Essaadi, Larache, Morocco. *Corresponding and presenting author: n.elaouad@uae.ac.ma

Abstract

Not provided.

O3. New Approach for the Screening for Modulatory Activities of Polymerization Depolymerization of Tubulins by Cannabinoids

Anissi Jaouad[1*], Khalid Sendide[2], Mohamed El Hassouni[3], and Salim Bounou[1]

[1] School of Engineering BIOMEDTECH, University EUMROMED of Fes, Fes, Morocco; [2] Laboratoty of Biotechnology, School of Science and Engineering, Al Akhawayn university, Av. Hassan II, P. O Box 104-Ifrane ; 3 Laboratoire de Biotechnologie, Faculté des Sciences Dhar El Mehrez, Université Sidi Mohamed Ben Abdellah, Fés, Morocco. *Corresponding and presenting author: j.anissi@ueuromed.org.

Abstract

Cannabinoids have been recognized as possessing anticancer properties by inducing cell cycle arrest. This paper aims to assess the hypothesis that tubulins/microtubules are among the targets of cannabinoids in the anti-proliferation process. Twenty-two cannabinoids were isolated from the aerial parts of C. sativa using a green process for extraction and purification. Their structures were characterized by detailed spectrometric and spectroscopic analysis. Subsequently, we carried out an in vitro screening of the modulation effect of cannabinoids on purified tubulins polymerization and depolymerization with IC50 values in the range of 1.5 µmol/L, and constant rates in average of 0.19 µM/s paclitaxel equivalent. The results show that several cannabinoids exhibit remarkable modulation activities of tubulin polymerization/depolymerization with a constant rate exceeding

those observed with the standard paclitaxel. Besides, results obtained provided a structure activity relationship that would be used to design new anticancer agent. Keywords: Cannabinoids, tubulin polymerization, tubulin depolymerization.

O4. Genetic Identification, Chemical and Biological Investigation of Moroccan *Cannabis sativa* L. Seeds.

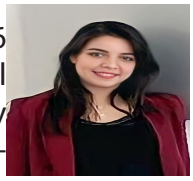
Amira Metouekel[1§], Elmostfa El Fahime[2*], Saïd El Kazzouli[1], and Nabil El Brahmi[1]

[1] Euromed Research Center, Euromed Faculty of Pharmacy, Euromed University of Fes (UEMF), Meknes Road, Fez 30000, Morocco; [2] Centre National de la Recherche Scientifique et Technique (CNRST), Angle Avenues des FAR et Allal El Fassi, Hay Ryad, Rabat 10102, Morocco. [*]Corresponding author: melfahime@gmail.com. [§]Presenting author:

Abstract

Cannabis contains an interesting group of natural metabolites that apply their actions by binding to specific receptors in different part of the human body such as the central nervous system, peripheral tissues and particularly the immune system. Recently, the interest on its main active secondary metabolites as therapeutic alternatives has grown. For their applications as pharmaceutical and medicinal purposes and according to the major national problem of cannabis' genetic identification, we conducted an in-depth genetic-chemical study on various Moroccan cannabis samples. In this communication, we will present a part of our study carried out on ten varieties of cannabis seeds originating from the north Morocco. A botanical, morphological, and biomolecular identification as well as, the total chemical composition studies using different analytical techniques. Finally, the biological properties of different seed extracted were also assessed. **Keywords:** Cannabis, seed, molecular identification, chemical characterization, biological properties.

Biography



Ms. Amira Metouekel, graduated with a bachelor degree in Applied Biology in 2016 and a Master degree in Environmental Engineering in 2018. She started her doctoral studies at the Euromed University of Fez, in 2019. Her research topic is: "The study and valorization of genetico-chemical diversity of *Cannabis sativa* L and the evaluation of anticancer activity of some interesting cannabinoids".

O5. Efficient Removal of Eriochrome Black-T Dye Using Activated Carbon of Waste Hemp (*Cannabis sativa* L.) Grown in Northern Morocco Enhanced by New Mathematical Models

Fouad El Mansouri[1,2*], Joaquim Esteves da Silva[2], and Jamal Brigui[1]

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Abstract

In this study, the adsorption behavior of Eriochrome Black T (EBT) on waste hemp activated carbon (WHAC) was investigated. The surface of the WHAC was modified by H3PO4 acid treatment. The surface and structural characterization of the adsorbents was carried out using Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM) analysis. The effect of influential adsorption parameters (pH, contact time, dosage, and initial concentration) on the adsorption of EBT onto WHAC was examined in batch experiments, some adsorption parameters such as pH, concentration and dose were improved by new mathematical models. The adsorption behavior of EBT on the surfaces of WHAC was evaluated by applying different isotherm models (Langmuir, Freundlich, Temkin and Dubinin Radushkevich) on equilibrium data. The adsorption kinetics was studied by using pseudo-first-order, pseudo-second-order, Elovich and intraparticle models on the model. Adsorption followed the pseudo-second-order rate kinetics. The maximum removal of EBT was found to be 44-62.08% by WHAC at pH= 7, adsorbent dose of 10-70 mg, contact time of 3 h and initial dye concentration of 10 mg.L-1. The maximum adsorption capacities were 14.025 mg.g-1 obtained by calculated according to the Langmuir model, while the maximum removal efficiency was obtained at 70 mg equal to 62.08% for the WHAC. Regarding the adsorption process is physical on the monolayer and multilayer. **Keywords:** Cannabis waste; isotherms; Eriochrome Black T; biosorbent, mathematical models.

O5. UM6P Initiative on *Cannabis sativa* Valorization

Mohamed Hafidi[1], Lamfeddal Kouisni[2], Mohamed El Gharous[3], Khalil El Mejahed[3], Loubna El Fels[1], Rachid Bouharroud[4], Redouan Qessaoui[4], Aziza Tangi[3], Khadija Nasraoui[3], Mohamed Louay Metougui[3], Adil Mazar[2], Abdelaziz Nilahyane[2§], Youssef El Kharrassi[2], and Amine Ezzariai[2*]

[1] Cadi Ayyad University, Marrakech, Morocco; [2] Mohammed VI Polytechnic University, African Sustainable Agriculture Research Institute (ASARI), Laayoune, Morocco; [3] Mohammed VI Polytechnic University, African Innovation and Technology Transfer Center (AITTC), Benguerir, Morocco; [4] INRA Agadir, Morocco. [*]Corresponding author: amine.ezzariai@um6p.ma. [§]Presenting author: abdelaziz.nilahyane@um6p.ma.

Abstract

Moroccan agriculture challenges require developing biomasses valorization with high added value. *Cannabis sativa* L is characterized by several properties that encourage the valorization of this plant in several areas, such as agriculture and medicine. Hence, CannabiVal project aims to develop scientific and strategic solutions for the valorization of cannabis through advanced biochemical extraction methods and innovative bioprocesses, for promising applications. The final products that will be developed through CannabiVal project will be tested in many experimental farms (Laâyoune, Benguerir, Agadir). This integrated approach will provide an original roadmap for the valorization of Cannabis sativa L and its derivatives in Morocco. **Keywords:** *Cannabis sativa* L, Valorization, Biochemical extraction, Bioprocesses.

Biography

Dr. Abdelaziz Nilahyane is currently working as a Research & Education Fellow at the Mohammed VI Polytechnic University-African Sustainable Agriculture Research Institute in Laayoune, Morocco. He obtained his Ph.D. degree in Agronomy from De-

partment of Plant Sciences at University of Wyoming, USA and agricultural engineering degree (M.S in Agronomy) with an emphasis in plant pathology and bio-pesticides from Hassan II Institute of Agronomy and Veterinary Sciences in Morocco. After his Ph.D., he worked as a Forage Research Assistant at University of Wyoming and as a Postdoctoral Research Associate at Montana State University and New Mexico State University, USA. His research interests focus on irrigation, soil fertility, abiotic stress, crop physiology, crop modeling and quality of forage crops. In his current role, much of his work has been on advancing the understanding of crop responses (annuals and perennials) to drought and salinity in the desertic-arid regions. In parallel, Dr. Nilahyane works on introducing new alternative crops tolerant to drought and salinity in marginal zones. Dr. Nilahyane has published several peer-reviewed research articles about agronomy and crop science, irrigation, fertilization and crop modeling. He also led and contributed in several funded research projects and he has supervised postdocs, graduate and undergraduate students, and agricultural technicians. He is an active member of several professional organizations including the American Society of Agronomy, Crop Science Society of America, Soil Science Society of America, and American Society of Agricultural and Biological Engineers. Dr. Nilahyane has also a passion for teaching. Currently, he is teaching Soil Fertility and Plant Nutrition course at post- graduate level of UM6P-ESAFE school in Benguerir, Morocco.

O5. Legalization of Cannabis in Morocco: Valorization of Hemp Seeds for Oil Extraction and their Incorporation into Poultry Feed

Elamrani Ahmed[1*], Y Taafi[1,3], Y Rbah[1], A Allay[1], C Benkirane[1], A Far-hat[2], E Azeroual[3], K Belhaj[1,4], F Mansouri, R Melhaoui[1], M Addi[1], M Abid[1], A Mihamou[1], and Caid H Serghini[1]

[1] Equipe Agroalimentaire, LAPABE, Faculté des sciences, Université Mohammed Premier, Oujda, Morocco; [2] Agence nationale de Plantes Médicinales & Aromatiques, Taounate, Morocco; [3] Institut Royal d'Elevage, Fouarat, Kenitra, Morocco; [4] Laboratoire de Management de l'Agriculture Durable, EST Sidi Bennour, Université Chouaib Doukkali, El Jadida, Morocco. [*]Corresponding and presenting author: ahmed.elamrani@gmail.com

Abstract

In May 2021, the Moroccan parliament adopted Law No. 13-21 (1) on the decriminalization and legalization of cannabis farming for medical, cosmetic and industrial use. Cannabis agribusiness mainly values the leaf parts and flowering tops of the plant; thus, it generates many co-products such as woody stems, branches and cannabis seeds. This opens a research field aimed at minimizing and efficiently managing this issue to support the concept of zero waste. This collaborative work (between UMP-Oujda, ANPMA-Taounate and IRTSEF Kenitra), focus on the chemical characterization of cannabis seeds, hemp seed oil and the agro-industrial valorization of whole seeds and cakes (residues from the extraction of oil from hemp seeds), by incorporating them into poultry feed. For this reason, the chemical composition and lipid profile of cannabis seeds of a local ecotype (Beldia) and a hybrid variety (Critical), from four regions of northern Morocco, were analyzed. Results registered show that biochemical composition of analyzed hemp seeds vary as follows: Protein (19.25 - 24.18%), fiber (26.40 - 37.40%, ash (3.72 - 5.39%), phenols (134.57 - 199.90 mg/100 g) and flavonoids (39.40 - 69.54 mg/100 g. In addition, oil recovery from hemp seed ranges from 26.42 to 35.19 g%, its tocopherols content varies between 376.46 and 796.06 mg/kg oil, with -tocopherol as the dominant isoform. "Rancimat test" for oil oxidation stability at 100°C ranged from 9.73 to 15.42h. The fatty acid profiles of hemp seed oils analyzed by CPG-FID show richness in unsaturated fatty acids (UFA: 87.30 to 88.96%) The main UFA are: Linoleic acid (48.26 - 55.39%) fol-

lowed by Oleic acid (14.75 - 22.49%) and -Linolenic acid (13.27-16,55 %). Moreover, optimal conditions extraction allows achieving the maximum TPC (53.65 mg GAE per g extract) with higher antioxidant activities. The major phenolic coumpounds identified by HPLC-DAD/ESI-MS2 are hydroxycinnamic acid amides and lignanamides, while N-trans-caffeoyltyramine, cannabisin A, and cannabisin B might contribute strongly to the potent antioxidant activity of hempseed extracts. These results are in line with what is reported in the literature (2, 3) and they are currently used for the industrial valorization of hemp seeds. For instance, the incorporation of (whole or ground) hemp seeds as an ingredient in the formulation of feed for laying hens with a view to produce omega 3-eggs. As well, hemp seed oils and bioactive molecules extracted from cakes are intended for use cosmetics or for medical and therapeutic purposes. **Keywords:** Hemp seeds oil, Oxidation stability, UFA, tocopherols, phenols Layer hen, Omega 3-eggs.

Biography

Ahmed Elamrani, PhD in Biochemistry and plant's physiology form University of Bordeaux I, France (1987). From 1987 to 1994 he occupied the position of an Associate Professor at Mohamed First University, Morocco and from 1995 Until now he is a full professor of Biochemistry and plant physiology, at the same university. Former Head of Department of Biology (1989-91) and the local coordinator of the Erasmus Mundus program Fatima Al Fihri,(2012-2017). In addition, from 2011 to 2018, he was the UMP's representative for the African Higher Education Harmonization and Tuning initiative /Africa- EU partnership (Codirected by University of Deusto, Spain). Prof A ELAMRANI has several scientific publications and contributions as a scientific reviewer in the fields of agriculture and agri-food. Currently he is head of the agri-food research team and coordinator of a Master's degree in food Sciences and foods' Safety. See the link: https://orcid.org/my-orcid?orcid=0000-0003-1634-8477.

Session III. Hemp, Cannabis, and Entrpreneurship

Co-Chair: Khalid Meksem, Southern Illinois University, USA

O1. A Pre-Scientific Expertise, Validating Moroccan Landrace Hemp for Architectural Science and Lightweight Composites

Monika Brümmer*

Coopérative Adrar Nouh, Morocco and Cannatektum Habitat and Materials Science, S.L., Spain. Corresponding and presenting author: info@cannabric.com and firtagourth@gmail.com.

Abstract

Energy-efficient building materials are increasingly attracting material science and architecture in the past decades. Novel formulations are based on the use of residues from agriculture to produce carbon storing insulation materials and lightweight bio aggregate concretes, replacing materials from non-renewable and energy intense synthetic and mineral resources. In addition, the valorization of agricultural products to develop into premade building materials might be a novel challenge of employment in remote rural regions, like the Moroccan Upper Central Rif. The use of plant-based materials in the energetic retrofit of vernacular housings and rurally inspired, bio constructive ways of building, might be an additional venture for socio-economic develop-

ment and valorization of architectural heritage. This paper reports on the expertise of employing stem materials of Moroccan landrace hemp, treated as a waste product of cannabinoid farming, in the preparation of lightweight composites and other building materials. The construction of two houses, in Benguerir (South Morocco) and Issaguen (Nord Morocco), has shown that Moroccan Beldiya hemp stem materials can be used and perform similar like industrial hemp building products and allow versatile solutions in architecture. The stem materials have been used untreaded or processed locally into hemp aggregates (Hurds) and hemp wool. The Hurds were used in self bearing and load bearing hemp concretes whereas the wool was used in hemp fiber concretes, masonry mortar reinforcement and hemp fiber composite. The present work emphasizes some fundamental parameters of hemp raw materials and composites and seeks to provide a useful tool for future research into sustainable building materials from Moroccan landrace hemp, and more efficient recycling of the waste produced by human activities. **Keywords:** Moroccan landrace hemp, beldiya hemp, hemp concrete, hemp lightweight composite, hemp stem materials, hemp hurd, hemp fiber, hemp-built architecture, basis of sustainable design.

Biography

Dr. Monika Brümmer is an independent architect of German origin, involved in Hempbuilding since her project final career (Berlin, 1996). She holds a master's degree in Sciences and Technologies of Restoration of Architectural Heritage and a PhD in History and Arts, both linked with advanced hemp building materials. Monika is the inventor of CANNABRIC (hemp-clay brick for loadbearing applications), that she manufactures in Spain since 1999. Her Granada based company, CANNATEKTUM habitat and materials science S.L., provides architectural design, retrofit of vernacular architecture and troglodyte housing, commerce of hemp building products, research and development of plant-based building materials and consulting. Since end 2013 she militated together with the Moroccan civil society to promote a legal valorisation of autochthonous hemp strains in traditional farming regions. In 2017, she co-founded the Moroccan Cooperative ADRAR NOUH that so far made use of wasted hemp stem materials of Cannabinoid farming for architectural and educational projects that promote integral rural Riffean socio-economic development.

O2. Hemp (Cannabis sativa L.) Seed and Its Cake Inclusion in Animal Nutrition

Belhaj Kamal[1*], Larb Allaii[1], Yassine Taaifi[2], Farid Mansouri[2], Embarek Azeroual[3], Hana Serghini-Caid [2], and Ahmed Elamrani[2]

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Abstract

Hemp (*Cannabis sativa* L.) has great potential as a useful plant. The hempseeds are an important source of several essential nutrients particularly the polyunsaturated fatty acids n-3 and digestible protein. In the last decades, the consumers have become more aware and demand healthy foods exempt from synthetic origin substances. The fatty acid (FA) profile of animal products reflects both the FA of tissues and those of ingested lipids. The omega-6/omega-3 ratio remains the main criterion for evaluating the fat quality of foodstuffs and should be lower than the 4-value

recommended by the WHO/FAO. Currently, this ratio turns out to be 10 to 30 times more omega-6 than omega-3. These findings indicate a deficiency in polyunsaturated fatty acids (PUFA) n-3. In response to the concerns of the health organizations and health-conscious consumers, research in meat and egg production has focused on the diminution of the omega-6/omega-3 ratio, by enhancing the content of PUFA n−3. Animal products are important sources of essential amino acids, some vitamins, and oligo-elements, but their lipid composition is often criticized. The enrichment of animal products with n-3 PUFAs remains a sustainable solution for a healthy diet. Furthermore, the use of phytogenic feed additives is becoming an attractive and sustainable strategy to improve the lipid quality and functional properties of animal products. The hemp seed and its cake represent a main source of bioactive compounds such as amino acids, phenols, flavonoids, tocopherols, minerals and particularly polyunsaturated fatty acids n-3.These characteristics imply its potential use as a phytogenic ingredient or as an additive in animal feed with health-promoting properties. In the present review, we will present the chemical and nutritional values of hempseed and cake. In addition, the beneficial properties of hempseed and cake in poultry and ruminants 'nutrition will be discussed. **Keywords:** Polyunsaturated fatty acids, Omega 3, Hempseed, Eggs, Meat.

Biography

Prof. Kamal Belhaj has expertise in meat sciences and animal-origin foods' quality. He got his Ph.D. degree in 2020 from the faculty of sciences, University Mohamed First, Morocco. As a postdoctoral researcher, he worked on the enrichment of foods of animal origin with long-chain fatty acids n-3". He is a Professor at Higher School of Technology Sidi Bennour, University Chouaib Doukkali. He has received several awards and scholarships. The author has co-authored 30 papers in international journals. His research interests are in the area of food chem-istry, food quality, and food technology.

O3. Transformation, Valorization, and Commercialization of Cannabis Products

Aziz Makhlouf*

BIO CANNAT Cooperative, Douar Beni Yabta, Bab Berred, Chefchaouen, Morocco. *Corresponding and presenting author: biocannat@gmail.com

Abstract

BIO CANNAT is a cooperative created in 2021 on the initiative of a young Moroccan, son of a farmer from the Chefchaouen region, more precisely from the municipality of Bab Berred. The cooperative has developed with an emphasis on finding the opportunities that cannabis offers for MOROCCO. It has thus shown the potential that Moroccan cannabis can offer to farmers in the region and to the socio-economic development of the RIF. This work of a year and a half was distinguished by the receipt of Authorization Number 1 in Morocco for the processing, marketing and export of cannabis and its products. Today, the journey continues with the establishment and construction of the first cannabis processing unit in the province of Chefchaouen.

O4. Broad Access to Safe, Reliable, and Sustainable Cannabis Derived Products

Brett Goldman*

The Ocan Group, USA. *Correspondinmg and presenting author:

Biography

Brett Goldman brings nearly a decade and a half of public/private experience working in economic development, international trade, public affairs, politics and government relations, operations and business strategy. Upon joining GenCanna in 2015, Brett's federal/state lobbying experience drove some of the most important contributions to the nascent hemp industry's federal legislative and regulatory developments. As the first significant federally legal participant in the emerging cannabinoid space, the combined company and industry stewardship benefited from Brett's strategic initiatives with leadership at USDA's AMS and RMA. This direct public and discreet private engagement with federal policymakers resulted in significant regulations and normalization of hemp as an agricultural commodity. The dramatic changes stemming from the 2014 Farm Bill provided the backdrop for an extensive and positive relationship between operational teams and regulators that caused legislators to have confidence in beginning the convergence of cannabis and the mainstream. Brett's ability to blend his communications from all points of the emerging hemp production chain--especially growers--with mainstream supply chain quality needs resulted in the formation of the world's first hemp Self-Regulatory Organization: the US Hemp Authority. Brett presently contributes as a member of the USHA Technical Committee. OCan Group now benefits from Brett's vision and mission to create global access to cannabinoids. Brett is a firm believer of inclusivity in the cannabis industry through commerce and cooperation between rural and urban stakeholders. As federally legal cannabis evolves, the benefits will accrue at each part of the supply chain as gains in environmental, social, and governance (ESG) practices are felt. OCan Group's holistic long view marries the existing CPG infrastructure through food, beverage, cosmetic, and supplement product supply chain growth. Ultimately, Brett and the team at OCan Group believe that domestic and international standards will demarcate the raw material and product flows according to regulatory and consumer acceptance as scaled, quality assured products begin to dominate the market. Brett began his career working in politics and public affairs in Philadelphia and New Jersey. He earned his BA in History and MA in Education from Fairleigh Dickinson University and his MA in Government and Strategy from Reichman University.

O5. Challenges and Opportunities with Opening a Hemp Fiber Processing Center

Patrick Van Meter*

Midwest Natural Fiber, Columbia, MO, USA. *Corresponding and presenting author: patrick@midwestnaturalfiber.com.

Session IV: Regulatory Policies of Hemp and Cannabis Production and Compliances

Co-Chair: Khalid Meksem, Southern Illinois University, USA

O1. The Rif and the Kif Beldiya: Past, Present, and Future

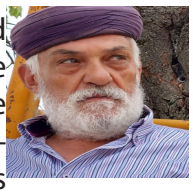
Abdellatif Adebibe*

Coopérative Adrar Nouh (Sustainable Socio-Economic of the High Rif Region), Douar Assegzaf, Issaguen 32302, Al Hoceima, Morocco. *Corresponding and presenting author: boujmildev@gmail.com

Abstract

Indigenous Beldiya hemp was cultivated for centuries in Morocco's historic hemp farming area of the Central Rif and was historically used in very versatile ways in Morocco, without legal concerns. The difficulties came in recent decades with the consequences of prohibitive laws. Parallel to the legal ban, farmers had no choice but to continue with their usual activity and have been victims of cannabis traffickers and repression. We have militated to seek legal alternatives and participated in the dynamization of a legalization process. We also were promoting the creation of alternative rural socio-economies with hemp. The new law means a mayor challenge for the Berber population of the historic farming area, it is necessary that we get support in this transition period to be able to act in favour of the development of a region that still is very poor in infrastructures. The solutions, projects and hemp processing industries have to part from the heart of the affected areas, be implanted there, and then spread to other new hemp farming areas in Morocco.

Biography



As a native of the historical Cannabis cultivation region of Morocco, he abandoned his political science studies (Rabat 1974-1976) to defend the human rights of the Senhaja-Rif Berbers. In 1999 he created the "Association for the Development of the Central Rif" and from 2014 to 2017 he chaired the "Confederation of Senhaja Associations of the Rif for Development". He represented Moroccan Cannabis producers internationally through the first and "second world forum of farmers of so-called illicit plants" organized by TNI, in ICAD2, in sessions of UNODC in Vienna or UNGASS in New York and in international thematic discussions such as the SA Drug policy week. In 2017 he co-founded the Moroccan Cooperative ADRAR NOUH that uses agricultural waste (stem materials) of the cultivation of Cannabinoids for architectural and educational projects (Solar Decathlon Africa 2019 and others), that promote socio-economic rural development in the Central Rif.

Adrar Nouh coopérative

O2. Navigating the Evolving Complex Cannabis Legislative/Regulatory Challenges

Steve Bevan*

The Ocan Group, USA. *Corresponding and presenting author:

Biography

Steve Bevan is a world-renowned expert and ambassador for federally legal outdoor cannabis -- hemp. He brings with him decades of experience in finance, management, and corporate leadership. In 2014 Steve and partners founded GenCanna Global, Inc.; under his direction GenCanna established itself in Kentucky and was awarded the first cannabinoid focused hemp MOU issued by the Kentucky Department of Agriculture (KDA). In the years that followed, Steve solidified the company's relationships with the USDA, EPA, FDA, and other federal regulatory agencies, focusing on the convergence of agriculture and cannabis. Steve has advised legislators and staff from over 30 states and countries-- including then-Senate Majority Leader Mitch McConnell--to help define legislation and regulation that align sustainable cannabinoid production with the value chains of agricultural and food/consumer packaged goods. Based on his experience building the first vertical in the federally legal cannabis industry, from hands in the dirt to finished goods, Steve is a sought-after collaborator for projects at every step of the outdoor cannabis supply chain. Steve's record of industry stewardship includes founding the U.S. Hemp Roundtable, and conceptualizing and driving the establishment of the U.S. Hemp Authority -- the only federally legal cannabis self regulatory organization. His continuing mission to increase global access to natural cannabinoids now involves participation in the development of global cannabis standards to help unify and spread economic value across the emerging cannabinoid supply chain, especially at the farm gate. At OCan Group, Steve's vision for the convergence of cannabis and the mainstream provides a unique perspective into the evolution of cannabis- derived products through legality, compliance, quality, and towards the inevitable scaling of consumer packaged goods. The standardization of sustainable cannabinoid products will be recognizable by regulators, the CPG industry, and consumers. It will define the developing supply chain from farm fields to family tables, increasingly involving the world's largest agriculture, processing, food/beverage, pharmaceutical, and financial service companies. Steve maintains deep relationships with farmers and policymakers across the world, including in UK, Germany, France, Slovenia, Israel, Morocco, Uruguay, Thailand, Colombia, Mexico.

O3. Foundation of Cannabis Unified Standards

Lezli Engelking*

FOCUS [FOCUS: The International Cannabis Health & Safety Organization (www.focusstandards.org)], USA. *Corresponding and presenting author:

Biography

Lezli Engelking is the Founder and President of Foundation of Cannabis Unified Standards (FOCUS), located in Scottsdale, Arizona. After receiving her Bachelor of Science in Communication and Statistics from Arizona State University, Lezli spent two decades in the healthcare and non-profit sectors. Her keen understanding around the importance of quality and safety gained during her 12-year tenure with Eli Lilly prompted her to pivot and apply her expertise to the burgeoning cannabis industry. In 2011, Lezli opened the first chain of vertically integrated cannabis companies in Arizona, where she gained first-hand experience around the challenges with running a successful cannabis business. It was this experience that led Lezli to found FOCUS in 2014 as the first and only International Cannabis Health & Safety Organization. FOCUS has since worked around the globe to help bring adequate protec-

tions for health and safety and sensible regulations to the burgeoning cannabis industry.

O4. Cannabis: Innovation and Challenges

Myriam Lahlou-Filali* and Abdelmoumen Mahly*

Pharma 5, Morocco

Biography

Married and mother of two boys, from a dual Moroccan and Austrian culture, Mia Lahlou-Filali was born in 1973 in Morocco, where she grew up. She completed her schooling at the Lycée Français de Casablanca (Lycée Lyautey) where she obtained her baccalaureate with honors in 1991. She then decided to continue her higher education in Paris, France. She graduated with a double major from two universities: Sciences-Po Paris, Economics and Financial Section / Paris IX-Dauphine University, Master of Management Sciences (MSG). After 10 years in the International Marketing Department in the field of Perfumes and Cosmetics of the LVMH group in Paris (world leader in luxury), she chose to join the family business and became General Manager of the Pharma 5 Group in Casablanca in January 2012. Founded in 1985 by her father, Dr. Abdallah Lahlou-Filali, the Pharma 5 laboratories is one of the leading groups in African in the development and production of generic drugs. Its mission is to make medicines available to the greatest number of patients, while respecting the best international quality standards. Pharma 5 is the best-selling Moroccan drug brand in Morocco and Africa. Since taking over alongside her sister, Yasmine, to administer the group founded by their father almost 40 years ago, Mia Lahlou-Filali has worked every day to make the drug accessible to everyone. Since her arrival, she has been able to manage large-scale projects, in particular the development of the first 100% Moroccan treatment of the latest generation against Hepatitis C, and the deployment of the group internationally via, among other things, the launch of the construction of a pharmaceutical factory in Abidjan, Ivory Coast as well as the creation of the first 4.0 drug factory on the Continent. She is also actively involved with poor populations through the social and civic actions of the Noufissa Pharma 5 Foundation created in May 2013 and which she co-directs with her sister Yasmine.

Session XIVB: Academic Exchange Programs Between Morocco and USA

Co-Chair: Moulay Abdelmajid Kassem, Fayetteville State University, USA
Co-Chair: Khalid Meksem, Southern Illinois University, USA

O1. Educational and Cultural Exchange Programs Between Morocco and the USA, The Fulbright Programs

Hafsa El Bastami* (Deputy Executive Director) and Meryem Hammam* (Community Engagement Officer)

The Moroccan American Commission for Educational and Cultural Exchange (MACECE), Rabat, Morocco

Abstract

Several Educational and Cultural Exchange programs between Morocco and the USA will be discussed including the Fulbright-National Archives Heritage Science Fellowship, Fulbright-National Archives Heritage Science Fellowship, Fulbright Study Grant, The Fulbright Joint-Supervision Program, Fulbright Post-Doctoral Research Grant, Fulbright Fulbright Scholar In-Residence (SIR) Program, Fulbright (FLTA) Program, Fulbright Distinguished Awards in Teaching (DAI) Program, Teachers of Critical Languages Program (TCLP), Hubert H. Humphrey Fellowship Program, Fulbright U.S. Student Research Program, Fulbright Teaching Assistant Program, and other programs relevant to the audience.

O2. Attending US Universities: Graduate School Application

Khalid Meksem*

Department of Plant, Soil, and Agricultural Systems, Southern Illinois University, Carbondale, IL 62901, USA. *Corresponding and presenting author: meksem@siu.edu.

Abstract

About 800,000 to 1 million international students are enrolled in varuous degrees and certificates in US institutions of higher education. Therefore, many students worldwide intend and plan to pursue their studies in the USA. Here, we will discuss how to apply to the Graduate School in the US in a step-by-step basis, show you how to access and apply online as well as how to apply to scholarships and teaching assistantships.

Session XVII: Students Oral Presentations III

Co-Chair: Noureddine El Aouad, Univ. Abdelmalek Essaadi, Morocco
Co-Chair: Malika Abid, University Mohamed I, Morocco

O1. Olive Oil Quality Characteristics of Olive Orchards (*Olea Europaea* var. Europaea L.) in a Semi-Arid Continental Zone: Case of the Beni Mellal-Khenifra Region in Morocco

Elhabty Mohamed[1*], Jamal Aabdousse[1], Zehor Ait Yacine[1], Khalid Benhssain[2], Aziz Hasib[1], and Abdelhaq Boundi[3]

[1] Environmental, Ecological and Agro-industrial Engineering Laboratory, Department of Life Sciences, Faculty of Sciences and Techniques, Sulatn Moulay Slimane University Beni Mellal, BP 523, 23000 Beni Mellal, Morocco; [2] Polyvalent team in research and development, Department of Biology and Geology, Polydisciplinary Faculty of Beni Mellal, Sulatn Moulay Slimane University Beni Mellal, BP 592, 23000 Beni Mellal, Morocco ; [3] Regional Office of Agricultural Development of Tadla Morocco. *Corresponding and presenting author: mohamed.elhabty@usms.ma.

Abstract

The physical and chemical analysis of the quality of olive oil trees (*Olea Europaea* var. Europaea L.) in the years 2017-2019 period in a continental environment with a semi-arid climate, Beni Mellal-Khenifra lands, located in central Morocco, revealed territorial specifications. Four homogeneous agricultural territorial units were identified. The result showed the plain with great hydraulic irrigation, the pluviometry plain with private irrigation pumping, the piedmont zone (alias "Dir" zone), and the medium mountain zone. These spatial units showed significant differences in the values of the essential parameters of the quality of the olive oil. The percentage free acidity content was 0.96, 1.76, 1.19, and 1.31, peroxide index (with meq/O2/kg) were 7.38, 6.34, 10.00, 7. 09, the two specific extinctions under ultraviolet radiation at wavelength 232 nm showed 0.94, 1.34, 0.79 and 0.74, respectively. The wavelength at 270 nm showed non-significant differences in the values of 0.08, 0.09, 0.15, and 0.08. It was found that the agricultural territorial unit "the plain of great hydraulic irrigation" presented significantly the best quality of olive oil. It was the nearly equal frequency of the class of extra virgin oil (50.02%) and the class of virgin oil (49.48 %). The performance of the area is explained by the fertility of the soils, the judicious choice of the plant material, the relatively young age of the olive orchards, the suitable levels of technicality of the local olive growers, and the respect of the good practices of hygiene by the crushing units with improved modes within the studied area. **Keywords:** Beni Mellal Khenifra Morocco region's, Olive oil quality, Olive orchard, Physical- chemical, Semi-arid climate.

O2. Technological Characterization and Exopolysaccharide Production By Lactococcus lactis Strains Isolated Raw Milk of Cows in Eastern Morocco

Nora Hamdaoui[1,2*], Mohamed Mouncif[2], and Mustapha Meziane[1]

[1] Laboratory for the Improvement of Agricultural Production, Biotechnology, and the Environment, Department of Biology, Faculty of Sciences, University Mohammed I, 60000 Oujda, Morocco; [2] Process Engineering and Food Technologies Departement, Institute of Agronomy and Veterinary medicine (IAV-Hassan II) BP 6202 Rabat, Morocco. *Corresponding and presenting author:

n.hamdaoui@ump.ac.ma.

Abstract

Raw milk contains many essential nutrients and is characterized by a rich and diverse lactic microflora. Lactic acid bacteria (LAB) are natural and important microorganisms used in various forms in the field of health and in industrial food fermentations. Their metabolites are generally regarded as safe. LAB can be used in foods as probiotics and preservatives that prevent numerous disorders caused by oxidation in the host. They also play an important role in the manufacture of cheese and various fermented dairy products and contribute to texture, flavor and the production of aromatic compounds, The aim of the present research was the identification and investigation of technological attributes of Lactococcus Lactis and focused on dextran production test, extraction and quantification of (EPS), lipolytic and proteolytic abilities, thickening, texturizing, coagulating and acidifying properties by 24 strains of Lactic acid bacteria (LAB) genus Lactococcus Lactis isolated from raw cow milk from eastern Morocco. The search for EPS production was based on two types of tests: qualitative tests (on modified MRS agar, MSE medium, Rhutenium red medium, Chinese ink, and Chalmers medium, skimmed milk) . and quantitative tests (modified MRS broth). The results of the evaluation of the technological aptitudes of the Lactococcus lactis strains indicate a significant acidifying power (39°D to 88°D), high viscosity, and important proteolytic power (8mm and 25 mm). The strains Lc 10, and Lc 26 remain the most highly productive of exopolysaccharide (ESP). Lc 1, Lc 10 Lc 11 Lc 12 Lc 24 Lc 26 and Lc 27 strains, by their thickening capacity can be classified as thickening food additives. Thus the result shows the composition of the culture medium (carbon) influences the production of EPS. The strains are selected for their ability to acidify milk and form flavors and produce exopolysaccharides, three parameters crucial to their utility as dairy starters. all strains presented good technological potential. The Lc.lactis isolated from raw cow milk can be used in the dairy-product industry. **Keywords:** Raw milk, Lactococcus Lactis, Acidity, Proteolytic , Viscosity , EPS.

O3. Beneficial Role of Exogenous Silicon and Phosphate-Solubilizing Bacillus subtilis on Yield and Antioxidant Metabolism in Chickpea (*Cicer arietinum* L.) Under Low Phosphorus Availability

Habiba Kamal[1§], Mohammed Mouradi[1], Cherki Ghoulam[2], and Mohamed Farissi[1*]

[1] Unit of Biotechnology & Sustainable Development of Natural Resource, Sultan Moulay Slimane University, Polydisciplinary Faculty of Beni–Mellal, Morocco; [2] Centre of Agrobiotechnology & Bioengineering, Research Unit Labeled CNRST, Cadi Ayyad University, Marrakech, Morocco. [*]Correspondence: farissimohamed@gmail.com/mohamed.farissi@usms.ac.ma. [§]Presenting author: kamalhabiba20@gmail.com.

Abstract

Low phosphorus (P) availability is a limiting factor of plant growth in many agricultural regions. To remedy this problem, farmers use chemical P fertilizers extensively, although these are a serious menace to the environment. The use of biofertilizers-biostimulants such as Silicon (Si) and P-solubilizing bacteria (PSB) have been emerged as a promising way to improve plant P nutrition. In this context, the present study aimed at investigating the synergistic effects of Si treatment and phosphate-solubilizing Bacilus subtilis inoculum on plant growth, P nutrition, oxidative stress markers and antioxidant response in Moroccan chickpea Zahour (ZA) variety under low P availability. Results revealed a significant reduction in dry biomass, plant height, leaf number, and area

under low P conditions. P deficiency also altered P nutrition and chlorophyll (Chl) content. However, P-deficient chickpea plants treated with Si or inoculated with PSB strain showed higher plant growth, Chl content, and remarkably the effect was more important when Si was applied together with PSB strain. Moreover, the simultaneous application of Si and PSB strain to the P-deficient chickpea plants improved P content in both the shoots and roots. The content of malonyldialdehyd and hydrogen peroxide and the level of electrolyte leakage were significantly increased in P-deficient chickpea, while were significantly decreased after simultaneous application of Si and PSB inoculum. This reduction was correlated with a significant increase in both enzymatic and non-enzymatic antioxidant systems including superoxide dismutase, polyphenol and flavonoid contents. Our findings suggest that the combined application of Si and phosphate-solubilizing Bacilus subtilis could be a promoting strategy to mitigate the damages of low-P availability on chickpea growth and yield. **Keywords:** Chickpea, silicon, Phosphorus deficiency, PSB, Antoxidant metabolism.

O4. Antioxidant Activity and Chemical Characteristics of Wild Prickly Pear Seed Oil Grown in the wild in Northeastern Morocco

Marhri Ahmed[1*], Kamal Belhaj[1,3], Reda Melhaoui[1], Mehdi Boumediene[1], Aziz Tikent[1], Aatika Mihamou[1], Hana Serghini-Caid[1], Ahmed Elamrani[1], Christophe Hano[2], Malika Abid[1], and Mohamed Addi[1]

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Abstract

The great usefulness of the species Opuntia ficus indica makes it a very important species in the cactus family. The aim of this work is to initiate a study on the quality of prickly pear oil produced in the area of Chouihia located in the north of eastern Morocco. Due to the high price of the oil, the sector of the seeds is the best yield. Hence, nopal cactus industry is active and expanding rapidly. To assess the quality of the studying oil, the quality index, oxidative stability, flavonoid, total phenolic, chlorophyll and carotenoid content of prickly pear seed oil were analyzed. The samples were obtained from wild trees during the harvesting season 2020. The results showed that the acidity and peroxide index were 1.11% and 4.44 meq O2/kg, respectively. While the total phenolic and flavonoid contents in these seed oils were 260.07 mg/kg and 65.99 mg/kg, respectively. In addition, the results show a carotenoid content of 0.61 mg/kg and a total chlorophyll content of 1.52 mg/kg, and an oxidative stability of 17.31 hours. **Keywords:** Prickly pear, Chemical characteristics, oil, Opuntia ficus india, eastern Morocco.

O5. Validation of a Composite of Epigenetic Biomarkers for Screening, Early Diagnosis and Precise Prognosis of Colorectal Cancer

Omayma Mazouji* and Hicham Mansour

GES-LCM2E, FPN, Mohamed First University, Oujda, Morocco. *Corresponding and presenting author: omazouji@gmail.com.

Abstract

Colorectal cancer (CRC) is one of the major health concerns and a leading cause of carcinogenic death worldwide. According to statistics from GLOBOCAN, CRC is ranked the second one in the aspect of mortality and the third one in terms of incidence with an estimated number of more than 1.9 million new cases in 2020. In the clinical field, the management of CRC is based on the use of solid biopsy as a golden standard for the determination of CRC status. In this project we identified the methylation sites in the DNA extracted from patients with CRC at stages I and II. A DNA biobank of 100 samples from patients with CRC, 25 in stage I, 25 in stage II and 50 normal autologous tissues has already been collected. The DNAs from these patients were extracted and quantified. The Next generation sequencing tool was used to target 84MB of the human genome containing 3.7 million of CpGs. These CpGs are present mainly in the CpG islands, found in the 20,000 annotated human genes and theirs promoters, as well as in all referenced regulatory sequences. Between 8 and 10 GB of data were generated per patient in order to have at least 100X of sequencing coverage. A bioinformatics and statistical analysis were carried out in order to determine the relevant methylation sites. These sites have been identified on six genes: KCNA1, KCNA6, COL4A2, GDF7, ARHGEF7 & H4C9. Real-time PCR validation of these sites is in progress. These genes are able to: 1/ discriminate between tumor and normal condition, 2/ detect the sites which induce (driver sites) the tumor and 3/ determine the prognosis of affected patients. This work aims to validate the methylation sites obtained in the previous study, determine the statistical power of the relevant methylated sites and offer a reliable and less expensive molecular tool for the early detection and prognosis of CRC patients. Finding the methylation sites that contribute to the early development of CRC is critical and essential not only for early cancer detection, but also for collecting information and providing strategies for colorectal cancer therapy. **Keywords:** Colorectal cancer, biomarkers, methylation, diagnosis, prognosis, screening.

O6. Optimization of Phenolic Compounds Extraction from Hemp (*Cannabis sativa* L.) Seeds Using Simplex Lattice Mixture Design and HPLC-DAD/ESI-MS2 Analysis

Chaymae Benkirane[1*], Abdessamad Ben Moumen[1], Marie-Laure Fauconnier[2], Yassine Taaifi[1], Youssef Rbah[1], Allay Aymane[1], Kamal Belhaj[1], Farid Mansouri[1,3], Malika Abid[1], Hana Serghini Caid[1], and Ahmed Elamrani[1]

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Abstract

Hemp (*Cannabis sativa* L.) is an annual plant of the Cannabaceae family. It is cultivated for industrial, therapeutic, recreational, and nutritional purposes. Hemp seeds are a good source of protein, oil, fiber, and bioactive compounds. In this study, the extraction of phenolic compounds from defatted hempseeds was optimized using a simplex lattice mixture design with three solvents (water, methanol, and acetone). The total phenolic content (TPC) was evaluated by FolinCiocalteu's method. The results showed that the binary acetone-water mixture in equal proportions is the optimal combination to achieve the maximum TPC (53.65 mg GAE per g of extract). The phe-

nolic profile analysis of defatted hempseeds showed the predominance of hydroxycinnamic acid amides and lignanamides, especially N-trans-caffeoyltyramine, cannabisin A, and cannabisin B. In addition, HPLC-DAD/ESI-MS2 analysis allowed visualizing the effect of each solvent mixture on the relative extracted amount of each identified phenolic compound. This study encourages the use of defatted hemp seeds as a source of bioactive compounds with added value for pharmaceutical and cosmetic applications. **Keywords:** Hemp, Bioactive compounds, TPC, Mixture design, HPLC-DAD/ESI-MS2 analysis.

Session XVII: Students Oral Presentations IV

Co-Chair: Abdelghani Tahiri, University Ibn Zohr, Morocco
Co-Chair: Karen Midden, Southern Illinois University, USA

O1. Dynamics of Soil Nitrates in a Plot Under Onion Cultivation in the Saiss Basin

Nessah Chaimae[1,2*], Abdellah El Hmaidi[3], El Faleh El Mâti[2], and Bouhafa Karima[1]

[1] National Institute of Agronomic Research, Soil, Plant, and Water Laboratory, Meknes, Morocco; [2] Department of Geology Faculty of Sciences, Moulay Ismail University, Geosciences: Geodynamics and Georesources, Meknes, Morocco; [3] Department of Geology Faculty of Sciences, Moulay Ismail University, Laboratory of Geo-Engineering and Environment, Meknes, Morocco. [*]Corresponding and presenting author: nessah.chaimae@gmail.com.

Abstract

Morocco has always made the development of the agricultural sector a strategic choice. This sector is faced with the challenge of the intensive use of nitrogen fertilizers which threaten the quality of agricultural soils.This study is part of the research related to this issue. It aims to establish the spatio-temporal variation of soil nitrate concentration in an onion plot. A nitrogen fertilization trial was carried out in the "Douyet" experimental station of the Regional Center of Agronomic Research of Meknes. The experimental design adopted is Complete Random Blocks. Six nitrogen treatments (0, 90, 135, 180, 225 and 270Kg N/ha) were tested. Soil samples were taken at five depths (0-20 cm, 20-40 cm, 40-60cm, 60-80cm and 80-100cm) for their nitrate content. The monitoring shows a richness in nitric elements. The direct impact of nitrogen application is more felt after the herbaceous growth stage, and it seems to have more of a marked impact at shallow depths, this root zone could lose NO_3^- at the time of bulbing when the crop rapidly absorbs nitrogen.The results show that for each of the rates, the soil measured concentrations decrease gradually with time. The assimilation of nitrogen by the plant during the crop cycle may explain this result. The difference in soil NO_3^- concentrations is clearly noted between the 0, 90 and 135kg/ha rates and the 180, 225 and 270kg/ha rates. A significant difference in soil nitrate levels over time was observed. However, no significant difference was observed between the concentrations measured at different depths for the different N application rates. **Keywords:** Nitrogen fertilization, onion, soil nitrate dynamic, Saiss basin, Morocco.

O2. Forest Composition Effect on Carbon Stock Potential and other Soil Physico-Chemical Properties in the Oulmes Central Plateau

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Abstract

The Climate change repercussions are more than ever recognized and felt by humanity and are no longer to be denied. These changes, which are essentially due to the increase of greenhouse gases (GHG) in the atmosphere, are manifested by the recurrence of extreme events such as drought, floods and pandemics. This increase in GHGs is due to human activity through the combustion of fossil carbon by industry and transportation. Nevertheless, the planet earth has always had sinks able to store a large part of the GHGs, represented essentially by CO2, but at different potentials. Among these sinks we note the forest ecosystem, which captures CO2, in the form of organic carbon, at different levels, namely the aerial biomass, the root biomass and the soil. The present study is a contribution to assess the effect of forest composition on soil carbon storage potential and others physico-chemical properties. The study took place in Oulmes central plateau which hosts forest formations based on cork oak, green oak and thuja. The stock of organic carbon of the soil were operated on the organo-mineral layer above 30 cm depth. these soil samples were subjected to conventional physical and chemical analyses. The results of the analyses show a clear effect of the forest composition on the organic carbon stock in the soil. Indeed, this stock is high when the forest composition of the woody species is in its pure state (pure thuja strata [47.91 t ha-1]) and decreases in the presence of mixtures with other woody species, especially in the presence of hardwood/softwood mixtures (thuja and holm oak strata [6.71 t ha-1]). These results are considered very useful for a rational management in the framework of forest management, by recommending mono-specific reforestation of forest species promoting a great potential of organic carbon stock in the soil, and thus of reduction of greenhouse gases and mitigation of the effects of climate change. **Keywords:** Climate change, Greenhouse gases, Soil organic carbon, Forest ecosystem, Oulmes Central Plateau.

O3. Concentrations of Arsenic, Cadmium, Mercury, and Lead in *Sardina pilchardus* from the three Moroccan Mediterranean Coasts

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Abstract

In Morocco, maritime fishing is a main component of the national economy given its geographical position and its long coastline. The total Moroccan production of fishery products is around 1,376,420 tons with a contribution of 2.5% of the national GDP. Heavy metals are a severe threat because of their toxicity, long persistence, bioaccumulation, and biomagnification in the food chain. This investigation deals with human health risk assessment of metal contamination through the consumption of *Sardina pilchardus* (Walbaum, 1792) as the most consumed fish species in

Morocco. The aim of this study is to assess the health risks associated with the consumption of sardine by assessing the contamination level of mercury (Hg), lead (Pb), arsenic (As), cadmium (Cd) in the muscle of this species. Three hundred sixty (n = 360) specimens of sardine sampled between December 2020 and December 2021 at 3 Mediterranean coast sites Beni Ensar, Cap-de l'eau and Al-Hoceïma in the northern region of Morocco. The results show that the As and Hg were influenced by geographical area and season ($p<0.05$), while the lead and cadmium were not affected ($p>0.05$). The highest values were recorded in winter season ($p<0.05$). The lowest contamination's levels were found in spring season. Geographically, the Al-Hoceïma specimens present the highest heavy metals content ($p<0.05$). According to the standard of world health organization, we conclude that the consumption of *S. pilchardus* from the Moroccan Mediterranean coast was not likely to have an adverse effect on human health. **Keywords:** Sardina pilchardus, Moroccan coast, Toxicity, Heavy metals.

O4. Distribution of Earthworms in a *Valencia orange* Orchard as affected by Distance to Trees and Soil Properties

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Abstract

Earthworms are an important component of the soil macrofauna that plays a significant role in maintaining soil fertility and plant productivity in various agroecosystems. However, these organisms are still poorly studied in Moroccan agricultural soils. In this study, we examined the effect of distance to tree and soil properties on earthworm distribution in a Valencia orange orchard. Ten points were chosen randomly, five were close to the tree (1 m) and five points were about 2.5m away from the tree. In each point, we collected soil samples and earthworms by handsorting from a pit of 0.16m^2 and 25 cm depth. The soil samples were analyzed for pH, electrical conductivity and moisture. The earthworms were preserved in an ethanol solution (80%) and brought to the laboratory for identification and biomass measurement. The results, obtained so far, showed no significant difference in earthworm abundance and biomass between distance the tree. Moreover, we did not found any significant correlation between earthworms and the measured soil properties. Further investigations should be conducted with larger sample size on multiple orchards to better understand earthworm distribution in citrus orchads in Morocco. **Keywords:** Earthworm, Soil, Citrus, Orange, Spatial distribution.

O5. Assessment of Performance of five Rootstocks Under Iron and Lime Stress

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Abstract

Rootstocks play a crucial role in the mineral nutrition of citrus crops and can have a strong influence on their uptake of iron. Iron deficiency is, indeed, a serious concern for citrus production in Mediterranean countries, including Morocco, where soil alkalinity and calcareousness reduce the bioavailability of iron to crop uptake. In this study, we examined the effect of iron and lime stress on the performance of five rootstocks, increasingly used in Moroccan commercial orchards as substituent to sour orange rootstock. The experiment was conducted on a greenhouse, in pots containing sandy soil planted with one of the five rootstocks (*Carrizo citrange*, Citrumelo, *Poncirus trifoliaite*, Macrophylla, Volkameriana) and subjected to one of three treatments (control, lime stress, lime stress + iron stress) replicated 10 times in a completely randomized bloc design. We induced lime stress by the addition of $CaCO_3$ to the nutrient solution used in irrigation, while iron stress implied the non-addition of iron to the nutrient solution. The results, obtained so far, showed a significant difference between rootstocks in response to the applied treatments. Citrumelo rootstock was the most affected by lime and iron stress, followed by Poncirus trifoliaite, Carrizo citrange, Volkameriana and Macrophylla. Ongoing measurement of iron concentration in plant tissue will help us better determining the joined effect of lime and iron on rootstock performance. **Keywords:** Citrus, Rootstocks, Soil, Calcareous, Lime, Iron.

O6. Prevalence, Risk Factors and Multidrug Resistance Profile of Gram-negative Bacteria Recovered from Patients Admitted to Beni Mellal Regional Hospital

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Abstract

The aim of this study was to determine the burden of multi-drug resistance, the production of extended-spectrum β-lactamases (ESBLs) and carbapenemase in Gram-negative bacilli recovered from patients admitted to Beni Mellal regional hospital and risk factors associated with MDR infection. A total of 75 Gram-negative bacilli were recovered from Oct-2021 to Oct-2022, among which Escherichia coli were the predominant isolates followed by Klebsiella pneumoniae, Acinetobacter baumannii, Pseudomonas aerogenosa, Serratia marcescens and Pantoea agglomerans. The highest percentage of antibiotic resistance was noted against ampicillin (84%) followed by nalidixic acid (66.7%) and ciprofloxacin (62.7%). Moreover, the isolates showed better sensitivity towards chloramphenicol and carbapenem drugs. Out of 75 isolates, 61.3% were multi drug resistant. Nearly 34.7 % and 22.7 % of isolates were producers of ESBL and carbapenemase, respectively. Previously hospitalization, previous antibiotherapy, patient admitted to surgical ward, patients with malignancy and patients with anemia, urinary tract infection and urinary tract catheter was found as significant risk factors. The emergence of MDR bacteria in our hospital specifically isolates producing ESBL and cabapenemase is highly alarming. **Keywords:** Gram negative, MDR, ESBL, Carbapenemase, Risk factor.

Poster Presentations Abstracts

AMAHLS V & CHSE I

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POSTER PRESENTATIONS ABSTRACTS

P01. Genome Wide Association Study (GWAS) of Grain Yield and Yield Related Traits in Spring Bread Wheat (*Triticum aestivum* L.) Under Drought and Heat Conditions in Three Locations

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Abstract

Abiotic stress, especially drought and heat, affects cereal yields and wheat production worldwide, more particularly in West and South Asia, North Africa, and sub-Saharan Africa. The present study was carried out on 229 spring bread wheat (Triticum aestivum L.) genotypes from the International Center for Agricultural Research in Dry Areas (ICARDA) to identify the genomic region and marker-trait associations (MTA) responsible for drought and heat tolerance. The study was carried out in three different locations, Merchouch station (Morocco), Sids station (Egypt), and Wadmadani station (Sudan) over a period of two years (2018 and 2019). A genome-wide association study (GWAS) was performed by using the mixed linear model (MLM) and 13,698 DArTseq markers were used for genotyping. Linkage disequilibrium revealed that 1914 pairs of markers mapped on the B sub-genome, followed by D and A sub-genomes with 1745 and 1726 paired markers, respectively. A total of 342 MTAs ($P < 0.05$) and 78 genes were identified in the three environments, of which 134 MTAs were recorded at Sids station and 128 and 80 MTAs at Wadmadani station and Merchouch station. The markers 822842, 196565, and 753901 were significantly correlated with grain yield under drought, heat, and yield potential stations in Morocco, Sudan, and Egypt, respectively. The markers and candidate genes identified in this study have the potential for marker-assisted selection to develop high yielding wheat genotypes with resistance to heat and drought stresses.
Keywords: GWAS, MTA, Drought stress, Heat stress, Wheat.

P02. *Calendula officinalis* L. and *Ammi visnaga* L.: Phytochemical Tests, Total Polyphenols, and Total Flavonoids and FTIR Analysis

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Abstract

The Moroccan flora contains many plant species that have long been used as aromatic and medicinal plants. *Calendula officinalis* L., a member of the Asteraceae family and *Ammi visnaga* L., a

member of the Apiaceae family both belong to this rich flora. These two herbaceous annual medicinal plants are observed in the Mediterranean region and have many benefits. Thus, this study demonstrates the richness in biological compounds of the aqueous extracts from the two plants. In addition, a study of an organic extract with potential therapeutic properties and a comparison of the chemical compositions by FTIR were conducted. The two plants were collected in two localities of the region of Meknes then dried and crushed to prepare the extracts. Two types of aqueous extracts were made: the infused and the decocted and an organic extract (methanolic). The aqueous extract was used to investigate some chemical compounds using standard tests and both extracts were used for total polyphenols and total flavonoids. FTIR analysis was performed using the powder obtained by grinding. Phytochemical screening showed a richness of both plants in terpenoids, alkaloids, flavonoids and coumarins. There is a total absence of saponosides in both plants. In comparing the two types of aqueous extracts, we observed that the infused ones are much more concentrated in polyphenols than the decocted ones. The comparative analysis of the aqueous and organic extracts shows a higher polyphenol content in the methanolic extract for both plants. Flavonoids are more numerous in the infusion. The powders analyzed by FTIR reveal the existence of a variety of chemical compounds and showed characteristic absorption bands in approximately the same wavelength regions. This abundance of active ingredients gives these plants remarkable properties that could justify its multiple therapeutic indications and its use in traditional medicine. **Keywords:** *Calendula officinalis* L., *Ammi visnaga* L., phytochemical screening, FTIR.

P03. Predict the Threshold Wind Erosion Velocity of Cultivated Organic Soils in Montérégie (Quebec, Canada)

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Abstract

The aim of this research is to evaluate the necessary wind velocities to initiate wind erosion based on the field measured characteristics of the organic soil (particle diameter, bulk density, gravimetric water content) and of the measured aerodynamic roughness length. Organic soils are very vulnerable to wind erosion. When dry and exposed to wind erosivity, organic soils are likely to lose large amounts of soil. As such, threshold friction velocities in air dry and wet conditions as well as bare or plant covered were computed to find the required friction velocities in these soil conditions. The variation of the threshold friction velocity as a function of soil particle diameters, bulk density and soil cover was determined. The results suggest that the threshold friction velocity averages 0.14 m/s for air dry soil, goes up to 2.62 m/s for wet (100 % to 203 % of gravimetric water content) soil condition and reaches1.88 m/s for soil covered by vegetation or plant residues. The threshold friction velocity in the dry soil condition increases with increasing soil particle diameter and bulk density. The threshold friction velocity in covered soil condition is found to increase with the aerodynamic roughness length. Indeed, under wet and covered soil conditions, the threshold friction velocity increases up to 13 to 18 times compared to the threshold friction velocity for a bare air-dry soil on average. **Keywords:** Organic soil, wind erosion, friction threshold velocity, bulk density, soil particle diameter.

P04. Effect of Inclusion of Hemp Seeds in the Diet of Laying Hens on Liver Fatty Acids Profile, Tocopherols, and Cholesterol Contents

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Abstract

Hemp seeds (HS) are a good source of protein, fat, fiber, and other micronutrients (vitamins and minerals), they can be used as poultry feed. Currently, the low availability and high cost of most oilseeds commonly used in poultry feed are pushing feed producers to find alternative ingredients. HS known for its richness of omega-3 fatty acids especially, alpha-linoleic acid (ALA: C18 :3n-3), could be an excellent oilseed ingredient for poultry feed formulation. Thus, this study focuses on the evaluation of the alteration of fatty acid profiles, cholesterol, and tocopherol levels in the liver of laying hens fed with different doses of HS. One hundred and eight (n=108) 22-week-old laying hens (Lohmann's Classic Brown), were divided into 3 batches of 36 laying hens, with 6 repetitions of 6 hens each, and received a formulated poultry feed containing 0%-HS (control),10%-HS or 30%-HS. The results demonstrate a significant decrease ($p<0.001$) in the amount of saturated fatty acids (SFAs) between the 30-HS treatment and the control however, diets containing HS show a substantial increase ($p<0.001$) in n-3 and n-6 PUFAs and a significant decrease ($p<0.001$) in the n-6/n-3 ratio. The content of cholesterol decreased significantly ($p<0.05$) in the 10%-HS treatment compared to the control. Concerning tocopherol content and in parallel with the HS incorporation rate, a significant increase ($p<0.001$) is noted. For the amount of α, γ- tocopherols, a significant rise ($p<0.001$) it is observed for the 30%-HS treatment. The results indicated that HS supplementation up to 30% has interesting effects and is beneficial for the lipid profile of the liver, mainly n-3 fatty acids and the n-6/n-3 ratio, cholesterol concentration; and tocopherol content. **Keywords:** Hemp seed, Layer hen, Diet, Fatty acid, n-3, n-6/n-3 ratio, Cholesterol, α, γ-tocopherol.

P05. Physico-Chemical Characterization of a Rehabilitated Soil Mine Based on Phosphate Industry By-Products and Sewage Sludge

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Abstract

Reclamation of mining sites and valorization of phosphate by-product are at the heart of OCP strategies [1]. Mixtures of these by-products along with sludge can improve soil physical and

chemical properties and therefore contribute to sustain revegetation of mine sites. Thus, the recent studies of [2], related pots trial showed that mixture of 65% PG, 30% BL and 5% BS was the best substrate when compared to other mixtures. The objective of this study was to evaluate soil physico-chemical parameters in the rhizosphere of six species planted on substrate under field conditions. The study was carried out on 1.15 hectares with the above substrate. The experimental layout consists of Randomized Complete Bloc Design with 6 replicates and six tree species: Argan, Eucalyptus, Pistachio, False Pepper, Carob and Olive. The physical and chemical parameters such as particle size, Electrical Conductivity, pH, CEC and heavy metals contents, were determined using appropriate analytical techniques. The results showed that the texture was sandy-silt. Soils pH (7.74-7.90) were slightly alkaline. Conductivity ranged from 3.14 to 3.30 dS/cm. The organic matter was low with values varied between 1.20% and 1.23%. CEC was high with values between 40.50 and 45.80 Cmol.Kg-1. The heavy metal contents of the rhizosphere samples of the different species showed that the mean values of Cd, Pb, Zn, Ni, Cr and Cu ranged from 4.30 to 4.66 mg.kg-1, 3.80 to 4.39 mg.kg-1, 52.52 to 58.02 mg.kg-1, 9.48 to 10.30 mg.kg-1, 34.03 to 37.09 mg.kg-1, 6.22 to 7.51 mg.kg-1, respectively. Comparison of the heavy metal contents with the standard guidelines for agriculture indicated that Cd (5 mg.kg-1), Pb (100 mg.kg-1), Zn (300 mg.kg-1), Ni (100 mg.kg-1), Cr (100 mg.kg-1) and Cu (100 mg.kg-1) are below the standard guidelines [3]. In our experimental conditions, the 65% PG, 30% BL and 5% BS substrate used in this study contributes to soil properties improvement without generating or constituting any hazardous pollution t for the environment. **Keywords:** Phosphate industry, Phosphogypsum, Phosphate Sludge, Sewage sludge, Rehabilitation, Mining soils.

P06. Effect of Hemp Seed Incorporation in the Diet of Laying Hens on Laying Performance and Physical Quality Traits of Eggs

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Abstract

Hemp seeds could be a valuable alternative to improve and to reduce the cost of imported feeding stuff for animals, mainly for poultry. In fact, hemp seeds, which are considered a by-product of cannabiculture, have a low commercial value; however, they have many advantageous nutritional values in terms of lipid profile. The final objective of the research is to promote hemp seeds by incorporation into the poultry diet. The present study was carried out to evaluate the effect of the diets based on various incorporation rates of hemp seeds on the laying performance and physical quality characteristics of the eggs. Ninety-six (n= 96) Lohmann Brown classic laying hens were randomly assigned to 3 feed treatments and a control group: each treatment was repeated 6 times (4 Hens/replicates). Sampling was performed after 30 weeks of breeding (laying peak). No significant differences in laying performance were observed between the groups examined at this stage of production. Egg weight, length, and diameter decreased with increasing hempseed incorporation rate ($p<0.001$). In addition, the yolk height was influenced by the hempseed rate ($p<0.05$), while the albumen height was not affected ($p>0.05$). High levels of hemp seed incor-

poration had a negative effect on the physical quality characteristics of the eggs, however, egg laying performance was not affected ($p>0.05$). On the basis of this finding, we can conclude, that at small incorporation rates, hemp seeds could be used in poultry feeding as an alternative constituent to partially replace high-cost imported ingredients such as corn and soybeans. **Keywords:** Hempseed, Laying hens, Laying performance, Eggs physical traits.

P07. Faisibility study of Producing Unpasteurized Liquid Egg White with Enhanced Functional Properties: Safety and Technological Assessments

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Abstract

Pasteurization allows to preserve the salubrity of liquid egg white by destroying the pathogenic microorganisms. On the other hand, the pasteurization to has effects on the functional properties of the egg products. Compared to manually separated raw egg white, mechanically separated pasteurized liquid egg white reduces the volume and stability of the foam. It is for, In Morocco, pasteurized liquid egg white is not well accepted by the intended users. The present study was to evaluate the possibility of producing liquid egg white without the necessity of pasteurization and to evaluate the functional qualities of such a product. The study was realized in an approved egg product plant. The tests were done under real conditions of production. Thus, and through several tests, the microbiological stability of liquid egg white not pasteurized was evaluated both in relation to the flora of alteration and the pathogenic flora. The results obtained indicated that a liquid egg white improved in terms of functional characteristics can be attained without the need for pasteurization. The microbiological evaluations agreed with a safe product. **Keywords:** Raw Liquid egg whites, Pasteurization, Microbiological quality, Functional properties, Safety, Salmonella.

P08. Effect of Provenance on Phenolic Compounds of *Arbutus unedo* in Morocco

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Abstract

Aromatic and medicinal plants (MAP) contain a multitude of compounds involved in the enzymatic and physiological reactions of the organism. These compounds implicated in the physiology of plants have a positive impact on human health. Among these compounds are the phenolic compounds differentially synthesized by plants at the level of different organs and this according to the vegetative state of the plant. Currently, phenolic compounds are the subject of several research works because of their benefits on human health thanks to their virtues and their various

biological activities. In this context, the present study aims to determine the content of phenolic compounds in a medicinal plant, and we have chosen the strawberry tree as a case study. This plant, which knew an evaluation of the nutritive value of its fruit in opposition to its leafy part that remains limited and fragmentary in Morocco. In addition, we also aim to evaluate the effect of provenance on the composition and phenolic compound content of the leaf extracts of the said species. In order to cover the entire range of the arbutus in Morocco, samples were collected in different biogeographic regions of Morocco where this species thrives (Pre-Rif, Western Rif, Central Plateau, Middle Atlas and High Atlas). The collected leaves are dried at room temperature, protected from light and humidity, and then reduced to powder. The extraction is carried out by maceration in methanol to obtain dry extracts for the determination of phenolic compounds. The content of total polyphenols and flavonoids was determined by the colorimetric method using the visible spectrophotometer. The results obtained show that there is a significant variability between the populations studied in terms of total polyphenol and flavonoid content of leaf extracts. Thus, analysis of variance (ANOVA) and principal component analysis (PCA) show that the provenance of the plant material could be the cause of this intra- and inter-population variability in phenolic compound content of arbutus leaves extracts. This variability seems to be correlated with the variation in environmental conditions such as climate, soil, orography, etc. **Keywords:** *Arbtus unedo*, phenolic compounds, provenance, climate, Morocco.

P09. Screening of Microorganisms in the Rhiosphere of the Grapevine, and Study of the Antagonistic Activity Towards *Allorhizobium vitis* and *Botrytis cinerea* for the Implementation of a Biological Control Method

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Abstract

Bacteria form complex and dynamic associations with plants that range from mutually beneficial to commensal or pathogenic and play key roles in soil quality, host productivity, and host health through direct or indirect mechanisms, such as mineralizing soil organic matter, activating plant defense mechanisms, and even producing antibiotics against phytopathogens. Viticulture represents one of the most important agricultural domains in the world in terms of cultivated surface and financial profitability and occupies an important place in Moroccan agriculture. However, Crop diseases take heavy toll on viticulture; it is subject to various biotic threats, notably crown gall and grey rot caused by Allorhizobium vitis and Botrytis cinerea respectively. Agricultural practices are getting innovative with advancement in science and technology. Out of several management options of disease control potential use of microbial consortia immerge as a new eco-friendly, sustainable approach. Synthetic biology has generated many examples of what microbes can do and what we can learn from them when they are creatively engineered in the laboratory environment. Microbial consortia help to increase tolerance toward several stresses such as drought, salinity, heavy metal, and biotic stress . The aim is to better understand the role of the soil and root microbiome, in the context of , discovering the composition of a microbial consortium to defend the vine against these biotic and abiotic stresses. For this purpose, isolations from the rhizosphere and the roots of the vine were carried out and the morphologically different colonies were tested for their antagonistic activity against Allorhizoium vitis and Botrytis cinerea. These strains were

tested for their compatibility with each other, in order to form a microbial consortium capable of defending the vine against these pathogens and which could be marketed as a biopesticide. **Keywords:** Viticulture, *Allorhizobium vitis, Botrytis cinerea*, biocontrol, microbial consortia.

P10. Nutritional Quality of Feeds used for Fattening Local Kids in the Moroccan Western Rif Region

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Abstract

This study is a contribution to evaluate nutritional quality of feeds resources used for fattening local goat kids of extensive livestock farms in northern Moroccan region. For this purpose, samples were analyzed for dry matter, mineral matter, nitrogenous matter, ether extract and fibers content. The analyses were also interested in the digestibility by using two methods: enzymatic and in vitro. The protein value (PDI) and energy value (UF) of the samples were calculated to evaluate the nutritional value of goat kids feeding. The result showed that the mineral content varies between 96 and 17 g/kg DM, the highest content is observed in the pelleted feed. Most of the species are characterized by low fat contents, however the energetic species are characterized by important fat contents (25 to 48 g/kg DM). For protein content, the species with high content are represented by vetches, faba beans and bitter vetch (279, 237 and 264 g/kg DM respectively). For the NDF content varied between extreme values of 661.85 g/kg DM for barley and 512.35g/kg DM for bitter vetch with an average content of 600.54 g/kg DM. The lignocellulosic fraction ADF, varied between 160.21 and 79.20 g/kg DM. The lignin ADL content was an average of 25.40 g/kg DM. For the energy value (UFL and UFV), the results record an average of 0.90/kg DM for UFL and 0.87/kg DM for UFV. The PDINs have an overall average of 110.93 g/kg DM while the PDIEs have an average of 103.49 g/kg DM. The nutritional quality of the concentrated feeds used in the fattening of goat kids is now well known, it will allow a better optimization of the use of the available fodder resources and a good feeding of the kids in the northern region of Morocco. **Keywords:** Concentrated feeds, chemical composition, digestibility, PDI, UF.

P11. Hydroponic Green Fodder: An Alternative Solution for Feeding Livestock in Arid and Semi-Arid Areas

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Abstract

In arid and semi-arid areas, the animal production subsystem is an essential component of the production of agricultural holdings, however several constraints hinder the development of the sector, which are mentioned: the low and irregular rainfall resulting in fluctuations in the food supply of the livestock resulting in high feed prices, the small area reserved for fodder crops and thus the weakening of the livelihoods of millions of farmers. Taking climate change into account,

as a structural phenomenon affecting Morocco like many other countries with semi-arid or arid climates, the question of the resilience of production systems to climate change is at the heart of the Morocco Green Plan. The PMV's approach to mitigate, adapt and prevent its effects and impact is based on the deployment of innovative and sustainable techniques and practices. The adoption of the technique of green hydroponic fodder, will thus allow the breeders to be able to produce large quantities of good quality fodder all year round on reduced areas. The objective of this study is to rely on hydroponic green fodder as an alternative solution for the sustainable feeding of livestock in arid and semi-arid areas, by studying and monitoring the growth and morphological and physiological characteristics of a hydroponic crop with a mixture of cereals (barley, triticale, forage peas) grown alone and in a mixture. Crop growth was monitored, and several measurements were made, measuring morphological characteristics: germination rate, biomass, root and leaf length, and physiological characteristics: nitrogen content, mineral matter, dry matter, fiber content. **Keywords:** Green fodder, hydroponics, barley, feed peas, triticale, livestock feed.

P12. Grapevine Microbiome: A Biological Control Method Against Biotic Stresses

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Abstract

Viticulture represents one of the most important crops in the world in terms of cultivated surface, and socioeconomic impact and occupies an important role in Moroccan agriculture. However, crop diseases take a heavy toll on viticulture; it is subject to various biotic threats. Soil microbial communities represent the greatest reservoir of biological diversity. An increasing body of evidence also signifies the importance of this plant microbiome, which consists of the entire complex of rhizosphere-associated microbes, their genetic elements, and their interactions, in determining plant health. The collective genome of this microbial community is much larger than that of the plant and is referred to as the plant's second genome. It is from these various microbial populations that the idea of selecting a microbial consortium containing compatible, beneficial, and antagonistic strains against the various plant pathogens has immerged. The application of microbial consortium consisting of efficient strains for biological control is a superior technique compared to the application of individual microbes for managing plant diseases. Moreover, the application of microbes in a consortium may improve the efficacy, reliability, and consistency of the microbes under diverse soil and environmental conditions. Compatible microbial strains that have no suppressive effect on other microbial strains, in the consortium may have an enhanced impact on plant growth promotion or disease suppression. This microbial consortium triggers several mechanisms of action including competition for resources, boosting systemically the defensive capacity of the plant, and the creation of anti-microbial metabolites. **Keywords:** Viticulture, biocontrol, microbial consortium.

P13. Optimization of Roasting Process of Almonds Intended for Preparation of Healthy, Weight-Loss-Friendly Snacks

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Abstract

Due to the drought resistance of almond trees, the almond industry is becoming a lever for development in the semi-arid regions of eastern Morocco. According to *DRA-Oriental, young almond plantations contribute to the performance of the sector, where the production of shelled almonds continues to increase, (13,000 tons in 2008 to 30,000 tons in 2020), and a better post-harvest recovery of almonds is noticed. Indeed, several Agri-food cooperatives have been created and various transformation processes for the valorization of almonds in almond products with high added value have emerged (e.g.: marzipan, almond oil for food and cosmetic use). This study focuses on the optimization of the roasting process of almonds in order to improve their nutritional quality. Whole or split roasted almonds are used with cereals and other ingredients in the formulation of new healthy and weight loss -friendly snacks (Healthy bars snacks). We will present here the results of the method for optimizing the almonds torrefaction. Indeed, response surface methodology (RSM) was used to determine the optimal roasting conditions. Twenty experiments were randomly selected using a central composite design (CCD) with two-controlled factors. Almonds were roasted at five temperatures (112, 120, 140, 160 and 168 °C) and for five duration times (7, 10, 17.5, 25 and 28 min). Mathematical models have shown that roasting conditions significantly affected response variables ($p < 0.001$), namely color, browning index, sweet, acid bitter and roasted tastes, hardness, and peroxide index. The optimized results showed that the best responses were reached when the roasting time was 17.5 min and roasting temperature was 140°C. The roasting process at these conditions produced the most acceptable almonds by consumers. **Keywords:** Almond Roasting, Nutritional quality, Healthy bars snacks.

P14. Incidence of Codling Moth (*C. pomonella* L.) in Apple Tree Cultivars According to Its Voltinism and Several Physicochemical Traits of Fruits

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Abstract

Codling moth, *C. pomonella* L., is known as one of the main pests of pome fruits (apple and pear) and walnuts worldwide. Several control methods have been performed to decrease its incidence, however, it still represents a threat to the production and remains unsuccessfully managed. The current study has been conducted to highlight potential correlations between the codling moth damage and the physicochemical traits of fruits according to the voltinism of the insect through a growing season. The voltinism was determined and thirteen well-known apple cultivars were investigated between June and July, for codling moth damage as well as for physicochemical fruits characterization. Results showed highly significant differences between varieties in terms of codling moth infestation. The incidence of the insect varied according to the maturity stage of the fruits; the medium maturing varieties were the most attacked among the studied varieties, namely Galaxy and Obro Gala. Moreover, the firmness and sugar content seemed to be involved in codling moth attraction towards certain varieties. The preference to these two parameters changed among the insect's generations. **Keywords:** Apple cultivars, *C. pomonella*, fruits physicochemical traits, voltinism.

P15. Mitigating Global Warming Through the Recovery of Organic Waste

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Abstract

Over the past decade, the amount of organic waste has increased worldwide. This biomass is underestimated despite its richness in biomolecules of interest that can be transformed into several types of biological products such as biostimulants, biofertilizers, anti-aging, nutraceuticals, and pharmaceutical drugs. The non-valorization of these co-products of plant or animal origin is the main cause of greenhouse gases (GHG) responsible for climate change and its harmful effects on agriculture, human health, and the environment. The scientific community encourages the recovery of this waste by producing natural agricultural inputs such as biofertilizers, biopesticides, and biostimulants, to satisfy the food security of the population and minimize polluting waste. Care must be taken to recover this abandoned organic biomass rich in biomolecules of interest. Indeed, the challenge that appears from this proposed valuation is to find the most eco-efficient technique that preserves the environment and improves economic profitability within the framework of a circular bioeconomy.The main aim of this communication is to discuss and interpret the different opportunities for the recovery of organic waste. Additionally, various valuation limits are revealed and discussed, to which we offer recommendations to minimize the adverse effects of climate change to ensure food security. **Keywords:** Recovery, organic waste, valorization, biomolecules, circular economy, climate change, food security.

P16. Antioxidants from Rubus idaeus L. cv Maravilla Leaves: Ability to inhibit the formation of Glycation End Products and Key Hyperglycemia Enzymes

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Abstract

As a by-product of red raspberry production, *Rubus idaeus* L. cultivar Maravilla leaves, which are well-known for their antioxidant-rich fruits, are discarded as trash. This study intends to determine for the first time the potential inhibitory activity of key enzymes related to hyperglycemia, α- glucosidase and α-amylase, as well as the protein glycation inhibitory ability of this plant methanolic extract, in order to discover natural remedies. The results demonstrated that the leaves had a high levels of phenolic compounds (167.2 mg GAE/g DW) and a flavonoid content of 17.08 mg QE/g DW. Furthermore, the leaves showed a significant antioxidant potential in various tests, including DPPH free radical scavenging (IC50= 0.03 mg/ml) and 2,2'-azino-bis(3- ethylbenzothiazoline-6-sulphonic acid) scavenging (IC50= 0. 049 mg/ml), ferrous ion chelation (IC50= 1.28 mg/ml), and ferric iron reducing power (266.03 mg/ml). Moreover, the antidiabetic assays revealed that the extract could considerably reduce the activity of both α-glucosidase and α- amylase enzymes. An albumin/fructose glycation model was also used to assess the extract's protein glycation inhibitory ability. Various biochemical indicators, such as fructosamine and protein carbonyl group, were used to estimate glycation inhibition, and the formation of advanced glycation end products (AGEs) was determined using a fluorometer. The present investigation confirmed that Rubus idaeus cv Maravilla leaves could be a prospective plant, as replacements for synthetic drugs, for diabetes treatment and glycation-related diabetic complications prevention. **Keywords:** *Rubus idaeus* leaves extract, antioxidant activity, alpha-glucosidase, alpha-amylase, glycation, AGEs.

P17. Pre-incubation of Rhizobia Strains with Hesperetin affect Vicia faba Growth and Nodulation Under Salt Stress Conditions

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Abstract

Associated with appropriate crop and soil management, inoculation of legumes with rhizobacterial biofertilizers can improve food legume yield and soil fertility and reduce pollution by inorganic fertilizers. Plant-rhizobial symbiosis are subjected to osmotic stress imposed by high levels of NaCl that is frequently found in arid and semi-arid lands. Poor nodulation and N_2 fixation of legumes, which can lead to substantial loss of yield, has been attributed to negative effect of abiotic stress in the signal exchange process between the Plant-rhizobial symbiosis. It well known that successful symbiotic interactions are complex and require the regulation and function of multiple genes/gene families in both partners. indeed, flavonoids (e.g., Hesperetin) play a crucial role as signal molecules in promoting the formation of nodules by symbiotic bacteria. This study examines the

effect of inoculation with preinduced rhizobia by hesperetin on V. faba plant growth and nodulation under salt stress conditions. Three rhizobia strains (RhOF4, RhOF6 and RhOF53), which have a different tolerance to salinity, were used to inoculate faba bean plants grown under controlled environmental conditions. Germinated seeds were inoculated with rhizobial strains preinduced with 10 µM hesperetin, at different levels of salt stress (0 and 70 mM). Rhizobia grown without signal molecules were used as control inoculums. Data collected from this experiment showed that saline treatment inhibits plant growth of faba bean. Pretreatment of the bacteria with hesperetin had no stimulatory effect on nodulation. However, it seems to stimulate plant growth by increasing shoot and root biomass in V. faba inoculated with the tolerant strain RhOF53. **Keywords:** Faba bean (*Vicia faba*), rhizobia, salt stress, flavonoid, hesperetin.

P18. Variability of Phenological Traits of Mediterranean Olive (*Olea europae*a L.) Cultivars from the World Olive Germplasm Bank of Marrakech

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Abstract

Flowering phenology is an adaptive trait controlled by two major mechanisms: the chilling requirements (CR) necessary to start growth and floral development when the risk of frost decreases and the heat requirements (HR) for the development of flowering stages. Future warming predicted in the Mediterranean region may reduce winter chill and increase heat. Therefore, the characterization of germplasm collections constitutes a cornerstone for the selection of cultivars with low CR and the orientation of breeding programs towards accurate climate change mitigation strategies. Phenological records for six years from 2014 to 2019 of 331 identified cultivars were used for assessment of olive phenology and the estimation of CR and HR of all cultivars. Full flowering dates (FFD) were significantly affected by genotype, year, and their interaction. FFD Cultivar Characterization showed early flowering cultivars and late-flowering cultivars ranging between Day of the Year (DOY) 115 to DOY 132. Partial Least Squares (PLS) estimation of chilling and heat phases revealed high variability between cultivars for their CR computed using the dynamic model. However, limited inter-cultivar variability for Heat Requirement HR was observed. Our findings suggest that the temperature variation during the chilling and the forcing periods has a great influence on the FFD of olive cultivars. These results provide a strong portfolio to be explored in the framework of adaptation to climate change. **Keywords:** *Olea europaea* L., Climate change, Phenology, PLS regression, chilling and heat requirements.

P19. Biofilm Formation Among Carbapenemase-Producing Enterobacterales Isolated from Patients at Mohammed VI University Hospital Center

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Abstract

The prevalence of carbapenemase-producing Enterobacterales (EPCs) infections is increasing worldwide. These infections are often a source of therapeutic impasses, leading to increased mortality and morbidity in infected patients. The emergence of this type of resistance as well as the property of biofilm formation contribute significantly to the wide diffusion of multidrug-resistant Enterobacterales in the hospital environment. The main objective of this work was to detect in vitro biofilm formation in 50 clinical strains of Enterobacterales resistant to carbapenems by producing metallo-beta-lactamases. The study is conducted on 195 carbapenem-resistant Enterobacterales isolated from patients hospitalized at the Mohammed VI University Hospital Centre of Marrakech, between the period 01 January to 31 December 2018. The bacterial identification as well as the antibiogram of the strains were done according to the standard procedures of medical microbiology. The search for carbapenem resistance genes (OXA-48, IMP, NDM, VIM, and KPC) was performed by phenotypic methods and subsequently confirmed by PCR. Quantification of biofilm formation was measured by the tissue culture plate method. During the study period, among 195 carbapenem-resistant Enterobacterales, 50 strains were NDM carbapenemase producers. The coexistence of the blaNDM and blaOXA-48 genes was detected in 8 strains. Bacterial identification showed a dominance of Enterobacter cloacae (54%), followed by Klebsiella pneumoniae (28%), Escherichia coli (12%), and Serratia marcescens (6%). All 50 strains had high levels of resistance to imipenem, ciprofloxacin, and gentamicin. More than 50% of the strains were categorized as strong biofilm formers. The study underlines the importance of implementing surveillance methods for EPCs and their biofilm-forming capacity, in order to control their diffusion in the hospital environment. **Keywords:** Enterobacterlaes, carbapenemases, resistance, biofilm formation.

P20. Inoculation with Rhizobacteria Consortia for Mitigating the Effect of Stress Combining Water and Phosphorus Deficiency in Intercropped Faba Bean and Wheat

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Abstract

Drought and phosphorus (P) shortage are among the most prevailing stresses throughout the world especially in arid and semiarid areas. Thereby, they are hampering crop production, quality, and energy. In Moroccan agrosystems, faba bean and wheat crops are submitted to the stress combining water deficit and P limitation that adversely affect their productions. Inocula-tion with osmotolerant P solubilizing bacteria (PSB) under adapted cropping system could con-tribute a lot

in mitigating the negative effects of this combined stress. Thus, our study aims to assess, under greenhouse, the impact of stress combining water deficit and P limitation on faba bean-rhizobia symbiosis and intercropped wheat and the role of inoculation withbacterial con-sortia gathering rhizobia and non-antagonistic plant growth promoting rhizobacteria (PGPR) to alleviate this impact and improve plant growth under such conditions. Two Vicia faba varieties Aguadulce (Ag) and Reina Mora (RM), and one Triticum durum variety Karim (k), grown as sole crop or intercropped in pot culture, were inoculated with two rhizobacterial consortia and submitted to. The sandy substrate was added either with rock phosphate (RP) (P deficient) or with monoammonium phosphate fertilizer (P sufficient) and plants were inoculated with two rhizobacterial consortia C1 and C2, each one contains one rhizobia strain and two PSB identi-fied during the previous works of BioAS team of FST at Cadi Ayyad university. Plants were then submitted to water deficit based on 40% of substrate field capacity (FC) versus 80% FC for the control plants. The results demonstrated that the inoculation with both consortia im-proved plant biomass, leaf water parameters, membrane stability, and Phytase and phosphatase activity under P limitation especially for AG variety inoculated with C2 compared to RM varie-ty. Inoculation and the intercropping system improved plant biomass, leaf water parameters, membrane stability, and Phytase and phosphatase activity for wheat plants compared to sole cropped ones under all stress conditions. The results confirmed that consortium C2 was more performing and could be used as inoculum for enhancing faba bean and wheat production un-der the combined stress of water deficit and P limitation.
Keywords: Drought, Phosphorus, intercropping, PGPR, *Triticum durum, Vicia faba*.

P21. *Cistus monspeliensis* Extract as a Prospective Biostimulant for Enhancing Antioxidant Defense System in Sorghum Plant Under Cadmium Stress

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Abstract

Sorghum (*Sorghum bicolor* L.) is a species known for accumulating high quantities of cadmium (Cd), which can damage physiological and metabolic functions, impede growth, and reduce yield. Maintaining sorghum's production, therefore, requires enhancing its tolerance to the toxic effects of Cd. In this study, we investigate the effects of Cistus monspeliensis extract (CME) on Cd stress tolerance in sorghum. Sorghum plants exposed to Cd (200 µM) showed a decrease in their growth, biomass, and chlorophyll content as well as increased signs of oxidative stress compared to unstressed ones. However, CME supplementation (5 mg/l, 20 mg/l, and 60 mg/l) to the stressed plants reversed the detrimental effect of Cd and elevated biomass and pigment content. CME also reduced superoxide ions (O -) accumulation and boosted antioxidant enzyme activities (superoxide dismutase (SOD), glutathione peroxidase (GPx), glutathione reductase (GR), and glutathione -S- transferase (GST)). CME, therefore, appears to improve Cd stress tolerance by upregulating antioxidant defense enzymes and decreasing ROS production, thus leading to a better growth rate.

Keywords: *Cistus monspeliensis* extract, cadmium stress, *Sorghum bicolor*, antioxidant enzymes.

P22. Impact of Innovation Platforms on the Dissemination of Biotechnological Innovation for the Date Palms' Sustainable Production: Case of Tafilalet Palm Groves (Southeast of Morocco)

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Abstract

The sustainability of date palm production, in Tafilalet's palm groves, is threatened by many constraints related to the dryland's severe environment, climate change, and improper human activities. Biotechnological innovations are new agricultural research discoveries increasingly used to improve agricultural sustainability. Such as compost, which has proved its benefits in facing date palm production constraints, improving its productivity, and enhancing soil health. Using linear approaches has proven their ineffectiveness to disseminate innovations' advantages to small producers. As an alternative, Innovation Platforms (IPs) are a participatory approach based on a multi-stakeholder alliance for disseminating innovations. The purpose of this article is to determine IPs' impacts on the adoption and dissemination process and to evaluate compost impacts on the date palm production system. Two types of investigation tools were conducted on 47 IPs' members. A survey was conducted on 33 producers' members of IPs, and a semi-structured interview was destined for 14 institutional actors. Data were analysed using factorial analysis, content analysis, and communication network analysis. The results show that IPs are a new organizational innovation impacting positively on date palm social systems. They create powerful collective learning through their strong dynamism and interaction. The producers who adopted compost are characterized by a high level of education, take a responsible position in GIE, have a large social network, interact with the research team and other producers, engage and participate in IPs' activities, search for agricultural news, and have the ability to accept change and develop their skills. Compost can improve soil's water-holding capacity, increase yield, and reduce expenses by decreasing the need for water, fertilizers, and phytosanitary treatments. **Keywords:** Innovation platforms, date palm's sustainable production, Tafilalet's palm groves, biotechnological innovation, compost, adoption and dissemination process.

P23. Drivers of Post-Harvest Aflatoxin Contamination: Evidence Gathered from Knowledge Disparities and Field Surveys of Maize Farmers in the Rift-Valley Region of Kenya

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Abstract

Maize-dependent populations in Kenya are continually exposed to aflatoxin poisoning owing to their regular consumption of this dietetic cereal. This study assessed awareness levels, knowledge disparities and perceptions regarding aflatoxin contamination at the post-harvest phase among farmers in the Rift-valley region of Kenya. Households were randomly selected using a Geographical Positioning System (GPS) overlay of the agro-ecological zones within Uasin Gishu and Elgeyo Marakwet counties. Face-to-face interviews were conducted in 212 smallholder and large-scale farms. The study documented the demographic profiles of farmers, knowledge, awareness and perceptions of aflatoxin contamination using a pre-designed structured questionnaire. Most farmers were familiar with aflatoxins and the adverse effects they present to health (61.32%). Almost all the farmers (94.37%) were aware of storage molds and food spoilage fungi. However, few farmers adopted good post-harvest practices (PHPs) such as avoiding premature harvests (49.8%), using well-ventilated storage spaces (44.6%), grain sorting (30.5%), proper drying of maize (17.8%) and using hermetic bags for storage (30.5%). Intensified farmer education is required to train farmers on good PHPs to protect their maize from aflatoxigenic fungi and aflatoxin accumulation. **Keywords:** stored maize; aflatoxins; Hybrid-6 series maize cultivars; food security; Rift-valley; Kenya.

P24. Soil Amendments improve Quinoa Tolerance Level to high Salinity: Agrophysiological Analysis

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Abstract

Salinity stress is among the most severe abiotic stresses that cause many disruptions to soil and crop productivity. Therefore, in order to deal with this problematic, we rely on cultivating alternative crops that can tolerate salinity stress, such as quinoa (Chenopodium quinoa). Despite of its tolerance to salinity, quinoa performance could be affected under high salinity levels. Our study aimed at the assessment of the effects of some seeds treatments and soil amendment to improve quinoa tolerance under high salinity level. Three quinoa varieties (Puno, ICBA-Q5 and Titicaca) were grown in the greenhouse in pots containing soil with five amendments; Biochar "Bc", compost "Cp", black soldier insect frass "If", cow manure "Fb" and phosphogypsum "Pg", with a negative control "T (-)"and a positive control "T (+)" with no amendment, the plants were irrigated after 20 days after the seed sowing with saline water at 16 dS/m of NaCl except the "T (+)" that was ir-

rigated with distilled water. The results showed that salinity stress induced negative impact on the quinoa plants for all the tested agrophysiological parameters in the three varieties compared to their positive controls "T (+)". However, most of these parameters were significantly enhanced by the application of soil amendments compared to the negative controls "T (-)". For instance, in Puno variety biomass was especially increased by more than 90%, for the total nitrogen and phosphorus amount by more than 300% with "Bc" amendment application. Yet, for Titicaca, the most important improvement was noted in the potassium amount where it was 606% better with "Pg" amendment compared to the negative control. Besides, ICAB-Q5 amended with Bc showed an improvement of 222% for the leaves area, of 219% for yield, and of 170% for nitrate reductase activity. Nevertheless, differences between varieties were noticed with Puno and Titicaca presenting the highest performances particularly when amended with If, Bc and Pg. **Keywords:** Quinoa (*Chenopodium quinoa*), salinity stress, tolerance to salinity, soil amendments, Biochar, compost, black soldier insect frass, cow manure, phosphogypsum.

P25. Epidemiological Profile and Clinical Characteristics of Nasopharyngeal Cancer in Northern Morocco

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Abstract

Nasopharyngeal cancer is a complex disease distinguished from other cancers of the head and neck by its risk factors and geographic distribution mainly affecting the Asian and North African populations including Morocco. The aim of this study was to determine the epidemiological and clinical characteristics of nasopharyngeal cancer in Northern Morocco. One hundred twenty-nine (129) patients diagnosed with nasopharyngeal cancer and followed at the regional center of oncology of Tangier between 2017 and 2019 were included in this study. Epidemiological and clinical data was collected using technical sheets and analyzed using Statistical Package for the Social Sciences (SPSS) software. The survival analysis was performed using the Kaplan Meier method. Nasopharyngeal cancer (NPC) represented 5% of all cases of cancer with a median age of 50 and a remarkable sex disparity counting 65.9% of men (sex ratio= 1.93 M/F). The most affected age group was 40-54 years (41.1%). Cervical mass caused by lymphadenopathy was the most frequent symptom in our cohort. 96.12% of patients had undifferentiated nasopharyngeal carcinomas (UCNT) which is the most common histological type of this type of cancer. Most patients (82.2%) had an advanced stage of NPC at diagnosis including 5.4% of metastatic cases. 81.4% of patients received radiotherapy combined with chemotherapy preceded in 54.3% of cases by induction chemotherapy. The overall survival (OS) at 5 years was 86.8% for all patients. This latter was significantly influenced by disease staging. These findings show that nasopharyngeal cancer is very common in Northern Morocco as is the case in other endemic areas with a late declaration problem. These results converge with the literature data and show the necessity of further studies regarding this type of cancer for better understanding and a better diagnosis. **Keywords:**

Nasopharyngeal cancer, oncology, epidemiology, clinicopathology, prevalence, therapy, survival, Morocco, Northern Morocco.

P26. Gut Microbiota: A Strong Correlation with Colorectal Cancer

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Abstract

Colorectal Cancer (CRC) is ranked among the most common cancers worldwide, it is defined as a pathology that develops from the cells that line the inner wall of the colon or rectum. It represents the second leading cause of death by cancer of both sexes. In Morocco, its incidence ranks third for all genders. The human gut microbiota is the sum of non-pathogenic microorganisms called commensals, it's an organ composed of billions of bacteria, viruses, yeasts and fungi that reside mainly in the distal colon. The microbiota plays an essential role in the metabolism of the host and at the same time it maintains a symbiotic relationship with the latter. This microbiota can be sometimes unbalanced, it is intestinal dysbiosis, the results of a decrease and/or an increase of certain types of bacteria. In other words, it is the modification of the composition of the gut microbiota. Several studies have highlighted the correlation between colorectal cancer and the gut microbiota. Indeed, the alteration and the dysfunction of this microbiota triggers and facilitates the carcinogenesis process, by inducing inflammation and disturbing the permeability of the intestinal wall. The new discoveries of the composition, the functions of the gut microbiota and the way in which it intervenes in carcinogenesis, can today consider the microbiota as an excellent tool for the management of colorectal cancer. **Keywords:** Gut Microbiota, Colorectal Cancer, Dysbiosis.

P27. Antifungal Effect of Some Plants on Fusarium oxysporum f. sp. albedinis (Foa), the Causal Agent of Bayoud of Date Palm

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Abstract

"Bayoud", a vascular disease caused by *Fusarium oxysporum f. sp. albedinis* (Foa), is the main threat to date palm in Morocco. Nine plants (Atriplex canescens, Atriplex lentiformis, Teucrium polium, *Chrysopogon zizanioides*, *Thymus vulgaris, Foeniculum vulgare, Retama monosperma, Opuntia ficus indica, and Artimesia herba* alba) were grounded and added to GZAPECK culture medium at 2 doses each, C1 (5g/L) and C2 (10g/L). The resulting medium was filtered and used to evaluate plant fungitoxic and/or fungistatic effects on Foa by measuring its spore germination and mycelia. Spore germination inhibition ranged between 41% to 69% at dose C1, and from 37% to 92% at dose C2. The three plants with the greatest effects on spore germination, Thymus vulgaris, Atriplex canescens, and Atriplex lentiformis, showed also strong inhibitory effects against myce-

lial growth, ranging from 16% to 47% for dose C1 and from 20% to 68% for dose C2. These results highlight the potential of plants to produce bioactive compounds and open new research paths for their use in the management of "Bayoud" disease of date palm. **Keywords:** Bayoud, Bioactive compounds, date palm.

P28. *In vitro* and *in vivo* Effect of Salts to Control Postharvest Citrus Blue Mold disease caused by *Penicillium italicum*

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Abstract

Blue mold caused by Penicillium italicum is among the most economically impactful post-harvest diseases of citrus fruit. Chemical control is the most employed method used to fight this disease around the world. However, prolonged and excessive application of fungicides adversely impacts the environment and human health. The use of alternative approaches is considered a safe and more sustainable strategy to reduce gradually fungicide utilization. The present study aimed to evaluate the in vitro and in vivo antifungal activity of some salts including, potassium sorbate, sodium benzoate, sodium tetraborate and sodium bicarbonate against P. italicum. In in vitro experiments, the solutions of salts were added to the PDA medium to obtain the final concentrations of 0, 500, 1000, 1500 and 2000 ppm. The in vivo curative activity of salts to control citrus blue mold was evaluated on 'Valencia late' oranges artificially inoculated with P. italicum. Fruits were dipped, after 24 h of inoculation, in 0, 20 g/L and 40 g/L salt solutions for 2 min. Results showed that the potassium sorbate reduced the P. italicum mycelial growth by 45 % at 500 ppm, with a CI50 = 2.75 ppm.The complete inhibition of P. italicum was observed with sodium bicarbonate and sodium tetraborate at 1000 ppm and 2000 ppm, respectively. The in vivo findings showed significant antifungal activity of potassium sorbate, sodium benzoate and sodium tetraborate.They totally inhibited (100 %) the development of blue mold on 'Valencia late' oranges at a low concentration of 20 g/L. Its effectiveness was similar to that obtained by the conventional fungicide "Imazalil" used as positive control. Keywords: Citrus, post-harvest diseases, Penicillium italicum, blue mold, salts, antifungal activity.

P29. Genetic Diversity and Population Structure of Isolates of Alternaria spp., the Causal Agent of the Postharvest Diseases in Citrus Fruits in Morocco

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Abstract

Alternaria alternata is one of the most important fungi causing various diseases on citrus worldwide. In Morocco, Alternaria black rot (ABR) and Alternaria brown spot (ABS) are two major diseases causing serious losses in commercial cultivars of citrus. The aim of the present work was to study the genetic diversity and the population structure of isolates belonging to sect. Alternaria obtained from infected citrus fruits, collected from seven provinces at different locations in Morocco (markets, packinghouses, and orchards). Forty-five isolates were analyzed by sequence-related amplified polymorphism (SRAP) markers, and cluster analysis of DNA fragments was performed using UPGMA method and Jaccard coefficient. Cluster analysis revealed that isolates were classified in four distinct groups. AMOVA revealed also a large extent of variation within sect. Alternaria isolates (99%). The results demonstrate that no correlation was found among SRAP pattern, host, and geographical origin of these isolates. Population structure analyses showed that the Alternaria isolates from the same collection origin had almost a similar level of admixture. **Keywords:** Citrus, Alternaria alternata, post-harvest diseases, Genetic diversity, population Structure.

P30. Weeds Associated with the Arganery Ecosystem of Souss Valley: Case of the Rasmouka Region (Tiznit)

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Abstract

Weeds are major constraints on crop production in general. The success of argan orchard under the National Arganiculture Program depends on the control of alias linked to bioaggressors and weeds. The identification of the most important weed species may allow an understanding to address their interactions with argan orchards and prevent their negative effects of competition in water and fertilizers. Our study aimed to investigate the distribution and diversity of weeds in selected argan orchard and surrounding forest in Argan Biosphere. To explore the weed flora, a floristic inventory was carried out in Rasmouka, Tiznit region during the month of March 2021. A total of 19 species belonging to 19 genera of 14 botanical families were recorded. Asteraceae was the dominant family with 4 species, Amarranthaceae (2 species) and Poaceaes (2 species). However, the most abundant family in argan orchard is Plantaginaceae with a single species (Plantago arenaria) while the Amarranthaceae family (Chenopodiastrum murale) is the most represented under argan trees of neighboring forest. It should be noted that no species belonging to the fabaceae family was observed in the bordering forest. Similarly, no species belonging to the 4 families Rubiaceae, Boraginaceae, Caryophyllaceae and Brassicaceae was identified in the Argan orchard. **Keywords:** Argan tree, weeds, diversity, abundance, species richness.

P31. Tomato in the Souss Massa Region

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Abstract

Agriculture in Morocco is a strategic sector for the social and economic development of the country. The Green Morocco Plan (PMV) and the Generation Green strategy are two major programs whose main objectives are to increase productivity, promote and encourage new technologies in agriculture. Currently, the market gardening sector, of which tomatoes represent 84% play an important socio-economic role in Morocco. It is an essential source of employment and a lever for foreign currency entry. The objective of this study is to make an inventory on the phytosanitary plan of tomato cultivation in the Souss Massa region. The results obtained show that four types of tomato are the most used in the Souss region: round tomato, elongated round tomato, round cherry tomato and elongated cherry tomato and several types of varieties are adopted for each type of tomato. Calvi is the variety most used for the round tomato with a percentage of use exceeding 35%, followed by the Pristyla and Pitenza variety with 20%. For the elongated round tomato, three varieties are more used, Marcus, Adriano and Papales with 30, 35 and 35% of use respectively. Angelle is the most used variety for the elongated cherry tomato, likewise Creativo and Genio for the round cherry tomato with 75 and 25% use respectively. The survey results also show that Maxifort-type rootstock is the most used for the majority of tomato varieties in the Souss Massa region (20 to 100% depending on the tomato variety), followed by Arazi and Superpro rootstock. Open-ground cultivation is dominant in the Souss region by (67%). However, market gardeners are increasingly moving towards soilless crops with a rate of (33%). The most recorded yield is around 201 to 240 T/ha. Indeed, 80% of tomato exports are recorded by varieties of cherry tomatoes. Despite this significant tomato production, the latter is subject to attacks due to diseases and pests. Tomato leaf mold and gray mold cause very remarkable economic damage. Farmers in the region rely heavily on a conventional system. Indeed, more than twelve active molecules have been used to combat this disease. **Keywords:** Tomato, tomato leaf mold, gray mold, Souss Massa region.

P32. Effects of Organic Fertilization and Intercropping of Potato (*Solanum tuberosum*) with Faba bean (*Vicia faba*) on Microbial Load and Biomass, Compared to those of Potato Sole Crop

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Abstract

Microorganisms play a very important role in nutrient cycling in agriculture and can lead to enhance soil quality and improve crop production. Thus, there is a huge need to identify some suitable management practices which contribute to increases in soil microbial load and biomass. Intercropping can achieve sustainable agricultural development by increasing plant diversity. Organic fertilization can contribute to improve microbial biomass and diversity due to the availabil-

ity of organic substrates that can be used by microorganisms as an energy and carbon substrate. Potato (Solanum tuberosum) is one of the most cultivated crops in Morocco, but its continuous cultivation in monoculture systems represents the greater factor deteriorating soil organic matter. In the aim to break this rule, we investigated the effects of potato monoculture and potato intercropping system (Potato/Faba bean) under and without organic fertilization on microbial characteristics such as microbial load and biomass. The treatments are: T1 (Potato sole crop), T2 (Potato + Organic fertilization), T3 (Potato + Faba bean), T4 (Potato+ Faba bean+ Organic fertilization). The results showed that the microbial load evolved over time in all treatments, it was abundant in the intercropping model compared to the potato sole crop. Organic fertilization and intercropping increased the microbial load in terms of bacteria and fungi. Soil microbial biomass plays a significant role in soils, and it is often used as an early indicator of change in soil quality. We found that intercropping increased the microbial biomass, however it was strongly impacted by treatment T1 (potato sole crop). Keywords: Intercropping, Monoculture, Microbial load, Microbial biomass, Organic fertilization.

P33. Antibiofilmogram: An Innovative Test for Personalized Treatment of Pathogenic Biofilm-Producing Bacteria

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Abstract

Pathogenic bacteria are characterized by their ability to adhere to a surface and form a protective biofilm, highly tolerant to antimicrobial agents. In routine medical microbiology, the classical techniques of antibiogram: agar diffusion method or liquid microdilution method are adapted to the evaluation of the activity of antibiotics on planktonic bacteria. The minimum inhibitory concentrations and the resulting classification of strains (resistant or sensitive) allow, in most cases, to choose an effective antibiotic therapy for an acute infection. However, we have seen that in chronic infections where a biofilm is present, bacteria are able to tolerate very high concentrations of antibiotics, which can lead to therapeutic failures, despite the administration of an antibiotic therapy classified as effective by the classical methods of antibiogram. The latter are no longer systematically predictive of therapeutic success. Indeed, the methods currently used routinely in clinical microbiology do not take into account the sessile forms potentially present in a biofilm. Knowing that 65% of human infections seem to involve the formation of a biofilm, it appears necessary today that the approaches chosen to predict the activity of antibiotics in vivo integrate the "biofilm" dimension of bacterial phenotypes found in an infectious context. We are therefore talking about a new generation of tests that can be described as Antibiofilmogram. The realization of Antibiofilmogram on clinical isolates has made it possible to highlight phenomena of inhibition and induction of biofilm formation. More precisely, aminoglycosides are able to delay bacterial adhesion. Conversely, the β-lactam family has the ability to stimulate early adhesion of microorganisms. The clinical relevance of the Antibiofilmogram is therefore confirmed by its ability to detect the early initiation of bacterial adhesion, to select the molecules that inhibit it and to rule out those that may induce it. Combined with traditional antibiotic susceptibility tests, its application can be used to refine therapeutic strategies for the treatment and monitoring of bacterial infections. Keywords: Antibiofilmogram, Antibiogram, bacterial infections, antibiotic therapy.

P34. Prevalence and Antibacterial Resistance of Uropathogenic Staphylococci, Casablanca, Morocco

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Abstract

The purpose of this research is to evaluate the resistance profile of uropathogenic Staphylococci bacteria isolated from medical analysis laboratories, Casablanca, Morocco. In this retrospective cross-sectional research, from January 1, 2017 to December 30, 2020, a total of 4374 patients attended medical analysis laboratories for Cytobacteriological examination of the urine. The culture was carried out according to the usual techniques in medical microbiology, and the antibiogram was performed according to the guidelines proposed by the Antibiogram Committee of the French Society of Microbiology (CA-SFM). Data were grouped as percentages, and presented as tables and figures using IBM SPSS Statistics 26 (IBM, Armonk, NY, USA). During our research, we discovered eighteen percent of cases of urinary tract infection (UTIs). UTIs were more frequent in females 483 (63%) than male 289 (37%). The prevalence of uropathogenic Staphylococci bacteria was 37.61%. Coagulase-Negative Staphylococcal (CoNS) was more prevalent (92.68%). S. saprophyticus was the most frequently isolated CoNS (39.47%). Several strains of S. aureus were also reported (7.32%). The proportion of Methicillin-resistant S. aureus (MRSA) among the isolates was observed in sixty-six percent. All S. aureus isolates were susceptible to aminoglycosides, quinolones, erythromycin, linezolid, cotrimoxazole, and vancomycin. Also, S. saprophyticus isolates were highly resistant to Fusidic acid (60%), but 66,66% of the S. heomolyticus isolates were resistant to kanamycin and tobramycin. For S. heomolyticus, S. hominis, and S. warneri we also demonstrated 100% sensitivity to Linezolid, cotrimoxazole, and vancomycin. The frequency of MRSA was found to be rather high in this research study. There are additional isolates that are resistant to other antibiotics that have been studied, such as vancomycin, linezolid and cotrimoxazole. The findings have significant implications for the quality of patient treatment in both settings, including antibiotic selection and infection control procedures, as well as the need for more research. **Keywords:** Urinary Tract Infection, S. aureus, Coagulase-Negative Staphylococcal, Antibiotics resistance.

P35. Crop Association and Agroforestry Approach for the Resilience and Sustainability of Argan Farming

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Abstract

In the arid and semi-arid areas, exploitation of water and plants calls attention in terms of the ecological, social and economic balance. Climate change and drought accentuate the sensitivity to degradation as is the case for the ecosystems of argan forest in southwestern Morocco where biodiversity is subjected to human pressure and grazing. Consequently, cultivation of argan tree has become an essential niche for the safeguard and competitiveness of this region. However, the monoculture of the argan crop raises the question of the sustainability and health of the plants. An agro-ecological practice has proved to be a solution to remedy this risk like the association of crops in agroforestry approach, which could be an alternative to reduce the vulnerability of the argan farming. Thus, our study consists in evaluating the adaptation of this production system, using some aromatic and medicinal plants as associated crops. The monitoring includes growth and performance of young plants of the argan tree and associated plants as well as the beneficial impact on water and soil conservation. In general, the combination of crops show beneficial effects and conserves the water state of the soil as long as the critical point of competition for light and soil nutrients is not attained, this is the reason why low-density planting is recommended for the argan farming as part of this agro-ecological approach. The association of the argan with underlying crops has a positive impact on the stability of the soil structure and the upgrading of its fertility, this production model demonstrates an agro-ecological option to enhance marginal areas and thus contribute to soil conservation, carbon sequestration and rehabilitation of degraded lands. Finally, on the economic level, the rehabilitation of degraded lands has enabled rights holders to benefit remarkably, to enrich their harvesting schedule and at the same time to contribute to the mitigation of the impact of climate change. **Keywords:** Agroforestry, Crop association, argan farming.

P36. Modeling Using Machine Learning of Resistance to Scald (Rhynchosporium commune) in two Specific Barley Genetic Resources Subsets

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Abstract

Barley production worldwide is limited by several abiotic and biotic stresses and breeding of highly productive and adapted varieties is key to overcome these challenges. Leaf scald, caused by Rhynchosporium commune is a major disease of barley that requires the identification of novel sources of resistance. In this study two subsets of genebank accessions were used: one extracted from the Reference set developed within the Generation Challenge Program (GCP) with 191 accessions, and the other with 101 accessions selected using the filtering approach of the Focused Identification of Germplasm Strategy (FIGS). These subsets were evaluated for resistance to scald at the seedling stage under controlled conditions using two Moroccan isolates, and at the adult plant stage in Ethiopia and Morocco. The results showed that both GCP and FIGS subsets were

able to identify sources of resistance to leaf scald at both plant growth stages. In addition, the test of independence and goodness of fit showed that FIGS filtering approach was able to capture higher percentages of resistant accessions compared to GCP subset at the seedling stage against two Moroccan scald isolates, and at the adult plant stage against four field populations of Morocco and Ethiopia, with the exception of Holetta nursery 2017. Furthermore, four machine learning models were tuned on training sets to predict scald reactions on the test sets based on diverse metrics (accuracy, specificity, and Kappa). All models efficiently identified resistant accessions with specificities higher than 0.88 but showed different performances between isolates at the seedling and to field populations at the adult plant stage. The findings of our study will help in fine tuning FIGS approach using machine learning for the selection of best bet subsets for resistance to scald disease from the large number of genebank accessions. **Keywords:** Machine learning, Rhynchosporium commune, scald, barley, genetic resources.

P37. Diversity and Abundance of Breeding Birds, Habitat and Nesting-Support Use: A Relevant Case se in Fez, Morocco

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Abstract

Urban areas may impact the richness of avian species. The abundance and diversity of urban landscapes might offer breeding habitats and nesting resources for urban-adapted species. In our study, we investigated the breeding birds in urban landscapes of Fez historical city (Morocco), the habitat uses counting breeding habitats and nesting resources, and predicting factors. We used the line-transect method and we searched nests of birds on threes and cavities of historical walls in four habitats counting green gardens, old city walls, urban farms, and urban forests. A total of 109 nests of 13 breeding species, 12 resident-breeders, and one migrant-breeder were observed. Most nests were recorded in cavities (50 nests), Olea europaea (17), Citrus aurantium (15), Bambusa vulgaris (11), and Eucalyptus globulus (7). Olea oleaster, Cupressus sp. hosted only 3 nests each, Populus sp. and Washingtonia filifera hosted only one nest each. Most nests were recorded in habitats rich in nesting trees and close to water sources. On the contrary, the number of nests declined while the habitats increased surface and distance to the urban center. Our data revealed the diversity, habitat use, and nesting support of urban breeding bird communities in Morocco and Southern slope of the Western Palearctic. Future urban plans must integrate measures to provide suitable breeding resources such as cavities of old walls and diversity of green areas for urban birds to enhance their breeding performances, thus promoting the well-being of the population via increasing biodiversity. Keywords: Breeding birds, nests, habitat use, nesting trees, urban landscapes, urbanization.

P38. Cadmium Tolerance of (Averrhoa carambola) and Its Potential use for Remediating Cd Polluted Environments

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Abstract

Carambola (*Averrhoa carambola*), often known as star fruit, is a high-biomass and fast-growing tropical evergreen perennial tree that has spread widely throughout the tropical and subtropical regions of the world. In its tropical habitat, the carambola tree blooms nearly year-round. This tree has potential for Cd phytoextraction, it can accumulate considerable amounts of Cd in its shoots (about 500 mg kg−1, on a dry weight basis) without significant reduction in biomass when grown in solutions containing 5 mg Cd L−1 for 3 months. Root-specific uptake of the symplastic component and root-to-dust translocation of Cd in A. carambola is a lot more efficient compared to other non-Cd accumulating species, contributing to its high ability for Cd accumulation. The phytoextraction of cadmium by the carambola tree is an ideal solution for the decontamination of soils in Cd, it has been proven that 50% of the Cd can be extracted throughout 13 years in the soil slightly contaminated in Cd. Carambola is not significantly affected by Zn, whereas Zn transport is strongly inhibited by Cd. This implies that Cd accumulation in this species is mediated at least partially by Zn transporters, which seem to have a greater affinity for Cd than for Zn. These mainly indicate that A. carambola has developed remarkable physiological mechanisms to accumulate Cd at a high level. Which qualifies it as one of the best plants for Cd phytoextraction currently discovered. **Keywords:** Averrhoa carambola; Perennial tree; Tropical-subtropical tree; Cd hyperaccumulation; Cd phytoextraction.

P39. Plant Growth Promoting Potential of Bacillus subtilis Isolated from Ziziphus lotus

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Abstract

Plant growth under different biotic and abiotic stresses is enhanced by the presence of plant microbiota. The latter plays an important role in the production of secondary metabolites that promote plant growth. Among this microbiota we distinguish endophytes, plant beneficial bacteria that thrive inside plants and can improve plant growth under normal and stress conditions. The objective of this work is to characterize the beneficial effect of endophytic bacteria isolated from the root of the wild jujube (*Ziziphus lotus* L.), with the aim of selecting bacteria possessing a maximum of phyto-beneficial functions. For this, we first isolated endophytes then performed a set of in vitro tests namely: P, K and Zn solubilization, phytohormones production such as IAA, siderophores production, atmospheric nitrogen fixation, NaCl tolerance. The identification of these strains was achieved by amplifying the gene encoding rRNA 16s. This study allowed the selection of the most efficient bacterial strains, namely: Bacillus, Pseudomonas, and Arthrobacters which have different profiles whose strain ED24 has shown a high performance. It solubilizes 108 mg/l of TCP, 7.71mg/l Potassium, produces IAA, siderophore, ammonia, and cellulase, tolerates 6% NaCl, also resistant to ampicillin, kanamycin, and spectinomycin. Based on these results, we studied

the inoculation effect of this bacterium on the germination and growth of wheat seeds, where it showed a significant difference, with a germination rate of 66.66 % compared to a negative control of 26.667%. As perspectives, we aim to study the root colonization and penetration of the DE24 bacteria using GFP reporter gene. **Keywords:** Wild jujube, Endophytic bacterial, antibiotic resistance, Phosphate and Zinc solubilization, soil fertilization.

P40. The Preservation of Green Spaces: A Means to Improve Biodiversity in Morocco

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Abstract

The diversity of Morocco's landscape is illustrated by its green spaces, which include multiple types such as parks, gardens, square,... each one more characteristic than the other. They assure to every city a continuity and proximity of the natural element, a reduction of the oppression of the constructed spaces and the improvement of the quality of the living environment and the urban landscape of the city. They are truly green lungs in the heart of the city. The objective of the work is to analyze green spaces according to a scientific approach in order to establish an inventory in terms of green space development. The method adapted for this study is based on a data analysis that relies on field observation, maps, satellite images, determination of certain factors, etc. with the help of software; all this information is based on archival sources, and cartographic tools. We studied the different types of green spaces, based on the one hand on the landscape analysis and on the other hand on the process of determining certain factors. The green space is constructed according to precise rules of perspective and composition in order to understand the different architectural, natural and landscape elements that characterize the space (lines, reliefs...). These elements will structure the design and their systemic action will lead to the definition of the garden type. This approach aims to bring an in-depth reflection on the green component, aspires to reposition it and capitalize the Moroccan experience in this regard, as part of the preservation and enhancement of national green heritage. **Keywords:** Biodiversity, Green Heritage, Green space, Landscape analysis, Morocco, Parks.

P41. Evaluation of the Food Deficit of Livestock Goats in the region of Chefchaouen

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Abstract

This study contributes to the evaluation of the feed deficit of the goat herd in the northern region of Morocco. For a first test, the study of the food deficit of goats in pasture was carried out by collecting data on the diet adopted by three different breeders of the northern regions in cold period and which is based essentially on the pastoral plants of the region, we note the breeders of the region

Kalaa, Bouhala and Chrafat and who have herds of goats composed of goats, billy goats and goat kids. In a second test, a collection of data from three breeders in the same regions above having a main activity which is fattening goat kids. The study of the feed deficit of billy goats showed that their diet is deficient in 15% in UF and 32% in PDI. For goats showed more deficit, where it has provided high protein intake that is 118.48% (71%), certainly, for a deficit of 29%. And in terms of energy, their diet provided an intake of 1.08 in UF and a deficit of 35%. For the kids on pasture, the protein intake is 85% and for UF is 0.46 UF. And for the doeling, there protein intakes were high. For the fattening kids, the inputs provided made it possible to ensure an input of 42.03 g/Day in protein value, and 55% of deficit in UF. The feed provided to the goats on extensive farms assured a good portion of their needs. The feeding of the fattening kids provided a high protein value compared to the energy value and the deficit is higher in UF than in PDI. **Keywords:** Food deficit, goat, diet, UF, PDI.

P42. History and Inconsistencies within the Rhizobiaceae Family Taxon

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Abstract

The Rhizobiaceae family is one of the most inconsistent bacteria family due to the varied behavior of its species that interact with plants; while it contains multiple plant growth promoting Rhizobacteria (PGPR) such as Rhizobium Leguminosarum (Frank, 1889) which conducts symbiosis with the Leguminoseae family, it also contains non-symbiotic pathogens such as Agrobacterium tumefaciens, a specie that is also referred to as Rhizobium radiobacter depending on the author, putting both a PGPR and a pathogen on the same genus. And while phenotypically speaking, both bacteria exhibit different behavior, genetically, they're significantly similar since both the symbiosis and the pathogenicity is linked to different plasmids (Young et al, 2001). But for some species such as Ensifer (also called Synorhizobium), the symbiosis is linked to the DNA. Since several Rhizobiaceae species do not exhibit robust phylogenetic positions, it has caused controversy in taxonomic studies. Currently, the Rhizobiaceae family contains 25 genera, of which 4 are not validly published, 5 being a synonymous name with another genera within the Rhizobiaceae family, 3 having a single entry research, With 8 valid genera having an interaction with plants Rhizobium, Neorhizobium, pararhizobium, Agrobacterium, Allorhizobium, Ensifer, Shinella, and Ciceribacter. **Keywords:** Rhizobiaceae, Taxonomy, PGPR, Phytopathogens.

P43. Potential Effects of P Solubilizing Bacteria in Improving Wheat Tolerance to Cadmium Stress

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Abstract

Heavy metals phytotoxicity is one of the biggest abiotic threats that affects negatively cropping systems. Among these, cadmium (Cd) is the most abundant contaminant in soils that is known to impair plant growth and affects human health. With this in mind, the objective of this study was to examine the effect of applying Cd-tolerant phosphate solubilizing bacteria (PSB) to stimulate the growth and resistance of Cd-stressed plants, while enhancing phosphorus (P) bio-availabililty. In our experiment, three isolates B8 (Bacillus sp.), B12 (Bacillus sp.) and B31 (Rahnella sp.) were selected based their Cd-tolerance potential (showing a minimum inhibitory concentration (MIC) of 300 ppm CdCl2 (Cd [300])), along with others plant growth promoting features. To determine their effect on wheat growth under Cd stress, seeds were inoculated with these isolates individually (B8, B12 and B31) or in the form of consortium and grown under controlled conditions (in-vitro and in-planta) using three levels of Cd (0 ppm = Cd [0], 50 ppm = Cd [50] and 100 ppm = Cd [100]). Based on the obtained results, isolate B31 belonging to the genus Rahnella sp. significantly increased plant physiological parameters such as stomatal conductance (SC) and the Chlorophyll content index (CCI).Moreover, a significant increase was reported in the plants' morphological traits namely length, and spike length at 100 ppm of Cd. The isolate B31 was found to induce a relatively high Cd tolerance capacity compared to the remaining isolates by increasing plant dry weight and root morphological. On the other hand, the three isolates B12, B31 and the consortium showed a high solubilization of P in the 75-days old roots at 100 ppm of Cd compared to the control with the isolate B31 showing the highest results. Our findings suggest that isolate B31 may have a positive impact on stimulating plants growth under Cd-stressed conditions. **Keywords:** Cadmium, wheat, rhizobacteria, phosphate, phosphate solubilizing bacteria, solubilization, tolerance.

P44. Behaviour, Production Potential and Capacity for Carbon Sequestration by Different Species of Reforestation Pine in the Western Rif (Northern Morocco)

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Abstract

The need for wood is steadily growing. Consequently, the areas of artificial plantations continue worldwide to colonize forest lands at the expense of natural forest areas. Today 7% of all forest lands are occupied by artificial plantations. Hence the importance of their study both on ecological and economical aspects. Artificial plantations based on softwood species are increasingly widespread, due to their rapid growth and easy success. Nevertheless, they are very vulnerable to pathogenic agents and fire. In the western Rif (Northern Morocco), the most used coniferous species to reforestation are (Aleppo pine (Pinus Halepensis), maritime pine (Pinus pinaster) and (Monterey pine) Pinus radiata)). These species are usually planted for three principal roles that can be summarised in wood production, soil and infrastructures protection, or recreation. In all cases,

trees purify the air through the process of photosynthesis, thereby limiting the concentration of greenhouse gas by their potential of carbon sequestration. In the current global context marked by climate change, the present study aims to measure the contribution of the species above mentioned to mitigate the impact of climate change. therefore, we are going to deal with two main axis relating to (1) identification of the potential of wood production in order to put forward silvicultural practices, adapted to each of the three species, according to the type of stations identified, (2) quantification of carbon sequestration by the different strata of the stands (tree, shrub, herbaceous, soil), their contribution and role in limiting greenhouse gas emissions. For this purpose, stratified sampling will be used. The stratification criteria being the age of plantation, and type of substrate for each forest specie. The distribution of the sampling plots will be carried out randomly. The field and laboratory phases will afford valuable data for (1) identification of suitable environments for optimal growth of the three pines, (2) estimation of their production potential, and (3) assessment of carbon sequestration. **Keywords:** Maritime pine, radiata pine, Aleppo pine, Western Rif, carbon sequestration.

P45. Effect of Sulla flexuosa (*Hedysarum flexuosum*) on the Milk Production and Fatty Acid Profile of Milk from Beni Arouss Goats in Northern Morocco

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Abstract

Sulla flexuosa is a spontaneous and non-cultivated legume from the northern region of Morocco. It is conducted on rainfed conditions and can be considered as an interesting alternative source of protein especially in the climate change conditions. In the perspective of its cultivation and use in animal feed, the objective of the present work was to evaluate the effect of its incorporation in the diet of goats on the production and fatty acid (FA) profile of milk. Thirty Beni Arouss goats were divided into three groups and fed an isoenergetic and isoproteinic diet of either 70% Sulla flexuosa hay (SF70), 35% Sulla flexuosa hay and 22.5% alfalfa hay (SF35), or 50% alfalfa hay (Co). The three groups received 30% of concentrates based on oat and barley grains. For three months, milk production was sampled weekly to analyze milk production and quality parameters. As a result, Sulla flexuosa incorporation did not impact milk production. Compared with Co group, MUFA, LCFA, PUFA, n-9, n-6, and n-3 ratios increased while MCFA and SFA contents decreased in the SF70 group. In the SF35 group, only LCFA and MUFA were increased compared to Co group. Moreover, SF70 diet decreased MUFA/PUFA and increased PUFA/SFA compared to Co diet. In addition to its environmental and nutritional effects, SF enhanced health promoting indexes as its incorporation increased proportionally EPA+DHA. We presume that Sulla flexuosa hay has positive effects on the FA profile of goat milk which will consequently positively impact consumers health. **Keywords:** *Hedysarum flexuosum*; hay; goat; milk production; milk quality; fatty acid.

P46. Effect of Modified Atmosphere Packaging on the Preservation of Strawberry and Extension of its Shelf Life

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Abstract

Strawberry is a highly perishable fruit, due to respiration, weight loss and fungus. It is an excellent source of vitamin C, phenolic compounds. The sugars contained in strawberries promote not only the development of microorganisms but also the rotting of the fruit. The physiological and physical deterioration of the strawberry increases if the method of conservation is not controlled. The shelf life of this product, when fresh, is limited to 1 or 2 days at room temperature. The shelf-life of fresh strawberry is inversely proportional to its respiration rate. The method commonly used for preservation is for extending the shelf is low temperature. The impact of modified atmosphere packaging (MAP) with low oxygen & high carbon dioxide in combination with low temperature on the preservation of strawberry" Palmarita variety " was studied. The aim of the present work was to evaluate the integrated effects of MAP and low temperature investigate the change of quality of strawberry : pH, acidity, mass loss, decay, color, firmness, total soluble solids (TSS), acidity, polyphenol, anthocyanin, microbiological quality and color, , etc. in order to establish an optimum preservation technology for strawberry. The impact of Modified Atmosphere Packaging (MAP) was studied with a stable low oxygen content (2,5 %) and a variation in carbon dioxide (5% to 20%) in combination with nitrogen on the quality parameters of Palmarita strawberries. For this purpose, polyethylene terephthalate trays were used to pack the strawberries under four different initial gas compositions P1(CO2, 5%),, P2(CO2,10%,), P3(CO2,15%,) and P4(CO2, 20%,) The physico-chemical and microbiological analysis were monitored during a storage period of 12 days at a refrigerated temperature (4°C). The results showed that the MAP packaging conditions significantly prevented weight loss, rotting rate and improved the appearance of the strawberries, and inhibited the growth of total aerobic mesophilic flora during storage compared to the fruits packaged with ambient air that were used as reference. The MAP at 15% of CO2 technique was found to significantly reduce weight loss, improve appearance, control rot of strawberries, and extend storage time. **Keywords:** Strawberry, modified atmosphere, quality, conservation, shelf life.

P47. Synergistic Impacts of Endophytic Bacteria Bacillus subtilis Bera 71 and Biochar to Alleviate Salinity Stress in Maize

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Abstract

The efficiency of salinity-tolerant endophytic bacteria (*Bacillus subtilis*, Bera 71) and Biochar (BC) in maize growing in salt marsh clay soils was investigated in the current study. The endophytic bacterium exhibited plant growth stimulation and had a synergistic impact on plant growth promotion with BC in a pot experiment. Both alone and in combination, these therapies alleviated the adverse impact of salt stress, resulting in improved stress metabolism and defense responses. The combined treatments alleviated the adverse impacts of salinity by suppressing oxidative stress (H2O2) and stimulating enzymatic and non-enzymatic antioxidant activities (SOD, APX, CAT, POD, GR, GST, DHAR, MDHAR, GSH, ASC, proline, GB), as well as protecting cell membrane integrity (MDA, electrolyte leakage). Our current study provided physiological evidence provide fresh insights on the use of combined treatments (separately and/ or in combination) as a viable and environmentally benign strategy for alleviating the adverse impact of salt stress in maize. **Keywords:** Maize, Salt stress, *Bacillus subtilis* (Bera 71), Biochar, antioxidant, non-enzymatic antioxidant activities.

P48. Polyphenolic Characterization and Evaluation of Antioxidant Activity and Antimicrobial Activity of Caper (*Capparis spinosa*) Cultivars

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Abstract

Currently, the research interest is focused on the study of natural antioxidant molecules, which are related to the prevention of various diseases. The present study aims to evaluate the phenolic potential, the antioxidant activity and the antimicrobial activity against ten reference pathogenic bacteria of methanolic extracts from ten Moroccan caper (Capparis spinosa) cultivars (V0, V1, V2, V3, V5, V6, V7, V8, V9 and VR). The results showed an interesting antioxidant activity, especially for cultivars V9, V0, VR and V2, which were registered the lowest values of IC50. However, these values are weak compared to the DPPH radical scavenging capacity of ascorbic acid with IC50 = 0.12 mg / ml. In addition, the findings revealed that the caper cultivars fruits contain significant levels of polyphenols mainly for the cultivars V0, V6 and V5, whereas the cultivar V1 showed the lowest content. Regarding the antimicrobial activity, it showed the efficiency of the extracts against most of the strains. The Pseudomonas aeruginosa showed greatest sensitivity to the all extracts excluding V0, in contrast to Salmonella sp which remained resistant to extracts except V8. For the other extracts, the bacteria reacted differently. These results reveal the richness of Moroccan caper in bioactive compounds providing a very important antioxidant and bacterial activity that could provide a wide range of applications. **Keywords:** *Capparis spinosa*; polyphenols; antioxidant activity; antimicrobial activity.

P49. Seed Protein and Oil Contents of the Soybean Mutant, FM6-847, in North Carolina

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Abstract

In soybean [*Glycine max* (L.) Merr.], protein and oil contents traits are polygenic in nature and depend on growth and environmental conditions, and genotype. FM6-847 is a high yielding mutant developed by ethyl methanesulfonate (EMS) mutagenesis at Southern Illinois University from cultivar 'Forrest' (Meksem's Lab). We aim at comparing FM6-847's seed protein and oil contents with those of three USDA reference lines (LD00-2817, LD06-7620, and LD07-3395) grown in a field in North Carolina. FM6-847 and the reference lines seeds have been sown in a field in Spring Lake, NC and seed, protein and oil contents as well as several yield components have been quantified. The results showed that the mutant's 100-seed weight (100-SW) was significantly higher ($p<0.056$) than 100-SW of the three reference lines. Likewise, the mutant's protein content was significantly higher ($p<0.09$) than the protein contents of the reference lines. However, the mutant's plant height (PH), pod number (PN), seed number (SN), total seed weight (TSW), and oil contents were not significantly higher than the reference lines with p values of ($p<0.18$), ($p<0.11$), ($p<0.1$), and ($p<0.22$), respectively. The mutant FM6-847 generated higher protein content and seed weight but lower oil content and is a stable line; therefore, it will increase yield and profit benefitting farmers not only in NC but also in other parts of the US and the world. Keywords: Soybean, mutant FM6-847, seed yield, protein, oil, plant heigh, pod number, total seed weight.

P50. Correlation Between Root Traits and Seed Protein and Oil Contents in Soybean Grown Under Drought Stress

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Abstract

The root system is very important for plants including soybean because it receives water and minerals from the soil so that the plant can photosynthesize, grow, and increase its yield. The objective of this study was to grow the 'MD 96-5722' by 'Spencer' recombinant inbred line (RIL) population (n=86) in the greenhouse under normal (Group I) and drought stress (Group II) conditions, and compare the root length (RL), root surface area (RSA), average root diam¬eter (ARD), and average root volume (ARV) in the two groups of plants. The results showed that there is a huge variation in these traits among the parents 'MD 96-5722' and 'Spencer', and among their RILs. For Group I plants, the RL of parents and RILs ranged from 20.67 cm to 2,327.88 cm; the RSA ranged from 4.57 cm2 to 1,176.79 cm2; the ARD ranged from 0.38 mm to 4.04 mm; and the ARV ranged from 0.08 cm3 to 47.34 cm3. For Group II plants, the RL of parents and RILs ranged from 15.70 cm to 3,562.42 cm; the RSA ranged from 4.15 cm^2 to 829.72 cm^2; the ARD ranged from 0.24 mm to 5.74 mm; and the ARV ranged from 0.03 cm3 to 23.67 cm^3. Group I plants have higher means of RL [572.58 cm vs. 537.33 cm], RSA [201.20 cm^2 vs. 165.50 cm^2], ARD [3.96 mm vs. 1.45 mm], and ARV [6.31 cm^3

vs. 5.61 cm^3] compared to Group II plants which demonstrates that drought-stressed plants have reduced overall plant growth and development. However, statistically, these differences were not significant; therefore, further studies with several replicates should be conducted both in the greenhouse and the field in order to determine the effects of drought stress on the 'MD 96-5722' by 'Spencer' RILs.**Keywords:** Root length, Root surface area, Average root diameter, Average root volume, MD 96-5722, Spencer.

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Organizers' Biographies

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Biography

Born in Casablanca, Morocco, I graduated from the university of Casablanca and Fes in 1989 with a major in Biology and Genetics, I earned my MS in Plant Molecular and Cellular Biology, Plant Biotechnology in 1990 from the University of Paris XI, France and my PhD from the Max-Planck Institute for Plant Breeding and Genetics and the University of Cologne in Germany.Following my postdoctoral work from 1996-1999 on an NSF funded project to develop a genome physical map of soybean, I joined in the year 2000 the Agronomy faculty at Southern Illinois University Carbondale (SIUC), where I was later promoted to associate (2005) and full professor in 2009. My research interests cover forward and reverse genetics, structural and functional genomics, gene mutations and evolution and genetic diversity, with a long-time area of interest residing in the molecular dissection of plant disease resistance mechanisms (nematodes) and the improvement of economically important traits in soybean and cannabis (Oil, Proteins, and secondary metabolites). I co-authored more than 108 refereed manuscripts, including the discovery of a metabolic gene with a role in disease resistance that was published in the prestigious journal Nature 2012, and the discovery of the oil biosynthesis pathway in soybean. I participated with more than 250 conference presentations; I was invited more than 80 times to give talks at venues across North and South America, Africa, Europe, Asia, and Australia, I published 4 book chapters and edited 3 books and was awarded 5 patents for my work on disease resistance genes in potato and soybean. I am a member of the National Academy of Inventors. With a total career external funding of over 24 million US dollars from federal, state, industry, commodity boards, and regional agencies. Recognitions of my research include the 2021 SIU System's Inventor of the Year, the 2021 Illinois Science & Technology Coalition (ISTC)' s Fourth Annual Researchers to Know, the 2008 and the 2014 Scholar Excellence award from the College of Agricultural Sciences at Southern Illinois University Carbondale. I was nominated to Editor in Chief of the section Plant Genetics, Genomics and Biotechnology of the Journal Plants. (2020-Present); Associate editor of The Plant Genome journal (2021-Present), the journal Frontiers in Plant Science. (2021-Now) and Editor of the Nature research journal Scientific Reports (2018-Now) I served and continue serving on several department, school, and university committees. Including, dean's and faculty searches committees, tenure and promotion, research, educational, faculty policy and I was honored to serve as a committee chair of thenew operating paper of the school of agricultural sciences and the chair of the governance committee at the faculty senate. I served and continue serving as panelist for national, federal, and international granting agencies. I am a founder and organizer of the International American Moroccan Agricultural, Health, and Life Sciences Conference (5 editions, 1st one started in 2013) and Originator and liaison person of 4 Memorandum of Understandings between four Moroccan academic and research institutions and the Board of Trustees of Southern Illinois University.

Organizers' Biographies

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Biography

Dr. Moulay Abdelmajid (Majid) Kassem earned a B.S. degree in Plant Biology at Mohamed V University, Rabat, Morocco in 1992. After graduation, he went to France then to the USA to pursue his graduate studies. Dr. Kassem earned a M.S. in Enzymatic Engineering, Bioconversion, and Microbiology from the University of Picardie Jules Verne in Amiens, France in 1995. After that, he joined the "Center for Excellence in Soybean Research, Teaching, and Outreach" at Southern Illinois University, Carbondale, Illinois, where he earned his Ph.D. in Plant Biology (Plant Genetics, Genomics, Biotechnology, and Physiology) in December 2003. In fall 2004, Dr. Kassem joined Kean University, NJ as Assistant Professor of Botany and worked there from 2004 to 2006. In 2006, Dr. Kassem joined the Department of Natural Sciences, Fayetteville State University, NC as an Associate Professor of Botany and was promoted to Full Professor in 2009 and Dept. Chair in 2010. During the academic year 2014-2015, Dr. Kassem served as the Dean of the School of Arts and Sciences at the American University of Ras Al Khaimah in United Arab Emirates (UAE) and returned to his position of Chair in fall 2015. Dr. Kassem serves as the Editor-In-Chief of Atlas Journal of Biology and a member of the Editorial Board of Journal of Biotech Research. Dr. Kassem is the Co-Founder, CEO, and Managing Editor of Atlas Publishing, LLC. Dr. Kassem's research interest and expertise is genetic and quantitative trait loci (QTL) mapping of important agronomic traits in soybean and other plant species especially seed composition traits. He is a standing member of several professional societies such as North Carolina Academy of Science (NCAS), American Society of Plant Biologists (ASPB), and the High Council of Moroccan American Scholars and Academics (HC-MASA) of which he served as President and Vice-President. Dr. Kassem, his students, and colleagues published 65+ refereed manuscripts and several book chapters and serves as a regular reviewer for several international journals and granting agencies. Recently (2022), Dr. Kassem published a book entitled "Soybean Seed Composition : Protein, Oil, Fatty Acids, Amino Acids, Sugars, Mineral Nutrients, Tocopherols, and Isoflavones" with the prestigious academic publisher, Springer Nature.

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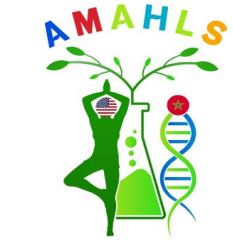

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Adam Styka (1890-1959)
Moroccan smoking kif pipe (sebsi)
(Dr. Meksem's art collection)

Louis Endres (1896-1986)
Moroccan smoking kif pipe (sebsi)
(Dr. Meksem's art collection)